Understanding and Encouraging Cycle Commuting in Workplace Setting: A Psychological Perspective

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Declaration

I declare that the work presented in this document is the original work of the author and that it has not been submitted for any other degree or professional qualification.

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Acknowledgements

Although my name is on this thesis, it is in no small part thanks to the support of the kind and generous people close to me that I have reached the end of my PhD studies.

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Abstract of Thesis

This thesis considers the roles that social cognitions play in cycle commuting behaviour. Currently in the field of active travel there is a strong drive towards ecological theories, which often focus on the wider environmental factors that influence cycling. However, research into utilitarian cycling and related physical activities suggests that psychological factors also have an important role to play. In light of the current political climate within the UK and the numerous benefits that cycling for transport can incur, it was deemed important to further explore the role that social cognitions play in the decision to cycle commute.

To date, there has been limited psychological research carried out into cycle commuting. Therefore, this thesis initially considers and critiques a number of relevant behavioural theories and psychological variables. The first study used semi-structured interviews along with interpretative phenomenological analysis (IPA) to explore the perception and attitudes of a group of cycle commuters (n = 8) and potential cycle commuters (n = 7) based in a workplace that supports cycling. The interest of this study was to identify if any differences and/or commonalities in social cognitions existed between the two groups. The findings indicated that potential cyclists are less aware of the range of benefits associated with cycling to work, and discussed more challenges and fewer coping strategies than regular and experienced cycle commuters. Whilst the study was inductive in nature, the findings to emerge suggest that cognitive variables involved in cycle commuting behaviour (motivations, barriers and coping strategies) could be aligned with a number of social cognition/ behaviour change theories.

The second and third studies were similar in design and used cross-sectional questionnaires to investigate perceptions of barriers (Study 2 & 3), perceptions of benefits (Study 3), self-efficacy (Study 3) and decisional balance scores (Study 3) related to cycle commuting behaviour. These social cognitions were measured in relation to stage of change, gender and job role. Both investigations were carried out in

workplaces that support cycling. Study 2 (n = 831) highlighted the important role that perceptions of barriers play in cycle commuting behaviour. Study 3 (n = 337) built on the previous two studies findings and demonstrated that perceived barriers and benefits and self-efficacy associated with cycle commuting were all significant predictors of cycle commuting behaviour, with barriers being the most powerful.

The forth and final study used a pre- and post-test control trial design to evaluate a psychologically-orientated intervention that was theoretically based on the Transtheoretical Model of Behaviour. The intervention was designed for people who were contemplating cycling to work. The small-scale intervention evaluation included one pre-test and two post-test measures that were collected over a four month period. The before and after results revealed that the intervention group (n = 17) significantly decreased their perceptions of barriers and progressed closer to action. This may be explained by increases in some of the processes of change that were reported. The control group (n = 16) reported no significant changes in their social cognitions, actions or in their use of the processes of change. These results suggest that the intervention designed, developed and trailed in this thesis is successful at encouraging people to cycle to work.

Together, these four studies demonstrate that social cognitions do play an important role in cycle commuting behaviour. Throughout this thesis, perceptions of barriers associated with cycle commuting have shown to play a powerful role in explaining and predicting behaviour. Whilst barriers can be both perceived (subjective) and actual (objective), the small-scale intervention study has demonstrated that by psychological intervention alone perceptions of barriers can be significantly reduced.

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Chapter 1
Utilitarian Cycling and Cycle Commuting: The Current Context

Aims of the Chapter

This chapter provides an overview of cycling for transport and cycle commuting within the current UK and Scottish context. Initially, the uptake of cycle commuting within the Scottish population is presented followed by evidence regarding the benefits and risks associated with cycling to work. Finally, key health and transport policy documents that underpin the recent focus on utilitarian cycling in today's political climate are presented. The aim of the discussion within this chapter is to provide a foundation for the rationale of this thesis.

1.1 Introduction

In the UK, the commute to work is one of the most common daily trips (Department for Transport, 2009a). National average figures indicate that commuting makes up 16% of all trips, taking a 19% share of overall distance travelled, with a further 3% of trips accounting for business taking a 9% share of overall distance travelled (Department for Transport, 2009a). In the latter half of the 20th century, technological advancements along with economic growth have led to increases in production and use of the motor car. This resulted in a rapid change in commuting habits, with a significant decline in train and bicycle use and a sharp increase in car use (Pooley & Turnbull, 2000). For instance, in the UK cycling for transport has declined from a modal share of 34% in 1949 to 1% - 2% in the 1990s (Hillman, 1992). Scottish figures suggest that single occupancy car use is still growing (Scottish Executive, 2009b) and forecasts predict that between 2005 and 2015, motorised road traffic in Scotland will grow by a further 22% (Transport Model for Scotland, 2002).

Today the car is the most dominant mode of transport for travelling to work, taking a modal share of 66% in Scotland (Scottish Executive, 2009b), which reflects similar UK figures (Department for Transport, 2007). The current car culture has raised a number of

public health concerns in terms of sedentary lifestyles linked to over-reliance on motorised transport, pollution and traffic congestion (Scottish Executive, 2003, 2005a). In the 1990's there was an increase in both policy and research that focussed on encouraging sustainable forms of travel such as walking and cycling. According to Scottish Household Survey data, over half of all commuting trips are under 6 kilometres, a distance that could easily be substituted by cycling (Scottish Executive, 2008). Therefore there is a real opportunity to shift substantial numbers of people out of cars and onto bikes.

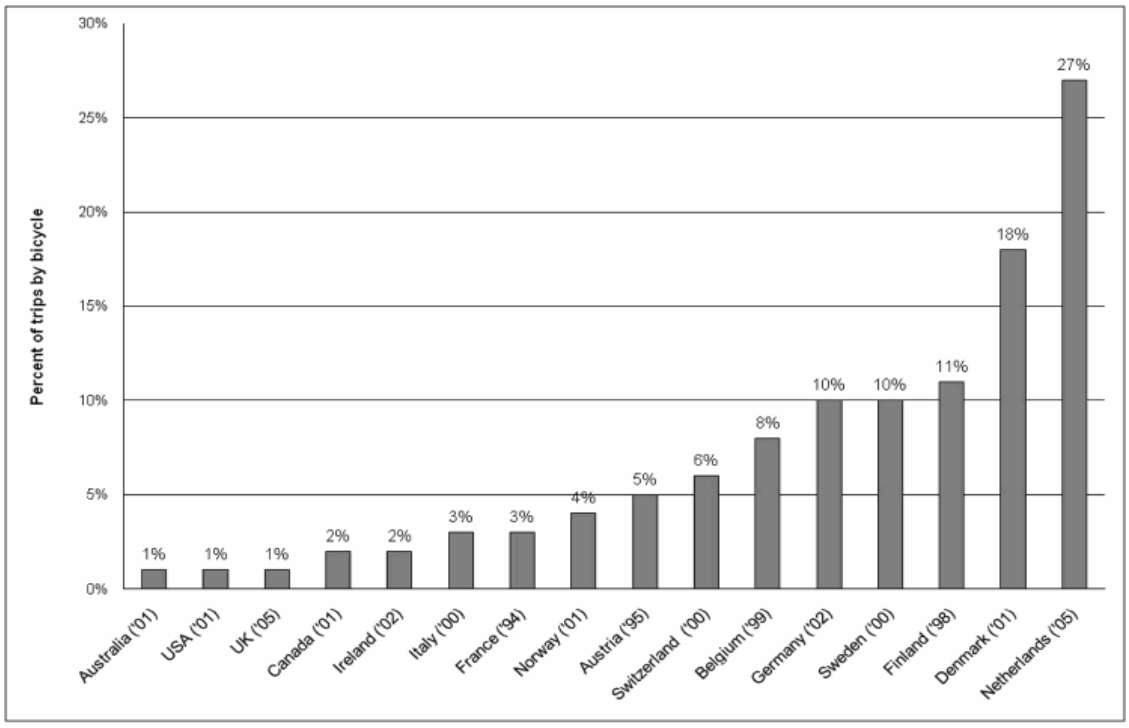
1.2 Demographics for Cycling

Figures from the 2008 Scottish Household Survey indicated that only 2% of Scottish people cycle to work as their usual mode of transport. From 1999 to 2008, Scottish figures appear to have remained relatively stable at around 2% of the modal share (Scottish Executive, 2009b). More generally, 1% of journeys in Scotland are made by bike (Scottish Government, 2009). In the wider UK context, the National Travel Survey reported a slightly higher figure of 3% of people cycling to work (Department for Transport, 2007), with a 1% modal share of overall distances travelled (Department for Transport, 2009b). Within the context of westernised countries, the UK ranks relatively low in its cycle use. As shown in Figure 1.1, countries such as the Netherlands (27%) and Denmark (18%) experience significantly higher amounts of cycle usage (Pucher & Buehler, 2008).

Evidence indicates that in the UK and Scotland more males than females cycle for transport. In the UK, cycling accounted for 3% of trips for males under 50 years old and 1% of trips for females of all ages along with men over the age of 60 (Scottish Executive, 2009a). Scottish data reveals a similar gender trend; approximately 7% of men claim to have cycled for either work or leisure in the past week compared to 2% of women (Scottish Executive, 2009a). In relation to work and/or leisure related cycling,

the Scottish Household Survey found little variation amongst additional demographic data in terms of income, deprivation and urban versus rural settings.

Figure 1.1: Cycle share of overall trips in selected countries (taken from Pucher & Buehler, 2008)[1]



Sources: European Union (2003); German Federal Ministry of Transport (2003); U.S. Department of Transportation (2003); European Conference of the Ministers of Transport (2004); Department for Transport (2005); Organisation for Economic Cooperation and Development (2005); Netherlands Ministry of Transport (2006); Australian Bureau of Statistics (2007)

1.3 Benefits Associated with Cycling

Cycling for transport has numerous public health benefits. A commonly acknowledged one is its potential to improve individuals' health and wellbeing, which has positive financial repercussions on a societal level such as reducing NHS costs and improving employees' productivity. There are also other beneficial effects that utilitarian cycling has on community and environmental levels. Within this section some of the key benefits associated with cycling for transport are discussed to illustrate its value within society.

[1] This Figure has been granted copyright clearance from the journal it has been published in for use in this thesis.

1.3.1 Individual-Level Benefits

Increasing national levels of physical activity is one of the Scottish Government's key objectives as 67% of women and 55% of men are not meeting the current recommendations of 30 minutes of moderate exercise on most days of the week (Scottish Government, 2009). Physical inactivity is associated with health problems such as coronary heart disease, high blood pressure, type II diabetes, obesity, colon cancer, osteoporosis, anxiety and stress (Scottish Executive, 2003; World Health Organisation, 2002). Scottish forecasts suggest that reducing the national level of inactivity by 1% per annum over five years would result in a marked reduction in associated diseases. It is estimated that hospital admissions for CHD, colon cancer and strokes would fall by 2231 cases, resulting in an annual saving of £3.5 million to the NHS. These forecasted figures are recognised as modest as they do not take into account the additional cost benefits of reducing incidences of type II diabetes, depression and high blood pressure (Physical Activity Task Force, 2003). UK based figures estimated that in 2002, the direct NHS costs of physical inactivity in relation to CHD, type II diabetes, cerebrovascular disease and breast and colon cancers was £1.06 billion (Allender, Foster, Scarborough, & Rayner, 2007).

Cycle commuting is a recommended form of moderate intensity physical activity because it fits into the daily routine and provides the working population with an opportunity to be regularly physically active (Vuori, Oja, & Paronen, 1994). Research evidence in this area reveals that cycle commuting can be beneficial for people's physical health and fitness levels (Andersen, Schnohr, Schroll, & Hein, 2000; de Geus, De Smet, Nijs, & Meeusen, 2007; Hendriksen, Zuiderveld, Kemper, & Bezemer, 2000; Oja, Vuori, & Paronen, 1998; Vuori et al., 1994). Randomised controlled and controlled trials indicate that regular cycle commuting, over a period of between 10 and 26 weeks, can significantly improve maximal oxygen uptake (Hendriksen et al., 2000), maximal power (de Geus et al., 2007; Hendriksen et al., 2000) and time to exhaustion (de Geus et al., 2007) as well as decreasing heart rate and blood lactate levels (Oja et al., 1998; Vuori et al., 1994). However, it is worth noting that some of these effects found were

linked to high-intensity level cycling, and in practice, cycle commuting is more likely to be a moderate-intensity level activity. Additionally, a large-scale epidemiological prospective study found that regularly cycling to work had a protective function to health, reducing the risk of all cause mortality by 39%, irrespective of other types of physical activity that people partake in (Andersen et al., 2000).

It is also well documented that moderate exercise can have a positive impact on psychological wellbeing, and on both reducing and preventing depression (Biddle & Mutrie, 2008; Cavill & Davis, 2007; Fox, 1999; Scottish Exexutive, 2003). However, the majority of reviews still focus on conventional physical activity and exercise with less structured activities such as active commuting and play being relatively under-represented in research (Whitelaw, Swift, Goodwin, & Clark, 2008).

Only one active commuting intervention study to date has tested psychological wellbeing using psychometrically tested measures (Mutrie, Carney, Blamey, Crawford, Aitchison et al., 2002). Their randomised-control intervention study, which aimed to increase walking and cycling to work, used the Short Form 36 Health Survey (Ware & Sherbourne, 1992) to measure psychological health (Mutrie et al., 2002). Whilst the intervention was not successful at increasing cycle commuting, results indicated that the walking intervention group enhanced participants' perceptions of mental health functioning.

A recent meta-analysis into green exercise (activity in the presence of nature) and improving mental health included one study that examined general cycling activity (Barton & Pretty, 2010). All ten studies included in the meta-analysis used the Rosenberg Self-Esteem measure (Rosenberg, 1965) and the Profile of Mood States Short Form measure (Shacham, 1983). The results indicated that there were large benefits in both self-esteem and mood for short engagements in green exercise.

1.3.2 Community-Level Benefits

Although it is recognised that local environmental factors can influence the uptake of cycling (Cavill & Watkin, 2007; Sloman, Cavill, Cope, & Kennedy, 2009), purely the human action of increasing cycle use and thus decreasing the use of motorised transport has positive effects on neighbourhoods and a sense of community. A seminal study conducted in this area looked at three streets with differing levels (low, medium and high) of motorised traffic flow (Appleyard & Lintell, 1972). Those living in low-flow traffic streets reported three times as many friends in their neighbourhoods compared with residents living in high-flow traffic streets. On the other hand, people living in high-flow traffic streets had withdrawn from the local environment and felt a low sense of local community.

Increasing the number of cyclists and walkers on streets has been found to decrease the relative risk of road-traffic accidents by approximately -0.6 power of the number of people cycling (Jacobsen, 2003). In practice this means that if cycling levels double, the risk of accidents will fall by 34%. This phenomenon, understood as the critical mass effect, has been supported by other studies (Ministry of Transport Public Works and Water Management, 1999b; Robinson, 2005). The critical mass effect is thought to occur through modifications in driver behaviour, as motorists who see more cyclists are likely to drive slower as they accept that the road is used by cyclists and as they themselves are more likely to cycle (Jacobsen, 2003).

Within the community context, the workplace has become a focus for physical activity and health promotion (Scottish Executive, 2005b). A white paper on health, 'Towards a Healthier Scotland', has highlighted the potential of the workplace to promote and protect employees' health (Scottish Office, 1999). Active travel has become increasingly important in the workplace because of its contribution to travel and to increasing levels of workplace-based physical activity (Physical Activity Health Alliance, 2006b). It has been estimated that in the UK, 2.3 million cases of ill-health are reported by employees resulting in approximately 40 million days lost to employers. The estimated costs of ill-

health and injury are £3.3 to £6.5 billion annually (Health and Saftey Executive, 2006). Active workforces report less illness, experience lower levels of absenteeism and lower staff turnover, have fewer work-related injuries, are more productive and more are satisfied with their work (Scottish Exexutive, 2003).

Davis and Jones (2007) carried out a review into workplace physical activity, absenteeism and productivity. They found evidence to suggest that workplace physical activity interventions comprising of more than one hour per week can lead to long-term reductions in absenteeism with some evidence indicating reductions in short and long-term health care costs. In light of these results the authors concluded that walking or cycling to work had the potential to lead to measurable reductions in levels of absenteeism (Davis & Jones, 2007). A meta-analysis of workplace physical activity interventions found that some workplace interventions can significantly improve work attendance and job satisfaction, and reduce job stress and health care utilisation (Conn, Hafdahl, Cooper, Brown & Lusk, 2009). However, both of the reviews discussed above noted difficulties in drawing conclusions due to the diverse quality of included studies' designs and measures.

Proper, van den Heuvel, De Vroome, Hildebrandt & Van der Beek, (2006) used cross-sectional, national survey data along with a prospective study to test the effectiveness of worksite physical activity programs. A dose-response relationship was found between high-intensity levels of regular physical activity and a reduction in sick leave. Although it was acknowledged that moderate intensity physical activity has positive health effects there was no evidence of a dose-response relationship with sick leave. In the Netherlands, a research organisation carried out a large-scale, cross-sectional survey with three organisations to specifically investigate the relationship between cycle commuting, health and work performance (Toegepast Natuurwetenschappelijk Onderzoek, 2009). It was found that regular cycle commuters took significantly less sick days annually than non-cycle commuters and the greater the distance they cycled, the lower the absenteeism.

The findings relating to workplace physical activity indicate that promoting a physically active workforce is likely to result in some benefits to employers. Although it appears that higher-intensity exercise (> 6 METs) carried out for a longer duration incurs the biggest benefits, the value of moderate-intensity physical activity (between 3 and 6 METs) should not be underestimated. Moderate-intensity physical activity is also likely to play a protective role in people's health. Therefore, the full extent of the benefits to employers may be more evident in the longer-term. The weaker findings relating to the moderate-intensity of activity and absenteeism are likely to result from the relatively short-term assessment follow-up period (≤ 12 months).

1.3.3 Physical Environmental Benefits

On an environmental-level, increasing the use of sustainable forms of transport (walking and cycling) to minimise emissions and to help protect the physical environment, has been proposed as a key objective within Scotland's national transport strategy (Scottish Executive, 2006). Pollution caused by motorised traffic is thought to be the biggest contributor to global warming worldwide (Unger, Bond, Wang, Koch, Menon, Shindell, et al., 2010; World Health Organisation, 1999). For example, in the United States, transportation accounts for one third of the countries CO_2 emissions (Davis, Diegel, & Boundy, 2009) and in Europe, one quarter (World Health Organisation, 1999). High levels of pollution not only impact negatively on the environment but also have negative repercussions on people's health. In a publication from the World Health Organisation (World Health Organisation, 1999), which investigated the links between transport, the environment and health it was concluded that:

> Road transport is a major contributor to human exposure to air pollution. Long-term exposure to air pollutants and levels exceeding air quality guideline values is associated with a number of adverse health impacts, including effects on cardiovascular diseases and on respiratory diseases in adults and children. Such exposure may reduce life expectancy. Some pollutants such as benzene and some types of particles increase cancer risks (World Health Organisation, 1999, p. 4).

To decrease air pollution levels, changing shorter trips made by cars to sustainable forms of transport is seen as favourable as short trips by car contribute disproportionately to emissions due to the initial increased use of fuel needed to start a car (Frank, Stone, & Bachman, 2000). It has been found that reducing short trips made by motorised vehicles (≤ 3 miles) would result in modest reductions in air pollution (de Nazelle, Morton, Jerrett, & Crawford-Brown, 2010). Although these reductions may be classified as modest, they are actually high in comparison to most surface transportation interventions aimed at reducing vehicle emissions (de Nazelle et al., 2010).

1.4 Risks Associated with Cycling

As outlined, there are numerous benefits associated with cycling; however, there are also risks that can have a detrimental effect on people's health such as road traffic accidents and increased exposure to air pollution (de Nazelle et al., 2009).

In Scotland, 725 cycle casualties were reported in 2008 with the majority of these occurring on built-up roads (Scottish Government, 2008b). In comparison to 1998 (1,440 casualties), reported cycle casualties have decreased by 36% (Scottish Government, 2008b). Although these data show a decline in cycle accidents they do not provide complimentary figures for levels of usage so it's not possible to gauge the relative risk. UK figures revealed a similar trend, with numbers of cycle casualties decreasing 38% from 1994 to 2008. Although UK cycle traffic levels have fluctuated during this period, there has been a general, small increase in cycle uptake, which indicates the risk of accidents has decreased relative to cycle use (Department for Transport, 2009b). However, there is some concern surrounding the accuracy of UK accident figures. This concern stems from under-reporting, as a substantial number of cycle accidents are never reported, and from misclassification and miscommunication between the police force and hospitals regarding types of injuries and accidents reported (Department for Transport, 2004; Gill, Goldacre, & Yeates, 2006; Simpson, 1996; Spencer, Adams, Malone, Roy, & Yost, 2006). Therefore, figures regarding the risk of

cycling and cycle accidents should be viewed with caution as they may under-represent the true level of accidents.

