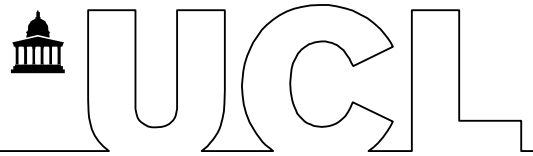UCL

COURSEWORK TITLE
Dissertation
The Impact of Bicycle Thefts on the Choice of Cycling as a Mode
of Transportation Among Recreational Cyclists

STUDENT NAME: Ursulia Kesani (HPVM4)

MODULE CODE: BGLP0014

WORD COUNT: 14218

IGP MSc COURSEWORK

DECLARATION OF OWNERSHIP AND COPYRIGHT FORM

1. DECLARATION OF OWNERSHIP

I confirm that I have read and understood the guidelines on plagiarism produced by IGP and UCL, that I understand the meaning of plagiarism as defined in those guidelines, and that I may be penalised for submitting work that has been plagiarised.

This piece of coursework must be submitted electronically through Turnitin on Moodle by the stipulated deadline. I understand that the coursework cannot be assessed unless it is submitted online and that penalties will be applied for late submissions as per UCL and IGP guidelines unless there is an approved case for Extenuating Circumstances or Reasonable Adjustments.

I declare that all material is entirely my own work except where explicitly, clearly and individually indicated and that all sources used in its preparation and all quotations are clearly cited using a recognised system for referencing and citation. Should this statement prove to be untrue, I recognise the right of the Board of Examiners to recommend disciplinary action in line with UCL regulations.

2. COPYRIGHT

The copyright of the coursework remains with me as its author. However, I understand that anonymised copies may be made available to future students for reference. Please, tick the box if you DO NOT want this report to be made available for teaching purposes.

The Impact of Bicycle Thefts on the Choice of Cycling as a Mode of Transportation Among Recreational Cyclists

Abstract

Cities like London have the potential to foster prosperity, and sustainable transportation can significantly enhance urban quality of life. One of the most sustainable forms of transportation is cycling, as it positively contributes not just to the environment but also to social, physical, and mental well-being. However, bicycle theft continues to be a major deterrent for potential cyclists and also affects the behaviour of those who currently ride. Understanding how the fear of bike theft affects cycling habits helps us create strategies to reduce the negative effects of bicycle theft. The goal of this dissertation is to understand if and how the fear of bike theft impacts the choice to use bicycles as a mode of transportation among experienced cyclists, as well as to gather perspectives on preventive measures against bike theft. The survey received 269 responses from recreational cyclists residing in London. The results, show that 93% of the respondents are concerned about their bikes being stolen. 50% of the respondents said that their fear of bike theft highly impacts their decision to use the bike as a mode of transportation, and because of this fear, 50% of the choices are made by participants had a negative impact on the environment.

Regarding preventive measures, recreational cyclists are not satisfied with the current options available to them, as no measure was rated as highly effective. The most popular measure in use is the U-lock, with 75% of respondents using it. However, participants believe that the most effective measures would be "more secure bike parking facilities" (79%), followed by "technological solutions" (51%).

In addition to answering the main research questions, this research also provides a unique demographic profile of recreational cyclists in London. Most recreational cyclists are middle-aged (54% are 45-64 years old), white (78%), and male (59%). They come from higher-income households (61%) and have high levels of education (84%).

Table of Contents

Chapter 1: Introduction

Bicycles are a key element for sustainable transportation in urban areas (Sax & Honey-Rosés, 2023). Commuting by bicycle offers advantages over other transportation modes, benefiting both the individual commuter and society at large. Although cycling is a viable option for many, a significant number of commuters opt for alternative transportation methods (Heinen et al., 2010). This holds significant implications for health, climate, and social equity (Ledsham et al., 2023). Acknowledging this, the Mayor's Transport Strategy aspires to transform London into the world's leading city for cycling, ensuring that anyone who wishes to cycle can do so and making cycling an integral part of a vibrant, forward-thinking urban environment (TfL, 2023). Actively developing infrastructure to support cycling is crucial for increasing cycling in London, recognizing its potential to improve urban living. However, with the rise in cycling popularity, opportunities for bike theft also increase, creating a significant barrier to cycling. In my dissertation, I aim to investigate a less-explored subject: bike theft and its impact on the decision to use bicycles for active commuting.

Drawing from personal experiences, such as the theft of my bike and a rare bike wheel, along with informal conversations with potential cycling commuters, it appears that such incidents may discourage people from commuting by bike or reduce their frequency of biking. This study aims to investigate this aspect more thoroughly to determine whether these observations are indicative of a broader trend. A significant part of my dissertation involves analysing literature to understand what is already known about the impact of bike thefts, as most studies focus on the victims of bike theft. My dissertation, however, focuses on whether the fear of bike theft has any impact, independent of the experience of bike theft.

The goal of this dissertation is to characterize if and how bicycle theft changes individual bicycling behaviour. The study has two main objectives: first, to explore whether the fear of having one's bike stolen influences London's recreational cyclists' decisions to use their bikes as a means of transport, and second, to identify which prevention measures can be effective against bike theft. The overarching aim is to provide strategies for bike theft reduction and preventive measures to decrease bike theft crime and increase the use of cycling for transportation.

Based on the main objectives, the primary research questions are as follow

1. *How does the experience or perception of bicycle theft influence individuals' willingness to choose bicycles as a mode of transportation?* This question aims to delve into the behavioural aspects, assessing how the risk or reality of bike theft affects people's choices about commuting actively on bicycles.
2. *What prevention methods are perceived by recreational cyclists as most effective in reducing bike thefts and thereby encouraging their decision to cycle?* This question explores recreational cyclists' opinions on various prevention methods, ranging from physical security measures to broader public policies, community-driven initiatives, and technological innovations. The goal is to understand which specific interventions these cyclists believe are most effective at reducing the risk of bike theft.

To answer the research questions, it is necessary to understand the background and context of the benefits of cycling, the prevalence of bicycle thefts, and their impacts. The literature review was conducted to synthesize existing knowledge and provide a comprehensive understanding of the topic. This involved analysing academic literature, research reports, and data from police and government sources. The review was structured to explore the following key topics:

1. Cycling and prosperity, and the benefits of cycling.
2. Cycling Inequalities in London
3. Bike thefts and their impact on cycling behaviour
4. Preventive measures and practical and theoretical application of bike theft prevention.

The second chapter presents a literature review and addresses four topics related to cycling and bike theft. The third chapter details the research methodology used in this dissertation. Chapter 4 provides the results of the survey and answers to the main research questions 1 and 2. Chapter 5 provides an analysis of the results, and Chapter 6 discusses potential strategies derived from the results analysis and theoretical framework. Chapter 7 addresses the limitations encountered during the research and provides suggestions for future research. Chapter 8 concludes the dissertation.

Definition and Rationale for Focusing on Recreational Cyclists

This research focuses on the perspectives of recreational cyclists in London regarding the fear of bike theft. In this research, recreational cycling is defined in line with the literature as a popular leisure activity involving riding a bicycle primarily for recreation or fitness, rather than for transportation or competitive purposes (Aizat et al., 2023). This type of cycling is typically practiced by families or informal groups of friends and acquaintances (Aizat et al., 2023) who are often part of the same cycling club or community. They often meet on specific days to cycle together in parks for laps or embark on longer rides during weekends. Although there can be a competitive element among peers, such as who is the strongest or fastest through a segment, the focus remains largely recreational. For this research, a recreational cyclist is defined as someone who cycles regularly (Schultz & Gordon, 2010) at least once a week and participates in no more than 50 organized cycling events annually. This definition ensures the focus is on cyclists whose primary engagement with cycling is for leisure and health, rather than competitive sport.

The decision to focus on data collection from recreational cyclists in this research is driven by their unique position within the cycling community. While many recreational cyclists in London engage primarily in leisure activities rather than commuting, they represent a substantial group with the potential to convert to bicycle commuting. These cyclists, both infrequent and frequent, have already overcome many initial barriers to cycling, typically own or have access to a bike, and are much more likely to consider using their bicycles for trips, according to TfL (2011). This existing engagement with cycling, coupled with their investment in bicycles and developed basic cycling skills, allows them to know how to navigate London traffic as they are already using bikes on busy roads. This positions them as ideal candidates for expanding their use into daily commuting. However, the threat and experience of bicycle theft may deter them from taking this step. By examining how bicycle theft influences recreational cyclists' willingness to cycle as a regular mode

5

of transportation, this study aims to uncover key barriers and facilitators in the adoption of cycling as mode of transportation.

It is important to separate recreational cyclists and utility cyclists in research, as their motives and demographics can differ significantly. While both recreational and utility cycling positively impact society through health and economic benefits, I argue that cycling as a mode of transportation offers higher societal benefits. By choosing to cycle to work or other destinations, individuals can potentially reduce the use of motor vehicles, further contributing to environmental health and the city's economy.

However, data collection often tends to group all cyclists together, which hampers understanding the distinct characteristics of each group. Recreational cycling and transportation cycling serve different purposes; the former is often a hobby, while the latter is a means of commuting. The challenge is that these categories can be interconnected. This research aims to understand how many recreational cyclists also use their bikes for transportation to maximize the benefits of cycling. While I separate these two groups in some cases, I will discuss cyclists in general in the literature review, as most academic articles and data on cyclists do not distinguish between them.

Cycling as a Mode of Transport

The term "mode of transportation" encompasses a wider range of cycling activities beyond the typical commute between home and work. According to the Cambridge Dictionary, 'the commute means to make the same journey regularly between work and home.' This definition limits the scope to routine travel, but cycling as 'a mode of transportation' includes meeting a friend at a café, shopping for groceries, or even incorporating errands into a daily commute. These scenarios imply varied start and end points and typically involve parking the bicycle in public, unsecured locations. The choice to study cycling as a "mode of transportation" or 'utility cycling' rather than strictly "commuting" reflects the intent to explore these non-linear and multifaceted journeys. It allows for an investigation into the impact of bicycle theft in situations where cyclists must secure their bikes outside, often in potentially risky environments. As per TFL Cycling Action Plan 2, bicycle journeys can serve diverse objectives, with merely 20 percent of potential cycle trips related to work (TFL, 2023). This broader perspective addresses the real concerns of cyclists who might hesitate to use their bicycles for a variety of trips due to the fear of theft.

Chapter 2: Literature Review

Cycling and prosperity, and the benefits of cycling

What Cycling Has to Do with Prosperity?

First of all, it is useful to highlight that prosperity is a multi-dimensional concept that encompasses various aspects (Mintchev, 2024). I will be using the redefined definition of prosperity found in many articles by Institute of Global Prosperity (IGP) scholars (Mintchev, 2024; Moore & Gore, 2015; Moore & Mintchev, 2021; Moore & Woodcraft, 2019), moving away from the traditional definition of prosperity where wealth and GDP play a big role and towards a new definition that emphasizes quality of life for both people and the planet (Mintchev, 2024). Prosperity can mean different things to different people; however, scholars redefining prosperity have attempted to identify its main characteristics. They describe prosperity as a holistic well-being that includes secure livelihoods, high-quality public services, a clean environment, and vibrant social and cultural lives (Moore & Mintchev, 2021). In this definition of prosperity, where the interconnectedness of nature and human beings is crucial, cycling as a sustainable form of transportation can play a significant role.

Moore and Woodcraft (2019) contend that, in the context of global urbanization, it is important to address how cities can foster shared prosperity. They highlight that cities, as hubs of prosperity, have extensive potential to create innovative partnerships and introduce new concepts for positive social change. The transport sector is vital in this regard, serving as a dynamic network that interconnects social, economic, and environmental aspects (Bao et al., 2022). Social sustainability within transportation systems significantly impacts social and economic opportunities, including employment and prosperity, health and well-being, and access to education (Sanchez et al., 2018). Recently, the United Nations (UN) Sustainable Development Goals (SDGs) have recognized cycling as a key element of a sustainable urban mobility system (Battiston et al., 2023).

Hopkinson et al. (2024) claim that investing in public transport and active travel (like walking and cycling) is more beneficial for increasing prosperity than investing in road infrastructure. This approach has social and environmental advantages. While transport, in general, can help achieve the aim of bringing jobs and prosperity to local areas and improving residents' well-being, the common focus on building new roads is not aligned with climate change goals and fails to solve congestion issues. Evidence indicates that investing in public transport and active travel, like cycling, can significantly boost prosperity in many parts of Britain and offer various social and environmental benefits (Hopkinson et al., 2024).

A new way of thinking about prosperity and subjective well-being rejects a one-size-fits-all definition. This approach allows for a variety of interpretations and goals tailored to specific local contexts (Moore & Woodcraft, 2019), accommodating the unique needs and aspirations of different communities. This means that not everyone would like or can use a bicycle as a mode of transportation. However, for those who choose to do so, it represents a part of their prosperity,

considering that happiness and well-being are part of prosperity. Research indicates that cyclists consistently report the highest levels of satisfaction with their commute compared to other modes of transportation (Wild & Woodward, 2019). Furthermore, by choosing to cycle, they are contributing to the prosperity of society through environmental care. This aligns with the redefined definition of prosperity that emphasizes living well together with others and with the planet (Moore & Mintchev, 2021; Moore & Woodcraft, 2019).

Although cycling is not always perceived as a way of living well together with others, public perception of cycling is often negative, as evidenced by social media discussions and non-academic articles. While academic literature on this topic is limited, numerous popular articles discuss this issue (Transportation Alternatives, 2022; Waring, 2022; Reid, 2022; Smith, 2023). A study by Basford et al. (2002) found that drivers often view cyclists as unpredictable on the road, leading to anxiety and negative attitudes. This perception is echoed in social media discussions, where many drivers report that cyclists frequently disregard traffic rules, such as running red lights, riding on sidewalks, or not signalling turns (goldenballs1212, 2023). Such behaviour is often perceived as arrogant and contributes to resentment towards cyclists. Additionally, cyclists are often seen as impeding traffic flow, particularly in areas lacking dedicated cycling infrastructure (Basford et al., 2002). This perception can exacerbate tensions between drivers and cyclists, especially in urban environments with limited road space. A deeper literature review and further research are needed to fully understand perceptions about cyclists, the reasons behind these perceptions, and whether changes in cyclist behaviour could contribute to achieving harmony between cyclists and non-cyclists.

Benefits of Cycling

Even if the connection between cycling and prosperity is established, it is essential to delve deeper into the specific benefits of cycling for individuals, society, and the environment. By understanding these benefits in detail, we can better appreciate how cycling contributes to overall prosperity. This includes recognizing the happiness individuals find in cycling (mental health) and the positive impacts on the environment and society as a whole.

Cycling offers extensive societal benefits: it is environmentally friendly, producing no direct emissions of pollutants or CO2 and minimal noise. Additionally, cycling requires less costly infrastructure compared to other transportation modes and significantly contributes to public health by promoting physical activity and reducing sedentary lifestyles (Olde Kalter, 2007; Heinen et al., 2010). Regular cycling also supports mental health by improving mood, reducing stress, and enhancing overall psychological well-being. These attributes make cycling a key component of sustainable urban mobility solutions.

Links between Cycling and Health

The public health impacts of cycling are significantly positive, primarily due to the substantial benefits derived from physical activity (Götschi et al., 2016). Research shows that the most physically active individuals can reduce their risk of all-cause mortality by about 30%, cardiovascular diseases including coronary heart disease and stroke by 20 to 35%, type 2

diabetes by 30 to 40%, colon cancer by about 30%, and breast cancer by about 20% (Physical Activity Guidelines Advisory Committee, 2008). Recent updates have also highlighted the potential of physical activity to lower the risk of additional cancers such as those of the bladder, endometrium, esophagus, kidney, lung, and stomach (Physical Activity Guidelines Advisory Committee, 2018). A study encompassing nearly a million adults highlighted that even 2.5 hours per week of moderate-intensity activity can reduce mortality risk by 19%, with an increase to 7 hours per week further reducing this risk by 24% (Woodcock et al., 2011). Moreover, engaging in moderate-to-vigorous physical activity can help maintain a healthy weight, prevent obesity, and enhance overall well-being, thereby making daily tasks easier and improving sleep quality (Physical Activity Guidelines Advisory Committee, 2018). Additionally, replacing car trips with cycling can also yield indirect health benefits, such as reduced air and noise pollution and increased social engagement, contributing to more liveable communities (Götschi et al., 2016).

Cycling, as a form of moderate-intensity physical activity, not only integrates seamlessly into daily routines, such as commuting, but is also accessible and cost-effective, making it an excellent choice for promoting health across broad segments of the population (Götschi et al., 2016). However, it carries certain health risks, primarily the risk of crashes and increased exposure to air pollution when cycling in motorized traffic (Götschi et al., 2016). Despite these risks, studies by de Hartog, Boogaard, Nijland, and Hoek (2010), Rabl and De Nazelle (2012), and Rojas-Rueda, de Nazelle, Teixidó, and Nieuwenhuijsen (2013) (Götschi et al., 2016) indicate that at the population level, the health benefits derived from the physical activity of cycling significantly outweigh the risks from crashes and air pollution, as well as the indirect benefits resulting from reductions in motor vehicle use (Götschi et al., 2016).