It is difficult to gauge the relative risk of cycling in relation to other modes of transport. Wardlaw (2002) has suggests that UK cycling fatality rates per kilometre travelled are not as high as for walking, with the exception of 11-14 year old boys but for fatalities per hour, cycling is higher than all other modes of transport. Cavil and Davis (2007) noted that cycling injury data has inherent biases on two grounds. First, the analyses includes car related injuries sustained on motorways, which cyclists do not travel on. The issue being that, for cars, motorways provide safer miles in relation to other roads. Second, the analysis includes children under 17 years old, who do not drive but are likely to cycle and be involved in cycle accidents per mile travelled. Both of these factors can potentially negatively skew the cycling figures in relation to risk. A Dutch report adjusted risk analysis figures to try and remove one of these biases (Ministry of Transport Public Works and Water Management, 1999a). They analysed data with the exclusion of motorway travel. These adjusted figures revealed that cycling is safer than initially suggested:

> Cycling is much safer for individuals aged 18 to 24 than is driving a car and that, considering the chance of a fatal accident, persons aged 25 to 34 could travel by bicycle just as safely as by car for shorter distances. Of all kilometres covered in the Netherlands by car, 18 to 34-year-olds drive around one third (Ministry of Transport Public Works and Water Management, 1999a, p. 93).

However, cycling for transport is three times as safe in the Netherlands than in the UK (Pucher & Buehler, 2008). Wardlaw (2002) carried out a detailed risk assessment of cycling on the roads in the UK and found that, with one cyclist dying every twenty million miles, the odds of dying from a cycle accident were very low and scarcely any different than the odds of an average driver.

Currently there is a paucity of literature concerning the hazards associated with exposure to emissions form motor traffic (de Nazelle & Nieuwenhuijsen, 2010). There is some

evidence to suggest that cyclists have less exposure to exhaust fumes than car drivers (Adams, Nieuwenhuijsen, Colvile, McMullen, & Khandelwal, 2001; Kaur, Nieuwenhuijsen, & Colvile, 2005; Kingham, Meaton, Sheard, & Lawrenson, 1998). However, there are many logistical and technical limitations reported in research studies carried out in this field (de Nazelle & Nieuwenhuijsen, 2010). Exhaust fume exposure is not as simple as the initial evidence suggests. Cycling is an active method of transportation and requires increased rates of breathing compared to travelling in a motorised vehicle. One study found cyclists' breathing rate to be 2.3 times higher than that of car drivers (van Wijnen, Verhoeff, Jans, & van Bruggen, 1995).

Taking into account lower exposure levels along with increased breathing, it has been suggested that overall, cyclists have the highest uptake in exhaust pollutants out of all transport modes (McNabola, Broderick, & Gill, 2008). This is dependent on numerous factors such as: the route taken, the cyclist's placement on the road, and level of respiration related to cycling activity. As cyclists are likely to take quieter, less polluted routes than cars, their exposure to pollution could arguably be lower.

1.5 Weighing up the Benefits and Risks

The information provided in preceding sections illustrates that there are many factors relating to the inherent nature of cycling and the context in which it occurs, that contribute to its health status. The benefits of cycling for transport are quite clear but the evidence regarding the associated risks is less robust due to inherent difficulties in data collection. In order to find out if cycling does provide any gains for public health, a popular method employed is to weigh up the available evidence regarding the associated benefits and risks. From a public health perspective, a UK analysis (Hillman, 1992) found that the health benefits of cycling outweigh the loss in life years through fatal accidents by 20. More recently, de Hartog, Boogaard, Nijland & Hoek (2010) reported more modest findings within the UK context that the health benefits of cycling are seven times larger than the risks of accident or air pollution. This ratio is subject to

improvement with increasing numbers of cyclists, as the critical mass phenomenon indicates that the risks of cycling would decrease.

After assessing the actual risks faced by cyclists, Wardlaw (2002) concluded that cycling posed less of a safety risk than its reputation would indicate:

> Road cycling in Britain is a low-risk activity. The belief that cycling is dangerous turns out to be a factoid: opinion based on long repetition, not evidence. The actual risk of death lies well within the bracket of Western European driver experience when fair comparison is made. This disparity between actual and perceived risk in cycling has been previously reported. Cycling in Britain contributes no more to road deaths overall than car use, since the higher user risks are balanced by reduced risks imposed on third parties. Cycling may even be saving lives. More cycling would dramatically improve cyclist safety through the widely observed 'safety in numbers' effect (Wardlaw, 2002, p. 355).

A more recent evidence review of cycling and health concluded that despite the risks involved in bicycle use, there is strong evidence of health benefits, suggesting cycling has the potential to improve many aspects of public health (Cavill & Davis, 2007). Additionally, a valid point raised by the authors is that the risks associated with inactivity are more severe that the risks associated with cycling.

An economic cost-benefit analysis tool called Health Economic Assessment Tool for Cycling (HEAT for Cycling) has been developed (Rutter, Cavill, Dinsdale, Kahlmeier, Racioppi et al., 2007). The tool uses the relative risk of all cause mortality amongst cycle commuters of 0.72 (Andersen et al., 2000) relative to the general population. The calculations control for economic variables such as sex, age and smoking, and levels of recreational physical activity. Additionally, it has taken into account the possibility of substitution in the sense that cycling for transport may replace existing physical activity. Using information on regularity of cycle trips, distance and speed, the HEAT for Cycling model calculates the economic saving of all cause mortality per kilometre cycled per trip (Rutter et al., 2007). Calculations made for Cycling England suggested a 20% increase in cycling levels would result in a saving of £107 million from a reduction

of premature deaths, £87 million from a reduction of absenteeism in workplaces and £52 million in lowered NHS costs (Macdonald, 2007).

1.6 Situating Cycling within a Policy Context

In order to establish the evolving societal and cultural position of cycling in the UK and Scotland, a summary of the national policy is now presented. Cycling for transport is on the current agenda of many political sectors. The focus of this section will centre on transport and health policies because whilst the benefits of cycling, in terms of sustainable travel and health, were not properly acknowledged in the UK until the 1990s, today these benefits are widely recognised in a policy context.

1.6.1 Transport Policy

Cycling was an important mode for commuting in the 1930s and 40s, but in the 1940s car use rapidly started to grow in popularity and by the 1960s the car was the most common mode for travelling to work (Pooley & Turnbull, 2005). The first UK transport policy was published in the 1940s and throughout the 1950s and 60s policy documents primarily focussed on building new road and motorway networks to accommodate the motor car. From the 1950s onwards, cycling for transport declined in popularity (Pooley and Turnbull 2000).

Continuing increases in car travel distances, car ownership and car use, resulted in raised levels of awareness towards the negative environmental impacts of the car (Health Scotland, 2007). However, still as late as 1991, the Department for Transport policy stance was to not encourage cycling due to the potential danger hazards posed by the road traffic (Lumsdon & Tolley, 2001). A shift in political thinking, which occurred in the 1990s, has resulted in more recent transport policy recognising the need to balance economic growth with protecting the environment, in an attempt to stabilise road traffic volumes (Department for Transport, 2004a; Scottish Executive, 2006). This has led to an

increased interest in cycling as a form of transport as it fits in with the new direction of emerging transport policies and acts.

UK/English Transport Policy

In 1996 the Department for Transport launched the first National Cycling Strategy (Department of Transport, 1996), which set a target to quadruple the number of cycle trips made by 2012. However, by 2002, across England as a whole, levels of cycling had not significantly increased above the base line figure of 2%. In 2004, a strategic plan called Walking and Cycling: An Action Plan, was created by the Department for Transport, and set out 42 actions across government aimed at increasing levels of walking and cycling (Department for Transport, 2004b). As the National Cycling Strategy target to increase cycling was not being met, it was dropped in 2004 with the launch of the white paper called The Future of Transport (Department for Transport, 2004a). Most stakeholders accepted that the original target of quadrupling cycling numbers by 2012 would not have been achieved. Many local authorities found this target unrealistic due to the lack of political commitment to take action (Department for Transport, 2004a). There were some examples of success in increasing cycling at local levels such as in London, York and Hull, but measures thought to underlie these successes were diverse suggesting that there is no one blueprint for achieving higher levels of cycling (Department for Transport, 2004a).

The new approach towards cycle promotion, which superseded the National Cycling Strategy, was outlined in the white paper called The Future of Transport (Department for Transport, 2004a). The new strategy's vision for increasing cycling was to promote local targets to be set that local authorities could be accountable for. This white paper was supported by re-structuring in the Department for Transport, which enabled officials to work more closely with local authorities.

In 2005, Cycling England was established by the Department for Transport solely to promote cycling in England through training, engineering and marketing projects.

Cycling England replaced the board that was set up in conjunction with the National Cycling Strategy in 1996. Cycling England's two key projects to date have been: developing cycling proficiency schemes and piloting the impact of six cycling demonstration towns in England. Cycling England's funding has now increased to £160 million from its baseline of £5 million in 2006. However, recent government budget cuts in 2010 have included the abolition of the central body Cycling England indicating that local authority cycling schemes will become the responsibility of Local Sustainable Transport Funds.

Scottish Transport Policy

It was not until 2004 that Scotland produced it own transport white paper, Scotland's Transport Future (Scottish Executive, 2004), which led to Scotland's first transport act in 2005. This was the first transport legislation produced by the Scottish Executive that focussed exclusively on Scotland's transport needs. Its overall objective was: "to promote economic growth, social inclusion, health and protect our environment through a safe, integrated, effective and efficient transport system" (Scottish Executive, 2004, p.17). This white paper (Scottish Executive, 2004) explicitly outlined its vision to reduce short car journeys and replace these with sustainable forms of transport such as walking, cycling and public transport. It also acknowledged that one of the biggest challenges of supporting sustainable transport would be "changing people's attitudes" (Scottish Executive, 2004, p. 12).

In 2004, a national body for cycling named Cycling Scotland was established with the purpose of developing cycling as an acceptable, attractive and practical lifestyle option. Cycling Scotland provides advice and support in school and workplace settings to encourage cycling for transport in these contexts. More recently, Cycling Scotland established a Community Cycling Innovation Fund in order to provide support to more disadvantages communities. In 2005, Transport Scotland was created along with Regional Transport Partnerships and Regional Transport Strategies to help achieve the transport white paper objectives (Scottish Executive, 2004).

In 2006, Scotland's first independent National Transport Strategy was published with the purpose of supporting and extending the objectives of the transport white paper (Scottish Executive, 2006). Again, protecting the environment and improving health featured in its key objectives. The strategy document is based on sustainable development principles and draws on numerous other policy documents from the sustainability, environmental and health sectors. Whilst it contains a small section on promoting walking and cycling as an alternative to car use, it did not set out any explicit targets for increasing walking and cycling for transport. Although the Scottish Government did sign up to the UK National Cycling Strategy when it was launched in 1996, as discussed above, this has since been superseded by other UK-based policy.

A board was established in 2008 to take forward the project of developing a Scottish national cycling policy paper. The Cycling Action Plan for Scotland (CAPS) was officially launched in June 2010 (Scottish Government, 2010). CAPS was developed by the Scottish Executive, local authorities, key stakeholders from both the transport and health sector (e.g. Cycling Scotland, NHS Scotland, Paths for All, Sustrans and Transport Scotland) and public input. The aim of CAPS is to effectively increase the number of people choosing to regularly cycle by coordinating the effort of cycling policy and provision stakeholders in Scotland (Rehfisch, 2009). A Scottish target has now been set for 10% of all journeys to be made by bike by 2020 (Scottish Government, 2010). Between 2010 and 2011, CAPS received £3.9 million to deliver its target, which will be invested in cycling infrastructure, facilities and child cycle training. The CAPS funding is being complemented by other investments aimed at increasing active travel and sustainability, totalling £13.4 million between 2010 and 2011 (Scottish Government, 2010). However, whilst the Netherlands is three times more populated than Scotland, it spends 60 million euros alone on cycling projects, which relatively speaking is far more than the Scottish budget.

1.6.2 Health Policy

Health-related behaviours are understood to underlie the epidemic of western diseases affecting developed counties such as the UK and the USA (Buchner & Schmid, 2009). However the important role that physical activity plays within public health was not fully established until the 1990s despite early findings in the 1950s (Buchner & Schmid, 2009). It was in 1996 that the Surgeon General's report, Physical Activity and Health, was published (USDHHS, 1996). This watershed report was a seminal review of physical activity research. It outlined the health benefits of physical activity and established guidelines regarding the recommended levels of physical activity required for a healthy population. Over the last 20 years, physical activity has increasingly become the focus health policy and strategies from Department of Health and the independent guidance body called The National Institute for Health and Clinical Excellence (NICE).

English/UK Health Policy

In 2002 the Strategy Unit and the Department for Culture, Media and Sport, published the report called Game Plan: A Strategy for Delivering Government's Sport and Physical Activity Objectives (Department for Sport, Media and Culture, 2002). This was the first policy document to substantially focus on grassroots physical activity as well as the first UK physical activity strategy plan. This document made mention of supporting cycling for transport and improving cycling routes and environments, with the emphasis on governmental departments working together to achieve such goals.

Leading on from The Game Plan report the Department of Health produced the white paper called Choosing Health: Making Healthy Choices Easier, which was published in 2004 (Department of Health, 2004b), and the subsequent action plan, Choosing activity: A Physical Activity Action Plan was published in 2005 (Department of Health, 2005). Both documents emphasised the need for strengthening links amongst policy areas and government departments such as health, travel, sustainability and social exclusion, which have previously been viewed as separate. Supporting cycling for everyday travel

was clearly outlined in terms of physical and cultural shifts (e.g. providing better cycling environments, better workplace and school facilities), and taking a 'whole town' promotional approach. Within this action plan, cycling for everyday transport and recreation was widely discussed and walking and cycling were acknowledged as being the easiest ways of building activity back into busy, time pressured lives.

Other recent UK policy documents and reports that have raised the profile of cycling for transport within the health sector are: At Least Five a Week: Evidence on the Impact of Physical Activity and its Relationship to Health (Department of Health, 2004a), Let's Get Moving - A New Physical Activity Care Pathway for the NHS (Foster, Thompson, & Harkin, 2009) and Be Active, Be Healthy: A Plan for Getting the Nation Involved (Department of Health, 2009). Additionally, NICE, who provide guidance for the NHS, has produced a number of evidence briefings that situate physical activity, and more specifically cycling for transport, firmly into the sphere of pro-active health care (Kiloran, Doyle, Waller, Wohlgemuth & Crombie, 2006; National Institute for Health and Clinical Excellence, 2006, 2008a, 2008b).

Scottish Health Policy

The white paper, Towards a Healthier Scotland (Scottish Office, 1999), and its preceding green paper outlined the need for healthy lifestyles, including physical activity (Scottish Office, 1998). This white paper committed to establishing a Physical Activity Task Force, for the purpose of developing the first national physical activity strategy for Scotland. Scotland's physical activity strategy called 'Let's make Scotland more Active' (Physical Activity Task Force, 2003) was launched in 2003 and encompassed a broad framework of objectives and priorities for the development of physical activity in Scotland. This report outlined the need for a balance of recognition between supporting sport (making up 8% of physical activity overall) and activities of daily living, which make up the majority of the populations' activity levels (64%). Active travel featured as a priority area for children and adults with promotion of active travel being centred on cultural changes in schools and workplaces and wider infrastructure changes within the

wider community. To support the implementation of the national physical activity strategy, the Physical Activity and Health Alliance (PAHA) was set up in 2006.

In parallel with the launch of the national physical activity strategy, the policy framework document called Improving Health in Scotland: The Challenge was published (Scottish Executive, 2003). This strategic framework builds on the foundations of the white paper, Towards a Healthier Scotland (Scottish Office, 1999), to support a more rapid rate of health improvement. The framework focused on the five key risk factors: tobacco, alcohol, low fruit and vegetable intake, physical activity levels and obesity along with the priority target areas: early years, teenage transition, workplace and communities. In 2005, 'Healthy Working Lives: A Plan for Action' was published (Scottish Executive, 2005b) and the Scottish Centre for Healthy Working Lives was set up to help workplaces promote public health and tackle health inequalities. Structured physical activity and daily lifestyle physical activity (such as walking, cycling and stair climbing) were outlined as key areas for promoting healthy workforces. Subsequent policy and briefing documents have also promoted and strengthened the links between active transport and health (Physical Activity Health Alliance 2006a, 2006b; Scottish Government, 2006; 2008a).

1.6.3 Integrated Policy

The instrumental benefits that cycling can contribute to society are far reaching. Although this chapter has focussed primarily on health and transport policy, increasing utilitarian cycling can also contribute to policy addressing the environmental, sustainability community and neighbourhood renewal, social inclusion, urban renaissance and rural revival. As illustrated in the previous sections, both UK and Scottish transport and health policy now recognise their inextricable link. A recent briefing published by NICE (Kiloran et al., 2006) exemplifies the current shift in political thinking towards a more integrated approach to prompting cycling for transport:

> UK transport policy is recognised by government as an important mechanism for increasing levels of cycling and walking, and for achieving potentially significant health benefits within our currently largely sedentary population (Kiloran et al., 2006, p. 1).

The strategy document called 'Building Britain's Future' (HM Government, 2009) is a good example of the advancements that have taken place towards interdisciplinary and integrated policy making. This plan has committed the UK Government to develop an Active Travel Strategy and National Cycle Plan which will be jointly led by the Department for Transport and the Department of Health. The Active Travel Strategy was launched in early 2010 and sets out aims for the next 10 years to: promote better public health and well-being by increasing levels of physical activity, increase accessibility, reduce congestion, improve air quality and reduce carbon emissions (Department for Transport, 2010a). The National Cycle Plan will be released later in 2010 and will encompass the same integrated approach as the Active Travel strategy.

Whilst the link between transport and health is becoming stronger within policy, Macdonald (2007) has highlighted the need to start realising the combined and synergic, as opposed to partial and isolated, benefits of cycling in society. Even today, the extent to which the health, transport and other relevant fields have thoroughly considered the full array of benefits that increasing cycle use can bring to society is questionable. Macdonald (2007) advocates that such an approach should be taken if we are to develop a comprehensive and accurate picture of what cycling for transport can offer.

1.7 Chapter Summary and Conclusions

This introductory chapter has outlined the demographics of the uptake of adult cycle commuting, the evidence regarding the benefits and risks of utilitarian cycling and the political landscape in which it is situated. Scottish data indicates that over the last decade cycle commuting uptake has remained relatively stable, making up around 2% of the modal share. Evidence suggests that although there are some personal safety risks associated with utilitarian cycling, these are outweighed by the benefits experienced on

an individual and societal level. The consensus view is that cycle commuting has the potential to improve many aspects of public health.

The evolution of political thinking towards utilitarian cycling from the transport and health sectors has been outlined, illustrating a shift in perspective over the last two decades to a more integrated, pro-cycling political culture. However, in light of the recent UK budget cuts which have proposed the abolition of Cycling England, it remains to be seen how genuinely pro-cycling the government is. National cycling figures indicate that the production of strategy documents and more joined up thinking has not yet had a substantial impact on cycling levels. Reversing the long established, car-orientated cultural norms and existing physical-infrastructure embedded in British society is a large undertaking. Whilst small increases in cycling and shorter-term benefits such as reduction in inactivity may be immediately observable, significant changes in commuting behaviour and more distal measures of cycling such as reduction in obesity and heart disease will be by no means immediate.

Although it is clear that utilitarian cycling is becoming firmly embedded in current political agendas, before hard measures such as behaviour change occur, softer measures such as attitudinal change need to take place. As acknowledged in the Scottish white paper, 'Scotland's Transport Future', one of the biggest challenges posed to supporting sustainable transport is changing people's attitudes. The subsequent chapters in this thesis will examine, critique and explore psychological theories deemed relevant to cycle commuting and attitudes and cognitions that are understood to influence an individual's decision to cycle to work.

Chapter 2
Social Cognition and Behaviour Change Theories

Aims of the Chapter

The aim of this chapter is to identify a number of theoretical models and concepts that are deemed relevant to understanding cycle commuting behaviour. The purpose of presenting this theoretical discussion is to further develop the foundations of this thesis and to set out the theories that will feature, to differing degrees, throughout the empirical research and the discussions that follow.

2.1 Introduction

Chapter 1 outlined the evidence that has led to the present understanding of the value of promoting utilitarian cycling in society. It also outlined the evolving political context, in which active travel is being propelled into the foreground of both health and transport agendas. This second chapter continues to develop the foundations of this thesis by critically discussing selected theories and concepts that are potentially relevant to explaining adult cycle commuting behaviour.

Traditionally, physical activity and health-orientated research has looked at psychological and social-psychological variables that influence individual behaviour such as: perceptions, attitudes, values, beliefs and norms (Sallis et al., 2004). Such variables are often encompassed in social-cognitive theories, which have dominated health psychology literature. By contrast, transport research has traditionally been interested in behavioural variables that influence entire communities (Sallis et al., 2004) such as the built environment (land-use mix, density and proximity) and utilitarian factors (time, cost, effort and safety) .

As discussed in Chapter 1, over the last two decades there has been a shift within policy towards broader, interdisciplinary approaches in transport and health; this shift is also

evident in academic literature. Subsequently, the emphasis that health and physical activity research has placed on identifying and examining psychological and social psychological factors has been criticised for not taking into account the wider environmental factors that exist (De Leeuw, 1989; Giles-Corti, Timperio, Bull & Pikora, 2005; Stevenson & Burke, 1991; Stokols, Smelser & Baltes, 2001). Similarly, transport research has received criticism for neglecting psychological factors contributing to modal choice (Elliott, Armitage & Baughan 2005; Paris & Van den Broucke, 2008). Both disciplines have now started to carry out research informed by a wider range of concepts and theories.