Environmental Impact

Active transportation is essential for reducing emissions in the transport sector and minimizing pollution (Heckwolf et al., 2024). Cycling, in particular, stands out as an almost carbon-neutral mode of transportation, offering a practical solution to the dual challenges of environmental degradation and declining physical activity levels (Fraser & Lock, 2011). By incorporating more cycling into daily routines, individuals can significantly reduce their carbon footprint. As one study shows, if an average person substitutes just one car trip with one cycling trip per day over 200 days in a year, it could lead to a reduction of approximately 0.5 tonnes in mobility-related lifecycle CO_2 emissions. This reduction constitutes a considerable portion of the average per capita CO_2 emissions from transport (Brand et al., 2021). To compare, the latest World Bank data from 2020 shows that the average per capita CO_2 emissions in the UK were around 4.6 tonnes (World Bank, 2023). A reduction of 0.5 tonnes represents about 11% of the UK's per capita emissions. Although it may not be feasible to replace all car trips with cycling, the potential for decreasing emissions through increased active travel remains substantial and significant (Brand et al., 2021).

Economic Impact

When evaluating the economic costs and benefits of cycling compared to other modes of transport, it is important to consider costs at multiple levels. These include costs and benefits to the individual, employers, and wider society (Logan et al., 2023).

9

Economic Benefits and Costs of Cycling to the Individual

Evidence from Denmark shows that cycling is significantly cheaper than driving, with cycling costing €0.048/km (£0.043) compared to €0.34/km (£0.29) for driving, including vehicle-related expenses (Logan et al., 2023). Even excluding taxes, cycling remains cheaper at €0.039/km (£0.035) versus €0.16/km (£0.14) for driving. Although cycling generally takes more time, the overall economic benefits, including health and longevity gains, outweigh these costs. The total cost to an individual per kilometre is €0.243 for cycling and €0.511 for driving, highlighting that cycling can reduce commuting costs by more than half. However, further research in different contexts is necessary to fully understand these benefits, as the Danish study's assumptions may not apply everywhere.

Economic Benefits to Employers

Limited evidence suggests that cycle commuting can improve productivity by reducing absenteeism. Studies in the UK and Denmark found that regular cyclists have about one day less absenteeism per year compared to non-cyclists (Logan et al., 2023). A 2007 report for Cycling England estimated that increased physical activity from cycling could save £64.40 per worker annually by reducing absenteeism by 0.4 days. Work-based cycle schemes, such as London's Bikes for Business, showed potential savings of £25-80 per month per bike for employers and £50 per month for employees. Despite limited data, existing evidence indicates that higher cycling levels among employees could provide net benefits to employers, suggesting the need for further research to quantify these benefits and identify effective interventions.

Economic Benefits to Society

The cycling sector contributes around £5.4 billion a year to the British economy, with every new bicycle purchased adding value to the economy of, on average, around £1800 (National Police Chiefs' Council, 2019). Increased levels of cycling bring NHS savings through physical and mental health improvements, obesity reduction, and the environmental benefits of lower emissions of pollutants and CO2, along with reduced congestion (National Police Chiefs' Council, 2019).

Cycling Inequalities in London

Above, I discussed the connection between cycling as a sustainable mode of transportation and prosperity. If we think of prosperity as the SDGs reframe it—describing prosperity as a shared and inclusive condition (Moore & Woodcraft, 2019)—the biggest critique of cycling is its inequalities.

Although cycling is promoted as a sustainable, health-enhancing, and cheaper mode of transportation, it should be easily accessible to everyone who decides to cycle. However, critiques in the literature highlight significant inequalities in cycling participation, particularly concerning socioeconomic status, ethnicity, and gender. In the UK, cycling, especially commuter cycling, is heavily concentrated among specific demographic groups: males, whites, able-bodied individuals, and the young (Sport England/DfT, 2014; Steinbach et al., 2011; TfL, 2012). Although some

research indicates that younger and older workers cycle less than their middle-aged peers (Goodman and Aldred, 2018; Department for Transport, 2024) more literature review is needed to fully understand the impact of age on cycling.

This section focuses on these disparities within the context of London. Despite a marked increase in cycling rates over the past fifteen years (Aldred et al., 2015) and a doubling of cycling activity since 2000 (TfL, 2023), the demographic profile of cyclists remains imbalanced. Importantly, simply increasing the total number of cyclists has not been enough to foster an inclusive cycling culture (Aldred et al., 2015). A typical London cyclist is 'predominantly male and white' (Bednarowska-Michael, 2023).

Socioeconomic Inequality

Policies promoting cycling in general have the unique potential to enhance overall population health and wellbeing (Martin et al., 2014) while addressing health and accessibility inequalities, making it easier to reach workplaces and other destinations (Lee et al., 2017; Manaugh et al., 2015; Lucas et al., 2019). Cycling is inherently a cost-effective mode of transportation and exercise, making these policies especially beneficial for individuals with lower socioeconomic status (SES), who are typically less active than those with higher SES and find alternative travel methods and forms of exercise expensive. If cycling can at least partially replace car journeys, residents of disadvantaged urban areas, who are disproportionately affected by heavy road traffic, could greatly benefit from environmental improvements such as reduced air pollution (Jarrett et al., 2012; Public Health England, 2016).

However, despite the increase in cycle commuting on average over time, studies by Martin et al. (2021) indicated that the socioeconomic profile of cyclists in London has shifted from being dominated by lower SES commuters to higher SES commuters. However, inequalities related to SES, especially income, are complex and less well understood (Vidal Tortosa et al., 2021).

Lack of access to a bike is a significant obstacle to cycling (2CV, 2021). The Department for Transport (2023), which shows that access to a bicycle is also dependent on household income: only 25% of individuals in households with an income of £14,999 or less per year had regular access to a bicycle, compared with half of the people in households with an income of £50,000 or more. This means that higher-income households are more likely to have access to bicycles, and therefore more people from these households can cycle regularly.

When analysing household income levels, it is important to define what constitutes low income. According to the Income Dynamics data, low income was defined as £30,316 per annum for a couple with no children during the period from January 2020 to December 2021 (Race Disparity Unit, 2023). Comparing the lowest income households to high-income households does not provide a complete picture. For instance, the number of bike owners increases with income, yet there are still households within the low-income bracket that own bikes. Among households with an income between £15,000 and £34,999, 35% have regular access to a bicycle (Department for Transport, 2023). Additionally, we must consider that this data only reflects bicycle ownership and does not specify the purpose of use. Recreational cyclists, for instance, may use bicycles for fitness and leisure, which offer different societal benefits compared to commuting cyclists who

contribute to sustainability efforts. The majority of studies concur that leisure cycling is more prevalent among individuals with higher incomes (Vidal Tortosa et al., 2021). On the other hand, some literature, such as Cohen et al. (2024), Aldred & Jungnickel (2014), and Anantharaman (2017), reveals that individuals with lower income levels are more likely to engage in consistent and frequent bicycling activity, primarily using bicycles for transportation purposes. The use of bicycles, for this group, may be more a result of necessity than preference (Cohen et al., 2024). However, this contradicts TFL data from 2023, which shows that the percentage of Londoners who used a bicycle in 2020 was 17% for low-income households, 31% for medium-income households, and 37% for high-income households. It is important to note that this data reflects cycling in general, not specifically for transportation purposes. Future research should focus specifically on the incomes of bicycle commuters, rather than all cyclists in general, as current data on commuter incomes is lacking. This targeted approach will help us understand whether income inequalities exist among commuters, recreational cyclists, or cyclists in general. Identifying these differences is crucial, as each group may require different strategies and approaches to effectively address their unique needs and challenges.

Ethnic Inequity

SES is not the only factor influencing cycling rates; in fact, SES had less impact on whether people cycled compared to other factors. The most significant differences in cycling rates were observed between ethnic minority groups and the White British population, even after accounting for the area people lived in and other personal characteristics. These disparities have been increasing over time (Martin et al., 2021).

According to the 2021 Census data for London, the ethnic composition is quite diverse: 36.8% of London's population identifies as White British, 46.2% are categorized as Asian, Black, Mixed, or 'Other' ethnic groups, and 17.0% belong to White ethnic minorities (Office for National Statistics, 2022). Despite this diversity, there are significant disparities in cycling participation. The cycling mode share is only 1.2% for BAME men, compared to 3.8% for White men and 1.4% for White women (Osei & Aldred, 2023). Transport for London (2021) found that among Londoners who had not cycled in the city, 19% of Whites were 'open to cycling', compared to 30% of Black Londoners. This suggests that there is potential to build cycling infrastructure around ethnic minority communities.

Findings from Goel et al. (2022) suggest several reasons why Black men cycle less: "Status, class, and affordability," "Racism in wider society," "Representation and invisibility," and "Infrastructure and culture." The authors also emphasize that policymakers must consider the impact of less obvious exclusions on cycling participation. London's Black population faces higher rates of exclusion from better-paid jobs, with 33% of Black residents in employment being low paid, compared to 19% of White residents. Furthermore, only 65% of Black Londoners of working age are employed, compared to 80% of Whites. Consequently, Black Londoners have lower access to the Cycle to Work scheme, which requires stable employment and a participating employer. As a result, ethnic minorities in London cycle to work less frequently than White Londoners (Bednarowska-Michaiel, 2023). Additionally, due to historic housing inequalities, Black Londoners are more likely to live in flats, which can exacerbate problems with cycle parking and

12

theft. Overall, as per TfL research, ethnic minorities are less likely to cycle due to affordability and limited access, as they also live further from the cycling network (TfL, 2011).

On a geographical level, studies by Bednarowska-Michael (2023) indicate that London boroughs with higher proportions of minority populations have lower levels of cycling commuting to work. This study was the first to analyze cycling to work and cycling equity in London from a regional and spatial perspective. It found that diverse boroughs have less access to the London Bike Sharing Scheme (LBSS) and cycling infrastructure.

Gender Gap in Cycling

Despite some recent positive trends, such as an increase in the number of women cycling in London over the last three years, cycling participation does not yet reflect the city's great diversity (TFL, 2018). The London Travel Demand Survey shows that between 2010 and 2019, almost two-thirds of people who cycled at least once a year were male, with only a slight increase in the proportion of women cycling during the same period, from 36 to 38 percent (TFL, 2023). In the UK, men are twice as likely as women to cycle (Aldred et al., 2015), a stark contrast to countries with more established cycling infrastructure, such as the Netherlands, where 55 percent of cycle journeys are made by women (TFL, 2018). Academic literature identifies behavioural and psychological factors as key determinants of the gender gap in cycling. Women often perceive cycling as a riskier activity compared to men, leading to a stronger preference for infrastructure that is physically separated from motorized traffic (Garrard et al., 2008). Evidence from high-cycling countries like Denmark, Germany, and the Netherlands shows that gender gaps in cycling are not intrinsic but result from place-specific barriers that can be addressed to make cycling more universal (Battiston et al., 2023). Enhancing the quality of dedicated cycling infrastructure may make urban environments more accessible for women, promoting a more sustainable mode of transport for everyone (Battiston et al., 2023). However, simply increasing the cycling modal share has not been sufficient to create an inclusive cycling culture in the UK, as culturally specific factors continue to limit female participation in cycling even where cycling rates have increased (Aldred et al., 2015). This highlights the need for targeted infrastructure and policies to support underrepresented groups and achieve a more equal cycling culture.

Bike Thefts and Their Impact on Cycling Behaviour

Cycling Prevalence in London - Challenges and Opportunities

Cycling as a mode of transport offers numerous benefits, positively impacting physical and mental health, local air quality, and broader environmental concerns. Despite these advantages, many people opt for other modes of transportation. Heinen et al. (2010) categorize the reasons for this into several factors: 'Socio-Economic Factors,' 'Psychological Factors: Attitudes and Social Norms and Habits,' the 'Natural environment' (weather conditions, seasons, hilliness), and the 'Built environment' (infrastructure and facilities at work). While the natural environment is beyond our control, improvements to the built environment can significantly encourage cycling. Socio-

economic and psychological factors can also be positively influenced by better infrastructure. For instance, in London, safety concerns are the primary reason people are discouraged from cycling, cited by 48% of respondents, followed by poor weather (36%) and living too far from their destination (33%) (Department for Transport, 2024). While weather cannot be controlled, cyclist safety can be enhanced through improved infrastructure. Recognizing this, the UK government is committed to policies encouraging a shift away from motorized travel towards walking and cycling, aiming for half of all trips in towns and cities to be walked or cycled by 2030 (Department for Transport, 2020).

There is significant potential to increase cycling in London, the most populated region in the UK, with a population of over 9 million people (Macrotrends, 2024). The city is divided into 32 boroughs, with the City of London as the 33rd division. Potential cycle journeys are spread across London, with the highest density in inner London, while the greatest volume is in outer London, accounting for 55% of potential cycle journeys (TfL, 2023).

Between 2019 and 2022, cycling in London increased by 13%, and by 155% since 2000 (TfL, 2023). Analysis of cycling potential shows that Londoners make over eight million trips by motorized modes each day that could potentially be cycled instead (TfL, 2023). Most of these cyclable trips are currently made by car, with about two-thirds of all car trips being less than five kilometres, well within cycling range. This means that approximately 63% of all car trips in London are potentially cyclable (TfL, 2023).

By 2030, TfL plans, together with London boroughs, to have 40% of Londoners living within 400 meters of a Cycleway, up from 22% in 2022 (TfL, 2023). This could result in 1.6 million daily cycle journeys by 2030, an increase of one-third from the 1.2 million journeys made in 2022 (TfL, 2023). The strategy also aims for 80% of all trips to be made by sustainable modes by 2041, up from 63% in 2015 (TfL, 2023).

There is already the positive impact of the introduction of Low Traffic Neighbourhoods (LTNs) by local government authorities. LTNs have shown many benefits, including the reduction of road danger, an increase in walking and cycling activities, and improvement in air quality (Low Traffic Neighbourhoods, 2024). However, it is important to note that areas with LTNs have experienced an increase in bicycle theft, likely linked to the estimated 59% increase in cycling within these neighbourhoods (TfL, 2023). This phenomenon underscores the correlation between an increase in the population of cyclists and a rise in opportunities for cycle theft, as indicated by both Mburu and Helbich (2016) and Sidebottom et al. (2009). Therefore, along with promoting cycling and improving infrastructure, we must also consider how to protect bicycles from theft.

Bike Theft Statistics and Trends

One of the objectives of the literature review was to understand the profile of bicycle thefts and assess the magnitude of the issue. Initially, I intended to focus on data available nationally and globally, with a particular emphasis on London, where the research will be conducted. However, due to issues with data consistency, I decided to narrow the focus to England and Wales for a broader scale analysis while providing specific numbers for London. The review also synthesized existing knowledge from academic literature, research, and police data on bicycle theft. Open-source research was conducted to enhance the intelligence picture, utilizing data from the

Metropolitan Police Service Dashboard and the Office for National Statistics. This included reviewing documents and articles from central government, academia, and the cycling industry.

Although research into bicycle theft is limited compared to other volume crimes, analyses of data from the International Crime Victim Survey indicate that cyclists are approximately three times more likely to have their bikes stolen than car owners are to have their cars stolen, or motorcyclists to have their motorbikes stolen (Sidebottom et al., 2009). In England and Wales, the total reported bicycle thefts in 2023 amounted to 68,612 (ONS, 2024). According to the Police Recorded Crime by Police Force Area data, the areas with the highest number of bicycle thefts are Thames Valley with 3,581, Manchester with 3,026, and Avon and Somerset with 2,240 (ONS, 2024). However, the largest number of bicycle thefts occurred in London, with 16,174 bikes stolen in 2023 (MPS, 2024). The highest number of bike thefts in London was reported in the Hackney Borough, with 1,412 incidents in 2023, followed by Tower Hamlets with 1,282 in the same year. This was anticipated due to the size and population density of the areas covered by these police forces compared to other regions across England and Wales (NPCC, 2019)

It is noteworthy that the number of bike thefts has been decreasing for three consecutive years, both nationally across England and Wales, and in London. England and Wales experienced a decrease of approximately 11.9% in bike thefts, with 77,876 reported in 2022 and 68,612 in 2023 (ONS, 2024). Similarly, in London, there was an 11.9% decrease in bike thefts reported to the Metropolitan Police Service, from 18,352 in 2022 to 16,174 in 2023 (MPS, 2024). To investigate why this is happening, it is important to determine whether the decrease in bike thefts is due to more effective police and prevention measures making it harder to steal bikes, or if it is attributable to a declining cycling population, although the latter would contradict TFL's (2023) claim that cycling in London is increasing.

Estimates of the volume of cycle theft using police-recorded crime data likely underrepresent the actual extent of the problem due to high levels of underreporting; typically, the police are informed about only one cycle theft for every five that occur (Sidebottom et al., 2009). This is old data that has been repeated several times in the literature, and no recent findings are available to confirm this number or to understand if underreporting has changed over time. A significant factor contributing to this underreporting is the low recovery rate of stolen bicycles; police data indicates that only 3% of stolen bicycles are recovered (NPCC, 2019), which may discourage victims from reporting thefts as they perceive little chance of retrieval. Furthermore, crime figures categorize bicycle theft as a low-volume offense, accounting for just under 2% of all police-recorded crime in England and Wales (NPCC, 2019). Nationwide, bicycle theft is considered a low-priority crime in terms of the social harm it causes (Levy et al., 2018).