This thesis adopts a health and exercise orientation, taking a psychological interest towards cycle commuting behaviour. Within the context of this thesis, psychological factors that are later examined are understood from a social-cognitive perspective. The social-cognitive perspective, proposes that individuals are not solely guided by subjective thoughts and attitudes (cognitions) nor automatically controlled by the social and physical environment rather they function in a reciprocal way (Biddle & Mutrie, 2001). This notion has been termed as 'reciprocal determinism' (Bandura, 1986). Therefore, although the focus of psychological theories is largely on cognitions, these are implicitly understood to be impacted by ones social surroundings. A number of the psychologically-orientated theories discussed in this chapter also more explicitly acknowledge social and environmental influences within the decision making process.

An arguably more integrated approach to health and exercise behaviour that has been growing in popularity is the concept of the Ecological Model, which is interdisciplinary by nature. The Ecological Model exemplifies all of the different layers of existence that are understood to play a role in shaping behaviour such as individual, social and environmental factors. Whilst the Ecological Model presents an overarching, multi-level approach to behaviour, emphasis is most often placed on the influence of social systems, public policies and physical environments, that limit and shape behaviour (Sallis & Owen, 1999) as opposed to individual's cognitions. In recent years, research into

physical activity and active travel has shifted its focus towards the Ecological Model of behaviour; therefore, this thesis could be seen to be going somewhat against the current research trend as it focuses on social-cognitions. However, investigating how people's social cognitions shape information about their environment and influence their behaviour is under-researched and forms an important component to better understanding cycle behaviour.

Taking a more detailed psychological perspective towards cycle commuting behaviour is also important because within the domain of public health there is still a need to design interventions that target individuals (Giles-Corti, 2006). Psychological factors such as perceptions, attitudes, values, beliefs and norms are relatively stable characteristics that underlie behaviour and whilst these characteristics are stable they are also amenable to change through psychological intervention, thus posing as a cost-effective approach to targeting individual behaviour change (Conner & Norman, 2005). Psychological factors are also understood to mediate the effects of other variables such as demographic factors and social and physical environmental factors, indicating that they have a strong influence on an individual's decision making (Anable, Lane & Kelay, 2006; Biddle & Mutrie, 2001; Conner & Norman, 2005). Therefore, in the context of this thesis the adopted psychological perspective and the ecological perspective are not dichotomous, rather the Ecological Model is viewed as a macro-level theory that positions micro-level psychological variables and theories within its larger holistic framework (see Figure 2.1).

Figure 2.1: An example of the Ecological Model concept

To date, psychologically-orientated research into cycle commuting has tended to investigate a number of variables as opposed to theories in their entirety. Instead such research has focused on searching for instrumental insights and knowledge towards promoting cycling that can be applied to relevant practices as opposed to proving theories *per se.* Most commonly, these psychological variables fall under the broad concepts of motivations and barriers, although often using different measurement indicators and differing semantics. Although many variable-based studies have been carried out, theoretically informed research is generally endorsed as theories provide an explanatory hypothesis testing framework for understanding and empirically researching relationships between variables (Michie, Rothman & Sheeran, 2007). In relation to exercise, Biddle & Mutrie (2001) propose:

> A good theory provides an integrating framework to allow a clearer picture to emerge from what is likely to be a complex process. Participation in structured exercise and active living through habitual physical activity is a complex behavioural phenomenon and certainly needs good theoretical research to make sense of it (Biddle & Mutrie, 2001, p. 131).

In this chapter a number of formal psychological theories are critiqued. The psychological theories that are used to understand behaviour can be split into two complementary categories (Darnton, 2008): formal 'social cognition models' that focus on explaining factors that determine behaviour and 'behaviour change theories' that show how behaviours can be changed over time to develop knowledge and interventions that target individuals. Whilst reference is made to cycle-orientated studies that have drawn upon the theories discussed in this chapter, much of the empirical cycling research will be discussed more comprehensively in subsequent chapters.

The psychological theories and concepts under discussion are by no means an exhaustive list. Rather, they are discussed either because of their contributions in physical activity and active travel promotion or because they are deemed insightful in the context of cycle commuting. The theories and concepts to be outlined and critically appraised are: the Transtheoretical Model of Behaviour Change, the Theory of Reasoned

Action, the Theory of Planned Behaviour, the concept of the behaviour-intention gap (including Implementation Intentions and the Health Action Process Approach), the concepts of 'theoretical convergence' and 'theoretical integration' and finally we will return to the concept of the Ecological Model, which whilst not a predominantly psychological theory does in principle include psychological factors.

2.2 Transtheoretical Model of Behaviour Change (TTM)

The TTM (Prochaska & DiClemente, 1982) is considered first and foremost because it is the theory that features most substantially within this thesis. The model is classed as a behaviour change theory and was initially developed and empirically tested in relation to smoking cessation. It was named the 'transtheoretical model' because it draws on a number of psychological theories such as Social Cognitive Theory (Bandura, 1977) and Social Learning Theory (Skinner, 1953) alongside 24 leading models of psychotherapy (Prochaska, 1984). The TTM was later successfully applied to exercise behaviour (Buxton, Wyse & Mercer, 1996; Marcus, Eaton, Rossi & Harlow, 1994; Marcus & Simkin, 1994), and has become a prominent theory in exercise psychology.

The TTM is made up of 14 individual components which are split into four core constructs. These constructs are: stage of change (five components relating to motivational readiness to change behaviour) (see Figure 2.2), decisional balance (the pros and cons of changing behaviour), self-efficacy (a person's confidence to undertake a behaviour) and the processes of change (comprising 10 cognitive and behaviour processes) (see Figure.2.3). Stage-based theories are discrete in nature. As individuals progress through the stages of change they undertake different qualitative processes of change, and as a result their perceptions of pros and cons (decisional balance) and their level of self-efficacy are positively influenced. It is the stage component that forms a key concept of the TTM and that has fuelled its popularity (Marcus & Forsyth, 2003; Sallis & Owen, 1999). Although the theory is largely psychological, some of the

processes of change and the decisional balance components include social environmental and physical environmental factors (Prochaska & Marcus, 1994).

Figure 2.2: Stage of change categories applied to physical activity (taken from Biddle & Mutrie, 2008)

Stage	Description
Precontemplation	Little or no physical activity with no intention to start being active
Contemplation	Little or no physical activity with intention to start being active in the next 6 months
Preparation	Small positive changes in physical activity
Action	Physically active for less than 6 months
Maintenance	Physically active for more than 6 months

Within psychological research towards cycle commuting, elements of the TTM are frequently employed. The model has high practical applicability, in the sense that identifying an individual's stage of change towards cycling to work allows tailored intervention strategies to be developed that can prescriptively be administered to individuals in the appropriate stage. The TTM has explicitly featured in a number of studies but often not in its entirety. Only one psychologically-orientated intervention study, which aimed to promote walking and cycling to work, used the TTM in its entirety to both inform and measure the intervention (Mutrie et al., 2002). The study found that targeting people who are motivated to change their transport behaviour through a self-help booklet was effective in increasing walking to work, but not cycling. Mutrie et al., (2002) attributed lack of success in increasing cycle commuting to wider environmental factors which were deemed insurmountable. Whilst Mutrie et al. (2002) raise a valid point that environmental factors can make cycling a more challenging transport option that walking solely attributing their lack of success to increase cycling behaviour to insurmountable environmental factors is an arguably simplistic proposition. As discussed later in the thesis (see Section 7.3.2), some of the limitations of the study are likely to in part underlie lack of significant findings in the cycling cohort.

Three cross-sectional questionnaire studies and one intervention study investigating cycle commuting have used the stages of change construct from the TTM to categorise

participants into behavioural groupings, but the theory as a whole has not been adopted (Crawford, Mutrie & Hanlon, 2001; Gatersleben & Appleton, 2007; Shannon, Giles-Corti, Pikora, Bulsara, Shilton et al., 2006). Rather, the stage of change construct was used to exemplify that people in different stages have differing attitudes towards cycling to work. In a qualitative cycling study and a subsequent questionnaire-based study (Davies, Halliday, Mayes & Pocock, 1997; Gardner, 1999), a version of the TTM was also presented as a guidance framework for promoting cycling. Again, the TTM was not used in its entirety in these two studies. As previously mentioned, motivations and barriers have commonly featured in cycling studies, which could be understood broadly as decisional balance components. However, the concept of barriers and motivations implicitly and explicitly feature in numerous social cognition and behaviour change theories. Therefore, studies into cycle commuting that feature barriers and motivations but do not explicitly align with any one theoretical model will be discussed in the subsequent literature review chapter (Chapter 3).

Figure 2.3: Processes of change applied to physical activity (taken from Marcus & Forsyth, 2003)

Processes	Description
Cognitive processes	
Increasing knowledge	Increasing information about oneself and physical activity
Being aware of risks	Understanding the risks of inactivity and sedentary living
Caring about consequences of others	Recognising how inactivity might affect others, such as family and co-workers
Increasing healthy alternatives	Increasing awareness of the alternative ways of being physically active
Understanding the benefits	Increasing awareness of the benefits of physical activity
Behavioural strategies	
Substituting alternatives	Seeking ways of being physically active when encountering barriers e.g. time
Enlisting social support	Seeking support from others for your physical activity efforts
Rewarding yourself	Praising and rewarding yourself, healthily, for making successful efforts
Committing yourself	Making plans and commitments for physical activity
Reminding yourself	Establishing reminders and prompts for physical activity e.g. diary time slots

The TTM is the most popular stage-based model of behavioural change in health psychology and has been very influential in promoting the concept that behaviour involves movement through discrete stages (Conner & Norman, 2005). Review-level

evidence from active travel promotion has indicated that TTM-based interventions, which target motivated individuals, are effective (Kiloran et al., 2006). However, despite its popularity, the TTM has also faced much scrutiny (Adams & White, 2003; Armitage, 2009b; Bridle, Riemsma, Pattenden, Sowden, Mather et al., 2005; Griffin-Blake & DeJoy 2006; Hutchinson, Breckon & Johnston, 2009; Riemsma, Pattenden, Bridle, Sowden, Mather et al., 2002; Spencer et al., 2006; West, 2005).

The most severe of critics is West (2005) who has called for the model to be abandoned on the grounds that the stage of change construct merely provides arbitrary lines and represents a mixture of incoherent constructs. In West's view the model is nothing more than "a security blanket" (West, 2005, p.1039) for researchers and practitioners that encourages the validity of soft outcomes (attitudes) as opposed to hard outcomes (behaviours) and encourages incorrect intervention strategies. As physical activity research into the TTM is still at an early stage (Biddle & Mutrie, 2001), West's opinion is arguably extreme. His opposition to the validation of soft outcomes, which are usually the most proximal indicators of behavioural change, is also perhaps unhelpful as if we are to better understand behaviour change, the measuring of attitudes and intentions should be endorsed. However, the cohort of TTM-based research carried out to date does appear to have some potential weaknesses. The main concerns surrounding the model are: the validity of the stages of change construct and the effectiveness and application of TTM-based interventions.

The validity of the stage of change construct has been some what questioned (Armitage & Arden, 2008; Greene, Rossi, Rossi, Velicer, Fava et al., 1999; Herzog & Blagg, 2007; Ronda, Van Assema & Brug, 2001; Sutton, 2000). Using cross-sectional questionnaires, strong linear relationships have been found between the stage of change construct and other social-cognitive variables (Armitage & Arden, 2007; Armitage, Povey & Arden, 2003; Marcus, Rakowski & Rossi, 1992a; Marcus, Selby, Niaura & Rosi, 1992c; Weinstein, Rothman & Sutton, 1998). For example, a strong correlation ($r = 0.78$, $p < 0.01$) between the stage of change construct and intention has been reported (Armitage

& Arden, 2008). Although such findings suggest the stage of change construct exhibits concurrent validity with these variables, this also highlights one of the concerns voiced by West (2005). These strong linear relations indicate that the stages of change may be somewhat arbitrary, 'pseudostages' that crudely split up underlying continuums into stages (Armitage, 2009b; Weinstein et al., 1998; West, 2005). However, there is some emerging evidence that the stages of change may be more than just arbitrary divisions. For instance, the variable ambivalence (relevant to the decisional balance construct), has been found to function in a discontinuous manner in relation to the stage of change construct (Armitage et al., 2003; Armitage & Arden, 2007). Thus, inferring in the case of ambivalence that true stages exist as opposed to pseudostages. This was also found to be the case for perceptions of vulnerability in relation to physical inactivity (Lippke & Plotnikoff, 2005). Individuals in precontemplation, preparation and maintenance stages of exercise behaviour felt the least vulnerable, whereas those in contemplation and action phases felt the most vulnerable.

Evidence from longitudinal studies, which are deemed more robust to investigate the stage of change construct than cross-sectional studies (Weinstein et al., 1998), also contests, to a degree, the notion of pseudostages. Findings indicate that the function of the five stages of change may be more than just arbitrarily splitting up numerous social-cognitive variables exhibiting continuum trends. Diet-based studies have found a disjoint between numerous social-cognitive variables, which in cross-sectional studies have previously revealed linear relationships with the stages of change (Armitage, Sheeran, Conner & Arden, 2004; Plotnikoff, Hotz, Birkett & Courneya, 2001). However, these discontinuous patterns reveal two overarching phases, as opposed to five stages of change. One phase encompasses the 'motivational' stages: precontemplation, contemplation and preparation and the second phase encompasses the 'volitional' stages: action and maintenance. The notion of an existing split between motivational and volitional phases of behaviour features more explicitly in other theories such as Implementation Intentions (Gollwitzer, 1999) and the Health Action Process Approach (Schwarzer, 1992), which will be discussed later in this chapter.

In relation to the stage of change construct, validity criticisms have been raised regarding measurement of the complexities of physical activity behaviour. First, physical activity is not made up of a single behaviour like smoking, but rather many different behaviours (e.g. gardening, active travel, recreational activities) and therefore individuals can be in different stages of changes for different activities (Adams & White, 2005; Brug, Conner, Harre, Kremers, McKellar et al., 2005; Miilunpalo, Nupponen, Laitakari, Marttila & Paronen, 2000). For example, Miilunpalo et al. (2000) found that only 46% of individuals who engaged in outdoor activities also engaged in active commuting, resulting in a large number of individuals being in different stages for the two activities. Therefore, generalising 'physical activity' as a unitary concept neglects the complexities of interventions designed to promote specific physical activities (Adams & White, 2005; Hutchinson et al., 2009). A second criticism relates to commonly made adaptations of existing valid TTM-based constructs (Brug et al., 2005). In order to make measures more behaviour specific, modifications are made to existing constructs, which can reduce the accuracy of placing individuals in the correct stage of change, therefore, diminishing the validity of the whole (Riemsma et al., 2002). An additional validity issue stems from use of self-measurement and people-related misconceptions towards their behaviour, which could be somewhat overcome by the inclusion of more objective measures (Greene et al., 1999; Ronda et al., 2001).

A keen point of enquiry has also been to investigate the effectiveness of physical activity interventions based on the TTM. A number of reviews have been carried out to investigate the effectiveness of the TTM applied to health promotion (Adams & White, 2003; Bridle et al., 2005; Hutchinson et al., 2009; Riemsma et al., 2002; Spencer et al., 2006). Results from studies included in these reviews are mixed and difficult to judge due to the wide heterogeneity of design, application and quality. Riemsma et al. (2002) and Bridle et al. (2005) published findings from the same systematic review, which looked at a wide range of TTM-based health interventions. Seven of the 37 reviewed studies were physical activity-orientated. Overall, the papers drew the same conclusions,

namely that there was limited evidence for the effectiveness of interventions based on stages of behaviour change due to tenuous connections to the TTM and the use of poor methodological designs. However, reviews that have more specifically focused on physical activity stage-based interventions have been more positive. Adams & White (2003) and Spencer et al. (2006) concluded that, although somewhat limited, there is evidence to support the short-term effectiveness of TTM-based physical activity interventions. Both sets of authors cautioned that the majority of studies within these reviews involved white-middle class females, indicating limited generalisability to their findings.

The most recent review of TTM-based exercise interventions was unable to determine the effectiveness or efficacy of the model (Hutchinson et al., 2009). This was due to chronic inconsistencies with the development and application of TTM-based interventions. A major criticism was that numerous studies did not apply the entire TTM framework to their interventions. The stage of change construct has been the most commonly used aspect of the TTM in exercise interventions, but as this is a categorising variable and not an explanatory one such interventions should not be classed as theory-based, but rather as variable-based (Hutchinson et al., 2009). However, Hutchinson et al. (2009) found that regardless of whether the entire or only parts of the theory were applied, it did not appear to make a significant difference to the outcome. Other factors such as the intensity of the intervention (the amount of time and input involved in the intervention) may be more predictive of success than TTM variables. For instance, 89% of medium-to-intense interventions were effective in the short-term compared with 57% of brief interventions (Hutchinson et al., 2009).

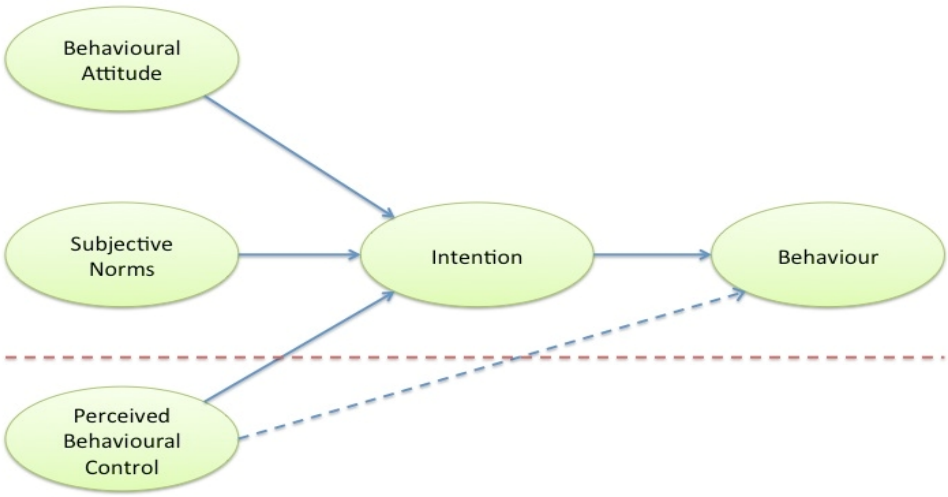
Unlike the conclusions drawn by West (2005) discussed above, the main evidence surrounding the TTM applied to physical activity interventions has not condemned the theory *per se*. Rather it has highlighted the limited amount of well-conducted research that has been carried out in this area, which has resulted in weak conclusions about the value of the TTM in relation to exercise promotion. In order for the TTM to be properly

appraised, there needs to be a stronger evidence base, regardless of mixed evidence and potential pitfalls regarding the use of the stage of change construct. To date, the TTM has provided valuable developments on the static social cognition models by proposing how and when behaviour change is likely to occur (Biddle & Mutrie, 2008). In light of the overall evidence, Biddle & Mutrie (2001) suggest that the TTM is an important model, which should be seriously considered in physical activity research and practice.

2.3 Theory of Reason Action (TRA) and Planned Behaviour (TPB)

The TRA (Ajzen & Fishbein,1980) and the subsequent TPB (Ajzen, 1995) are classed as social-cognition models and have been used extensively in exercise psychology (Biddle & Mutrie 2001). Both theories are continuum models, which place individuals along a continuum that indicates the likeliness of a specific behaviour as opposed to discrete stages. The TRA is concerned with "the causal antecedents of volitional behaviour" (Ajzen, 1988; p. 117). It is assumed that intention is a proximal antecedent of volitional behaviour and that intention can be determined by two factors: attitudes towards a specific behaviour and subjective norms (see Figure 2.4). In this context, attitudes are made up of held beliefs and values understood as an expectancy-value interaction (Fishbein, 1963). Subjective norms represent beliefs that significant others have regarding the behaviour in question and the motivation to comply with others' beliefs.

Figure 2.4: The Theory of Reasoned Action and the Theory of Planned Behaviour



The TRA is one of the original theories to be applied to exercise behaviour and has facilitated substantial theoretical development to occur in the exercise domain (Biddle & Mutrie, 2008):

> The theory has proved to be a viable unifying theoretical framework that has been successful in furthering our understanding of exercise intentions and behaviours. It has also been instrumental in moving research on physical activity correlates from being largely a-theoretical to theoretical (Biddle & Mutrie, 2008, p.63).

However, the TRA works on the assumption that target behaviours are under volitional control. Therefore it may not be as effective at predicting behaviours that are only partially under volitional control (Hagger & Chatzisarantis, 2005). For example, with regard to cycle commuting, contextual factors such as the availability of facilities or family responsibilities may pose barriers that are out of a person's volitional control. In order to address this short-coming of the TRA, the TPB was developed (Ajzen, 1985). The TPB is an extension of the TRA with the addition of the variable, perceived behavioural control (see Figure 2.4). Perceived behavioural control refers to "people's perception of the ease or difficulty of performing the behaviour of interest" (p.183) (Ajzen, 1991) and is determined by control beliefs and the perceived power of these beliefs. Control beliefs refer to the perceived presence of factors that can either help or hinder behaviour and perceived power relates to the impact such factors may have on behaviour (Ajzen, 1991).