Impact of Bicycle Theft on Cycling Behaviour

Both the occurrence of theft and the fear of bicycle theft have been found to discourage cycling (Sidebottom et al., 2009). In regard to non-cyclists, the Cycling Action Plan 2 indicates that 69% of non-cyclists are deterred from cycling due to fear of their cycle being stolen (TFL, 2023). Those who have experienced bike thefts, as indicated by a recent study conducted by Sax & Honey-Rosés (2023) in Barcelona, replicated findings from the literature, revealing that 17% of victims whose entire bikes were stolen discontinued cycling after the incident. The newest research by

Cohen et al. (2024), which involved an online survey across North America (United States and Canada), shows similar results. Among overall participants, 15% discontinued their bicycling activities altogether, and 30% showed diminished activity in bicycling. The negative impact is more pronounced among those who do not recover their stolen bicycles. Among those who could not recover their stolen bicycles, 17% stopped cycling altogether, and 31% reported a reduction in their cycling activity. In comparison, among those who successfully recovered their bicycles, 22% decreased cycling, and a mere 6% stopped bicycling following recovery. This trend aligns with previous mentions in literature that many bicycle theft victims do not buy a replacement (Johnson et al., 2008).

The reduction in bicycling activity after the bike theft, as explored in the Cohen et al. (2024) study, depends on the number of bikes owned by the victim. Among single bicycle owners, 47% exhibited a reduction in bicycling activity, with 37% bicycling less and 10% stopping entirely. In contrast, the decline in future ridership decreased to just 20% for individuals owning five or more bicycles, and none from this group discontinued bicycling. Although these findings do not directly indicate socioeconomic status (SES), it can be inferred that individuals with more bicycles are likely from higher-income households. This is because they can afford multiple bikes and have the space to store them at home. In any case, the consequences of bicycle theft are more severe for individuals with lower incomes (Cohen et al., 2024).

From the crime perspective, a single bicycle theft does not necessarily equate to one offense but may lead to a series of related crimes. Studies suggest that victims of bicycle theft sometimes either steal bicycles themselves to compensate for their loss or knowingly purchase bicycles that are themselves stolen (Johnson et al., 2008). This complex cycle of theft and re-theft highlights the broader social and economic impacts of what may initially appear to be isolated incidents. There are also significant indirect impacts on society that must be considered if victims stop cycling and choose a less sustainable mode of transportation. Notably, 40% of individuals who experienced bike theft switched from bicycling to less sustainable transportation options after their bikes were stolen (Cohen et al. 2024). According to Chen et al. (2018), such changes in transport behaviour can negatively affect public health, increase greenhouse gas emissions, and reduce overall quality of life.

In regard to bike theft as a barrier to cycling in general, according to research conducted by 2CV (2021), bike theft is the third biggest barrier to cycling for non-cyclists, affecting 66 percent of respondents. This issue comes after concerns about road safety, which impact 82 percent of participants, and personal safety worries, which affect 69 percent. However, for regular cyclists, the order of barriers changes a bit. In this group, bike theft is the second biggest concern, affecting 78 percent of respondents, just behind road safety and collision worries, which affect 80 percent.

Preventive Measures and Practical and Theoretical Application of Bike Theft Prevention.

Preventive Measures and Responses to Bicycle Theft

Johnson et al. (2008) classify responses to bike theft into four categories based on how they aim to reduce crime: (1) interventions designed to detect bicycle thieves; (2) responses that aim to deter bicycle theft by focusing on the registration and recovery of bicycles; (3) schemes aiming to improve bicycle parking facilities; and (4) schemes seeking to increase the use of locks and the manner in which they are applied. There is a fair amount of literature discussing locks and locking practices as suggested interventions to reduce bicycle theft (Johnson et al., 2008; Sidebottom et al., 2009; Sas et al., 2022), especially regarding educating the public on how to effectively lock their bikes. However, as Johnson et al. (2008) emphasize, it is critical to tailor responses to local circumstances and to justify each response based on reliable data analysis. In most cases, an effective strategy will involve implementing several different responses. For instance, while adding additional appropriate facilities can address the issue of fly-parking in areas where bike parking is not available (Johnson et al., 2008), other efforts may be required in some cases. These areas are generally less secure than those with purpose-built facilities. In many areas, improving parking furniture is crucial. The design and type of bicycle parking furniture used is important not only for security but also because it can influence cyclists' locking practices (Johnson et al., 2008). For example, M stands encourage cyclists to lock the frame and both wheels, as recommended.

Registering bike frames as a preventive measure is also very important. Many bikes that are found cannot be returned to their owners because there is no proof of ownership. Registration makes it much more difficult for criminals to get away with reselling stolen bikes and makes it easier for the police to catch and prosecute thieves. Bike Register, the UK's only police-approved cycle database. By registering their bikes, cyclists can ensure that if their bike is stolen and subsequently recovered, it can be traced back to them.

Routine Activity Theory and Technological Crime Prevention

Bike theft is a crime that can be examined from both macro and micro levels. At the macro level, we consider broader social and economic factors, such as overall crime rates, societal attitudes towards bike theft, and the effectiveness of community and law enforcement responses (Eck, 1995). In this paper I would like to focus on the micro level and Routine Activity Theory. Routine Activity Theory, a criminological concept introduced by Lawrence E. Cohen and Marcus Felson in 1979, explains the occurrence of crime. The theory identifies three essential elements necessary for most crimes: likely offenders, suitable targets, and the absence of capable guardians. The absence of any one of these elements can prevent crime from occurring (Schultz & Gordon, 2010). Here, I will argue that the presence of a guardian has the most significant effect on preventing bike theft.

As mentioned earlier, cycling is increasing, which in turn increases the opportunities for bike theft. We don't want to reduce the number of bikes in the city (suitable targets), as this would not be beneficial for society. Managing the offender element is more challenging because it relates to macro-level factors, such as economic conditions and attitudes towards bike theft (often viewed as

17

a low-value, low-priority crime). However, criminals make decisions based on perceived risks and rewards (Eck, 1995), and bike theft is seen as low-risk and high-reward. The chances of being caught are low, and the payoff from selling stolen bikes is high. Therefore, focusing on strategies aimed at reducing opportunities for crime, such as Situational Crime Prevention (SCP), will likely be the most effective approach for addressing bike theft. SCP aims to reduce crime by making it more difficult, risky, or less rewarding to commit, regardless of the offender's motivation or intent. This is achieved by implementing measures that deter offenders, minimize situational cues that may motivate criminal behaviour, or make it nearly impossible to commit the crime during specific events (Freilich & Newman, 2017). Unlike other criminological approaches that emphasize offender punishment or rehabilitation, SCP takes a distinct approach by concentrating on minimizing opportunities for criminal activity to occur (Freilich & Newman, 2017). In the context of bike theft, this involves putting effective guardianship measures in place. These guardians can include both human elements (e.g., security personnel, attentive bystanders) and environmental design features (e.g., improved lighting, secure bike racks, surveillance cameras). While public places and increased foot traffic can help prevent bike thefts, these measures do not always provide effective protection. Footage often shows that thieves are still able to steal bikes in busy areas, and the public is often too scared to intervene due to the potential danger. For example, one of my bikes was stolen in Oxford Circus next to the John Lewis shop. It was dark due to the late autumn, but it was a very busy street as it was early evening. Another incident occurred when my rear wheel, a very expensive part of the bike, was stolen just outside a local grocery shop in Canning Town, very close to the station and early in a day. People are understandably hesitant to engage with thieves as it can be too dangerous.

Ekblom (2017) suggests that technology can enhance the role of guardians in preventing crime. Technological innovation has been one of the main driving forces leading to the continuous improvement of crime control and prevention strategies, such as GPS tracking, tagging, and video surveillance (Ortega Anderez et al., 2021). In the context of bike theft prevention, several technologies have emerged to protect bicycles, including smart bike locks that can be controlled with a smartphone, GPS tracking devices, and connected bike alarms. However, there is limited evidence on the effectiveness of these technologies. It's important to remember that most of this technology should be used alongside traditional locking mechanisms; even a smart lock requires additional physical security. Securing a bike to a fixed point remains essential in preventing theft (Rothar, 2024).

Several factors must be considered when applying technology as a prevention measure. According to McQuade (2001), technology evolves on both sides: those preventing crime and those committing it. This co-evolution creates an ongoing "arms race" between crime and policing, where both adapt to each other's advancements. Second, while continuous innovation aims to enhance processes, products, and services, the actual benefits are often debatable. Not everyone agrees that new technologies or methods are better and more secure. Third, there's the cost: Creating technologically secure solutions is expensive, and it may not be worthwhile to secure a less expensive commuter bike. These solutions do not necessarily provide greater benefits or outweigh the costs for organizations and society (McQuade, 2001),.

However, in cases where the police cannot afford to investigate low-priority crimes, expecting them to focus extensively on bike thefts is impractical. This diverts their attention from more urgent

or important tasks, especially when there is little prospect of successfully solving the crime (Sax & Honey-Rosés, 2023). The Situational Crime Prevention (SCP) strategy, which is dynamic and encourages innovation, can transfer crime control responsibility from law enforcement to other organizations, both public and private, that are better suited to implement effective crime reduction measures (Freilich & Newman, 2017). In this context, entrepreneurs could further develop more secure and effective bike theft prevention products, especially considering that London is leading the way in digital transformation and modernization, aiming to become a 'smart city.' This involves using new information and communication technologies to enhance citizen well-being and make services more efficient, including improvements to safety and security (Laufs & Borrion, 2021).

Chapter 3: Methodology

To examine the impact of bicycle theft, I deployed a quantitative method using an online survey targeting recreational cyclists in London. The survey was primarily distributed through WhatsApp groups of recreational cyclists. Additionally, a social media platform, X, was used by a cyclist with many followers (@hackneyBikeFit) to further distribute the survey. As the social media post was reshared, it became more challenging to control the geographical scope of respondents, resulting in many responses from outside London.

In total, 466 responses were collected, of which 197 were from outside London, as survey participants had the option to indicate their location as either a London borough or outside London. Since the primary purpose of this research is to gather perspectives of recreational cyclists in London, my analysis focuses on the 269 responses from London residents. However, the data from cyclists outside London remains valuable for understanding the broader impact of bike thefts and comparing perspectives between London and other areas. This additional data, including demographic information, is discussed and compared in a separate section.

Survey Design

The survey questions were designed using Qualtrics online survey software to assess variables across five main categories: 1) Demographic and Socioeconomic Information: Including participants' age, gender, borough of residence, ethnic origin, and household income. 2)Frequency of Engagement in Different Types of Cycling: To determine whether recreational cyclists also use their bikes for transportation. 3) Impact of Theft Fear on Transportation Choices: Directly asking participants whether the possibility of their bike being stolen affects their choice to commute by bike and how this fear impacts their decisions. 4) Experience with Bicycle Theft: Including whether participants have experienced bike theft and what impact it had on them. 5) Perception and Preventive Measures: Aiming to explore what preventive measures participants currently use to protect their bikes and their perceptions of the most effective preventive measures.

Data Collection

An online survey was distributed between 2nd July 2024 and 17th July 2024 to adult recreational cyclists residing in London to assess their cycling experiences and attitudes towards bike theft in the city. As a keen outdoor cyclist myself, I have access to a few community-initiated cycling groups like Rogues CC, of which I am a member. Rogues CC has 157 members on WhatsApp. I also have contact with the Regents Park Cycling Leaders WhatsApp group, which has 73 leaders from various London clubs that use Regents Park for cycling. I don't have a direct access to the group. Therefore, I asked a credentialed person to post the survey to this group. This group represents the recreational cycling community of London's Regent's Park. The leaders were asked to distribute the survey to their respective clubs. I am unsure how many groups the survey was distributed to. However, based on the responses received, it appears that the distribution was limited. To reach a larger community, and get as many sample as possible I contacted the president of the UCL Cycling Club and asked for the survey to be distributed in their chat, as well as reaching out to other cycling communities like Dirty Wknd cycling club, Islington Cycling Club, and other smaller cycling communities. Additionally, towards the end of the survey collection period, the survey was distributed on the social media platform X, under the account @hackneyBikeFit. This post was widely shared, resulting in approximately 110 additional responses from London. This brought the total number of London responses to 269 out of the 466 total responses collected. In the main analysis, only 269 responses from London will be analysed.

The demographics of London participants revealed a diverse sample with notable trends. The gender distribution showed a majority of males (59%), followed by females (38%), and a small percentage of nonbinary individuals (1%). Ethnically, the sample was predominantly white (78%). Age distribution indicated a concentration in middle-aged groups, with 45-64 years old being the largest (54%), followed by 35-44 (23%), while younger age groups were less represented (18-34: 14%). Household income data showed a skew towards higher earners, with 37% reporting incomes over £100,000, followed by 36% in the £60,000-£99,999 range, and 27% of households earning less than £59,999, with 3% earning under £20,000. Educational attainment was notably high, with most respondents holding advanced degrees: 38% had Master's degrees, 37% held Bachelor's degrees, 9% had earned Doctorate degrees (PhDs), and 12% had a high school diploma. Geographically, participants were distributed across London, with a higher concentration in Inner London areas (55%). Haringey had the highest representation (16%) among all boroughs. Following Haringey, Hackney and Camden each accounted for 9% of the participants.

Ethical Considerations

Originally, a mixed-methods approach, integrating both quantitative and qualitative techniques, was planned, including surveys and focus group discussions. However, due to time constraints and the desire to focus on the quality of the analysis, I decided to proceed with a survey using quantitative methods. However, all necessary ethical preparations were completed for both the surveys and potential discussion groups. This included obtaining informed consent from participants, providing a participation information sheet, and conducting risk assessments. The study was registered and approved by the Data Protection Office, ensuring compliance with data

protection regulations. The research was identified as low risk, as it did not involve vulnerable populations. Participants were all adults.

To ensure ethical integrity, the survey was designed to minimize any potential psychological or emotional distress. Questions were carefully crafted to avoid causing stress to participants. Additionally, every question included an option for participants to choose "prefer not to say." Qualtrics online survey software was used for creating and distributing the survey with an anonymous link. The survey was distributed through WhatsApp group chats and the X social media platform, with clear guidance to ensure that participants understood their participation was anonymous and voluntary. All collected data is securely stored in UCL's OneDrive, following guidelines for data protection and confidentiality.

Chapter 4: Results

For analysing data, I have used Tableau, a tool for analysing, visualizing, and sharing data insights.

Before analysing the impacts of bike thefts, it is important to determine how often recreational cyclists already use their bikes for transportation. When participants were asked, "How often do you engage in cycling as a mode of transportation?", the results were encouraging (Figure1). A significant 68% reported using their bikes for transportation at least once a week, with 28% cycling daily and 40% cycling 3-5 times a week. Only 5% of respondents stated they never use their bikes for transportation, 4% use them once a month, and 8% use them rarely (less than once a month).
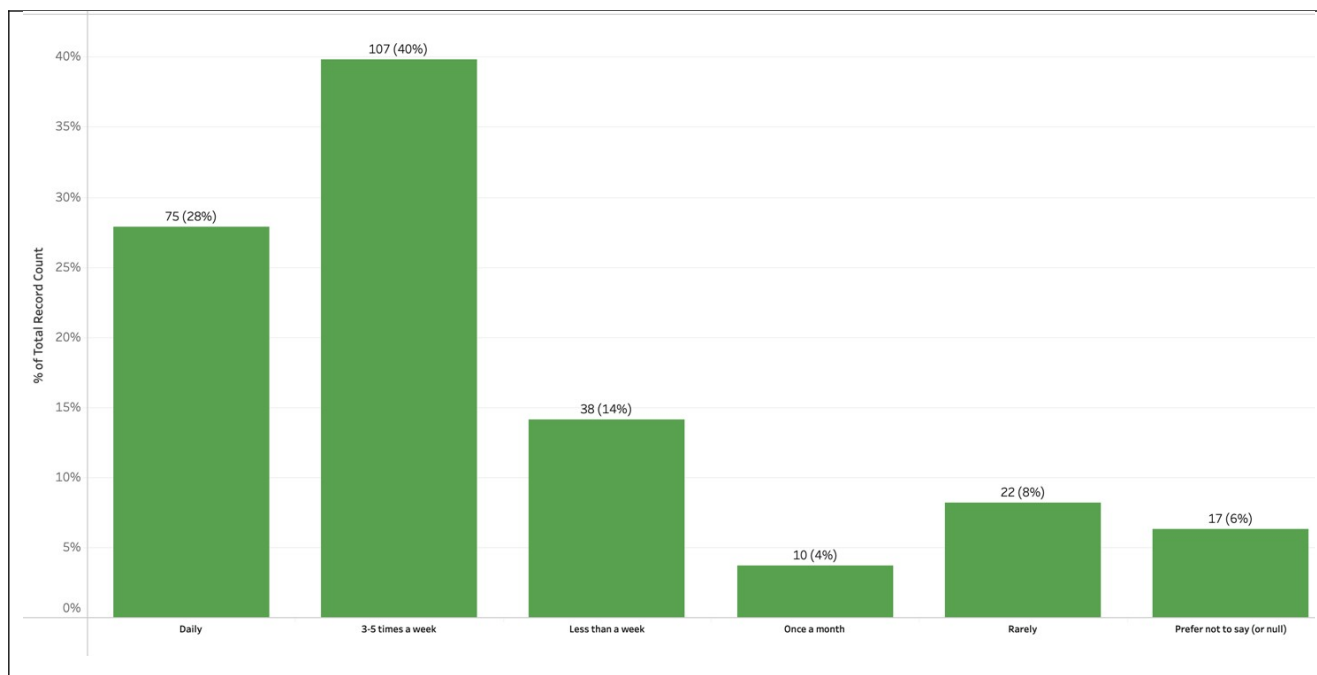

Figure 1: Frequency of Using Cycling as a Mode of Transportation *(Survey Question nr.7: "How often do you engage in the following type of cycling: Mode of Transportation?")*

How does the experience or perception of bicycle theft influence individuals' willingness to choose bicycles as a mode of transportation?