The inclusion of perceived behavioural control is important because it takes into account perceptions of additional environmental factors. The variable of perceived behavioural control influences both intention and behaviour directly (see Figure 2.4). Meta-analyses carried out on the efficacy of the TPB in relation to health promotion found the inclusion of perceived behavioural control superior at predicting behaviours than the TRA alone (Armitage & Conner, 2001; Hausenblas, Carron & Mack, 1997). The TPB is not only popular in health and exercise promotion but has also been applied to some areas of transport research such as examining speeding behaviour of car drivers (Conner,

Lawton, Parker, Chorlton, Manstead et al., 2007; Elliott, Armitage & Baughan, 2005; Paris & Van den Broucke, 2008).

The TRA and the TPB have also featured explicitly in a number of studies relevant to cycle commuting stemming primarily from transport studies. The TRA/TPB components have been found to predict significant levels of variance in cycling behaviour (Bamberg & Schmidt, 1994; de Bruijn, Kremers, Singh, van der Putte & van Mechelen, 2009; Eves, Hoppea & McLaren, 2003; Gardner, 2008; Lemieux & Godin, 2009). However, most of these studies have found that the inclusion of the proposed moderating variable(s), habit and/or past behaviour strengthen the prediction for intention towards cycling behaviour (de Bruijn et al., 2009; Eves et al., 2003; Gardner, 2008; Lemieux & Godin, 2009). In a more detailed examination of the role that habit plays in cycle commuting behaviour, Gardner (2008) found that where habit was weak, intention was a good predictor of behaviour, thus transport choice could be modelled on the TRA and TPB. However, where habit was strong or moderate, there was no association between intention and behaviour and a strong association with habit indicating that cycle commuting and general commuting behaviour was moderated by habitual tendencies.

Although the TPB does not capture all of the psychological factors that predict behaviour (Conner & Norman, 2005) it has been praised for its parsimony whilst still accounting for significant amounts of variance in intention and behaviour (Hagger & Chatzisarantis, 2005). Additionally, the TRA and TPB are viewed favourably as they have been designed as flexible frameworks to which additional appropriate variables can be added (e.g. past behaviour/habit). Reviews of the TPB have found strong evidence of its efficacy (Armitage & Conner, 2001; Hagger, Chatzisarantis & Biddle, 2002; Hausenblas et al., 1997; Sheppard, Hartwick & Warshaw, 1988). For example, Hagger et al. (2002) found that across 72 independent exercise studies, attitude, subjective norms and perceived behavioural control explained 45% of intention and 27% of behaviour. In exercise studies, it has been consistently found that social norms are a weaker predictor of intention than attitude and perceived behavioural control (Brickell,

Chatzisarantis & Pretty, 2006). The TPB has been found to be superior in its predictive capacity to other social-cognitive models such as the Health Belief Model, Protection Motivation Theory and the TRA (Hausenblas et al., 1997; Quine, Rutter & Arnold, 1998).

The TRA and TPB have also received much critical appraisal but their evidence base is more established and methodologically robust than that of the previously discussed TTM. However, there are also a number of criticisms regarding the TRA and TPB. The models are unidirectional and do not take into account the possibility that variables may interact reciprocally (Biddle & Mutrie, 2001, 2008). Although the TPB does include perceptions of control, which could relate to the environment, the models are primarily psycho-social in nature and do not fully take into account wider environmental factors (Biddle & Mutrie, 2001, 2008; Smith & Biddle, 1999). As previously mentioned, the models in their original form have neglected past behaviours and habitual tendencies, implying that they may only be suited for predicting new behaviours (Biddle & Mutrie, 2001, 2008; de Bruijn et al., 2009; Gardner, 2008). The models do not distinguish between intention and expectation and it has been proposed that expectation may be more predictive of behaviour than intention (Hagger et al., 2002). There are issues with the operationalisation and semantic differentials of TPB measures used in research (Armitage & Conner, 2001; Biddle & Mutrie, 2001, 2008; Hausenblas et al., 1997). Moderating variables such as anticipated regret, moral norms, stability and past behaviour/habit are likely to strengthen predictability of the models (Conner & Armitage, 1998; Sheeran & Orbell, 1999; Cooke & Sheeran, 2004; Conner & Norman, 2005). Although this is not an exhaustive list of criticisms, this exemplifies that whilst the TPB is a strong and applicable model in relation to exercise behaviour, it is not without its limitations.

2.4 The Intention-Behaviour Gap

Social-cognition models, in the main part, focus on people's motivation to carry out specific behaviours. They are primarily based on the assumption that decisions are made via a rational evaluation and that intention translates into behaviour. Although intention has been found to be a significant predictor of behaviour (as discussed in Section 2.3), the strong emphasis placed on motivational concepts (such as intention) in health psychology has been criticised as intentions are only modestly correlated with actions (Biddle & Mutrie, 2008; Orbell & Sheeran, 1998). This phenomenon is understood as the 'intention-behaviour gap' "reflecting the black box nature of the underlying psychological processes that lead from intention to action" (Sniehotta, Scholz & Schwarzer, 2005, p. 144) . Within this thesis, the concept of the behaviour-intention gap is deemed important because for complex behaviours such as cycle commuting, intentions do not necessarily smoothly translate into actions due to wider environmental constraints.

2.4.1 Implementation Intentions

There are various theories and concepts that have attempted to address the behaviour-intention gap. One increasingly popular theoretical concept that has been put forward to specifically target this gap is that of 'Implementation Intentions' (Gollwitzer, 1999). Implementation Intentions are self-regulatory strategies that involve the development of specific plans regarding 'when', 'where' and 'how' a behaviour will take place, which are postulated to increase the correspondence between intention and actual behaviour (Hagger & Chatzisarantis 2005). Implementation Intentions are thought to help move people from the motivational phase to the volitional (intentional) phase of behaviour, bridging the gap between intention and behaviour (Hagger, et al., 2002). The underlying mental processes involved in Implementation Intentions consist of creating automatic links between environmental cues and behaviours that are associated with these cues. This is thought to result in the initiation of targeted behaviours without conscious intent and effort, implying an automated control function (Gollwitzer, 1999).

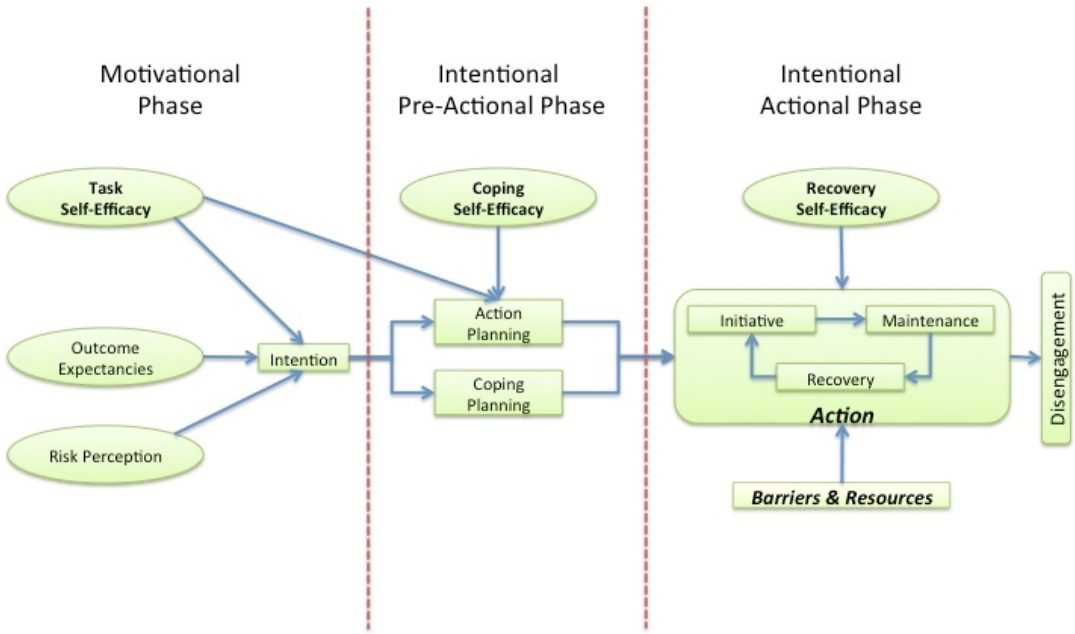
There are very few studies directly relevant to cycle commuting that have carried out research into the utility and efficacy of Implementation Intentions. One such study looked into reducing habitual car use and found that Implementation Intentions reduced the effect of habitual car use by essentially mimicking the cognitive habit process and thus facilitated the interruption of car use (Eriksson, Garvill & Norlund, 2008). There is a growing body of evidence to suggest that volitional strategies such as Implementation Intentions can augment the predictability of social-cognition models such as the TPB and other motivational strategies in health and exercise research (Armitage, 2007, 2008, 2009; Orbell, Hodgkins & Sheeran, 1997; Orbell & Sheeran 2000; Prestwich, Lawton & Conner, 2003; Rise, Thompson & Verplanken, 2003; Rivis & Sheeran, 2003). A meta-analysis of Implementation Intentions and health behaviours carried out on 94 independent studies found a medium to large magnitude ($d = 0.65$) for goal attainment, showing strong support for the use of Implementation Intentions (Gollwitzer, Sheeran & Conner, 2006).

More implicitly, the concept of the intention-behaviour gap is present in the TTM. The preparation stage as defined by Biddle & Mutrie (2001, 2008) represents the process in behavioural progression that is synonymous with the intention-behaviour gap phenomenon. Studies into alcohol reduction, smoking cessation and increasing physical activity used some of the processes of change from the TTM such as increasing knowledge, comprehending benefit and committing oneself to create Implementation Intentions (Armitage, 2006, 2009a; Armitage & Arden, 2008). The intervention studies that employed these TTM-based process interventions found significant positive results indicating that selected processes of change effectively attend to the disjoint between motivational and volitional behaviour. However, as Armitage (2009a) points out, extracting selective components of the TTM could be considered somewhat undermining to the foundations of the theoretical model.

2.4.2 Health Action Process Approach (HAPA)

The HAPA (Schwarzer, 1992) is a hybrid theory that explicitly acknowledges the behaviour-intention gap by addressing both motivational and volitional stages of behaviour. The HAPA is classed as a hybrid theory because it has been proposed as a continuous and a stage-based model rather than purely an attitude/belief-based model. It has three phases, which are the motivational phase, the intentional pre-actional phase and the intentional actional phase (see Figure 2.5). The motivational stage comprises task self-efficacy, outcome expectancies and risk perception, which underpin intention. The intentional pre-action phase consists of task self-efficacy and coping self-efficacy, action planning and coping planning and the intentional actional phase includes coping self-efficacy, recovery self-efficacy and is also directly influenced by environmental barriers and recourses. The stage of interest in relation to the intention-behaviour gap is the intentional pre-actional phase, in which the planning components are similar to the concept of Implementation Intentions.

Figure 2.5: The Health Action Process Approach Model



Not only does HAPA involve concepts resembling Implementation Intentions but it exhibits similarities to the stage-based TTM, whilst also sharing a degree of overlap with continuous social-cognitive models such as the Social Cognitive Theory, the TPB, the Health Belief Model (Becker, Haefner, Kasl, Kirscht, Maiman, et al., 1977) and the Protection Motivation Theory (Rogers, 1983). The model has only recently been subject to empirical testing (Sutton, 2005) and there is only a modest body of health and exercise-based evidence to support the assumptions of the HAPA (Lippke, Ziegelmann & Schwarzer, 2004; Luszczynska & Schwarzer, 2003; Schuz, Sniehotta & Schwarzer, 2007; Sniehotta et al., 2005). To date this model has not been adopted in cycle commuting-based research. Although the notion of strategic planning has received support for bridging the gap between intention and behaviour, it has not shown universal effectiveness (Sheeran, Milne, Web & Gollwitzer, 2005). Scientific understanding about volitional processes is not as established as is the knowledge base about motivational concepts (Conner, 2008). There are additional variables other than planning and self-

efficacy that may be important moderators in the behaviour-intention transitional process. Moderators such as past-behaviour/habit, anticipated regret, moral norms and stability, to name a few (Cooke & Sheeran, 2004) have already been identified earlier in relation to intentional- behaviour moderators of the TPB (see Section 2.4).

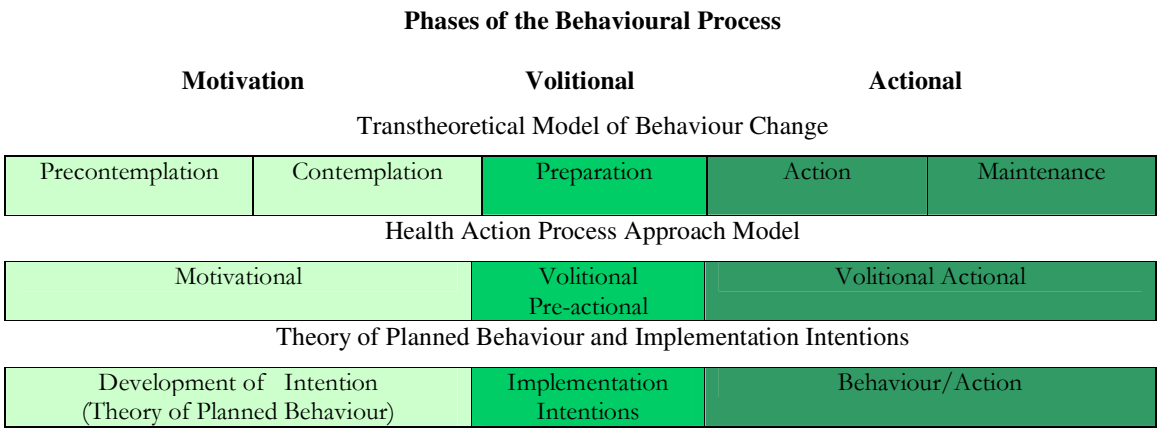
2.5 Theoretical Convergence and Integration

Within the health psychology, two more pragmatic concepts that have been receiving more attention in recent years are theoretical convergence and theoretical integration. Theoretical convergence relates to the recognition of common and similar ideas and constructs found within numerous health behaviour theories and models. The term theoretical integration describes the testing and integration of numerous health behaviour models in the endeavour to create a more effective and efficient, hybrid theory.

2.5.1 Theoretical Convergence

Throughout the discussion so far, although a number of different theories have been outlined, the overall evidence suggests there is substantial agreement with regards to the core phases that take place within behaviour change (see Figure 2.6). The three main process phases of behaviour that have been outlined consistently are a motivational, a volitional (intentional) and an action (behavioural) phase.

Figure 2.6: Commonalities between models in the processes of behaviour change



However, each theory has its own philosophy and a set of constructs proposed to underpin the behaviour change process, of which there is considerable overlap (Biddle & Mutrie, 2001; Schwarzer, 2008). Biddle & Mutrie (2001) presented a table to demonstrate the convergence of theoretical constructs between a number of the key social cognition-theories. This table has been adapted for this thesis to include the TTM, the HAPA and Implementation Intentions in order to demonstrate the convergence amongst the theories discussed within this chapter (see Figure 2.7). The key constructs that have consistently been evidenced within the motivational process of health behaviours are self-efficacy, outcome expectancy and intention (Conner & Norman, 2005). Although not the same, self-efficacy is deemed as a similar construct to perceived behavioural control.

Figure 2.7: Construct convergence across exercise theories (adapted from Biddle & Mutrie, 2001)

Theory or concept	Intention	Outcome Expectancy	Outcome Value	Social Norm	Self-Efficacy	PBC*	Situational Cues	Perceived Vulnerability
Transtheoretical Model	(√)	√	(√)	√	√	(√)	√	√
Theory of Reasoned Action	√	√	√	√				
Theory of Planned Behaviour	√	√	√	√	(√)	√		
Implementation Intentions							√	
Health Action Process Approach	(√)	√	(√)		√	(√)	√	√
Health Belief Model		√	(√)	(√)			√	√
Protection Motivation Theory	√	√	?	(√)	√	(√)	(√)	√
Self-Efficacy Theory		(√)		(√)	√	(√)	(√)	

Note. √ = Construct existing within theoretical framework, (√) = Construct existing in similar form, ? = Possible inclusion but not clear operational definitions

2.5.2 Theoretical Integration

Within health psychology, meta-analyses into theoretically-based research indicate that varying degrees of behaviour are unaccounted for (Armitage & Conner, 2001; Gollwitzer & Sheeran, 2006; Hausenblas et al., 1997; Milne et al., 2000). As a result of

this unexplained variance, the notion of theoretical integration has arisen. This essentially advocates selectively identifying variables from the dearth of psychological theories, in order to increase the predictability of behaviours and interventions aimed to target behaviour change.

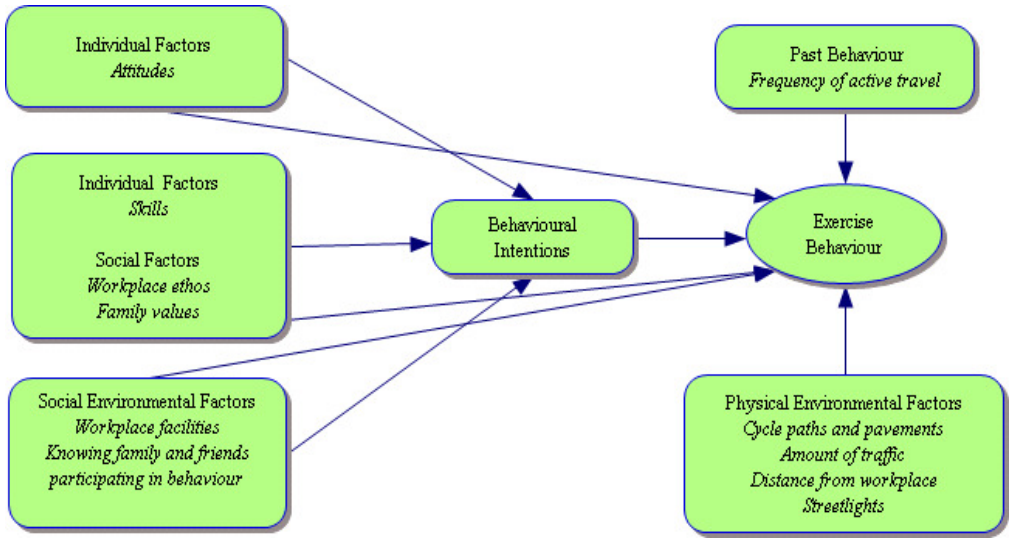
Theoretical integration has come about from researchers striving to identify the optimal variables that explain behaviour whilst reducing complexity and redundancy, thus resulting in an ongoing search for parsimony and high predictive capacity (Schwarzer, 2008). For instance, the HAPA model is viewed as an example of theoretical integration, drawing on concepts from TPB, PMT, SCT and Implementation Intentions to try and eliminate theoretical gaps and redundant variables (Hagger, 2010). Whilst Hutchinson et al., (2009), in their review of the TTM criticised researchers for only adopting aspects of the TTM, in the context of theoretical integration, this kind of practice would be not only valid but endorsed. Commonly, prominent social cognition models are combined for analysis and empirical testing to try and identify the weaknesses found in standalone models (Hagger & Chatzisarantis, 2008; Koestner, Lekes, Powers & Chicoine, 2002; Wilson & Rodgers, 2004). The theoretical integration of models has been proposed for many years but has only recently started to be rigorously tested in health psychology research. This exemplifies that the field has begun to think more critically and pragmatically about the principles of theories as well as the practices they apply to.

2.6. Ecological Model

Despite researchers' ongoing quest within health psychology to develop more streamlined and accurate conceptions of the behavioural process, psychologically-orientated theories have never been expected to predict all behavioural variance. This is because they generally include less consideration of the wider environmental factors (King, Stokols, Talen, Brassington & Killingsworth, 2002). In contrast, the concept of the Ecological Model places more focus on environmental constraints that influence behaviour (Sallis & Owen, 1999). As briefly discussed at the beginning of this chapter

(Section 2.1), this model has been growing in popularity within physical activity and active travel research (e.g. Cerin, Leslie & Owen, 2009; Giles-Corti & Donovan, 2002; McCormack et al., 2004; Ogilvie, Mitchell, Mutrie, Petticrew & Platt, 2006; Panter & Jones, 2010; Sallis, Bauman & Pratt, 1998; Sallis, Cervero, Ascher, Henderson; Foster & Hillsdon, 2004). The Ecological Model concept in principle incorporates individual, social and physical environmental factors that influence behaviour and aims to understand how these factors relate and interact with each other (see Figure 2.8).

Figure 2.8: A schematic example of an Ecological Framework to active travel behaviour (adapted from Pikora, Giles-Corti, Bull, Jamrozik & Donovan, 2003)



The concept of the Ecological Model is in part underpinned by Skinner's (1953) operant conditioning principles, which propose that behaviour is controlled by environmental stimuli (Sallis and Owen, 1999). Bronfenbrenner (1977) suggests that the philosophy of an Ecological Model is more akin to Lewin's (1931) behavioural equation, $B = f(P, E)$, which posits behaviour is a joint function of the person and the environment. This interaction is understood to occur in a more reciprocal and constructed manner between person and environment as opposed to the passive, more deterministic nature of operant conditioning. However, in some instances, ecologically-based research into physical

activity and active travel overlooks cognitive factors and focuses on wider environmental constraints (e.g. Hoehner, Brennan Ramirez, Elliott, Handy, & Brownson, 2005; Lee & Vernez Moudon, 2006; Rodríguez & Joo, 2004; Suminski, Poston, Petosa, Stevens, & Katzenmoyer, 2005).

To date there are few active travel studies that have attempted to better understand the true complexity of interactions that go on between individual, social and environmental factors (Ball, Timperio, Salmon, Giles-Corti & Crawford, 2007; Troped, Sunders, Pate, Reininger & Addy, 2003). Commonly active travel research that has taken an ecological approach has reported environmental factors such as population density, land mix use and urban infrastructure to be associated with higher levels of walking and cycling (e.g. Saelens, Sallis & Frank, 2003; Sallis, Frank, Saelens and Kraft, 2004).

Taking an ecological approach somewhat moves away from the ideas of parsimony and universal application that health psychologists strive for. As well as taking a more holistic approach to the factors that influence behaviour, proponents of the Ecological Model have highlighted the need to address the specifications of different contexts and behaviours, as both the nature of activity and the specific place in which it is carried out has an impact on behaviours (Giles-Corti, Timperio, Bull & Pikora., 2005; Pikora et al., 2003; Sallis et al., 2006). This proposition in itself makes the operationalisation of such a model more challenging because adapted versions of the model will be needed for different behaviours and contexts. Pikora et al., (2003) aimed to develop a behaviour specific framework, which included the environmental influences on walking and cycling for transport and for recreation separately. Four features were included within the framework: functionality, safety, aesthetics and destination. Some differences were found between individual behaviours; for instance, cyclists were more influenced by the presence of continuous routes and traffic safety than walkers. However, this study was based on limited empirical research and included the opinions of individuals classed as experts in the field, which may have biased the data to favour subjective views and hunches as opposed to empirical evidence.

The operationalisation of the Ecological Model framework in physical activity and active transport research is still in its infancy (Bauman & Bull, 2007). Whilst advancements are being made (Ogilvie, Mitchell, Mutrie, Petticrew & Platt, 2006; Pikora et al., 2003), so far the Ecological Model has largely remained as an overarching and somewhat conceptual framework as opposed to a single clearly defined and operational theory. Despite the limitations of operationalising the Ecological Model through empirical testing, a large scale 'whole town' intervention project to promote cycling, currently taking place in six selected UK cities adopted a broad ecological approach. Large amounts of European funding facilitated a comprehensive intervention including individual, organisational and environmental components. The preliminary results show significant success at increasing cycle use (Sloman et al., 2009).

Regardless of the growing popularity in active travel to investigate environmental variables associated with behaviour, social cognitions are understood to play a somewhat understated but equally important role in behaviour change (Giles-Corti, 2006). In some physical activity and active travel research, social cognitions have been found to be more predictive of behaviour than physical-environmental factors (Bagley & Mokhtarian, 2002; Cavero & Duncan, 2003; de Geus, De Bourdeaudhuij, Jannes & Meeusen, 2008; Giles-Corti & Donavan, 2002; Lemieux & Godin, 2009). For example, Giles-Corti and Donovan (2002) reported that individual and social factors were direct determinants in the decision to carry out recommended levels of activity, whereas the environmental factors determined whether or not local recreational facilities were used. Although this thesis takes a psychological approach to understanding cycle commuting behaviour, one could argue from a perspective of reciprocal determinism (Bandura, 1986) that there is a degree of overlap between social cognitions and environmental factors, in the way that they interact.

2.7 Chapter Summary and Conclusions

This chapter has discussed and critically appraised a number of prominent theories and concepts that address health behaviours, which are deemed relevant and in some cases have been used in cycle commuting research. Whilst the TTM has high practical applicability, questions over the validity of stage constructs and the effectiveness of TTM-based interventions have been raised. However, the TTM evidence base is not yet fully established and many criticisms stem from poor application and use of the theory in research and practice. Out of all of the theories presented here, the TPB has the most established evidence base in exercise behaviours, but is not without its limitations. The TPB focuses on motivational factors and pays less attention to volitional processes, which are deemed important in cycle commuting behaviour. In contrast, Implementation Intentions solely attend to this volitional phase between intention and behaviour and have been used to augment motivational focused theories such as the TPB. The HAPA model is a hybrid theory encompassing elements from the TTM, TPB, Implementation Intentions and other social-cognition models. It was outlined in this chapter to exemplify theories that incorporate the volitional phase of behaviour change. Whilst the volitional phase is deemed relevant to cycle commuting, there is limited research into the variables that moderate the intention-behaviour gap.

The theories outlined in this chapter and the concepts they encompass share some common ground. Theoretical integration acknowledges that sets of constructs within health psychology theories somewhat overlap. Commonly used constructs that have received the most empirical support for underpinning behaviour are outcome expectancies (appraisal of positive and negative consequences), self-efficacy and intention. A growing trend in health psychology is to empirically test multiple theories in an attempt to identify the most predictive combination of variables from each theory to develop new integrated theoretical models. This concept has been introduced to the reader to exemplify that health psychology is becoming more pragmatic and flexible in its approaches to both theory and the practices it applies to. Finally the Ecological Model has been introduced to exemplify the current direction of research within the field of

physical activity and active travel. However, investigating social cognitions is an important and under-researched approach in this field. It should be noted that theories with individual-level behaviour such as the TPB also include social and environmental elements; however, within such theories their scope is limited. The Ecological Model has also been discussed to highlight that whilst this thesis is psychologically-orientated, it advocates that the environment plays an interactive and supportive role in attitude formation, cognitions and behaviours towards cycle commuting.

This theoretical discussion has exemplified the paucity of theoretically informed research into cycle commuting. Whilst this could be seen as concerning, cycle commuting research is still in its early stages and comprises only a small body of research. Much cycling-orientated research has taken a variable-based approach as opposed to adhering to one specific theoretical framework. In the following chapter, a detailed review of empirical literature that focuses on social cognitions directly relevant to cycle commuting will be presented.

Chapter 3

Understanding Psychological Variables Associated with Cycle Commuting Behaviour

Aims of the Chapter

The aim of the present chapter is to primarily discuss the psychologically-orientated empirical literature relating to cycle commuting, in order to highlight what is known about the psychological factors associated with this behaviour. This chapter does not include findings from cycle commuting intervention studies as this body of literature will be discussed and critiqued in Chapter 7.

3.1 Introduction

The previous chapter provided an overview of a number of theories and concepts that were deemed potentially relevant to cycle commuting behaviour. It also highlighted there are relatively few cycle-orientated studies that have applied a strict theoretical framework to their research. The present chapter follows on from the previous chapter to develop an empirically-based understanding of what is currently known about social cognitive factors and how they influence cycle commuting behaviour. In order to understand the variables that influence cycle commuting behaviour, it is important, where possible, to focus on behaviour-specific findings (Giles-Corti et al., 2005). With this in mind, the discussion within this chapter prioritises cycle commuting studies. However, such research is very limited (Heinen, van Wee, & Maat, 2010), so where deemed relevant, studies discussing cycling in broader terms are also included (e.g. cycling for transport, utilitarian cycling, general cycling and active travel).

Psychologically-orientated studies investigating cycle commuting are heterogeneous in nature and many have adopted a variable-based approach as opposed to adopting a strict theoretical framework. The most commonly examined variables are perceived benefits (reasons to cycle) and perceived barriers (reasons not to cycle). These two variables

together broadly equate to the similar theoretical constructs of attitude, decisional balance or outcome expectancy found in social cognition and behaviour change theories (see Figure 2.7). Whilst other psychologically-orientated variables are considered in cycle research to a lesser degree, the main detailed discussion of psychological variables in this chapter centres on benefits and barriers.

Benefit and barrier measures employed in cycle-orientated studies often involve elements of the physical environment and sometimes the social environment too. However, studies that have a psychological focus as opposed to a wider environmental focus are concerned with 'subjective perceptions' that individuals hold about physical and social environmental factors instead of more 'objectified views'. How possible it is to differentiate subjective and objective views is open to ontological and epistemological debate. Nevertheless, researchers attempting to understand subjective perceptions often examine similar sub-groups of people with differing levels of intention or behaviour (e.g. cyclists versus non-cyclists) to identify perceptual and attitudinal differences that may exist between these groups.

The only known review of cycle commuting literature looked at the influence of individual, social and environmental factors (Heinen et al, 2010). This review was not carried out systematically, rather provided a more descriptive overview of research findings from a wide range of studies that differed in quality. The authors concluded that due to there being a diverse range of factors examined sporadically within the discourse, no one specific factor could be identified as most significantly influencing cycle commuting behaviour. From the available evidence the authors were able to more generally identify psychological factors such as perceptions and attitudes as "main contributors to the decision making process" (Heinen et al., 2010, p. 83). Building on the review from Heinen et al., (2010), the present chapter takes a more detailed look at the research designs, measurement tools and analysis techniques that underpin the findings from psychologically-oriented cycle commuting studies. Providing a more detailed critique of these studies will help to provide a context for data analysis techniques to be

used in the subsequent empirical research that is carried out for this thesis. Initially, questionnaire-based studies are discussed followed by interview-based studies,

3.2 Questionnaire-Based Social Cognitive Research

Cross-sectional questionnaire-based research is a commonly used methodological design employed to investigate cycling behaviour. Quantitative research stems from a positivist ontology and the integrity of such research is primarily concerned with: measurement, causality, generalisations and replication (Bryman, 2004). The positivist paradigm and its established practices are commonly viewed as the accepted scientific convention (Lyons & Coyle, 2007). Although cross-sectional questionnaires are unable to infer causation *per se,* they are valuable because this kind of research can reveal relationships (e.g. associations and correlations) between independent and dependent variables. Understanding relationships between variables can help to identify and develop appropriate theories that can be used to inform the promotion of cycle commuting. Quantitative research is also able to provide more empirical generalisability than qualitative research. However, questionnaire-based research is predominantly deductive by nature testing pre-determined sets of variables, which can only provide a static and partial picture of the influences of cycling (Bryman, 2004).

In total, 13 questionnaire-based studies that address social cognitions towards cycling and cycle commuting were identified. Initially, four studies that specifically addressed cycle commuting are discussed individually (Crawford et al., 2001; de Geus et al., 2008; Gatersleben & Appleton, 2007; Stinson & Bhat, 2004). After which, findings from the additional nine studies are collectively presented to give an overview of the findings (Eves et al., 2003; Garrard, Crawford & Hakman, 2006; Lemieux & Godin, 2009; Shannon et al., 2006; Titze, Giles-Corti, Knuiman, Pikora, Timperio et al., 2010; Titze, Stronegger, Janschitz & Oja, 2008 Unwin, 1992, 1995; Wardman, Hatfield, & Page, 1997). Keeping in mind the integrity of quantitative research, this discussion will pay attention to the measurements used and (addressing the concern of replication) the

validity and reliably of these measurements, the inferences that can be made from the findings, and the strengths of generalisations to come from these studies.

3.2.1 Cycle Commuting Studies

All four cycle commuting studies used different self-completion questionnaires to measure social cognitions of cyclists and non-cyclists, which differed in quality. The samples employed in these studies primarily ranged from 18 to 65 years-old. Perceived benefits and barriers featured significantly in each study. Whilst there were some common benefits and barriers examined across these studies, different measures and semantics are used to refer to the same phenomena (see appendix A).

The most robust study addressing cycle commuting was carried out by de Geus et al. (2008). The authors measured social cognitive and environmental variables, and perceptions of cycle destination time (see appendix A). The research was carried out in the Belgian town of Flanders and the survey was advertised in a local newsletter and disseminated by local cycle communities. After data cleaning 343 participants were included in the data analysis (43% men and 57% women). Individuals included in the study worked outside of the home, lived 10 km or less from the workplace and had no health problems preventing them from cycling. The participants were categorised as cyclists if they reported cycling to work at least once a week in the past six months (55%) and non-cyclists (45%), if they reported cycling to work less than once a week. The questionnaire was based on two existing physical activity measures (De Bourdeaudhuij & Sallis, 2002; De Bourdeaudhuij, Sallis, & Saelens, 2003). Cronbach's alpha tests revealed acceptable levels of reliability. Analysis of variance (ANOVA) and logistical regression were used to test for differences between the cyclists and non-cyclists.

The results from de Geus et al, (2008) revealed that cyclists reported more social support than non-cyclists for four out the five related question, which were having a cycling

partner, having a significant other stimulate them, having a significant other accompany them and having a role model. The cyclist groups indicated stronger internal[2] and external[3] self-efficacy than non-cyclists. Out of the five perceived benefits examined, ecological and economic awareness was the only one that was found to be stronger for cyclists than for non-cyclists. All four perceived barriers were regarded as more significant by non-cyclists than by cyclists, which were lack of skills and health, lack of time, lack of interest and external obstacles. Only one out of eight physical environment measures was viewed as being significantly worse by non-cyclists than cyclists, which was workplace facilities. Non-cyclists perceived three out of four local destinations to take significantly longer to reach by bike than cyclists, which were food shops, other shops and work. This result remained the same even when 'living environment' was controlled for within the analyses.

De Geus et al. (2008) also carried out a logistical regression analysis on the questionnaire variables. The analysis revealed that individuals were more likely to cycle if they had: relatives who cycled and provided social support, high levels of external self-efficacy, high levels of ecological and economic awareness, more positive perceptions of workplace cycle facilities, perceptions of having more available time, and more interest in cycling. Overall, the authors concluded that individual and social factors are more predictive of cycle behaviour than environmental ones. One potentially relevant finding that this study did not elaborate on was that all participants, regardless of whether they cycled to work or not, had a strong awareness of the health and wellbeing benefits and environmental and economic benefits associated with cycle commuting. Factors that were not explicitly measured in this study, but have proved significantly important in other work, are the potential barriers of inclement weather and terrain (e.g. hills or road surface). It is not clear whether these were addressed in the measure 'external obstacles', which comprised four items that were not individually

[2] Internal self-efficacy relates to how confident a person feels to cycle in relation to their personal situation such as being tired.
[3] External self-efficacy relates to how confident a person feels to cycle in relation to external conditions such as if the weather is bad.

reported. Whilst the study overall was well conducted, the sampling strategy that involved using local cycle communities to distribute the questionnaire may have created inherent biases in the data. Also, the sample reported higher than average levels of education, which has implications for the generalisability of the data.

Gatersleben & Appleton (2007) carried out a cross-sectional questionnaire study to investigate perceptions and attitudes towards cycling to work in a UK city. The questionnaire included measures of attitude, perceptions, personal barriers and structural barriers, and an open question enquiring under what circumstances participants would be prepared to cycle (see appendix A). The research was carried out at an English university and included 178 employees (28% response rate) of which 49% were female and 51% were male. It was not reported that the questionnaire was based on any previously established measures or that reliability or validity testing had been carried out. The participants were categorised into five stage groups based on the TTM stages of change, but the stage boundaries differed slightly in comparison to the stages of change construct adopted by this thesis and others (e.g. Crawford et al., 2001; Mutrie et al., 2002) (see appendix A). All participants included in the study lived five miles or less away from their workplace. A purely descriptive analysis was undertaken presenting percentages only, which related to the number of people in each stage category that either agreed or strongly agreed with a statement relating to each question asked.

The four attitudinal questions measured: participants' attitudes in terms of if they liked cycling, if they wanted to cycle, and their attitudes towards being environmentally friendly and being healthy. All attitudinal measures were viewed more favourably by those in the latter stages than those in the earlier stages. Across all stages, many participants ($\geq$ 78%) agreed that cycle commuting was healthy and environmentally friendly, with those in the maintenance stage exhibiting 100% agreement with these statements. There were three personal barrier questions that measured participants' perceptions of not being fit enough to cycle, cycling being uncomfortable and cycling being uncharacteristic. Perceptions of all three personal barriers incrementally decreased

from earlier to latter stages. There were four questions relating to structural barriers, which included being unsafe, a lack of cycle lanes, a lack of cycle parking and a lack of showers. There was some general variation in perceptions between groups but a lack of cycle lanes and safety concerns were viewed most commonly as cycling barriers overall. Looking at the overall data set, both attitudinal and personal barrier measures were viewed most positively by the maintainer group and most negatively by the precontemplator group.

The questionnaire also included an open box question to enquire under what circumstances participants would be willing to cycle to work. It was found that 19% of precontemplators would not be encouraged to cycle under any circumstances, whereas, in other stages only a small number, if any at all provided this response. Across all stages, the most commonly cited encouraging circumstances to cycle were: better weather, flatter terrain, and better safety facilities. The authors noted that the university was situated on a hill thus the result regarding terrain was not surprising. In relation to distance, 18% of precontemplators reported they would cycle if they lived nearer to work and this percentage incrementally decreased for the contemplators (16%) and preparers (7%), with no actors or maintainers raising this issue. Interestingly, the average distance from home to work was similar, ranging between two and three miles, for each stage group suggesting that, in this instance, responses were not based on objective constraints but instead rather subjective views.

Gatersleben and Appleton's (2007) study has provided valuable insights into the different perceptual and attitudinal profiles that individuals in the different stages of change possess towards cycle commuting. Whilst this study presented some novel results, they should be interpreted with caution for a number of reasons. The questionnaire was not reported to have been based on existing measures and no mention was made of validity or reliability tests being undertaken, which has potential repercussions on the quality of the data. For instance, the stage of change measure used did not align with the stage of change construct used in other cycle commuting studies

(Crawford et al., 2001; Mutrie et al., 2002). Additionally, the data presented revealed descriptive trends but was not analysed using inferential statistics so there are no statistical measures of significance underpinning these findings.

Stinson & Bhat (2004) carried out a questionnaire-based study conducted on the World Wide Web, which comprised a primarily North American and Canadian sample. A questionnaire was created for the study, to investigate both perceived barriers and benefits for cycling to work but the authors did not report carrying out any reliability and validity tests. Data on cycling barriers and data on cycling benefits was collected and reported separately. Participants were identified using cycle-related internet sources such as electronic mailing lists, websites and newsletters and non cycle-related electronic mailing lists.

In terms of the barriers portion of the questionnaire, there were 2822 participants in total but no gender information was reported. Both cycle commuters who were based on the criterion of cycling to work at least three times in a year and non-cycle commuters who cycled less than three times a year took part. Participants were required to select from a list of barriers, the ones that most applied to them (see appendix A) as well as writing down one barrier that was not on the list. The analysis was descriptive in nature, presenting percentages of how many of the sample selected each barrier. Across the whole sample the most common barrier was unpleasant weather. The authors, however, anticipated that the results may be prone to seasonal weather bias as the questions regarding barriers were posed in the context of the last three months and the data was collected in the springtime. Whilst cycle commuters only commonly identified unpleasant weather and injury/illness as being the biggest barriers, non-cycle commuters identified numerous big barriers such as: lack of daylight, unsafe neighbourhoods, and distance from work, dangerous traffic, and lack of workplace cycle facilities.

The second aspect of Stinson & Bhat's (2004) study investigated benefits of cycling to work and involved a sample of cycle commuting participants only (n = 2548). Again, no

information on gender was provided. Following the protocol and analysis outlined above, participants selected benefits associated with cycling from a list provided. The most commonly cited benefits were: health and fitness benefits, pleasure and enjoyment of cycling and ecological concerns for the environment. As only cyclists took part in the questionnaire relating to benefits, conclusion on any differences that existed between cyclists and non-cyclists could only be drawn for the reported barriers. The authors concluded that non-cyclists appear to hold some "misperceptions and misconceptions" about perceived barriers to cycling, such as a heightened sense of risk and danger when cycling. However, this may be a somewhat short sighted conclusion as there is a possibility that non-cyclists may be less skilled at cycling and hence more vulnerable to risks.

Whilst this research employed large sample sizes, there were a number of limitations identified that are understood to affect the quality of the findings. There was a lack of detailed methodological information, for example, demographic information such as gender was not reported. Additionally, no validity and reliability tests for the questionnaires were reported. The criterion by which 'cyclists' were identified should be heavily questioned too, as participants were classified as 'cyclists' if they cycled to work three or more times per year. In relation to other categorising methods, such as the stages of change construct that is more commonly used (Crawford et al., 2001), this level of cycling would not be classed as an active cyclist, but rather as someone contemplating or preparing to cycle commute. Therefore, it is not possible to discern whether the cycling groups' data from Stinson & Bhat's (2004) study is representative of true cycle commuters. Also, the sampling method, which included recruiting participants from cycle-orientated websites is likely to have introduced some bias. A final point of caution is that the data presented is purely descriptive; therefore, it is not possible to discern significant differences regarding perceived barriers between the cycle and non-cycle groups.

The final cycle commuting specific questionnaire-based study to be discussed was carried out in the Scottish city of Glasgow by Crawford et al. (2001). The investigation focused on perceptions of barriers and benefits associated with active commuting but cycling and walking were analysed separately. The questionnaire comprised of 13 cycle-specific barriers and 23 cycle-specific benefits (see appendix A). No mention was made of the questionnaire being based on previous measures or any validity or reliability testing procedures. In total 1000 questionnaires were distributed randomly to employees within two similar workplaces in the same area of the city. There was a 69% response rate reported (n = ~ 690) overall, 62% of which were women and 38% were men but there were no details on how many of these people responded to the cycling portion of the questionnaire (as opposed to the walking portion),

The strongest cycle commuting barrier reported was bad weather (including darkness and fog) followed by danger from motor traffic. Cross tabulations were used to identify any significant associations between stages and each barrier. A significant association was found for bad weather, with precontemplators holding the strongest negative views. Although danger from traffic was also a strong barrier, there was no significant association with stages of change. The strongest cycle commuting benefits reported were dedicated cycle routes/lanes, and health and fitness. These benefits did not significantly differ across stages of change. From the analysis carried out it appears that whilst the perceptions of the weather exhibited a strong subjective element, perceptions of danger from traffic, and the benefits of increased cycle infrastructure and health and fitness remained relatively stable and were more universally recognised by all participants. Whilst the sampling strategy of this research was robust, again there was no mention of validity and reliability test procedures being carried out on the questionnaire. Additionally, the majority of participants were female, limiting the generalisability of the study.