To answer the first main research question, the analysis focused on understanding two impacts: a general understanding of the impact of bike theft fear, independent of whether the respondent has personally experienced theft, and the specific experiences of those who have had their bikes stolen.

Bike Theft Experience

For the bike theft impact, participants were asked, "Have you ever had your bicycle stolen?" If they answered yes, the survey would navigate to a follow-up question: "How has the experience of theft impacted your cycling?". For analyses the responses were categorized into three groups: 1) Negative Impact on Environment, with examples such as "I completely stopped using my bike as a mode of transportation," "I stopped cycling for a period of time," or "I reduced the frequency of my cycling;" 2) Change in Behaviour, that wouldn't have any negative Environmental and Social impact, with examples like "I changed where I park my bike" or "I invested in better locks/security measures;" and 3) No Change, where participants reported that their cycling habits remained unchanged after the theft.

First of all, 60% of the respondents living in London reported that they had experienced bike theft (Figure 2).
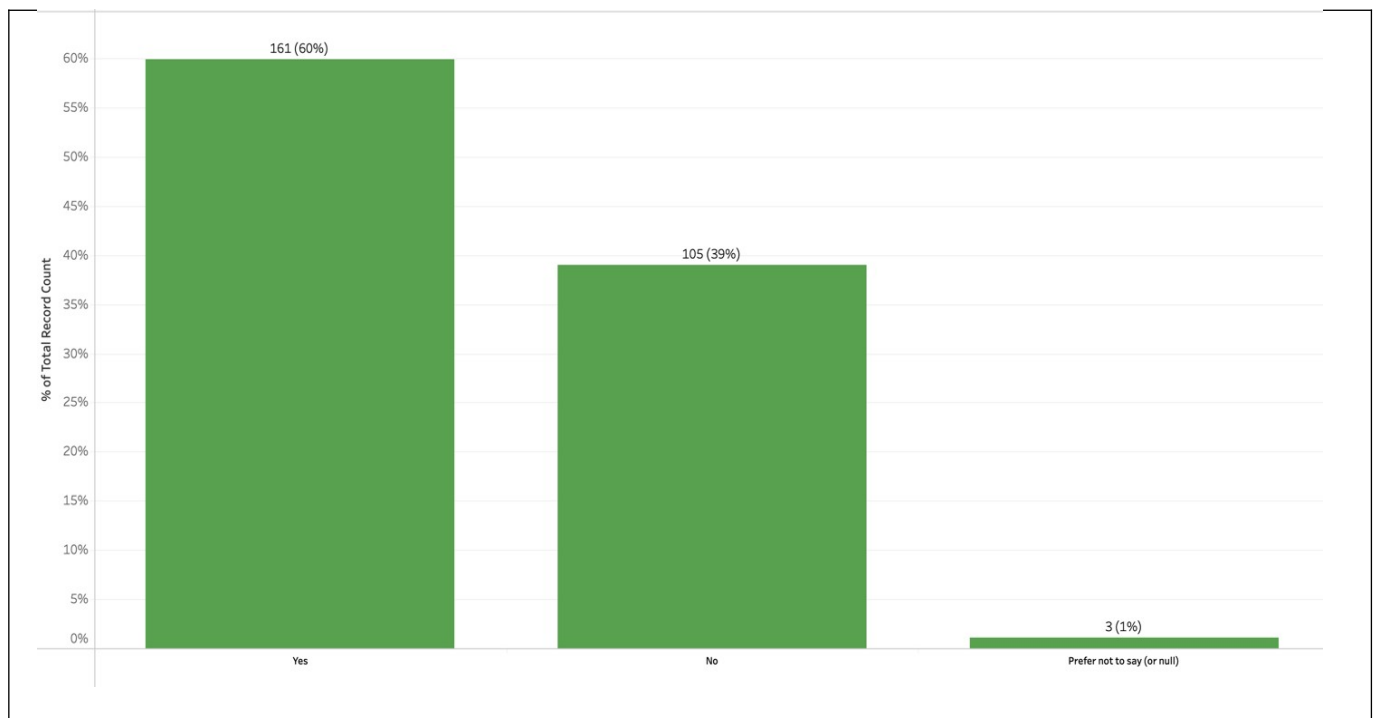

Figure 2: Bike Theft Experience *(Survey Question: "Have you ever had a bicycle stolen?")*

33% of the responses indicated that bike theft had a negative impact on the environment by significantly reducing or stopping their cycling activity. More than half (57%) of the decisions made after the bike thefts involved taking preventive measures to mitigate theft without discontinuing cycling, which didn't have a direct environmental impact. Additionally, 5% reported no change in their cycling habits (Figure 3).
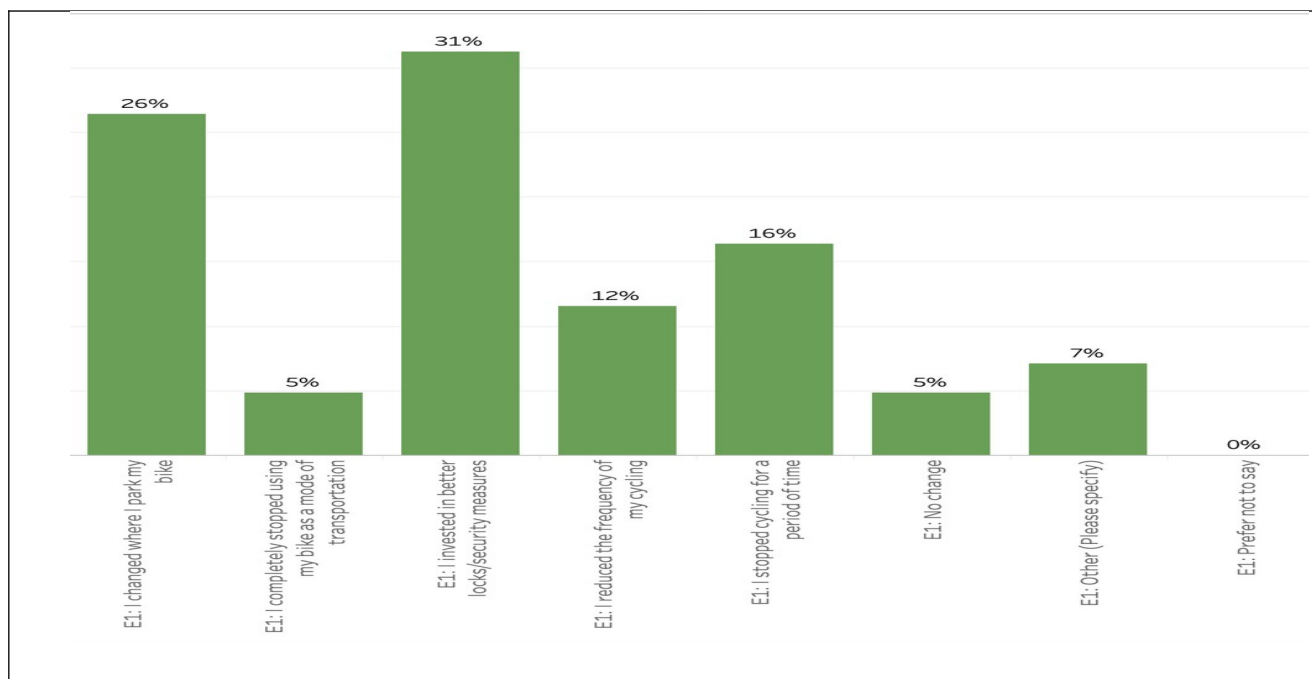

Figure 3: Impact of Bike Theft (Survey Question: "If yes, how has the experience of theft(s) impacted your cycling habits?")

Impact of the Fear of Bike Theft

The survey includes three dedicated questions exploring the impact of bike theft fear on participants. These questions assess how concerned they are about the possibility of their bike being stolen, whether this fear affects their decision to use their bike as a mode of transportation, and how specifically the fear of bike theft impacts their decision to use their bike. Responses to the last question were categorized into two distinct groups: (1) Negative Impact on Environment — this category includes participants who reported that they stopped or reduced their bicycling activity, opting for less sustainable transportation options (car, Uber, etc.); (2) No Negative Impact — this category comprises participants who stated that they use their bike regardless or that the fear doesn't affect the number of trips, indicating no negative social or environmental impact.

93% of the participants stated they are concerned about their bike being stolen, 4% were neutral, and only 8 participants responded that they are "Not Concerned at All." (Figure 4).
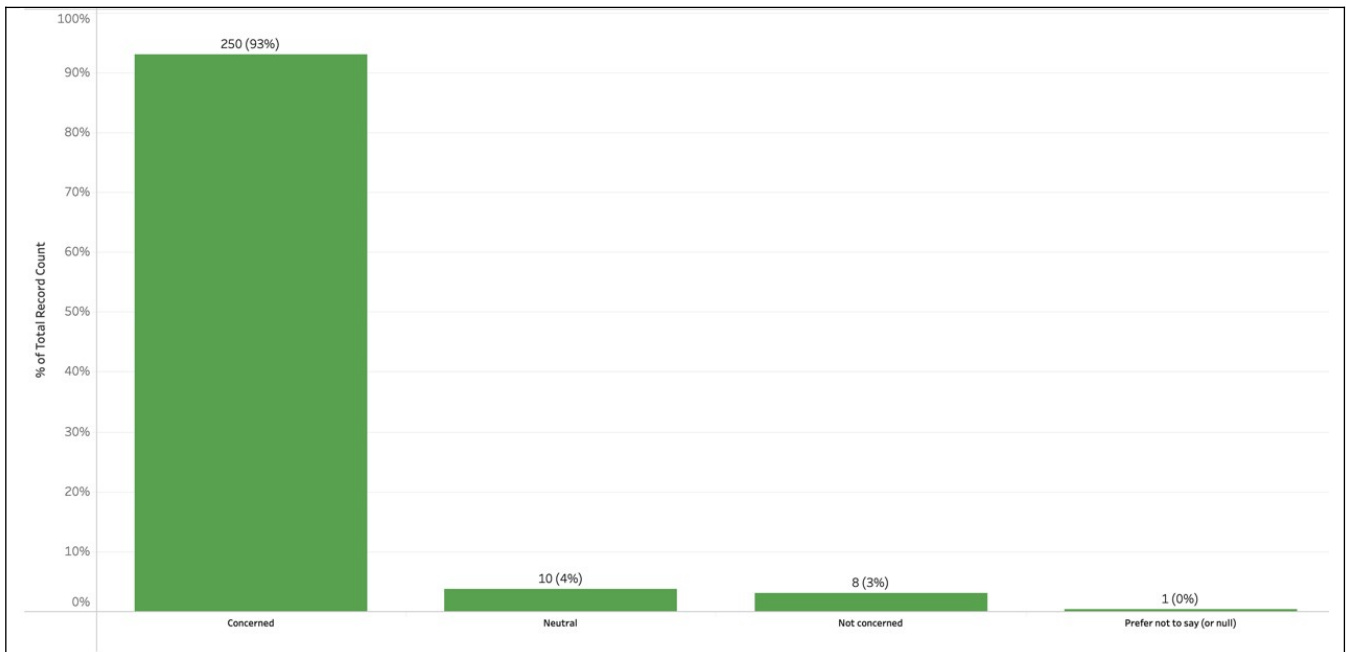
23

Figure 4: Concern about Bike Theft (Survey Question: "How concerned are you about the possibility of your bike being stolen?")

50% of the survey results indicate that the fear of bike theft has a high impact on recreational cyclists' decision to use bikes as a mode of transportation, 26% indicate a moderate impact, and 24% indicate that the fear has a very low impact (Figure 5).
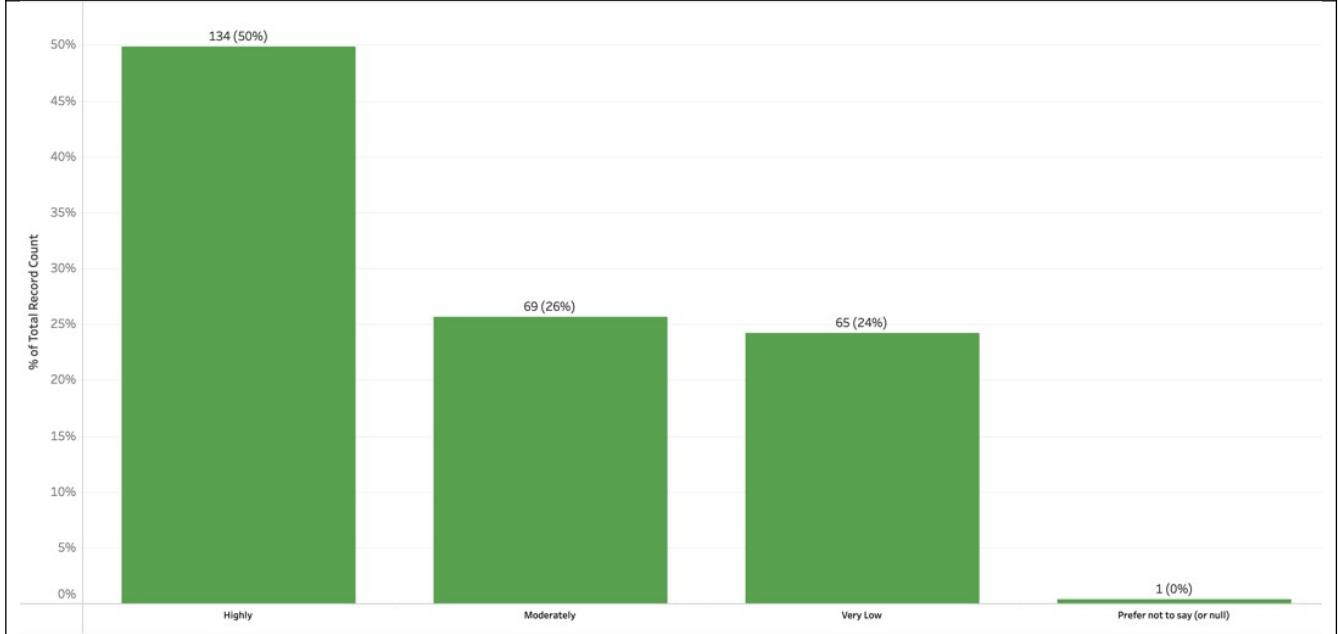

Figure 5: Impact on the Decision to Use a Bike as a Mode of Transportation (Survey Question: "Does the fear of bike theft impact your decision to use your bike as a mode of transportation?")

The results indicated that 50% of the travel choices made due to the fear of bike theft had a negative impact on the environment. The other half of the choices involved precautions such as carrying multiple locks (32%) or using a less expensive bike (41%), which do not have a direct negative impact on the environment (Figure 6)
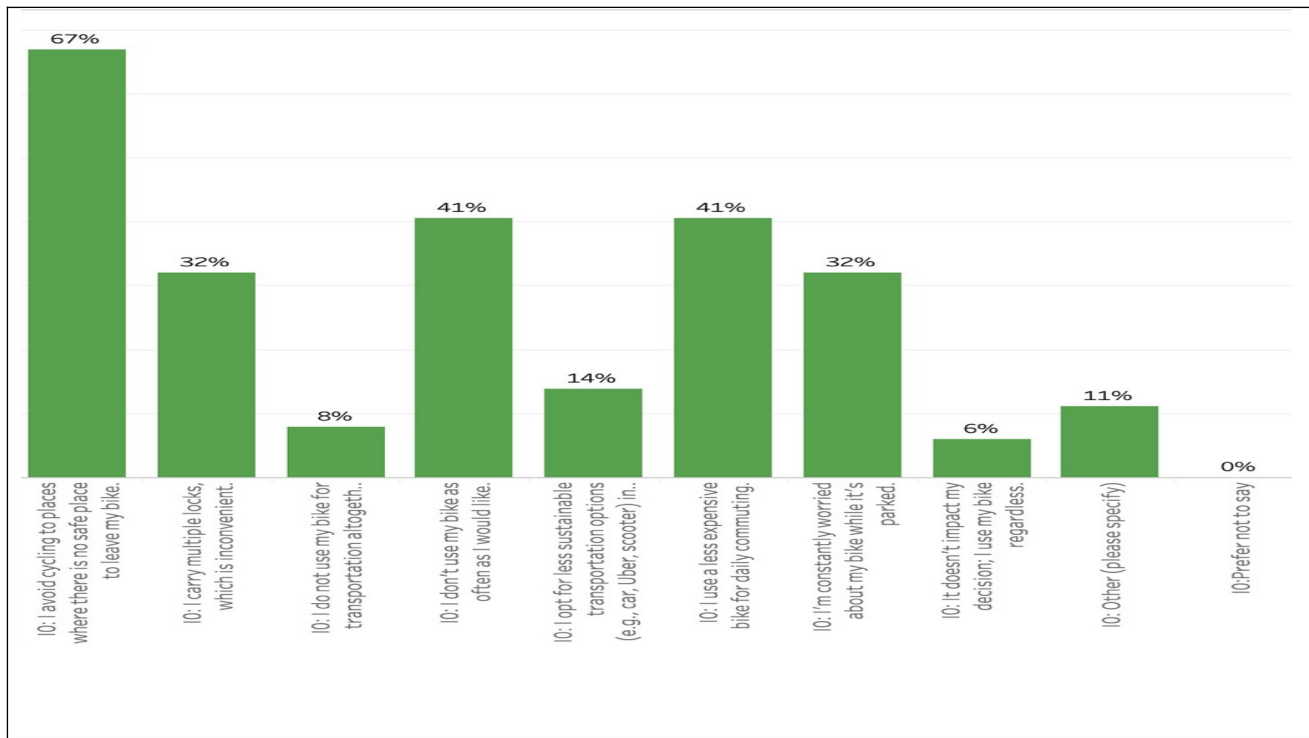
24

Figure 6: Specific Impact on the Decision to Use a Bike as a Mode of Transportation (Survey Question: "How specifically does the fear of bike theft impact your decision to use your bike as a mode of transportation?")