3.2.2 General Cycling Studies

The key findings from the nine additional questionnaire studies that addressed cycling behaviour are also presented in order to draw awareness to the evidence regarding more general utilitarian and lifestyle cycling. However, the quality and generalisability of these findings differ due to wide variations in research designs, sample sizes, contexts, and measures and analysis techniques used. For instance, all nine studies used different questionnaires but only one study reported carrying out Cronbach's alpha tests, producing high levels of reliability (Titze et al., 2010) and four of the studies reported carrying out test-retest reliability measures that satisfied acceptable reliability levels (Eves et al., 2003; Lemieux & Godin, 2009; Shannon et al., 2006; Titze et al., 2008). In terms of the variables examined, five studies used cross-sectional questionnaires to investigate perceptions of benefits and barriers related to cycling (Garrard et al., 2006; Shannon et al., 2006; Unwin, 1992, 1995; Wardman et al., 1997). Two studies explicitly examined social cognitive variables associated with the Theory of Planned Behaviour (TPB) (Eves et al., 2003; Lemieux & Godin, 2009) and two studies investigated social cognitive variables that were more implicitly associated with the TPB (Titze et al., 2010, 2008).

With regard to the five studies that focussed on benefits and barriers related to cycling, only one made data comparisons between cyclists and non-cyclists (Shannon et al., 2006). Collectively the reported barriers were found to be: bad weather, fear from traffic, distance time involved, hilliness, security, lack of facilities, exhaust fumes, activity and inconvenience of carrying belongings. The most common barriers cited were: fear of traffic (Wardman et al., 1997; Unwin, 1992, 1995) and time involved in cycling (Garrard et al., 2006; Shannon et al., 2006). Shannon et al. (2006) highlighted that cycle-related barriers play a potentially stronger role in cycling behaviour than benefits. Collectively, the benefits for cycling were found to be: health and fitness, enjoyment, ecological awareness, speed, cost, convenience and independence. The most common benefits reported were: health and fitness (Garrard et al., 2006; Shannon et al., 2006; Unwin, 1995), cost (Shannon et al, 2006; Unwin, 1992, 1995) and speed (Unwin,

1995). Any differences in the findings between these studies are likely to stem from the diverse nature of research designs, as mentioned above. For example, one study reported findings on walking and cycling for transport collectively (Shannon et al., 2006) whilst two studies did not differentiate between recreational and utilitarian cycling (Garrard, et al., 2006; Unwin, 1995). Another example is that research involving university students indicates cost saving is the biggest benefit associated with cycling (Shannon et al., 2006; Unwin, 1992), whereas studies using non-student based adult samples more commonly cited factors such as health as being the biggest benefit (Garrard et al., 2006; Shannon et al; 2006; Unwin, 1995).

The two studies that focussed on cycling and variables associated with the TPB examined attitude, perceived behavioural control, social norms and intention to find out if the TPB was able to predict utilitarian cycling behaviour (Eves et al. 2003; Lemieux & Godin 2009). These two studies used prospective designs on samples of university students. Both studies found that intention was predictive of behaviour and that in turn, intention was predicted by perceived behavioural control and attitude, but not subjective norms. Eves et al. (2003) found that affective attitudinal measures were more predictive than instrumental attitudinal measures of intention to cycle. Both studies also included past behaviour/habit, which was found to increase prediction of behaviour in both instances. The two final studies examined social cognitive variables more implicitly linked with the TPB in relation to cycling for transport (Titze et al., 2008; 2010). Both made comparisons between cyclists and non-cyclists. Titze et al., 2010 included the variables of attitude and perceived behavioural control, whereas Titze et al., 2008 included the variables of perceived benefits, perceived barriers and social support. In both studies, all social cognitive variables tested were found to have a significant influence on cycling behaviour and the authors proposed that the findings regarding the social cognitive variables were in accordance with the tenets of the TPB.

3.2.3 Overview of Quantitative Findings

The wide variation of research quality, measures and terminology used across the questionnaire-based studies that have been discussed make it difficult to draw clear conclusions about the inferences that exist between social cognitions and cycle commuting behaviour. A major methodological weakness within the evidence presented stems from the lack of internal validity reported in relation to the questionnaires used. As social cognitions such as attitudes and intentions are latent variables and cannot be observed directly it is important to carry out validity and reliability testing to ensure that a set of constructs has a degree of shared variance. Whilst some studies reported carrying out test-retest reliability and Cronbach's alpha testing, three out of the four cycle commuting studies did not report carrying out any such tests. If we are to better understand the relationships that exist between psychological factors and cycle commuting behaviour, validity concerns need to be taken more seriously as they provide the foundation for what kind of evidence claims can be made.

Although all four cycle commuting studies and a number of the more general cycling studies made comparisons between cyclists and non-cyclists there was very little consistency in the categorisation criteria for these two groups. This lack of consistency makes it difficult to draw conclusions about any differences that exist between non-cyclists and cyclists. Future studies would benefit from adopting a common set of criteria such as the stage of change construct as defined by Crawford et al. (2001), which is one of the few measures that has been used with any consistency in this field to date. Within the cohort of studies discussed, the sampling strategies, and the contexts in which research was carried out also varied, which have implications on the generalisability of the findings. A number of studies used strategies more akin to opportunistic sampling as opposed to random sampling. Opportunistic sampling strategies have a higher chance of introducing biases into the data. Carrying out research in differing contexts may also impose some limits on the reach of the findings. For example, in countries such as Belgium where there is higher utilitarian cycle use than in the UK, cultures, customs and

policies are likely to differ potentially impacting the way in which people perceive some of the barriers associated with cycling.

Taking on board the limitations of the evidence presented there are some common trends that have emerged from the collective findings. The most robust studies indicate that there are significant differences in social cognitions that exist between cyclists and non-cyclists (de Geus, et al., 2008; Shannon et al., 2006; Titze et al., 2008, 2010). Differences in social cognitions between cyclists and non-cyclists are also evident in less robust findings (Crawford et al., 2001; Gatersleben & Appleton, 2007; Stinson & Bhat, 2004). Overall, regular cyclists were found to view cycling in a more favourable light than non-cyclists. Although the types of barriers that studies investigated differed substantially, the more subjective or personal barriers examined, such as lack of time or fitness level, were consistently found to be perceived as greater barriers by non-cyclists in comparison to cyclists (de Geus et al., 2008; Gatersleben & Appleton, 2007; Stinson & Bhat, 2004; Titze et al., 2008). There were less consistent results regarding more objective barriers such as danger on the roads and weather. Such differences are likely to stem from the wide variation in the phrasing of the measures and the differing cultural contexts in which the research was carried out.

The evidence regarding the benefits associated with cycling most commonly reveals that there was less variation in perceptions between cyclists and non-cyclists than was found in the case of subjective barriers (Crawford et al., 2001; de Geus et al., 2008; Gatersleben & Appleton, 2007; Shannon et al., 2006). More often than not people, regardless of whether they cycled or not, reported a strong awareness of the health and environmental benefits associated with cycling (Crawford et al., 2001; de Geus et al., 2008; Gatersleben & Appleton, 2007). This indicates that reducing subjective barriers is more likely to be effective at promoting cycling than the benefits involved. Titze et al., (2008) found benefits to significantly predict cycling behaviour, however, they did not examine the measures of health and environmental benefits but included emotional satisfaction and speed.

Less commonly, the variables of self-efficacy and social norms were examined. Only one study investigated self-efficacy (de Geus., et al., 2008) and three investigated the similar variable of perceived behavioural control (Eves et al., 2003; Lemieux & Godin 2009; Titze et al., 2010). All four studies found higher levels of either external self-efficacy or perceived behavioural control more predictive of cycling behaviour, indicating that developing these concepts in people may help to increase cycling uptake. Four studies included measures relating to social support and social norms (de Geus, et al., 2008; Eves et al., 2003; Lemieux & Godin 2009; Titze et al., 2008). The one study that looked into the concept of social support in some detail found increased levels to be associated with cycle commuting (de Geus et al., 2008). Titze et al., (2008) and de Geus et al., (2008) found social norms to be predictive of cycle commuting. However, the other two studies that used prospective designs as opposed to a cross-sectional questionnaire design did not find social norms to be significantly predictive of intention to cycle (Eves et al., 2003; Lemieux & Godin, 2009). Prospective designs are understood to provide more robust evidence than cross-sectional questionnaire designs. However, in light of the many differences that exist between the four studies that investigated social support and social norms, it is not possible to draw any clear conclusion regarding social factors and their influence on cycling behaviour from this data.

3.3 Interview-Based Social Cognitive Research

There are only a small number of qualitative interview-based studies that have investigated cycling and even fewer that have investigated cycle commuting specifically. Within physical activity research there has been a call for more qualitative research to be carried out (Allender et al., 2006; Dale, 1996; Foster, Hillsdon, Cavill, Allender & Cowburn, 2005). It would also seem fitting to carry out more qualitative research into cycle commuting as we currently have a limited understanding of cycle commuting behaviour and the variables and mechanisms that underpin it. Qualitative research offers an exploratory, process-orientated and inductive approach that allows for new concepts,

relationships and themes to emerge, which may help to advance our knowledge (Bryman, 2004; Kvale, 2007; Silverman, 2005). Cycle commuting is understood as a complex behaviour (Crawford et al., 2001; Mutrie et al., 2002) and aspects of the wider environment as well as social cognitions are understood to play an important role in cycle commuting behaviour. As qualitative research, by nature, is contextually sensitive, using this methodology can provide a detailed account of the setting and the impact it may have on behaviour (Allender et al., 2006; Bryman, 2006). Qualitative research can also provide complementary and rich findings that 'hang flesh on the bones' of quantitative results (Coakley & Dunning, 2002; Silverman, 2005).

However, whilst qualitative research has its strengths, it also has its weaknesses too. Qualitative research is generally carried out using smaller samples and does not adhere to the same principles of scientific rigour as quantitative research, which means that findings do not have strong empirical generalisability, but rather more theoretical generalisablity. It is also more challenging to scrutinise the quality of qualitative research as unlike quantitative research, which largely aligns with a unified set of principles stemming from the positivist paradigm, there are multiple ontological paradigms that can guide qualitative research. For example, qualitative researchers that adopt a relativist ontology may not advocate carrying out inter-coder tests for reliability whereas qualitative researchers adopting a more realist or post-positivist ontology would be likely to use such a technique. Therefore, in order to be able to make judgements about the integrity of qualitative research it is important that researchers provide a high level of transparency throughout their work and where possible appropriate procedures to enhance credibility (Yardley, 2000).

There is only one known qualitative, peer-reviewed study that has specifically investigated cycle commuting (McKenna & Whatling, 2007). An additional five qualitative studies have addressed cycling more generally: two of which are peer reviewed (Cavill & Watkin, 2007; Daley, Rissel, & Lloyd, 2007), one university publication (Garrard et al., 2006) and two published by the Department for Transport

(Davies, Halliday, Mayes, & Pocock, 1997; Mayes, Halliday, & Hatch, 1996). The Department for Transport has also internally published a number of older qualitative cycle related papers that are not in the public domain, therefore, have not been included in this thesis .Each of the six studies is discussed below, paying attention to transparency and credibility associated with integrity of the research.

McKenna & Whatling's (2007) research was carried out in a UK town and adopted a phenomenological perspective, interviewing a purposive sample of nine regular adult cycle commuters (seven male and two female) recruited from the local area. In line with the ontological perspective, the researchers made clear their potential biases. To increase the credibility of the findings the authors analysed the data independently and then merged it together. The research focus was on cycle commuters' lived experiences and the findings were themed into four categories: time, space, body, and human relations.

A concern for better human relations with other road users was the most dominant theme to emerge. Closely linked to this was the dimension of space that emphasises the marginalisation of cyclists' space on the roads by other traffic. Participants also commonly discussed their embodied feelings towards self and their vulnerability within the surrounding environment (both the roads and the weather). Time was a concept discussed broadly in terms of the time needed to prepare for a journey, the predictability of journey time and the dynamic minute-by-minute experience that cyclists experienced during their journey to work. The findings overall highlighted the complexity of cycle commuting behaviour and the unequal power relationship cyclists have to other road users. Based on their findings, McKenna & Whatling (2007) bring into question the concept of grouping cycle commuting with other behaviours such as walking due to the unique nature of cycling as a form of transport.

The remaining five qualitative studies that focus primarily on utilitarian cycling carried out more descriptive analyses than McKenna and Whatling's (2007) approach, with findings focussing broadly on benefits and barriers associated with cycling. Daley et al.,

(2007) carried out their research in Sydney, Australia, using 12 focus groups (n = 70, 24 men and 46 women). The sample comprised local residents, who lived in the inner-city suburbs. Individuals that reported cycling less than four times in the last two years were grouped as non-cyclists, those who had cycled more than four times in the last two years were grouped as occasional cyclists and those who reported cycling at least two to three times a month were grouped as regular cyclists. There was no mention of the ontological stance taken or the type of data analysis used**,** although the information provided indicates that it was likely to be a form of descriptive analysis such as content analysis. There was no mention of any credibility procedures carried out.

All participants, to some degree, agreed that cycling was a healthy, enjoyable, recreational activity and an economic, efficient and sustainable form of travel. However, non-cyclists and occasional cyclists held more negative views overall about cycling in comparison to regular cyclists. Non-cyclists and occasional cyclists perceived higher levels of danger and reported having lower levels of skills and confidence than regular cyclists. They also felt deterred by lower personal fitness levels and viewed cycling as a slower, less convenient mode of travel than regular cyclists did. Within the non-cyclist and occasional cyclist groups, the women especially, assumed greater responsibility for family members and saw cycling for transport as impractical. By contrast, regular cyclists were less fearful of cycling in traffic and discussed the importance of remaining alert, clearly signalling, wearing visible clothing and taking greater ownership of road space. Regular cyclists also associated cycling with independence, freedom, speed and convenience and had a stronger connection with the social and physical environment.

Cavil & Watkin's (2007) study was based in North Liverpool and explored local residents' views of cycling in relation to a nearby purpose built cycle/walking path. The sample comprised a 'priority target group' for physical activity, which included young people (children and adolescents), single mothers and older people. Six focus groups were carried out (total n = 23; nine males, 14 females). All but one participant did not

regularly cycle. Thematic analysis was used to analyse the data and reliability and credibility checks were carried out between researchers and with community workers.

It was found that the specific environmental and social context in which the research was carried out had a strong effect on participants' views towards cycling. Most respondents had positive views about general physical activity and there was some positive feedback connecting cycling with fun, joy, freedom and being cool. However, fears of theft and personal safety stemming from general anti-social behaviour in the community were overriding concerns. Although the path in question was understood to be a peaceful, traffic-free place for people to enjoy cycling, the local residents interviewed did not take this view and thought of the path as a 'no go' area due to crime and delinquent youths. Cavil & Watkin (2007) concluded that in this study's setting, the environment had a far greater influence on people's decision to cycle than social cognitive factors. Although arguably, antisocial behaviour is a social cognitive factor, in line with an ecological perspective, the authors emphasise that the environment can help to create physical activity opportunities related to cycling.

Garrard, et al. (2006) carried out a qualitative study in Victoria, Australia, with an all female sample. The available report only provided a summary of research and did not include information regarding the ontological perspective adopted, or the type of data analysis used. Six case studies were carried out that focussed on initiatives aimed at increasing women's cycling. Six program coordinators were interviewed and 50 women took part in focus groups. Both non-cyclists and cyclists participated in this study but there was no information on how these groups were categorised. The study provided a descriptive summary of the findings.

The perceived benefits of cycling discussed by non-cyclists were: health and fitness; relaxation and stress relief; preparing for events; being active with family members; being an active role model for children; and encouragement from family and peers. The perceived benefits discussed by the cyclists were: a sense of fun, independence,

enjoyment, achieving goals, learning new skills, increased self-confidence and contact with realistic role models. The cyclists seemed to have a greater awareness of the value of more experiential and affective factors such as enjoyment experienced, flexibility and independence. The findings relating to cycling barriers did not distinguish between cyclists' and non-cyclists' views, but instead grouped participants all together regardless of their cycling activity. Overall, lack of confidence and fitness, juggling the development of many new skills at once, adverse traffic conditions, driver aggression and cultural norms such as appearance and the male-dominated environment of cycle shops were cited as key barriers.

The two remaining qualitative cycling studies included in this discussion were both commissioned and published by the UK Department for Transport (Davies et al., 1997; Mayes et al., 1996). These reports are summative overviews and provided limited methodological information on the nature of the study and the analysis techniques used. Mayes et al. (1996) explored attitudes to cycling in the UK and focused their research on reasons why people did and did not cycle. The authors used qualitative market research techniques, consisting of focus groups that used a number of communication techniques to elicit data such as drawing, image response, prompt boards and word association discussions. No information was provided regarding the sample size and very little information was provided about the characteristics of the sample group, other than that the research was carried out in five English cities with both cyclists and non-cyclists. The findings did not clearly distinguish cyclists' and non-cyclists' perceptions.

The key barrier cited by Mayes et al. (1996) was the perception of danger on the roads. Other barriers found included the car culture, in terms of people's biases towards car use, which acts as a barrier towards cycling. Young men in particular felt that bikes lacked status. Exposure to fumes, the outdoor elements, physical embarrassment, sexual harassment, cost of purchasing a bike and complexity of bike design were also seen as barriers. Women raised some specific concerns regarding appearance, dignity and personal safety. In terms of the benefits of cycling, these were viewed as: cost effective,

providing independence, providing an opportunity to be active, flexible, cheap, and an efficient and quick mode of travel. Participants with families also felt that cycling provided an opportunity to be active as a family unit. For the findings, the authors suggested a set of potential push and pull strategies that could be used to promote cycling.

Davies et al. (1997) carried out seven individual interviews and 13 focus groups (eight to 12 individuals per group) across eight English cities. Both cyclists and non-cyclists participated. The study examined reasons why people choose and choose not to cycle. Cyclists reported being highly motivated and cycled for daily travel as opposed to sport. They felt that cycling provided freedom, independence, greater flexibility than public transport, enjoyment (fun and speed), fresh air and a sense of achievement. For some, cycling was used as a family activity. In terms of barriers, two types were identified: indirect barriers (competing transport modes and alternative activities) and direct barriers. The indirect barriers focused around the dominance of the car. The authors suggested that drivers did not objectively reflect on whether to cycle or drive but rather were unquestionably dependent on the car. Additionally, the car seemed to have a 'halo effect' and it was linked to status, sexuality, convenience and safety, with the disadvantages of car driving being played down. The perceived direct barriers cited were: lack of status, danger from traffic, personal safety, bike security, sexual harassment, weather, hills, personal image, cycle technology, and cycle purchase and maintenance difficulties. Fear on the roads was the biggest direct barrier as well as fear relating to general vulnerability.

Both Davies et al. (1997) and Mayes et al. (1996) made links to a typology of cyclists that included: fairweather cyclists; lifestyle cyclists; practical cyclists; and idealist cyclists. Although neither study reported that this typology was created inductively from their findings. Both studies (Davies et al., 1997; Mayes et al., 1996) concluded that attitudes towards cycling are varied and complex. In light of the complex nature of cycling, Davies et al. (1997) suggested that individual, social and organisational change

along with situational and environmental measures need to be addressed to effectively promote it. Davies et al. (1997) went on further to make recommendations that for promoting individual cycling behaviour change, and the use of a tool called a situational status grid, the stages if change construct from the Transtheoretical Model of Behaviour Change and the innovation model, which stems from diffusion theory. However, there were no clear links to show that any of these three behaviour change concepts emerged as a result of the studies findings.

3.3.1 Overview of Qualitative Findings

The six qualitative studies that were included in this chapter have provided some insight into the factors that affect and influence people's propensity to cycle, however, only one study specifically focussed on cycle commuting. In light of the limited understanding we have of cycle commuting behaviour it is concerning that such little qualitative research has been carried out in this area. In terms of the quality of evidence presented, the three peer-reviewed studies discussed, provided a degree of transparency (Cavill & Watkin 2007; Daley et al., 2007; McKenna & Whatling, 2007) and in two instances provided information regarding credibility checks used to validate the findings (Cavill & Watkin, 2007; McKenna & Whatling, 2007). The three remaining studies provided very little methodological information but rather they focused on presenting the findings (Davies et al., 1997; Garrard et al., 2006; Mayes et al., 1996).

The cohort of qualitative studies discussed employed different sample types in terms of gender, age, socio economic status or individual's intentions to cycle. It would seem that in some instances these differences may have affected participants' views and concerns. For example, the research findings from participants such as single mothers, youth and the elderly in a deprived community setting, of which the majority did not cycle (Cavill & Watkin, 2007), provided different concerns than reported by active cycle commuting adults (McKenna & Whatling's 2007). Overall, the findings indicate that cycling is a

complex behaviour, which involves the consideration of factors that stem from individual, social and environmental factors.