What prevention methods are perceived by recreational cyclists as most effective in reducing bike thefts and thereby encouraging their decision to cycle?

To answer the second research question, participants were asked what preventive measures they currently use, whether these measures are effective, and their opinions on what preventive measures would make them feel more secure about cycling and parking their bicycles.

The largest number of respondents reported that to avoid theft, they use U-locks (75%). A significant portion relies on secure parking facilities (41%). The least used preventive measure is alarm system (6%) GPS tracking devices (15%) (Figure 7).
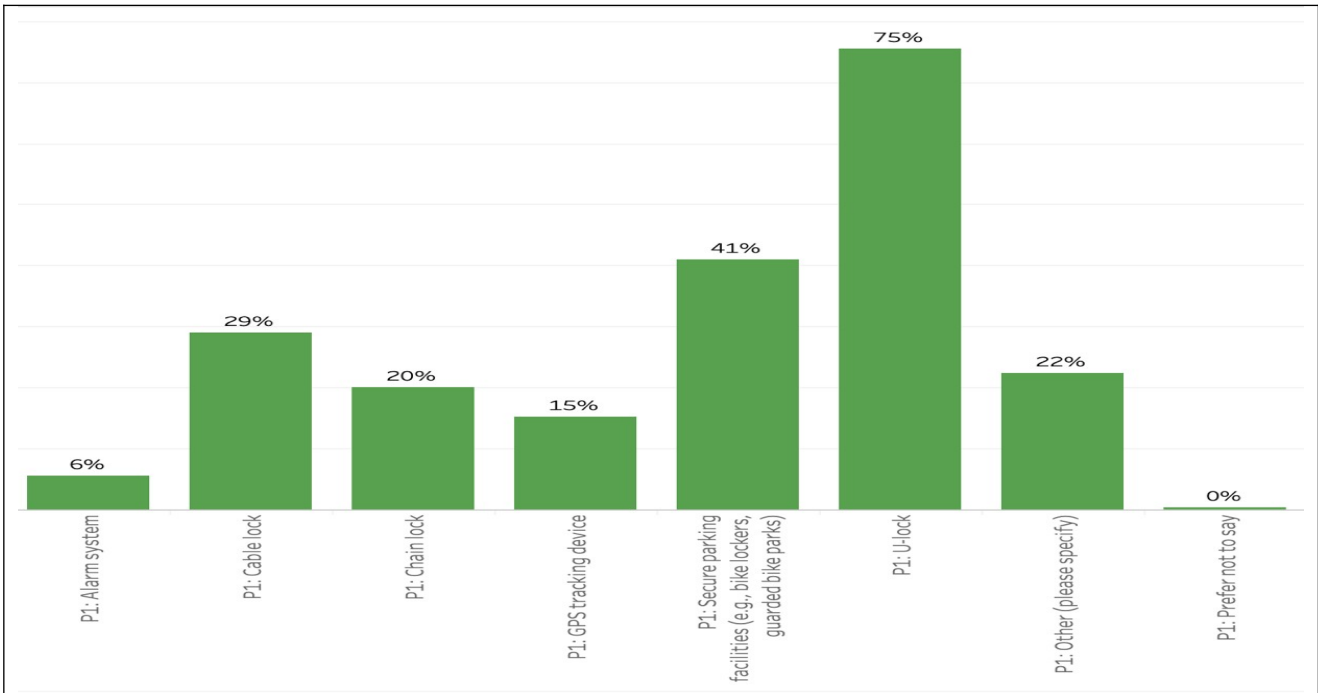
Figure 7: Preventive Measures Currently Used *(Survey Question: "Which of the following preventive measures do you take to avoid bike theft?")*

34% of the respondents think that these measures are low effective, 45% consider them moderately effective, and just 20% of the participants think that the measures they currently use are highly effective (Figure 8).
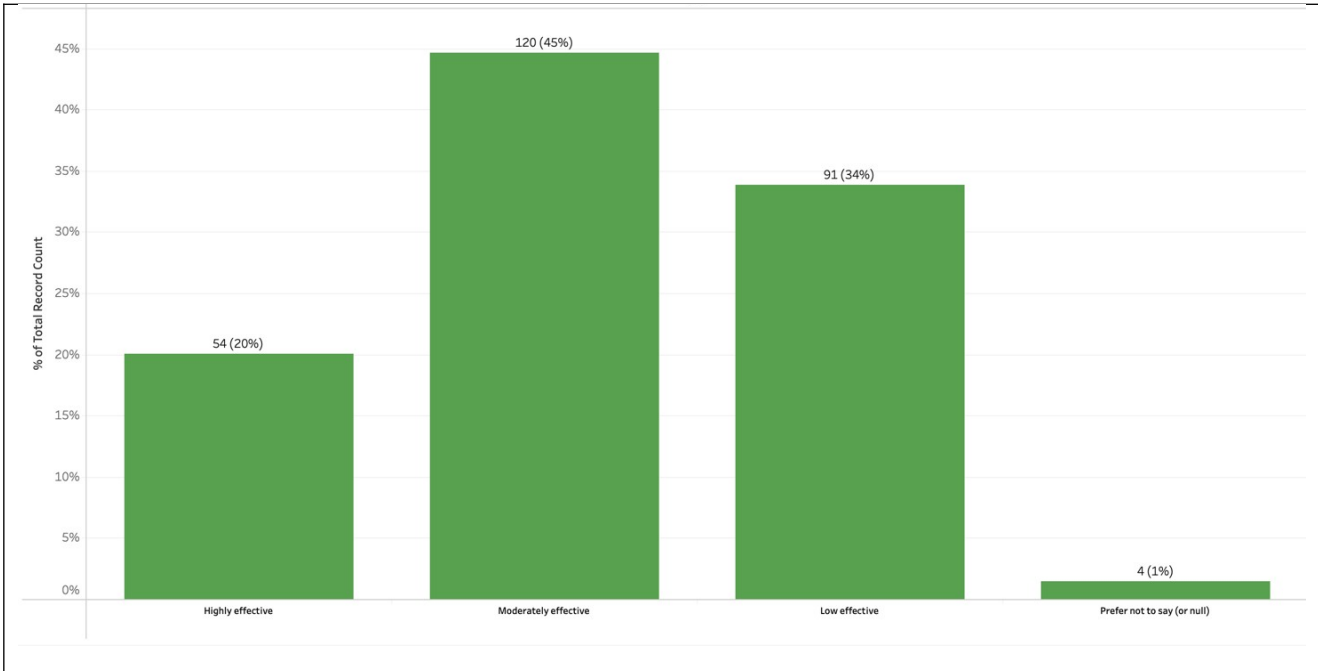

Figure 8: Effectiveness of the Preventive Measures Currently Used *(Survey Question: "How effective do you believe these measures are in preventing bicycle theft?")*

Most of the respondents (79%) believe that more secure parking facilities will make them feel secure, followed by technological solutions (51%) and increased police patrols in parking areas

26

(49%). The least effective measures according to the participants of the survey would be community watch programs (20%) (Figure 9).
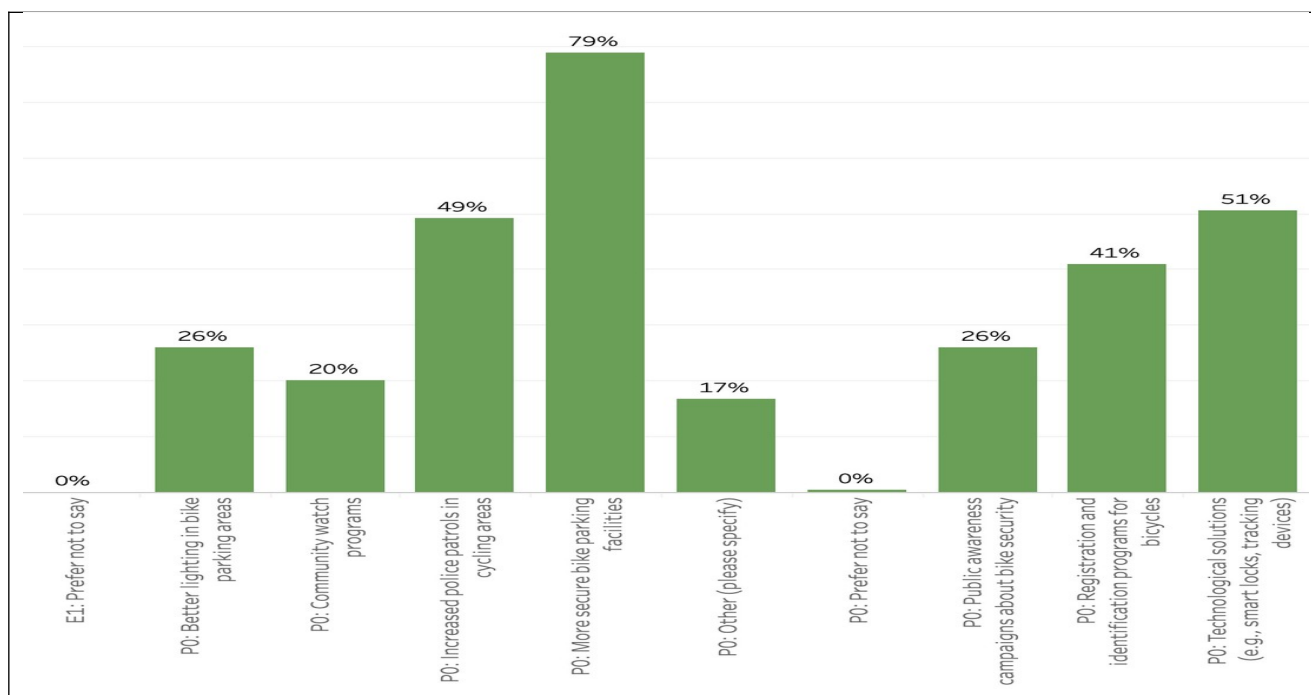

Figure 9: Perception of the Most Effective Preventive Measure *(Survey Question: "Which of the following measures would make you feel more secure about cycling and parking your bicycle?")*

Outside London

Demographics

The demographic profiles of recreational cyclists in London and outside of London exhibited both similarities and notable differences. Age distribution patterns were comparable, with a predominance of older participants in both regions. Outside of London, there was an even higher representation of older age groups, with 63% in the 45-64 range, 16% in the 35-44 range, and 14% in the 65+ range. Both regions had one participant over 75 years old. Notably, outside of London, there were no participants under 24 years old, and the 25-34 age group was less represented (6%) compared to London. Household income distribution showed similarities, with higher earners well-represented in both areas. However, the proportion of top earners (£100,000 and above) was lower outside of London at 19%, approximately half the percentage observed in London (37%). Outside of London had a slightly higher percentage of participants in the low-income bracket (less than £20,000) at 6%. The largest household income group outside of London was £60,000-£99,999 at 36%. Educational attainment was comparable, with most participants holding higher degrees in both regions. Outside of London showed a slightly higher percentage of PhD holders (14%) and Bachelor's degree holders (41%), but a lower proportion of Master's degree holders (28%) compared to London. The most significant demographic differences were observed in gender and ethnicity. Outside of London, there was a higher proportion of male

27

participants (72%) and a notably larger percentage of individuals identifying as white (94%) compared to London.

58% of participants outside of London use their bike as a mode of transportation regularly, at least once a week. The experience with bike thefts is similar to that in London, although the percentage is slightly lower. While 55% of respondents outside of London reported having experienced bike theft, this figure is almost the same as in the capital, indicating that bike theft is a widespread issue both in London and outside of it.

Impact of the Fear of Bike Theft

87% of participants living outside of London are concerned about their bike being stolen, which is slightly lower than in London. Additionally, a higher percentage, 9%, are 'not concerned' compared to those in London. The impact of the fear of bike theft outside of London is lower than that in London, with 43% stating that the fear has a high impact (7% less than those in London). However, 29% responded that it has a very low impact, more than in London. Similar to London, 51% of the choices made due to the fear of bike theft had a negative impact on the environment.

Preventive Measures

The most currently used preventive measure by cyclists who participated in the survey is the U-lock (74%), while the least used are GPS tracking (13%) and alarm systems (4%). Additionally, 22% think that the current measures are highly effective, and 30% think that they are minimally effective. Similar to Londoners, participants outside London believe that the most secure preventive measure would be 'more secure parking facilities' (91%), followed by technological solutions (43%) and increased police patrols in cycling areas (32%). However, trust in police patrols (32%) was significantly lower compared to London (49%).

Chapter 5: Analysis

Demographics

The survey revealed similarities with the literature review regarding cyclists' demographics, particularly gender. According to TFL 2023, in 2019, the proportion of women cycling was 38%, and our survey shows the same percentage of women respondents (Figure 10).
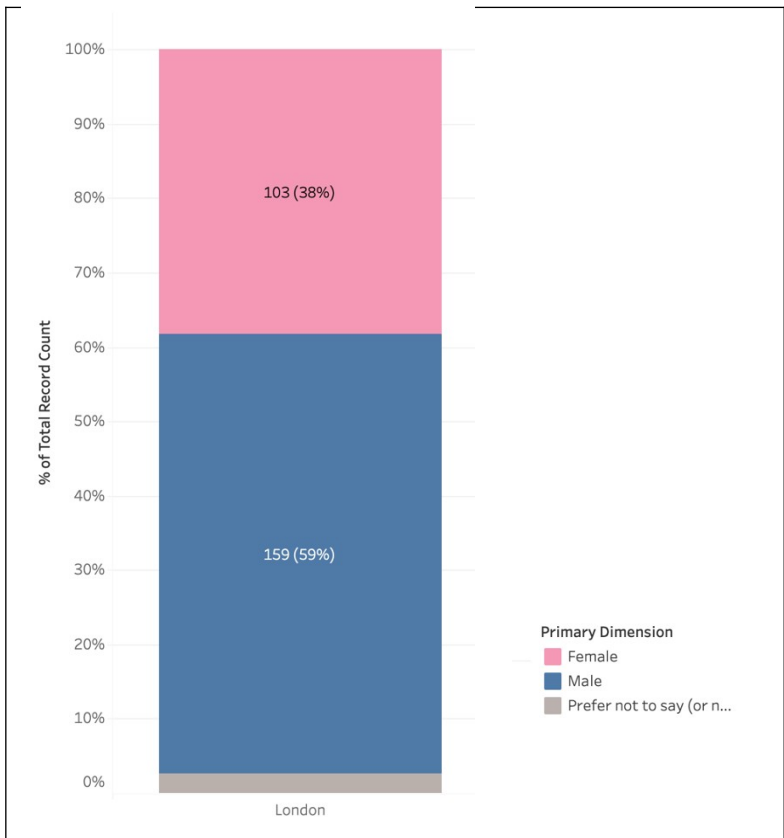
Figure 10: Gender Distribution *(Survey Question: "What is your gender?")*

Regarding ethnicity, research on the barriers to cycling among ethnic minorities is limited. TfL findings indicate that ethnic minorities are less likely to cycle (Bednarowska-Michaiel, 2023). This is confirmed by our survey, where the majority of respondents are White (78%), 54% of those are White British (Figure 11). It's worth mentioning that this comparison is focused on recreational cyclists, whereas the literature often discusses cyclists in general without distinguishing between different groups.
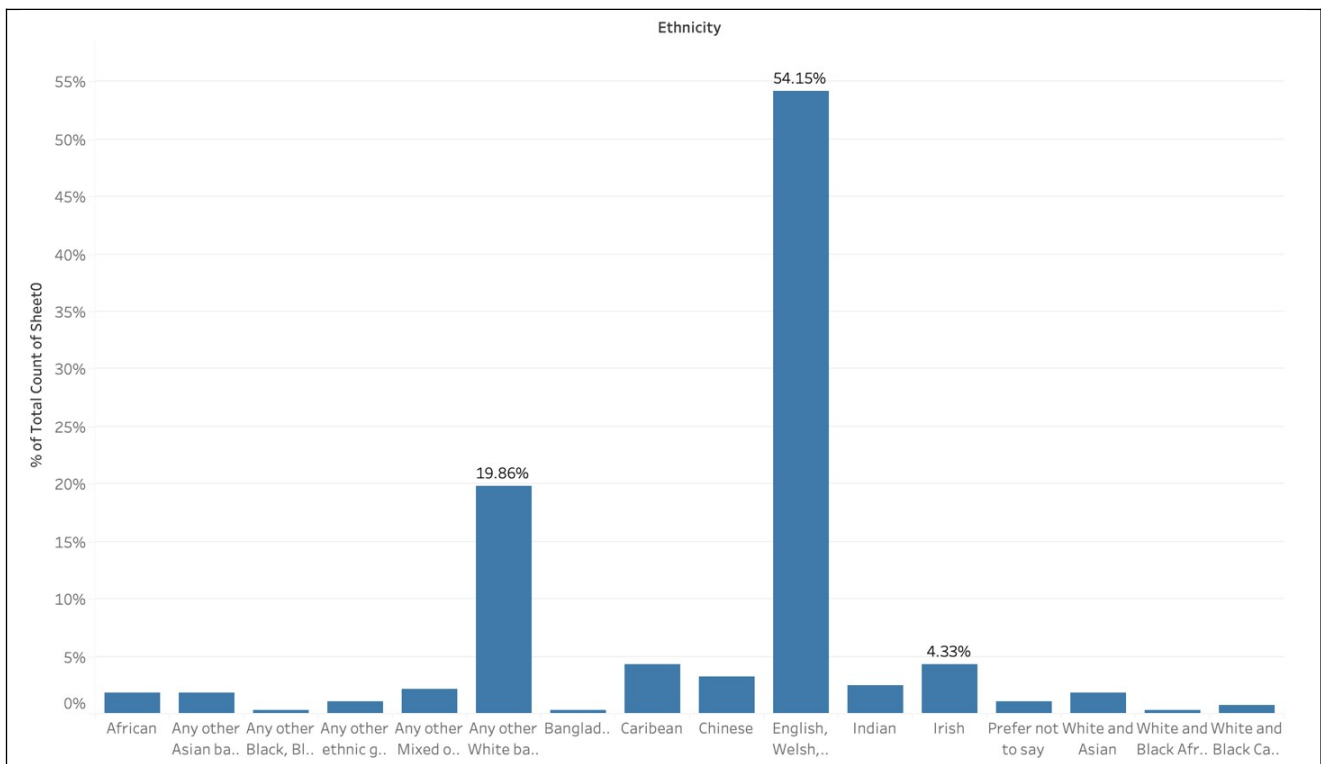
Figure 11: Ethnicity (Survey Question: "What is your ethnic group?")