Studies that reported comparisons between cyclists and non-cyclists supported some of the findings from the quantitative research in this area: non-cyclists identified more barriers than cyclists (Daley et al., 2007); non-cyclists perceived higher dangers on the roads due to lack of cycling skills and confidence (Daley et al, 2007; Garrard, 2006); both non-cyclists and cyclist seemed aware of the health benefits of cycling (Daley et al, 2007; Garrard et al., 2006); and cyclists were aware of a larger range of benefits related to cycling than non-cyclists were (Daley et al., 2007; Garrard et al., 2006).

All of these qualitative studies were carried out in either the UK or Australia, which both have low cycle usage for transport (Pucher & Buehler, 2008) (Figure 1.1). Looking at the findings collectively, danger or vulnerability was a commonly discussed barrier to cycling for transport. In the majority of the studies danger was linked to cycling on the roads, the dominance of the car, and/or car drivers' attitudes (Daley et al., 2007; Davies et al., 1997; Garrard et al., 2006; Mayes et al., 1996; McKenna & Whatling, 2007). An exception was Cavil and Watkin (2007), who found key danger concerns stemmed from crime (bike theft) and anti-social behaviour.

A final but important point to make is that out of the six qualitative studies discussed, none attempted to generate theory *per se.* Prior to their research being carried out McKenna & Whatling (2007), via a review of literature, decided on four categories (time, space, body and human relations) that would guide their study but these four categories did not emerge inductively from their empirical research. Davies et al., (1997) and Mayes et al., (1996) both made mention of a cycling typology and Davies et al., (1997) further elaborated on three potential concepts that could aid individual cycle promotion. However, there was not enough detail provided in either of these studies to be able to decipher how inductive or deductive these concepts and the discussed typology were in relation to the findings. Cavil & Watkin's (2007) findings did not

generate theory as such but rather they suggested that their research findings supported the Ecological Model in light of the strong social-environmental influences that were found to influence cycling within their research setting. The remaining two studies did not make any links to theory (Daley et al., 2007; Garrard et al., 2006). If qualitative research is to help advance our knowledge of cycle commuting behaviour studies should aim to report or generate a basic theoretical framework (Allender et al., 2006).

3.4 Chapter Summary and Conclusions

This chapter has discussed the psychologically-orientated empirical literature carried out on cycle commuting behaviour (with the exception of intervention studies that will be discussed in chapter 7). Although the focus of this thesis is on cycle commuting behaviour, this chapter included more general cycling research as there are currently limited psychologically-orientated studies that have investigated cycle commuting. To date, perceived barriers and benefits have been the most common variables that have been investigated in relation to cycling. Initially, questionnaire-based cycling studies were discussed followed by interview-based studies.

In total 13 questionnaire-based studies were identified, of which four specifically investigated cycle commuting and were discussed in more detail. Only a small number of these studies based their investigation on an operational theoretical model. Overall, the diversity of research quality made it more difficult to draw any clear conclusions regarding the role of social cognitions in cycle commuting behaviour. A main methodological weakness stemmed from the wide variation of measures used to investigate cycling and their associated internal validity, or lack there of. Nevertheless, there were some more general trends that emerged from these studies. The most robust studies indicate that: regular cyclists viewed cycle commuting more favourably than non-cyclists: subjective factors such as time and fitness levels were perceived as greater barriers by non-cyclists in comparison to cyclists; both non-cyclists and cyclists reported an awareness of health and environmental benefits associated with cycling; and higher

levels of self-efficacy or perceived behavioural control were more predictive of cycling than lower levels.

Six interview-based studies that investigated individual's perceptions of cycling were discussed. In some instances, limited methodological details made it difficult to gauge the level of quality of these studies. Although within this cohort of studies the samples and foci of research were diverse, the studies that reported more descriptive comparative findings between cyclist and non-cyclists supported the key findings to come from the quantitative studies (discussed above). Overall, cycle commuting was understood as a complex behaviour that was influenced by numerous factors. Perceptions of danger and vulnerability associated with cycling in traffic and the dominance of the car featured as a common barrier in the majority of studies. Overall, none of these qualitative studies reported generating any inductive theoretical knowledge from their data analyses.

As discussed in Chapter 1, cycling for transport is now recognised as having numerous public health benefits and in the last two decades both policy and academia have become increasingly interested in active travel behaviour. As highlighted in both this chapter and the previous one (Chapter 2), at present much of the psychologically-orientated research into cycling is not theory-based but rather, variable based. The overall discussion within the present chapter has highlighted that there are very few studies that have investigated cycle commuting from a psychological perspective to date. If we are to better understand cycle commuting behaviour more research into this specific activity needs to be carried out. As cycle commuting is a complex behaviour and there is a limited empirical understanding as to why people choose to cycle to work, it would be valuable for exploratory qualitative research to be carried out. More quantitative research in this domain should also be undertaken using established measures, which aim to test suitable theory. In light of the key points to come from the literature chapters (Chapters 1, 2 and 3), this thesis goes on to document a qualitative research investigation (Chapter 4) carried out to better understand individual's perceptions and attitudes towards cycle commuting behaviour. Informed by the literature chapters (Chapter 1, 2 and 3) and the

qualitative empirical findings to come from Chapter 4, the subsequent chapters (Chapter 5 and 6) go on to present questionnaire-based research that aims to develop our empirical and theoretical knowledge of cycle commuting behaviour from a psychological perspective.

Chapter 4

Study 1: Exploring Employees' Perceptions and Experiences of Cycle Commuting[4]

Aims of the Chapter

The present study aims to understand more about the social cognitions involved in cycle commuting behaviour. A qualitative, exploratory study was carried out to investigate people's perceptions and lived experiences of cycle commuting and how these influence the decision of whether to cycle to work or not. The research focus is on discerning a greater understanding of commonalities and differences of opinion regarding cycling to work between a group of cycle commuters and a group of potential cycle commuters based in a workplace that supports cycling for transport.

4.1 Introduction

The overall research objectives of this thesis are initially to discern a greater understanding of cycle commuting behaviour and subsequently attempt to encourage cycle commuting in a workplace setting by developing and trialling a psychologically-orientated intervention. Initially, in the present chapter, the research focus is on understanding more about social cognitions related to cycle commuting behaviour. The previous introductory chapters have highlighted that whilst social cognitions have an important role in cycling behaviour, they do not function in isolation of the wider social and environmental context. Therefore, the specific focus on social cognitions adopted in this thesis aims to contribute knowledge of individual-level factors within a holistic ecological context (as discussed in Chapter 2).

Chapter 3 highlighted the limited amount of qualitative research that has been carried out into cycle commuting. Several questionnaire studies have addressed psychological factors related to cycling such as motivations and barriers (Crawford et al., 2001;

[4] The data from this study is currently in press in *Health Education* (see appendix F)

Shannon, et al., 2006; Gatersleben & Appleton, 2007). However these quantitative surveys may overlook important issues influencing cycling behaviour. As opposed to quantitative research methods, which impose pre-determined hypotheses or theoretical frameworks onto the phenomenon under study, qualitative research is inductive by nature and enables patterns and theories to emerge from its participants' accounts.

Using qualitative methods to research different types of physical activity is important as it can provide insights into the interpersonal and intrapersonal processes that underlie behaviour as well as the context in which they occur (Allender, Cowburn & Foster, 2006; Thomas & Nelson, 2005). The valuable contribution that qualitative research can make towards the evidence base in health sciences is becoming increasingly recognised (Dixon-Woods & Fitzpatrick, 2001). As no dominant psychological theoretical framework for understanding cycle commuting behaviour has become established, exploratory and inductive research is of great value to understanding more about the variables that influence behaviour and how such variables interact. Additionally, learning more about social cognitive factors (e.g. perceptions, attitudes and beliefs) influencing the decision to cycle commute is also of value because individual factors are frequently more modifiable than environmental ones.

As discussed in Chapter 3, McKenna & Whatling (2007) carried out qualitative interview research into cycle commuting and contributed a unique perspective, which highlighted the power relations between the dominance of car users and the marginalisation of cyclists on the road. Qualitative research comprising post-intervention focus groups, discussed later in Chapter 7, also reported novel findings that walking and cycling to work may be linked to the use of coping strategies to overcome perceived barriers (Mutrie, et al., 2002; Crawford, Mutrie, Blamey & Carney, 2000). More in-depth qualitative research that focuses on individuals' perspectives may offer fresh insights on how to support and encourage cycle commuting (McKenna & Whatling, 2007).

4.1.1 The Present Study

The present study is designed to develop a person-centred understanding of the social cognitions that influence cycle commuting behaviour in a workplace setting. This work offers an original contribution to the field in a number of respects. Firstly, this study adopts a qualitative methodological approach to a research area that has largely been explored using quantitative surveys and interventions. Secondly, the focus purely on people's perceptions and experiences of cycle commuting allows the opportunity to explore the complexities of the psychological variables underlying this behaviour. Thirdly, the qualitative nature of the study facilitates closer consideration of the impact of context on cycle commuting. One main research question guides this study:

1. What differences and commonalities exist between cycle commuters' and non-cycle commuters' perceptions and attitudes towards individual, organisational and environmental factors related to cycle commuting?

4.2 Method

4.2.1 Research Approach

This study used semi-structured interviews alongside interpretative phenomenological analysis (IPA) to gain a more ideographic and detailed examination of participants' lived experiences with regard to cycle commuting (Smith and Osborn, 2003). IPA is an increasingly popular form of qualitative analysis (Reid, Flowers, & Larkin, 2005). The strength of IPA is the concern with individuals' subjective perceptions of a topic, referred to as the 'insider perspective' as opposed to trying to produce objective statements (Smith, Jarman, & Osborn, 1999).

In IPA the emphasis is placed on both the researcher's commitment to gain an in-depth understanding of the participant's world whilst also taking a step back and trying to learn something in common about the group (Smith & Eatough, 2007). It is acknowledged that participants' thoughts are not always immediately visible from their accounts as they try to make sense of their world. Rather, by engaging in an analytical

process the researcher can cautiously interpret a participant's cognitions (Smith et al., 1999). Prior to the research taking place ethical approval was granted inline with Moray House Ethics Guidelines, within the University of Edinburgh.

4.2.2 Participants

All participants were employees of a medium to large-sized workplace based in central Edinburgh, UK. The workplace held a Cycle-friendly Employer Certificate for providing good cycle facilities and support. These included: introduced or improved showers and changing rooms; storage space; and cycle parking facilities. The company also offered financial incentives for cycling (e.g. mileage allowances and discount schemes) and social support (e.g. promotional events). It was anticipated that using an urban, cycle-friendly employer would reduce organisational and environmental barriers to cycling and therefore facilitate a clearer understanding of the psychological factors that affect cycle commuting.

A purposive cohort of employees was invited to take part in the study (see appendix B) and in total, 15 people volunteered to take part. Participants were selected on the basis of fulfilling the criteria of being either regular cycle commuters (CC) (n = 8) or potential cycle commuters (PCC) (n = 7). PCC stated an interest in cycle commuting and were contemplating the idea of cycling to work. PCC were chosen as opposed to all non-cycle commuters because interventions to increase cycle commuting are more likely to be successful if focused on this group. Four women and 11 men took part, aged from 21 to 65 (see Tables 4.1 and 4.2). The daily commute made to work by CC participants ranged from two to nine miles. The PCC participants' commuting journeys ranged from two to 16 miles. However, those travelling longer distances planned to cycle only a part of their commuting journey. The CC participants' routes varied widely in terms of the actual paths and roads they take, as well as the surrounding landscape. Some journeys primarily consisted of quiet off-road cycle paths, green space and countryside. In

contrast, others cycled their entire journey on busy main roads, using shared cycle lanes, advisory on-road cycle lanes and, in some instances, no designated cycle lanes.

Table 4. 1: Demographic information for commute cyclists (CC)

Pseudonym	Gender	Cycle commuting experience	Distance to work (one-way)	Age category
Andrew	Male	3-4 years	8 miles	31-40 years
Bert	Male	40+ years	4 miles	61-70 years
Carl	Male	2 months	3.5 miles	31-40 years
Dan	Male	4 years	5 miles	31-40 years
Ed	Male	2 years	3 miles	31-40 years
Fred	Male	14 years	9 miles	51-60 years
Guy	Male	5 years	2 miles	31-40 years
Helen	Female	8 years	2 miles	41-50 years

Table 4. 2: Demographic information for potential commute cyclists (PCC)

Pseudonym	Gender	Commuting transport mode	Distance to work (one-way)	Age category
Amy	Female	Bus	5 miles	31-40 years
Belle	Female	Train	16 miles	31-40 years
Dawn	Female	Bus	2 miles	51-60 years
Euan	Male	Bus or walking	3 miles	31-40 years
Felix	Male	Walking	1.5 miles	21-30 years
Grant	Male	Bus or car	3 miles	21-30 years
Harry	Male	Bus and car	11 miles	41-50 years

4.2.3 Interviews

Semi-structured interviews were employed for this study, lasting between 30 minutes and one hour. Prior to the interviews, participants were sent a summary of the interview themes (see appendix B) and an informed consent document (see appendix B), which they were asked to read and sign. A flexible interview guide was designed (see appendix B) whereby questions could be ordered differently and novel areas could be explored if deemed helpful in addressing the research aims (Bryman, 2004). A similar interview

schedule was developed for the two groups with small modifications to attend to their different behaviours. The questions were designed to identify individual's perceptions related to cycle commuting. A list of follow-up questions and facilitative comments were developed in advance and were non-leading to encourage further elaboration of answers.

In an attempt to enhance the commitment to the participant's perspective the interviewer used the principle of bracketing, to identify and make explicit her own opinions and assumptions to encourage self-reflexivity (Langdridge, 2007). Emphasis was given to the participant's accounts and areas deemed important and salient to the participant's world. Each interview was audio-recorded and supplemented by filed notes of the interviewer's interpretations (Kvale, 2007). All interviews took place over the month of June.

4.2.4 Analysis

All interviews were transcribed word-for-word with pseudonyms assigned to each participant. Analysis guidelines were followed (Smith & Osborn, 2003) to ensure that a thorough analysis was carried out whilst paying attention to the original aims of the investigation. Throughout the transcription and analysis process a research journal was kept to document the researcher's ideas about tentative relationships and emerging themes within and between data sets. The CC and PCC groups were initially analysed separately to facilitate a more idiographic and nuanced analysis. Emerging themes from the initial notes were written in the right hand margin allowing for theoretical connections whilst still grounded in the specifics of the accounts. The transcripts were then re-read, with a more critical focus. Through carrying out this process some small changes were made to the existing interpretations. The transcripts were then uploaded into NVivo, a qualitative software package, and analysis entailed clustering the emerging themes into overarching themes across the two participant groups systematically.

Care was taken to keep interpretations as close as possible to the data and not to over-interpret. This was achieved through an analytical audit carried out on six transcripts by three coders. The method used here was intra-coder reliability as opposed to inter-coder reliability. The three coders were all provided with a large number of phrases from the six transcripts and the list of tentative themes. Each coder was asked to place the phrases in the most relevant theme. There was a high degree of concordance in the emergent themes and the few divergences were resolved through discussion.

4.3 Findings

Nine themes emerged from the interviews. These themes encompass beneficial, challenging and facilitating aspects of cycle commuting behaviour. The analysis attempts to strike a balance between the emic (insider perspective of the participant) and the etic (researcher's interpretation) by doing justice to the individual as well as emerging commonalities within the group (Reid et al., 2005). Within the themes, commonalities and differences between the CC and PCC groups are described.

4.3.1 Health and Wellbeing

All CC and PCC participants discussed how cycle commuting contributes to general health and wellbeing. Each individual spoke about the physical activity aspect of cycle commuting (e.g. aerobic fitness and weight management). For many this was a key reason for cycling to work. Additionally, several participants highlighted that cycling to work was a convenient opportunity to exercise in an otherwise busy day. One of the cycle commuters, Carl, stated:

> From a point of view of cycling, it fits in to the extent of, for me, it's just dead time. ... it's half an hour twice a day that I do it and that's just my exercise done… whereas otherwise because of the family side of things, I don't have that time.

Whilst most of the CC participants highlighted the psychological wellbeing they experienced from their cycle journeys, this was rarely discussed by the PCC group. Only Dawn and Grant in the PCC group, who had previously cycle commuted, spoke in any detail about the psychological benefits of cycling. Most CC participants discussed how cycle commuting can 'clear your head', 'provide thinking time', 'help you to de-stress and unwind', and 'make you feel better'. Fred who cycle commutes through mixed terrain said:

> It means that on most days here [at the workplace] and at home I'm probably in a reasonably positive frame of mind… I have the unwinding space on the way home and the contemplative space on the way in, which gives some balance and order, if you like, to my day… I wouldn't get this coming to work any other way.

Most of the CC participants spoke of how they also cycled for leisure. When discussing the advantages of cycle commuting, some PCC participants showed awareness of the impact cycle commuting may have on increasing their recreational cycling. For example, Amy stated: "I think if I cycled more regularly into work we'd probably increase what we did as a family". Euan and Felix (PCCs) thought that if they purchased a bike for the purpose of commuting they would also use it to cycle at the weekend with family and friends.

4.3.2 Time and Cost

Everyone in the CC group said that cycling to work either saved them time or took a similar amount of time to alternative forms of transport. CC participants living nearer to the city centre acknowledged that 'door to door' cycling was by far the quickest and most reliable means of transport, especially during rush hour. Carl stated: "I can't take the bus trip any more. Sometimes it doubles the amount of time it takes for me on a bike". By contrast, the view that cycling to work would save time was opposed by all, except one, of the PCC participants. Although some of the PCC participants provided a detailed estimate of the time their cycle journey would take them, Amy, Belle and Harry all thought that cycling would take longer than their current commute. Grant spoke of

the more pleasant cycling route to work taking longer and therefore being "less appealing".

Over half of the CC group mentioned that cycling into work saves money in terms of bus fares, car parking, petrol, and the costs of owning and maintaining a car. Bert, who has cycled for many years and does not own a car, found there to be a significant cost saving involved. Whilst recognising costs associated with cycling, Carl took a long-term view that cycling was a financially viable option: "So its £1.10 per single on the bus every time I go… with all my gear and bike it was around about £500 I think to buy everything, so, couple of years, so that's, it's paid for itself". In comparison, only two of the PCC group thought that cycling would save them money and one PCC participant mentioned that the expense of purchasing a bike was a deterring factor.

4.3.3 Enjoying the Cycling Experience

All CC participants positively discussed aspects of being outdoors. For many, travelling by bike provided the opportunity to get some fresh air, although some questioned the freshness of the air in the city centre. Fred, who cycles part of his route through the countryside said:

> There's something about being out in the open air and it doesn't really matter whether it's raining or windy or sunny or a combination of those things. ... it's something about a sense that you're enjoying, how would I best describe it, you enjoy the natural world… You're actually really feeling, you feel the sun, you feel the rain, let's say you enjoy the flowers; you smell the flowers and so on. … It's being out and in touch with the elements of the world.

In contrast, only Grant and Dawn from the PCC group, both with previous cycle commuting experience, spoke positively about enjoying being outdoors on their bikes. The other PCC participants did not speak in any detail about enjoying cycling.

4.3.4 Socially Responsible Behaviour

Both CC and PCC participants, who mentioned having young children, felt it was important to be healthy role models for them. Amy, a potential cycle commuter, stated: "I'd like my son to see that cycling was a viable choice of transport. He's too ready to jump into the car at every opportunity". Some CC and PCC participants mentioned environmentally friendly aspects of cycling into work, but this seemed a peripheral benefit. Fred, one of the cycle commuters said: "I am able to feel that I am doing something towards the environment".

4.3.5 Work and the Workplace

Many CC and PCC participants had to travel regularly within their work role and discussed the difficulty of cycling to work on these days. Carl, who cycled into work three days per week on average, said: "I work in Aberdeen a day; I'll be through in Glasgow, up and down to London so it's quite difficult to sort of work that all out". Working in different locations could also hinder cycle commuting the day before travelling as it was sometimes necessary to take large files and equipment home the evening before.

Within the CC group, those who carried their belongings in a backpack were more likely to view carrying their laptop as a barrier, whereas those who used panniers saw this as no problem. Of those in the PCC group who owned a bike, none of them used pannier bags and felt that carrying a laptop would create a barrier to cycling. Grant said:

> On some occasions I wouldn't have the option of leaving the laptop here [at the workplace] because I have some work at home… but I'm not going to carry six, seven, eight kilos on a back pack, do that as well as cycling up hill and over the cobbles. No, there's just no way that's going to happen.

The company dress code required participants to wear smart clothes. Most of the CC participants cycled to work in casual clothes and then got changed into their work attire.

Getting their clothes to the office and getting changed was seen as a challenge for some. Dan stated:

> It's a hassle trying to get all of your stuff in the same place, because it's important in what we do to have a nice suit and be well presented so that's kind of hard work sometimes, and then, how do you get your shirts to and from work?

Their workplace had many cycle facilities including showers, secure and sheltered cycle parking, lockers and changing facilities. These facilities were commonly discussed in positive terms. However, some participants commented on difficulties in accessing the cycle parking and one CC participant mentioned that on occasion there were queues for the showers.

The two PCC participants who did not own bikes were the least aware of the facilities the workplace had to offer. Euan was not sure if there were any showers and was concerned about arriving "all sweaty" at his work station. Although the workplace had two showers available for employees to use, Felix thought there was only one shower and he was concerned about queuing, which deterred him from cycling to work.