Household income

The survey responses indicated that recreational cyclists in London tend to have high incomes, with a significant percentage (37%) of participants reporting household incomes of £100,000 or more, and 27% earning less than £59,999, with a very small percentage (3%) earning less than £20,000. This aligns with the literature, which suggests that leisure cycling, such as recreational cycling, is more prevalent among individuals with higher incomes (Vidal Tortosa et al., 2021).

Literature, such as Cohen et al. (2024), Aldred & Jungnickel (2014), and Anantharaman (2017), suggests that individuals with lower income levels are more likely to engage in consistent and frequent bicycling activity, primarily using bicycles for transportation purposes. This trend is reflected in our survey of recreational cyclists and their frequency of using bikes for transportation. Figure 12 shows that 83% of participants who ride frequently for transportation are from the household income group under £59,999. Specifically, 36% of this group ride daily and 47% ride 3-5 times a week, compared to participants with higher household incomes who ride less frequently for transportation. However, in the income groups £60,000-£99,999 and over £100,000, more than half of the participants (63% and 62%, respectively) still ride frequently for transportation.

Figure 12: Frequency of Using Cycling as a Mode of Transportation vs. Household Income *(Survey Questions: "How often do you engage in the following type of cycling: mode of transportation?" and "What is your household's total annual income before taxes?")*

On the other hand, Figure 13 shows that the highest income group rides recreationally more frequently (68%) compared to the £60,000-£99,999 household income group (51%) and the under £59,999 income group (57%).
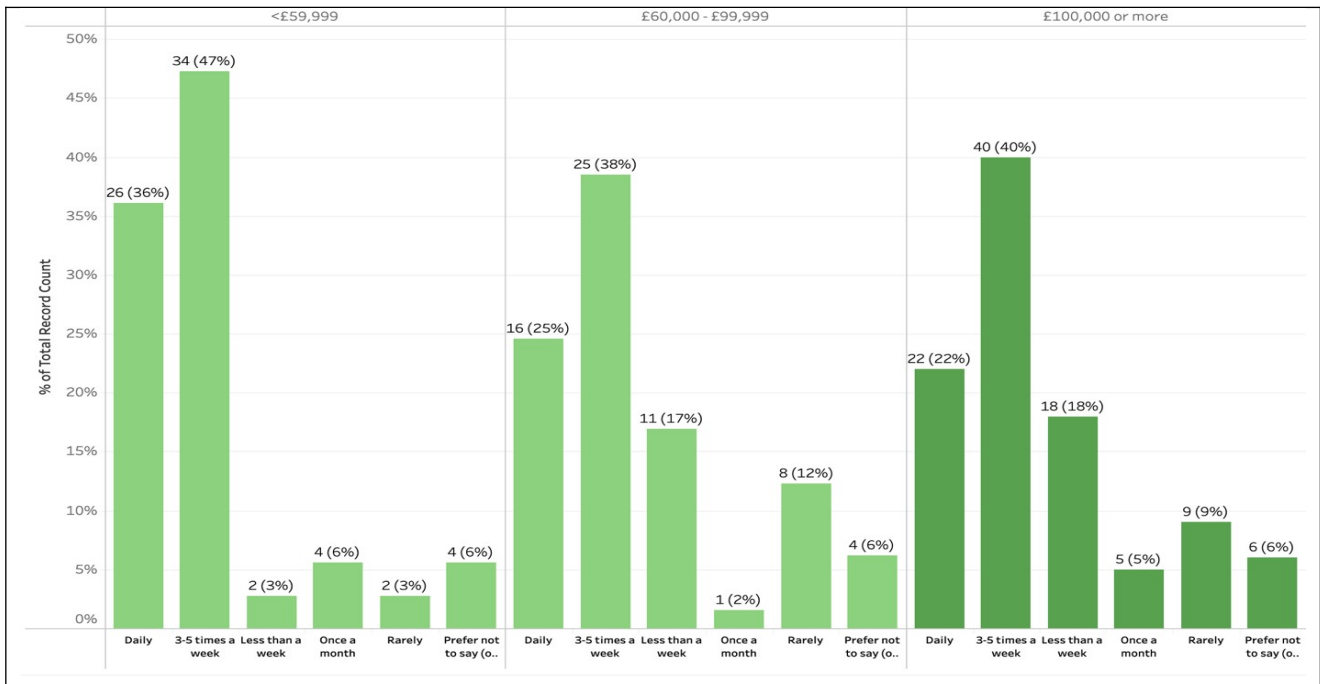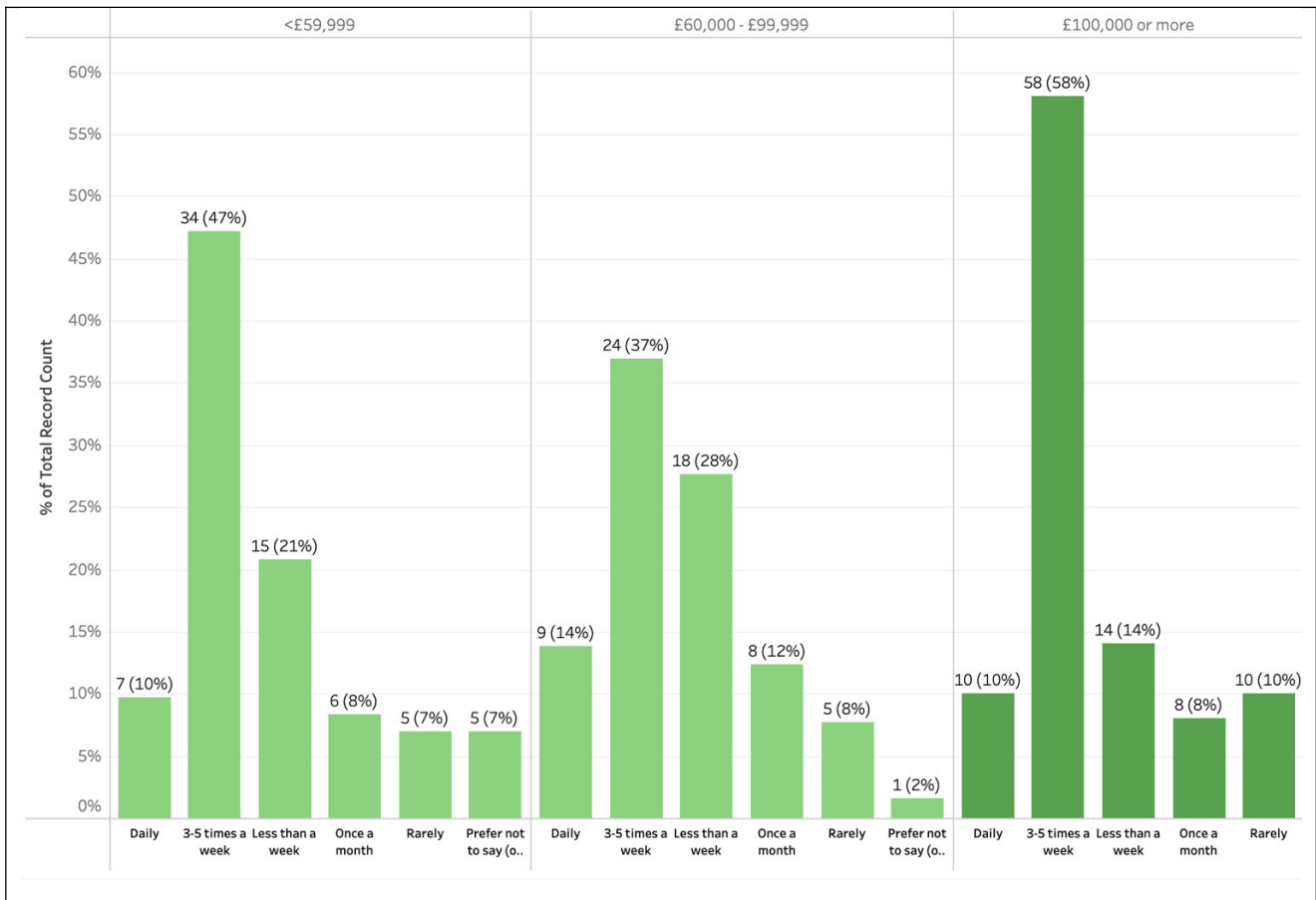
Figure 13: Frequency of Using Cycling Recreationally vs. Household Income *(Survey Questions: "How often do you engage in the following type of cycling: recreationally?" and "What is your household's total annual income before taxes?")*

Age

There are notable differences when comparing the survey results to the literature regarding cyclist age demographics. The TfL (2023) Cycling Action Plan revealed that the percentage of Londoners who used a cycle in 2020 was 36% for ages 16-34, 28% for ages 35-54, and 12% for those 55 and older. This contrasts with our survey results (Figurre 14), where the 35-64 age group makes up 78% of respondents. It's important to note that our survey participants were adults over 18 years old, and we lack data on those under 18. Interestingly, in our survey, the youngest group (18-34) made up the smallest percentage at 14%. This discrepancy might be attributed to the fact that recreational cyclists tend to be higher earners, and recreational cycling is often considered a hobby requiring some investment in bikes, gear, and equipment. This affordability typically comes with age.
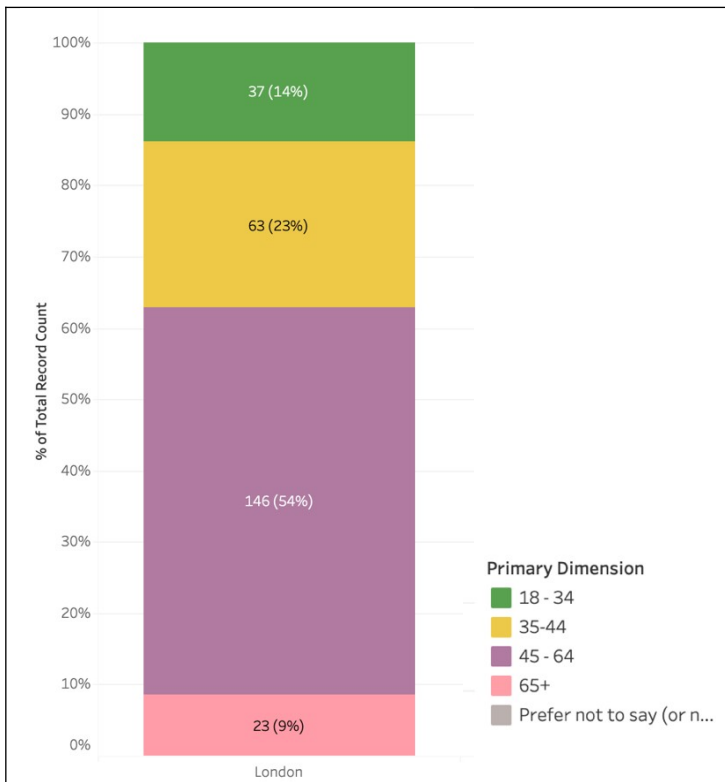
Figure 14: Age Distribution *(Survey Question: "What is your age?")*

Location

The literature review reveals that cycling infrastructure is predominantly concentrated in Inner London areas (Bednarowska-Michael, 2023). The network primarily consists of routes linking inner and central London (TfL, 2023). From the survey, we can see that a higher proportion of recreational cyclists (55%) are from Inner London. This pattern mirrors the distribution of cycling commuters, as most Outer London boroughs neither have a well-developed network nor a high proportion of cycling commuters as of 2011 (Bednarowska-Michaiel, 2023). The only exception is Haringey, which, although officially classified as an outer London borough, exhibits numerous traits typical of inner London boroughs due to its close proximity to Central London, excellent public transportation links, and demographic composition (London Borough of Haringey, 2010). Notably, Haringey had the highest representation (16%) (Figure 15) among all boroughs in the survey of recreational cyclists. There is a positive correlation between infrastructure and cyclability across boroughs (Bednarowska-Michaiel, 2023). This disparity in infrastructure might also contribute to ethnic inequalities in cycling, as regions with less developed cycling networks tend to have higher proportions of ethnic minority residents (Bednarowska-Michaiel, 2023). The similarity in patterns between commuter and recreational cycling suggests that infrastructure improvements could benefit both groups and potentially address these inequalities.
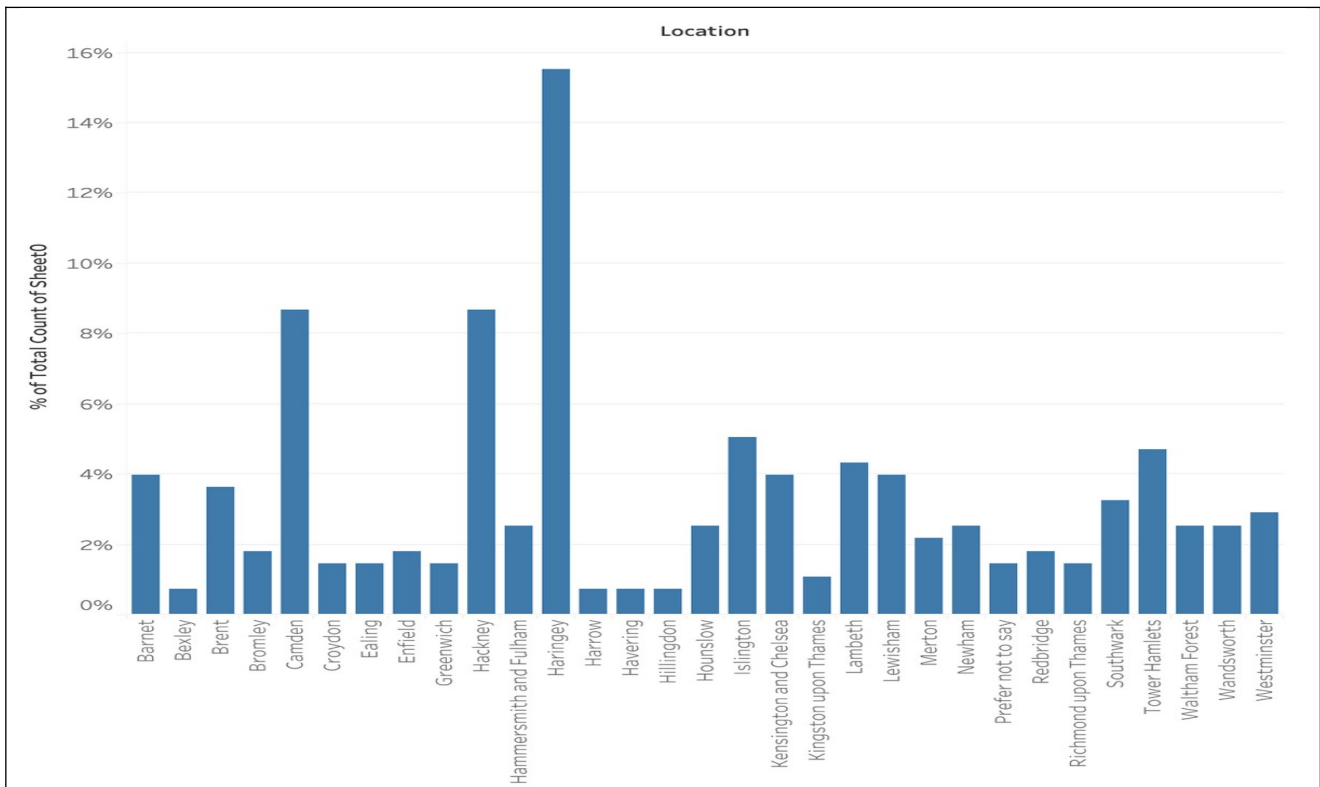
33

Figure 15: London Location by Borough *(Survey Question: "Which borough do you currently reside in?")*

Main Findings: Effectiveness and Usage of Bike Theft Preventive Measures

The analysis of the survey data provides insights into the effectiveness and usage of various bike theft preventive measures among London cyclists (Figure 16). First of all, there are no preventive measures currently used by cyclists that rate very highly on effectiveness. The U-lock emerged as the most popular preventive measure, with 75% of respondents using it to avoid bike theft. This measure is primarily employed by cyclists with lower levels of fear regarding bike theft, scoring around 3.3 on the fear scale, and is rated as moderately effective, with an effectiveness score of approximately 2.8. This widespread use suggests that U-locks strike a balance between effectiveness and practicality, making them a common choice for many cyclists. Secure parking facilities, although deemed the most effective preventive measure with an effectiveness rating of around 3.1, are not as widely used due to scalability issues within the urban setup of London. Cyclists utilizing these facilities report a moderate fear level of about 3.4, indicating a high perceived value of these facilities' security benefits. On the other hand, modern technological measures such as alarm systems and GPS tracking devices, while less popular (used by 15% and 6% of respondents, respectively) (Figure 7), are predominantly adopted by cyclists with the highest fear levels, around 3.6 to 3.7. Despite their lower perceived effectiveness (around 2.4 to 2.5), the high fear levels among their users. This indicates a need for more reliable and effective technological solutions that can better address the security concerns of these cyclists.
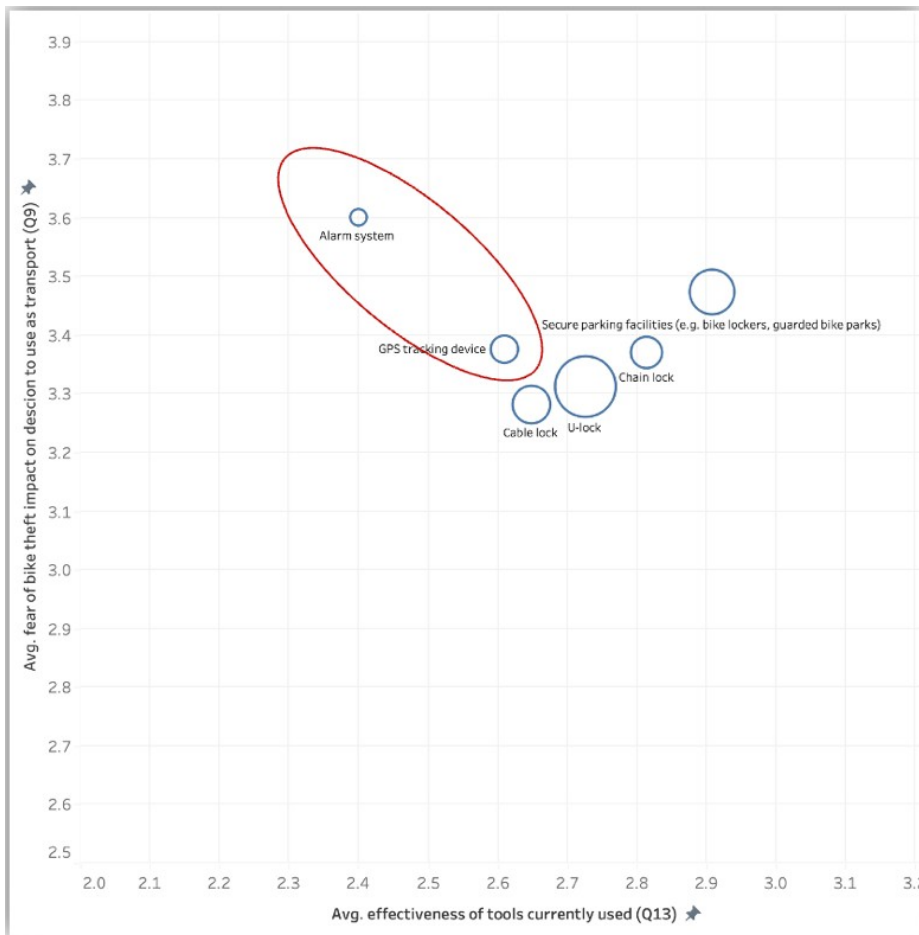
34

Figure 16: Effectiveness and Usage of Bike Theft Preventive Measures vs. Impact of Fear of Bike Theft on Bike Usage *(Survey Questions: "What preventive measures do you take to avoid bike theft?", "Does the fear of bike theft impact your decision to use your bike as a mode of transportation?", and "How effective do you believe these measures are in preventing bicycle theft?")*

Chapter 6: Discussion

Implementing Effective Bike Theft Preventive Measures in Urban Settings

From the theoretical framework discussed in the literature review chapter, eliminating crime requires addressing one of the crime elements: the offender, a suitable target, or the lack of a capable guardian (Sax & Honey-Rosés, 2023). Using Situational Crime Prevention strategies, which aim to reduce opportunities for crime by making criminal activities more difficult and riskier, we can adopt the survey opinions. 79% of respondents indicated that "more secure bike parking facilities" would be the best measure to make them feel more secure about cycling and parking. "Technological solutions" were the second most popular choice, with 51% of respondents supporting it. By adopting both of these preventive measures, which respondents see as most effective, we can make bike thefts more difficult by creating secure, unbreakable public bike locks in public spaces, making them secure bike parking facilities. Additionally, we can make bike thefts

35

riskier by adding technology that can notify the owner if tampered with and by adding alarms to the facilities or other innovations. It would be too difficult and time-consuming for a thief to break a very strong lock that cyclists don't have to carry with them while cycling (+convenience) and too risky with the added technology feature. This transforms a crime perceived as low risk, high reward into high risk, low reward. Although technology is currently not widely used as a preventive measure (with 15% using GPS trackers and 6% using alarm systems), Figure 16 shows that cyclists with the highest fear levels are willing to use them. Additionally, technological solutions receive high ratings from recreational cyclists regarding the measures that would make them feel more secure. However, Figure 16 indicates that there are no preventive measures currently used by cyclists in the market that rate very highly on effectiveness, creating a market gap.

This market opportunity for preventive measures products follows the principles of Situational Crime Prevention by promoting innovation and shifting some responsibility from law enforcement to other entities, including entrepreneurs who are willing to solve the bike theft problem. Implementing secure bike locks in public spaces using technologies as potential guardians also fits with Routine Activity Theory, which suggests that adding an appropriate guardian eliminates opportunities for crime.

Other Consideration

The fundings from the survey shows that 5% of respondents completely stopped using bicycles as a mode of transportation after experiencing bike theft (Figure 3). This percentage is slightly lower than previous findings, which reported that approximately 17-20% of cyclists discontinued cycling after a bike theft experience. The difference in percentages might be explained by the specific characteristics of the sample in the current study. For instance, if the study targeted recreational cyclists, who often own multiple bicycles, this could influence the results. Cohen et al. (2024) found that cyclists owning five or more bicycles were less likely to discontinue cycling after theft. However, without specific data on bicycle ownership in the current study, it's challenging to determine the exact correlation between the number of bikes owned and the likelihood of returning to cycling after theft in this group.

57% of respondents reported that after a bike theft, they changed their behaviour (Figure 3). Specifically, invested in better security measures and changed where they parked their bikes. The changes in victims' behaviour after a theft can be understood through the Routine Activity Theory, which posits that most thefts occur when there are likely offenders, suitable targets, and a lack of a capable guardian. Since cyclists cannot control the presence of bike thieves, they concentrate on preventing their bikes from becoming attractive targets or ensuring there is a capable guardian present (Sax & Honey-Rosés, 2023). To prevent their bikes from being suitable targets, recreational cyclists in London, as indicated by the survey, invest in new security mechanisms that increase the difficulty of theft, invest in better locks and security measures, or change where they park their bikes.

One of the strategies to make targets less attractive and to limit potential losses, adopted by many survey respondents (41%) (Figure 6), is using cheaper bicycles, which doesn't have a direct negative environmental impact. However, this approach comes with inherent risks. These lower-cost bicycles often have inferior components and construction, which can result in more frequent

36

mechanical failures or performance issues. This, in turn, may increase the likelihood of accidents, potentially leading to serious injuries for riders (Sax & Honey-Rosés, 2023). Additionally, the poor quality of these bikes can negatively impact the overall cycling experience, potentially discouraging regular use and undermining the benefits of cycling as a sustainable and healthy mode of transportation.

Chapter 7: Limitation and Recommendation

Limitation

The study examining the impact of bicycle theft on recreational cyclist behaviour offers important insights but faces several limitations. One significant limitation is the sample size and scope. With 269 London residents responding to the survey, the sample size is quite substantial. However, it may still not be fully representative of the broader population of recreational cyclists in London, potentially affecting the generalizability of the findings. While it is challenging to determine the exact number of recreational cyclists in London, the Regents Park Cyclists website, representing over 30 cycling clubs and approximately 5,000 individual cyclists, provides a conservative estimate. To achieve a 95% confidence level with a 5% margin of error, a sample size of 357 would be required. However, this estimate may still be inaccurate as not all recreational cycling clubs subscribe to the Regents Park Cyclists, and not every recreational cyclist belongs to a club. Identifying every recreational cycling group, let alone every individual cyclist, presents a significant challenge.

Another limitation of this study is potential sampling bias. The sampling method, which relied on distributing the survey through specific cycling groups and clubs, may not capture the experiences and opinions of recreational cyclists who are not affiliated with these organizations. While efforts were made to distribute the survey to diverse groups, ranging from UCL student clubs to women-specific cycling groups, as well as post on X platform, there is a possibility that the survey received more responses from groups with which the researcher is personally affiliated.

Additionally, there is the potential bias introduced by my involvement in developing a secure, unbreakable public smart bike lock. As a researcher working on this project, there is a possibility that my perspective on the effectiveness and necessity of such technological solutions could influence the interpretation of the survey results. To mitigate this bias, I have endeavoured to present the data objectively and transparently, relying on the survey responses and established theoretical frameworks to guide the analysis. Nonetheless, readers should be aware of this potential conflict of interest when considering the conclusions drawn from this research.

Recommendation

Throughout this research, an attempt was made to incorporate elements of the citizen science approach by involving members of the cycling community in addressing the problem of bike theft. As a researcher, I am also a part of these communities. Due to ethical considerations, such as access to personal data and the involvement of community volunteers, as well as time constraints,

a full citizen science approach was not implemented. However, I argue that for cycling communities, which are often self-initiated groups, a citizen science approach would be ideal for investigating the impact of bike thefts.

This approach aligns with Moore's (2023) observation that "citizen science is one way of working to unlock knowledge and value that exist in our local areas and communities" For instance, recruiting more volunteers from recreational cycling communities would help the research reach a broader, more diverse, and larger sample. This approach would also contribute to developing the kind of research that only locals can produce, as they have firsthand experience and unique insights into the issue (Woodcraft and Cook, 2024).

A citizen science approach in this context could harness community knowledge to tackle the complex challenge of bike theft, allowing for a more comprehensive understanding of its impact on cyclists and potentially leading to more effective prevention strategies. By engaging community members as active participants in the research process, we could gain deeper insights into the emotional and practical consequences of bike theft, while also empowering the community to contribute to solutions. This approach aligns with the principles of community-based participatory research, which emphasizes trust, transparency, and accountability in the research process. It would allow for a more equitable and inclusive approach to studying bike theft, potentially leading to more sustainable and community-driven solutions.

Future research is needed to conduct focus group discussions to gain a deeper understanding of the impact that bike thefts have on the choice to use cycling as a mode of transportation. These discussions should aim to identify more deeply the psychological impact of bike thefts on cyclists, as well as discuss preventive measures. For example, in addition to theft prevention, an alternative strategy is to acknowledge the possibility of bicycle theft and implement measures to address its consequences (Sax & Honey-Rosés, 2023). This approach includes several mitigation strategies that were not mentioned in the survey responses: Bicycle insurance: Implementing insurance coverage for bikes can help recover financial losses in case of theft, particularly relevant for recreational cyclists with more expensive bicycles. Bike-sharing systems: Utilizing bike-sharing services, such as Santander Cycles in London, can reduce the risk of personal bike theft while still providing a sustainable mode of transportation. In fact, the Santander Hire Scheme reported 8,531,168 hires in 2023 (Transport for London, 2024), demonstrating its popularity and effectiveness. Discussing these options during focus groups would strengthen the research by providing a more comprehensive view of theft prevention and mitigation strategies.

Chapter 8: Conclusion

The present study provides evidence of the adverse effects of the fear of bike theft on cyclists' choice to use cycling as a mode of transportation in London. 93% of respondents indicated that they are concerned about their bike being stolen, and 50% reported that the fear of their bike being stolen has a high impact on their decision to use their bike for transportation. Furthermore, because of fear of bike theft, 50% of their transportation choices have a negative impact on the

environment. These findings highlight a significant negative impact on society and urban prosperity. When individuals choose not to use bikes as a mode of transportation due to the fear of theft, it leads to increased reliance on motor vehicles, contributing to higher CO_2 emissions and exacerbating urban congestion.

The study has identified potential strategies to reduce bike theft by analysing survey responses, evaluating the most effective preventive measures, and applying theoretical frameworks. Recreational cyclists who participated in the survey expressed a lack of confidence in the effectiveness of current preventive measures, such as U-locks, which are the most popular preventive measure among recreational cyclists but do not score high on the effectiveness scale. In fact, none of the currently used preventive measures are rated highly effective. Secure parking facilities are rated as the most effective of the currently used preventive measures but are less widely used due to scalability issues. Surveyed cyclists believe that "more secure bike parking facilities" (79%) and "technological solutions" (51%) would be the most effective preventive measures. However, technological preventive measures like GPS trackers and alarm systems are currently not very popular, with only 15% and 6% of cyclists using them, respectively. These findings indicate a market gap for developing secure bike parking facilities equipped with technological preventive measures.

Implementing effective preventive measures, such as secure parking facilities and technological solutions in public areas, to make bike theft more difficult can lead to a positive chain reaction for society. Lowering the barriers to bike theft encourages more people to choose cycling as a mode of transportation. This shift benefits the physical and mental health of individual cyclists and has broader societal impacts. Increased cycling can improve air quality in urban areas and reduce congestion, contributing to the well-being of both people and the environment, which aligns with the redefined definition of prosperity.

Bibliography

Aizat, M. I., Zain, N. A. M., Hanafiah, M. H., Asyraff, M. A., & Ismail, H. (2023). Recreational Cycling Attributes, Perceived Value, and Satisfaction. Journal Name, Volume(Issue). https://doi-org.libproxy.ucl.ac.uk/10.1080/1528008X.2023.2243384

Aldred, R., Woodcock, J., & Goodman, A. (2016). Does more cycling mean more diversity in cycling? Transport Reviews, 36(1), 28–44. https://doi.org/10.1080/01441647.2015.1014451 . (Aldred et al., 2016)

Bao, L., Kusadokoro, M., Chitose, A., & Chen, C. (2022). Development of socially sustainable transport research: A bibliometric and visualization analysis. Transport and Behavior Studies. https://doi.org/10.1016/j.tbs.2022.08.012

Basford, L., Reid, S., Lester, T., Thomson, J., & Tolmie, A. (2002). Drivers' perceptions of cyclists (TRL Report TRL549). TRL Limited. https://trl.co.uk/reports/TRL549

Battiston, A., Napoli, L., Bajardi, P., Panisson, A., Perotti, A., Szell, M., & Schifanella, R. (2023). Revealing the determinants of gender inequality in urban cycling with large-scale data. EPJ Data Science, 12, 9. https://doi.org/10.1140/epjds/s13688-023-00366-5

Bednarowska-Michaiel, Z. (2023). Ethnic inequalities in cycling to work in London: Mobility injustice and regional approach. Regional Studies, Regional Science, 10(1), 475-488. https://doi.org/10.1080/21681376.2023.2186802

Bike Off 2 - Catalysing Anti-Theft Bike, Bike Parking, and Information Design for the 21st Century. Lead Research Organisation: University of the Arts London. Department: Central Saint Martins College. https://gtr.ukri.org/projects?ref=AH/E507956/1#tabOverview

Brand, C., Götschi, T., Dons, E., Gerike, R., Anaya-Boig, E., Avila-Palencia, I., de Nazelle, A., Gascon, M., Gaupp-Berghausen, M., Iacorossi, F., Kahlmeier, S., Int Panis, L., Racioppi, F., Rojas-Rueda, D., Standaert, A., Stigell, E., Sulikova, S., Wegener, S., & Nieuwenhuijsen, M. J. (2021). The climate change mitigation impacts of active travel: Evidence from a longitudinal panel study in seven European cities. Global Environmental Change, 67, Article 102224.

Bruno, M. (2022). Cycling and transitions theories: A conceptual framework to assess the relationship between cycling innovations and sustainability goals. Transportation Research Interdisciplinary Perspectives, 15, Article 100642. https://doi.org/10.1016/j.trip.2022.100642 .

Cambridge Dictionary. (n.d.). Definition of commute. Retrieved April 16, 2024, from https://dictionary.cambridge.org/dictionary/english/commute

Cervero, R. (2002) Built environments and mode choice: toward a normative framework, Transportation Research Part D: Transport and Environment, 7(4), pp. 265–284.

Chen, P., Liu, Q., & Sun, F. (2018). Bicycle parking security and built environments. Transportation Research Part D: Transport and Environment. https://www-sciencedirect-com.libproxy.ucl.ac.uk/science/article/pii/S1361920915300407

Clark, D. (2023, July 24). Bicycle theft in England and Wales 2002-2023. Statistics Reports. https://www.statista.com/statistics/303562/bicycle-theft-in-england-and-wales-uk-y-on-y/

Cohen, A., Nelson, T., Zanotto, M., Fitch-Polse, D. T., Schattle, L., & Herr, S. (2024). The impact of bicycle theft on ridership behavior. [Journal Name]. Published online 14 May 2024. https://doi.org/10.1080/15568318.2024.2350946

Department for Transport. (2020). Gear Change: A Bold Vision for Walking and Cycling. Department for Transport, London.

Department for Transport. (2024). National Travel Attitudes Study (NTAS) Wave 9: Cycling. Official Statistics. Published 18 January 2024.

Dill, J., & Carr, T. (2003). Bicycle Commuting and Facilities in Major U.S. Cities: If You Build Them, Commuters Will Use Them. Transportation Research Record, 1828(1), Article 10.3141/1828-14. Retrieved from https://doi-org.libproxy.ucl.ac.uk/10.3141/1828-14

Eck, J. E. (1995). Examining routine activity theory: A review of two books. Justice Quarterly, 12(4), 783-797. Abingdon: Taylor & Francis Group.

41

Ekblom, P. (2017). Crime, situational prevention and technology – the nature of opportunity and how it evolves. In M. McGuire & T. Holt (Eds.), The Routledge Handbook of Technology, Crime and Justice (pp. 353-374). Milton Park: Routledge.
https://crimeframeworks.com/wp-content/uploads/2023/02/crime-sit-prev-tech-opporty-how-evolves-ekblom-2017.pdf

European Cyclists' Federation asbl. (2014). Cycling and urban air quality: A study of European experiences (Dr. G. Hitchcock & M. Vedrenne, Authors; Prof. Dr. B. de Geus, Expert Review). Ricardo-AEA. https://www.ricardo-aea.com

Exploring the Relationship Between Leisure and Commuter Cycling Policy Analysis Research Summary. Transport for London, October 2011. https://content.tfl.gov.uk/exploring-the-relationship-between-cycling-leisure-and-utility-trips.pdf

Fraser, S. D. S., & Lock, K. (2011). Cycling for transport and public health: A systematic review of the effect of the environment on cycling. European Journal of Public Health, 21(6), 738-743. https://doi.org/10.1093/eurpub/ckq145

Freilich, J. D., & Newman, G. R. (2017). Situational crime prevention. In Oxford Research Encyclopedia of Criminology and Criminal Justice.
https://doi.org/10.1093/acrefore/9780190264079.013.3

Garrard J, Rose G, Lo SK (2008) Promoting transportation cycling for women: the role of bicycle infrastructure. Prev Med 46(1):55–59.

goldenballs1212. (2023, January 22). Hate towards cyclists on social media [Reddit post]. r/glasgow.
https://www.reddit.com/r/glasgow/comments/10q5za7/hate_towards_cyclists_on_social_media/

Golladay, K., & Holtfreter, K. (2016). The consequences of identity theft victimization: An examination of emotional and physical health outcomes. Victims & Offenders, 11(4), 741-760. https://doi.org/10.1080/15564886.2016.1177766

Götschi, T., Garrard, J., & Giles-Corti, B. (2016). Cycling as a part of daily life: A review of health perspectives. Transport Reviews, 36(1), 45-71. http://dx.doi.org/10.1080/01441647.2015.1057877
(Götschi, Garrard, & Giles-Corti, 2016)

Gundumogula, M. (2020). Importance of Focus Groups in Qualitative Research. International Journal of Humanities and Social Science, 8(11), 299-302. https://doi.org/10.24940/theijhss/2020/v8/i11/HS2011-082

Heckwolf, A., Scheer, A., & Wyckoff, P. (2024, March 12). Promoting active travel in London – benefits and barriers. https://www.lse.ac.uk/granthaminstitute/news/promoting-active-travel-in-london-benefits-and-barriers/

Heinen, E., van Wee, B., & Maat, K. (2010). "Commuting by Bicycle: An Overview of the Literature." In Transport Reviews, Vol. 30, No. 1, pp. 59–96, January 2010

Hollis, M. E., Felson, M., & Welsh, B. C. (2013). The capable guardian in routine activities theory: A theoretical and conceptual reappraisal. Crime Prevention and Community Safety, 15(1), 65-79. https://doi.org/10.1057/cpcs.2012.14

Hopkinson, L., Goodman, A., Kirkbride, A., Cairns, S., & Hiblin, B. (2024, March). Radical Transport Policy Two-Pager #11: The key to prosperity is a greener transport system. Radical Transport Policy Two-Pager #11.

J. Jarrett, J. Woodcock, U.K. Griffiths, et al. Effect of increasing active travel in urban England and Wales on costs to the National Health Service Lancet, 379 (9832) (2012), pp. 2198-2205, 10.1016/s0140-6736(12)60766-1

Johnson, S. D., Sidebottom, A. and Thorpe, A. (2008). Bicycle theft. Problem-Oriented Guides for Police Series. Washington, DC: US Department of Justice, Office of Community Oriented Policing Services https://heinonline-org.libproxy.ucl.ac.uk/HOL/Page?collection=journals&handle=hein.journals/eujcrim6&id=263&men_tab=srchresults

Keipi, T., Räsänen, P., Kajava, O., & Saarinen, A. (2018). The persisting link between physical recreation spending and education - the case of Finland. The International Journal of Sociology and Social Policy, 38(3/4), 182-193. https://doi.org/10.1108/IJSSP-08-2017-0101

Laufs, J., & Borrion, H. (2021). Technological innovation in policing and crime prevention: Practitioner perspectives from London. International Journal of Police Science and Management, 24(4), Article 146135572110640. https://doi.org/10.1177/14613557211064053

Ledsham, T., Zhang, Y., Farber, S., & Hess, P. (2023). Beyond downtown: Factors influencing utilitarian and recreational cycling in a low-income suburb. International Journal of Sustainable Transportation, 17(7), 740–761.

Logan, G., Somers, C., Baker, G., Connell, H., Gray, S., Kelly, P., McIntosh, E., Welsh, P., Gray, C. M., & Gill, J. M. R. (2023). Benefits, risks, barriers, and facilitators to cycling: a narrative review. Frontiers in Sports and Active Living, 5, 1168357. https://doi.org/10.3389/fspor.2023.1168357

London Borough of Haringey. (2010). Community Infrastructure Study. https://www.haringey.gov.uk/sites/haringeygovuk/files/lbh_community_infrastructure_study_2010.pdf

Low Traffic Neighbourhoods Research report (March 2024). Retrieved from https://assets.publishing.service.gov.uk/media/65f400adfa18510011011787/low-traffic-neighbourhoods-research-report.pdf

Macrotrends. (2024). London, UK Metro Area Population 1950-2024. Macrotrends. Retrieved June 7, 2024, from https://www.macrotrends.net/global-metrics/cities/22860/london/population

Márquez, L., & Soto, J. J. (2021). Integrating perceptions of safety and bicycle theft risk in the analysis of cycling infrastructure preferences. Transportation Research Part A: Policy and Practice, 150, 285–301. https://doi.org/10.1016/j.tra.2021.06.017

Martin, A., Morciano, M., & Suhrcke, M. (2021). Determinants of bicycle commuting and the effect of bicycle infrastructure investment in London: Evidence from UK census microdata. Economics & Human Biology, 41, 100945, 1-12. https://doi.org/10.1016/j.ehb.2020.100945

Mburu, L. W., & Helbich, M. (2016). "Environmental Risk Factors Influencing Bicycle Theft: A Spatial Analysis in London, UK." PLoS ONE, 11(9), e0163354. Published online 2016 Sep 19. DOI: 10.1371/journal.pone.0163354. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5028062/#pone.0163354.ref001

McQuade, S. (2001). Technology-enabled crime, policing and security. The Journal of Technology Studies. https://scholar.lib.vt.edu/ejournals/JOTS/v32/v32n1/pdf/mcquade.pdf

Metropolitan Police Service. (2024, February 22). Crime dashboard: Overview of crimes [data dashboard]. Tableau Public. https://public.tableau.com/app/profile/metropolitan.police.service/viz/MonthlyCrimeDataNewCats/Coversheet

Mintchev, N. (2024). What does it mean to redefine prosperity? A theory of definition for pathways to sustainable futures. Journal of Sociology, Published online. https://doi.org/10.1080/10350330.2024.2341388

Mintchev, N., Daher, M., Jallad, M., Pietrostefani, E., Moore, H. L., Ghamrawi, G., Al Harrache, A., Majed, A., & Younes, Y. (2022). Sustained Citizen Science From Research to Solutions: A New Impact Model for the Social Sciences. International Journal of Qualitative Methods, 21, 1–16. https://doi.org/10.1177/16094069221133232

Moore, Henrietta L. "Unlocking Knowledge within Local Communities as Part of 'Levelling Up'." University College London. Research management, 1 Aug 2023.

Moore, H. L., & Gore, C. (2015). Global Prosperity and Sustainable Development Goals. Journal of International Development, 27(6), 801-815.

Moore, H. L., & Mintchev, N. (2021, April). What is prosperity? Institute for Global Prosperity. (Moore & Mintchev, 2021) https://discovery.ucl.ac.uk/id/eprint/10126424/7/Moore_WP_What%20is%20Prosperity_DOI.pdf

Moore, H. L., & Woodcraft, S. (2019). Understanding Prosperity in East London: Local Meanings and "Sticky" Measures of the Good Life. City & Society, 31(2), 275-298. https://doi-org.libproxy.ucl.ac.uk/10.1111/ciso.12208

National Police Chiefs' Council. (2019). Cycle Safety & Security Plan 2019-2022. Retrieved from https://d2wmc3j6fsr8ll.cloudfront.net/BikeRegister/downloads/cycle-safety-security-plan-2019-2022/cycle-safety-security-plan-2019-2022-1573558392.pdf

Office for National Statistics. (2022, December 22). Regional ethnic diversity. Ethnicity Facts and Figures. https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity/national-and-regional-populations/regional-ethnic-diversity/latest/

Office for National Statistics. (2024). Crime in England and Wales: year ending December 2023. https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/bulletins/crimeinenglandandwales/yearendingdecember2023

Office for National Statistics. (2024). Crime in England and Wales: Police Force Area data tables. Retrieved from https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/datasets/policeforceareadatatables

Office for National Statistics. (2024). Recorded crime data by Community Safety Partnership area https://www.ons.gov.uk/peoplepopulationandcommunity/crimeandjustice/datasets/policeforceareadatatables

Ortega Anderez, D., Kanjo, E., Amnwar, A., Johnson, S., & Lucy, D. (2021). The Rise of Technology in Crime Prevention: Opportunities, Challenges and Practitioners Perspectives.

Osei, A., & Aldred, R. (2023). "You always think about what other people be thinking": Black men and barriers to cycling in London. Journal of Transport Geography, 103, 103576. https://doi.org/10.1016/j.jtrangeo.2023.103576

Physical Activity Guidelines Advisory Committee. (2018). Scientific Report to the Secretary of Health and Human Services. U.S. Department of Health and Human Services. https://health.gov/sites/default/files/2019-09/PAG_Advisory_Committee_Report.pdf

Race Disparity Unit. (2022, December 22). Regional ethnic diversity. Ethnicity Facts and Figures. GOV.UK. https://www.ethnicity-facts-figures.service.gov.uk/uk-population-by-ethnicity

Race Disparity Unit. (2023, December 14). Persistent low income. Ethnicity Facts and Figures. GOV.UK. https://www.ethnicity-facts-figures.service.gov.uk/work-pay-and-benefits/pay-and-income/low-income/latest/

Rahul Goel, Anna Goodman, Rachel Aldred, Ryota Nakamura, Lambed Tatah, Leandro Martin Totaro Garcia, Belen Zapata-Diomedi, Thiago Herick de Sa, Geetam Tiwari, Audrey de Nazelle, Tainio Marko, Ralph Buehler, Thomas Götschi Cycling behaviour in 17 countries across 6 continents: levels of cycling, who cycles, for what purpose, and how far? Transport Reviews, 42 (1) (2022), pp. 58-81, 10.1080/01441647.2021.1915898

Reid, C. (2022). New studies show some motorists hate cyclists, won't ever slow down when overtaking. Forbes. https://www.forbes.com/sites/carltonreid/2018/12/21/new-studies-show-some-motorists-hate-cyclists-wont-ever-slow-down-when-overtaking/?sh=9fe0e74622e9

Retrographic. (2024, January 28). Revolutionizing Bicycle Security: Technological Innovation in Bike Locks. Medium. https://medium.com/@retrographic/revolutionizing-bicycle-security-technological-innovation-in-bike-locks-a832cf12dead#:~:text=Gone%20are%20the%20days%20of,are%20emerging%20to%20deter%20thieves.

Rothar. (2024, April 2). Keeping your bike safe - products, technology and tips. https://rothar.ie/blogs/velostories/keeping-your-bike-safe-technology-locks-and-tips

Sas, M., Ponnet, K., Reniers, G., & Hardyns, W. (2022). Nudging as a crime prevention strategy: The use of nudges to improve cyclists' locking behavior and reduce the opportunities for bicycle theft. Volume 35, 463-485.

Sax, J., & Honey-Rosés, J. (2023). Bike Theft in Barcelona: Reporting Behaviour and Impacts on Cycling. Bellaterra: Universitat Autònoma de Barcelona. https://ddd.uab.cat/pub/trerecpro/2023/286669/JuliusSax_TFM2023.pdf

Sidebottom, A. "Bicycle Theft." JDiBrief – Crime Series. UCL Jill Dando Institute. https://www.ucl.ac.uk/jill-dando-institute/sites/jill-dando-institute/files/bicycle_theft_1-5_all.pdf

Sidebottom, A., Thorpe, A., & Johnson, S. D. (2009). Using targeted publicity to reduce opportunities for bicycle theft: A demonstration and replication. European Journal of Criminology, 6(3), 267-286. https://doi.org/10.1177/1477370809102168

Schaefer, L. (2021). Routine activity theory. In Oxford Research Encyclopedia of Criminology and Criminal Justice. https://doi.org/10.1093/acrefore/9780190264079.013.326

Schultz, S. J., & Gordon, S. J. (2010). Recreational cyclists: The relationship between low back pain and training characteristics. International Journal of Exercise Science, 3(3), 79-85. PMCID: PMC4738893, PMID: 27182332.

Smith, M. (2023, July 26). Britons have least favourable view of cycling of 12 countries. YouGov. https://www.yougov.co.uk/topics/travel/survey-results/daily/2017/09/19/edccf/2

Transportation Alternatives. (2022, October 19). Why everyone hates cyclists: Realistic group conflict theory and the plight of cyclists. Vision Zero Cities Journal. https://medium.com/vision-zero-cities-journal/why-everyone-hates-cyclists-66de63e23d72

Transport for London. (2020). Travel in London - Report 13. Transport for London. Available from https://content.tfl.gov.uk/travel-in-london-report-13.pdf (Transport for London, 2020)

Transport for London. (2023, December 6). New TfL data shows sustained increases in walking and cycling in the capital. Retrieved from https://tfl.gov.uk/info-for/media/press-releases/2023/december/new-tfl-data-shows-sustained-increases-in-walking-and-cycling-in-the-capital

Transport for London (TfL). (2024, May 31). Number of Bicycle Hires. Transport for London. https://data.london.gov.uk/dataset/number-bicycle-hires

Transport for London. (2023, June). Cycling Action Plan 2. Retrieved from https://content.tfl.gov.uk/cycling-action-plan.pdf

Vidal Tortosa, E., Lovelace, R., Heinen, E., & Mann, R. P. (2021). Cycling behaviour and socioeconomic disadvantage: An investigation based on the English National Travel Survey. Transportation Research Part A: Policy and Practice, 150, 25-39. https://doi.org/10.1016/j.tra.2021.08.004

Waring, C. (2022, May 1). Why do some motorists dislike cyclists so much? Personal Injury Blog. Road Traffic Accidents. https://www.mooneerams.com/blog/why-do-some-motorists-dislike-cyclists-so-much/

Wild, K., & Woodward, A. (2019). Why are cyclists the happiest commuters? Health, pleasure and the e-bike. Journal of Transport & Health, 13, 227-237. https://doi.org/10.1016/j.jth.2019.05.008

Woodcock, J., Franco, O. H., Orsini, N., & Roberts, I. (2011). Non-vigorous physical activity and all-cause mortality: systematic review and meta-analysis of cohort studies. International Journal of Epidemiology, 40(1), 121-138. https://doi.org/10.1093/ije/dyq104

Woodcraft, Saffron, and Joseph Cook. "How to Harness Community Knowledge to Tackle Complex Policy Challenges." University College London, Research Outreach and Communication Feature Article, Europe, 26 Jan 2024. (Woodcraft and Cook, 2024)

World Bank. (2023). CO2 emissions (metric tons per capita). Retrieved from https://data.worldbank.org/indicator/EN.ATM.CO2E.PC

Xiao, Y., & Watson, M. (2017). Guidance on conducting a systematic literature review. Journal of Planning Education and Research, 39(1). https://doi.org/10.1177/0739456X17723971.

2CV. (2021). Cycling potential in London's diverse communities. https://content.tfl.gov.uk/cycling-potential-in-londons-diverse-communities-2021.pdf (2CV, 2021)

Additional References used for grammar and sentence structure checks

OpenAI. (2024). ChatGPT (GPT-4) [Language model]

Perplexity. (2024). Perplexity AI [Language model].