Both groups considered that suitable workplace cycle facilities were an essential pre-requisite for cycle commuting and generally viewed their workplace facilities positively. Amy, one of the potential cycle commuters said: "The firm's made it as easy as possible if you want to come in on a bike. There's the storage and the showers and the lockers and so there's no disadvantage".

Another positive factor discussed by both groups was social support. Their workplace had a strong pro-cycling ethos and an active cycle community as well as a senior figure seen as a 'cycle champion' who offered support and advice to colleagues. Carl, who had recently started cycle commuting, talked about the impact that their cycle champion had on him:

> He has been really good at promoting it generally. And I guess it's just been chipping away at my collective thoughts for quite a while ... that I kind of know it's something that I should really try and do.

Additional forms of workplace support for cycling such as staff discounts at a local cycle shop, tax relief payment schemes for purchasing bikes, cycle training courses and cycling breakfasts were also discussed positively.

4.3.6 Roads and Paths

The overall view was that cyclists are vulnerable on the roads, though individuals varied widely with regard to how they personally felt about cycling on roads. Individuals from both groups who had more experience of cycling on roads generally perceived them to be safer than those with less experience. Within the CC group, Andrew and Carl, who had the least exposure to busy roads during their commute, both commented on their anxieties. Carl said that: "If I had to cycle on the actual 'road' roads all the time then that would really put me off". In contrast, Helen, who travelled all of her journey to work on busy main routes, felt comfortable cycling on the roads:

> It isn't dangerous, cycling in town, I'm sure there are more accidents with cars than there are with cyclists and things. I guess the other hurdle to get over is the fact that if a cyclist does have an accident then it can be very serious.

Some of the road infrastructure was viewed negatively by both the PCC and CC group participants. The CC group acknowledged that the city roads varied in the quality and quantity of cycling provision available. Certain areas were considered as dangerous and challenging for inexperienced cyclists. Ed stated:

> I'm OK nowadays, but if you weren't a regular cyclist I think a lot of people would get quite scared to go on the roads. When you've got buses this close to you… some of it is just dangerous.

PCC participants mainly mentioned the lack of separate cycle lanes on the roads. They discussed infrastructure issues in relation to the current routes they travelled on, which all seemed to be via busy main roads. These would not necessarily be the only routes available to them if they were to cycle to work. Felix felt deterred from cycling due to the busy main roads but later mentioned that there may be alternative cycle-friendly routes for him to travel on.

Over half of the CC group felt that cyclists were not respected enough by other road users. Bert spoke of drivers not giving enough road space to cyclists: "The worst sorts are not giving clearance and ... cutting in when the driver is not allowed, not being aware that a cyclist actually has got forward motion". Some PCC participants' concerns also related to other road users' attitudes. Amy, Dawn and Belle spoke of their experiences of seeing cyclists interact with traffic from a bus or a car's perspective. Amy said:

> Having been a bus user, having seen a lot of times how little respect is paid to cyclists, how close buses get to them ... how easy it is not to see a cyclist coming up the side of a bus. You know I'd just be very conscious, unconfident in both my behaviour in those circumstances and the other drivers' behaviour.

Although busy main roads were viewed by some as challenging, off-road cycle paths and shared bus and cycle lanes were discussed positively by the CC group. In particular, the off-road cycle routes were seen as facilitating pleasant cycling experiences. This view was shared by two of the PCC participants, Grant and Dawn, who had previously cycle commuted. Andrew (CC) stated:

> I'm lucky with the route, and that is a big driver for me in terms of the cycling I do… You're cycling through forest effectively, by water so it's, it's a really nice place to be, it's relaxing.

Over half of the PCC participants reported that if there was a more cycle-friendly route or path that they could use, they would be more encouraged to cycle commute.

4.3.7 Bad Weather

Some of the PCC group were deterred from cycle commuting by inclement weather regardless of the workplace facilities such as showers and changing rooms. They voiced their dislike of being outside in poor weather conditions. However, many of the CC group along with Dawn, a PCC participant with cycle commuting experience, highlighted that inclement weather conditions did not normally affect their decision to cycle. It was only more extreme weather conditions such as ice and snow that prevented them from cycling into work. Discussing inclement weather, Greg (CC) said: "That doesn't usually bother me too much either because unless it's really bad, we have all the facilities we need here".

4.3.8 Personal Challenges

The PCC group spoke about a variety of personal factors that they perceived as challenges when considering cycle commuting. In contrast, only self-motivation was discussed as a personal challenge by some of the CC group. PCC participants seemed less aware of the strategies that the CC group employed to overcome the daily challenges of cycling and perhaps consequently the PCC group seemed more concerned about these challenges.

The three PCC commuters with young children all spoke of the challenges of the school run. Amy and Belle felt that cycling into work may not be a feasible option until their children were slightly older:

> When you've got family and kids and it's just, your time is not really your own time you know to really make a choice and go for it… if I had to cycle I would probably leave a lot earlier you know, which wouldn't be too good for him (her son) ... But he's getting older so you never know, once they do their own thing and you've got your time you've got more choices.

Dawn and Felix (PCCs) perceived difficulties with bike storage and security. Both participants lived in flats within the city centre area. Living in a top-floor flat, Dawn

spoke of the challenge she would face, having to carry her bike up and down the stairs each day. Felix, who did not own a bike, had nowhere to store one and would not like to leave a bike outside in the street.

It was interpreted that in some cases, PCC participants' lack of awareness of cycling and cycle facilities acted as a barrier to cycle commuting. For instance, Felix, who discussed being deterred by busy roads, spoke of his general lack of awareness about cycling:

> I don't really pay attention to what cycling facilities there are. In terms of bike lanes and things like that, I just see kind of what's beside me or if I see people cycling and getting cut up by buses and I know that the bus lanes and cycle lanes are right beside each other. But other than that I don't really pay attention so there might be more out there that I'm not aware of.

In terms of initiating cycle commuting, two PCC participants, Dawn and Euan, both felt that lack of self-motivation played a detrimental role. Dawn said: "I think there's an element of just laziness". Harry spoke in similar terms about discipline: "So you know, it probably is more just a case of kind of personally making that commitment and getting on and doing it". Some CC participants also discussed the motivational challenges they faced when working late, very tired, or if the weather was particularly inclement. However, it was only on rare occasions that CC participants' lack of motivation stopped them from cycling. Andrew spoke of the kind of things that de-motivated him:

> At the end of the day or if you're running late or whatever it's just thinking 'right, I've just got to get on this bike now and cycle for the next hour' but generally once you get going it's fine. But sometimes you had a hard day here and you've got to cart stuff with you… sometimes you're a bit like 'can I really be bothered?'

Although many challenges were discussed by the PCC participants, it was commented on by some of the PCC group that each individual challenge, and many environmental ones, did not make cycle commuting impossible rather, as a collective, these challenges did not make it an easy or straightforward option. Harry said: "I think there are a number of factors in there but none of those are insurmountable".

4.3.9 Coping Strategies

To negotiate some of the challenging factors involved in cycle commuting, all CC participants had developed a range of personal coping strategies, to help them to fit cycling more easily into their daily lives. Planning and preparation were crucial in initiating and maintaining cycle commuting behaviour. The CC group and one PCC participant with previous experience of cycle commuting discussed the importance of developing a routine. They mentioned strategies such as: preparing the night before, planning which days of the week you are going to cycle into work in advance, obtaining the correct outdoor wear and cycle equipment and keeping clothes at the office.

Helen, one of the CC participants spoke about how she negotiates the school run. In her case, she was able to find ways of integrating the school run into her cycle commute by purchasing child seats for her bike and later buying her children their own bikes and cycling with them. When Greg (CC) felt unmotivated to cycle he reminded himself of the enjoyment he experienced from being outdoors. Similarly, Andrew (CC) overcame his lack of motivation for cycling by reminding himself of the limitations of his alternative journey:

> I could go and stand and wait for a bus for ten minutes. Then I'm going to be shoe-horned onto that and then, by the time I get to the other end I've got to walk up the hill anyway so, I might as well just cycle and I get home about the same time.

To minimise the risks of cycling on the roads, there was a strong consensus that cyclists need a high awareness level to counteract the low visibility cyclists have on the roads and the dangers posed by other traffic. Bert (CC) elaborated on the importance of developing what he termed 'road craft' to minimise the risks of cycling:

> I'm thinking not only of what's coming in front of me, but also people who may suddenly do a U turn in front of me or somebody coming from behind me that

> wants to cut me up… you've got to have a rubber neck, make sure you have eye contact with drivers at junctions... the key points are that other drivers are aware where you are and what your intention is.

Helen (CC) spoke about the strategies she employs to manage the traffic around her:

> You need to be assertive and demonstrate what your intentions are, make sure it's clear and carry those through, that's the way to control traffic I think. It's a lot safer if you can do that. I think it's having confidence.

In terms of initiating cycle commuting, some individuals from both the CC and PCC group spoke of preparatory plans and ideas that could be employed to overcome some of the initial hurdles and uncertainties related to starting to cycle. Plans and ideas were discussed such as: having a practice run by bike to work out a suitable route and how long it would take; investing in a suitable bike, panniers and clothing; seeking information from colleagues who cycled and from the internet; and going on a cycle training course to help build confidence to cycle in traffic.

4.4 Discussion

This study provides original insights into cycle commuting by qualitatively investigating both potential and regular cycle commuters' perceptions and experiences of cycling to work alongside exploring the impact of the context in which the research is set. A synthesis of findings indicates that potential cyclists are less aware of the range of benefits associated with cycling to work than regular and experienced cycle commuters. Potential and regular cycle commuters' accounts also differed in the way they discussed personal coping strategies, perceptions of supportive workplace facilities and perceptions of cycling infrastructure within the local environment. Cycle commuters discussed fewer challenges and more coping strategies than potential cycle commuters, who generally spoke more about challenges and less about coping strategies.

This study also brings to light the complex nature of cycle commuting and the high level of effort needed to take part in this behaviour. Even in a supportive workplace context, numerous psychological and perceptual factors can still pose as challenges to cycle commuting. In summary, the findings show that whilst cycling to work is a complex and effortful behaviour choice, cycle commuters are more able to favourably adapt their social cognitions towards cycling by either offsetting the challenges against the benefits they experience or by finding effective ways to cope with the challenges they encounter.

4.4.1 Being Aware of the Benefits

As with previous studies, physical health benefits and the convenience of exercising as part of your daily routine were viewed by both groups as motivating factors (Crawford et al., 2001; Unwin, 1995). The CC and PCC participants' views differed the most in relation to cycle journey times. Whilst the CC group viewed the journey time as being quicker or the same as other transport modes, the majority of the PCC group felt that cycling would extend their journey time. Previous research has suggested that non-cycle commuters may inaccurately estimate the time that their cycle journeys would take (de Geus et al., 2008). Although this may not always be the case, when promoting cycling, it would be valuable to provide information about average journey times by bike.

The CC group generally discussed more immediately experienced benefits associated with cycle commuting than the PCC group such as psychological wellbeing, relaxation, enjoyment of being outdoors and time and cost savings. Awareness of these immediate benefits may be more important than longer-term benefits (e.g. physical health) in promoting and maintaining cycling because behavioural decisions are more strongly influenced by immediate consequences (Gatersleben & Appleton, 2007). The present study found that the more immediate benefits associated with cycling to work were less recognised by potential cycle commuters. Although physical activity does not always confer emotional benefits (Backhouse et al., 2007) the majority of cycle group participants in this study highlighted this as a benefit for them. Emphasising the

immediate benefits and explaining the direct gains one can experience may encourage more people to start cycle commuting.

Being environmentally friendly was discussed by few participants and viewed as a peripheral benefit. This contradicts previous research that found the environmentally friendly factor to be an important benefit of cycle commuting (de Geus et al., 2008). The contrasting findings could relate to the differences in personal values, beliefs and cultures between the participant groups. Another beneficial but peripheral factor for those who had young children was being a positive role model. Although these may not form the key reasons for choosing to cycle, peripheral benefits add weight to the decision to start cycling. Therefore, they should be viewed as valuable counterparts within the decision-making process.

Over half of the PCC group believed that starting to cycle commute would lead to increases in leisure cycling. For some people this increase in leisure cycling related purely to purchasing a bike but for others, starting to regularly cycle to work would be a catalyst to increasing their overall cycling behaviour. Promoting cycle commuting may therefore have wider benefits to people's health (Wen, Orr, Bindon & Rissel., 2005) and potentially their families too, through increasing leisure cycling.

4.4.2 Overcoming the Challenges

It is clear that cycling to work is a complex and effortful behaviour, and that numerous challenges need to be negotiated in order to cycle commute. The CC group described a range of coping strategies, to help them to overcome a number of challenging factors, such as: planning; preparation; mental strategies; developing a routine; and learning 'road craft' (skills and confidence to cycle in traffic). Relatively little was said about such coping strategies by the PCC group, presumably because they were not yet familiar with the strategies that they could use to overcome the daily challenges of cycle commuting.

According to Mutrie et al. (2002), the use of effective coping strategies plays a role for people who successfully adopt active travel behaviours. Research into coping theory has received attention in performance sport (Gould, Eklund & Jackson, 1993a; Gould, Finch & Jackson, 1993b; Nicholls, Holt & Polman, 2005) but has not yet been discussed in detail in the context of cycle commuting. The Transactional Process Model of Stress and Coping (Lazarus & Folkman, 1984) proposes two main categories of coping: problem-focussed coping; and emotion-focussed coping. Problem-focussed responses are associated with situations amenable to change; whereas emotion-focussed responses are associated with situations not amenable to change. In this study the CC groups appeared to employ more problem-focussed coping strategies, (e.g. planning, problem solving and increasing efforts) than the PCC group. Potentially, problem-focussed coping strategies can be identified and developed through psychological interventions in a relatively short time period for a small cost. The coping strategies described by participants in this study could be easily incorporated into cycle commuting interventions. For instance: information about the use of panniers for carrying laptops; clear advice on how to deal with road traffic; suggestions on how to tackle lack of motivation; and tips on how to look presentable at work.

Preparatory plans and actions for initiating cycle commuting can also be understood as problem-focussed coping strategies that could help people considering cycle commuting to deal with uncertainties they may have about starting to cycle. In this study a number of the PCC group held uncertain or conflicting views towards aspects of cycling. According to Prochaska et al. (1994), individuals who are contemplating changing a particular behaviour are often in a state of ambivalence, which can prevent them from taking up a new behaviour. Plans and actions such as searching for information via the internet and by talking to peers, trying out prospective bike routes at quiet times, purchasing appropriate equipment, and taking cycle training courses, may all facilitate the transition from other modes of transport to cycling. Developing and carrying out such preparatory plans and actions could be capitalised upon in interventions by

promoting the use of specific action plans and Implementation Intentions (Gollwitzer, 1999). These have proved successful in encouraging change in habitual stable travel behaviour such as commuting (Gardner, 2009).

As with previous studies, adequate cycle workplace facilities and social support at work were seen as important for cycling to be a viable transport option (Cleary & McClintock, 2000; Wardman et al., 2007). However, this study demonstrates that even in cycle-friendly workplaces, where physical and social changes have already been made, there is still scope to enhance rates of cycle commuting through psychological intervention. Workplaces should not only invest in cycle facilities but also ensure that they are user-friendly, accessible and known about by staff. Some PCC participants were deterred from cycling due to misconceptions about workplace facilities and lack of knowledge about cycle routes in the city. People who do not regularly cycle and do not view themselves as cyclists are more likely to overlook cycle-related information in their environment. Targeted marketing and communications techniques could raise awareness of local cycling resources amongst potential cyclists.

It was commonly understood by participants that improving the cycling infrastructure within the local environment is an important foundational requirement to overcome many of the safety concerns surrounding cycling. Similar suggestions have been made by previous studies (Cavill & Watkin, 2007; de Geus et al., 2008; Wardman, et al., 2007). However, infrastructure changes alone may not be sufficient to lead to behaviour change. Social Ecological Theories (e.g. Giles-Corti et al., 2005) highlight the need to consider a complex range of diverse factors, including physical environment, social environmental and psychological variables that influence the up-take of cycle commuting and other forms of physical activity. Until the necessary infrastructure is created, cycle training courses are valuable resources that develop on-road cycling skills, safety and confidence towards road cycling.

4.4.3 Links to Theory

The present qualitative study was inductive by nature; however, the key findings parallel some of the main constructs found within social cognition and behaviour change theories outlined in Chapter 2. Benefits and challenges align constructs such as the decisional balance within the Transtheoretical Model of Behaviour Change (TTM), attitude within the Theory of Planned Behaviour (TPB) and outcome expectancy within the Health Action Process Approach (HAPA). Coping strategies relate to the processes of change within the TTM, coping planning within the HAPA and more indirectly with self-efficacy within the TTM and the HAPA and perceived behavioural control within the TPB. Indeed more social cognition theories could be mentioned in relation to the present findings as there is substantial convergence between constructs within numerous theories (see Figure 2.7). The present study indicates that in relation to cycle commuting taking a 'bottom up' inductive approach does not contradict a more 'top down' theoretical approach. Rather, understanding specific psychological factors that most closely relate to cycling can be valuable in identifying the most appropriate constructs, theories and techniques required to effectively promote cycle commuting.

4.4.4 Strengths and Limitations

In the present study, more empirically generalisable and universal knowledge, which would involve larger sample groups, has been traded for an in-depth analysis. IPA, in the context of this study, proved to be a useful tool for revealing the full complexities of the psychological reasoning involved in choosing to commute cycle. This study employed a purposive sample of 15 participants, selected on the basis of them being either active cycle commuters or having an interest in cycle commuting. All participants worked at a single city centre site which had Cycle-friendly Employer status. The type of generalisation that can be made here would be more analytical in nature, involving a reasoned judgement about the extent to which the findings from one study can be used as a guide to what might occur in another situation (Kvale, 2007). These findings are more likely to apply to individuals in similar settings in supportive cycle-friendly environments. For example, in the current study participants did not discuss any security

concerns which have been expressed by participants in studies based in other contexts (Cavill & Watkin, 2007). Future complementary research should be carried out on samples in different contexts to examine whether some of the findings that emerged within this study would be revealed in other populations.

4.5 Chapter Summary and Conclusions

This chapter documented a qualitative interview study into cycle commuting behaviour that was carried out to gain a deeper understanding of the social cognitions that influence employee's decisions to cycle to work. As the focus of this research was on social cognitions, the sample was recruited from a centrally-located workplace that is classified as 'cycle-friendly' in order to reduce social and environmental barriers that might overshadow the underlying social cognitions at play. Eight cycle commuters and seven potential cycle commuters who were contemplating cycling to work took part in the study; interpretative phenomenological analysis was used to discern a detailed understanding of the complexities involved in the decision to cycle to work

The findings from this research identify similarities and differences in perceived benefits, challenges, and coping strategies associated with cycle commuting between those considering and those regularly cycling to work. Potential cycle commuters perceived fewer immediate benefits, greater challenges and discussed less coping strategies compared with the regular cycle commuters. In contrast, the regular cycle commuters discussed more benefits and described a range of coping strategies that counteracted the challenges they encountered, which facilitated their cycling behaviour. Whilst the study was inductive in nature, the findings to emerge suggest that social cognitive variables involved in cycle commuting behaviour (motivations, barriers and coping strategies linked to self-efficacy) could be aligned with a number of social cognition theories (e.g. TPB and TTM).

4.6 Thesis Implications

The findings to come from this chapter support the available literature within the field (see Chapter 3), indicating that the challenges or more commonly termed barriers, that individuals perceive play a key role in the decision to cycle commute. However, the potential barriers associated with cycling are perhaps more complex and varied than previous studies have accounted for. Whilst some of the barriers associated with cycle commuting stem from objective as opposed to subjective constraints, as mentioned in Chapter 2, cognitions are known to mediate objective phenomena (Conner & Norman, 2005). Therefore, taking into account the potential barriers that have emerged from this study and commonly cited barriers from previous research (see Chapter 3), it would be valuable to carry out a larger-scale study, which, investigates the role of perceived barriers more comprehensively in relation to cycle commuting.

Overall, findings from the present study support the view that psychological interventions designed to enhance an understanding of the benefits of cycling to work, and develop more realistic perceptions of barriers to cycle commuting along with appropriate problem-focussed coping strategies, which implicitly involve self-efficacy, are appropriate means of enhancing behaviour. The high compliance that these emergent findings have with some of the established tenets of social cognition and behaviour change theory indicate that formal theories are potentially valuable at informing the promotion of cycle commuting. However, the qualitative research reported in this chapter lacks empirical generalisablity. Therefore, it would be valuable to investigate further how suitable the application of formal psychological theories are for promoting cycle commuting behaviour in a workplace setting within a larger sample. In light of the implications to come from this chapter the two following empirical studies go on to investigate quantitatively how perceived barriers influence cycle commuting behaviour (Chapter 5) and how suitable the principles and available measures associated with the Transtheoretical Model of Behaviour Change are at explaining cycle commuting behaviour (Chapter 6).

Chapter 5

Study 2: Investigating Barriers to Cycle Commuting in Relation to Stage of Change, Gender and Occupation[5]

Aims of the Chapter

The present study aims to explore the way that individuals based in a cycle-friendly workplace perceive a range of potential barriers associated with cycling to work. Using a cross sectional questionnaire, individuals' perceptions of 18 barriers were examined in relation to stages of change (used to classify people into the appropriate stage of readiness for behavioural change), gender and occupation. The aim was to examine the impact of stages of change, gender and occupational role on an individual's perceptions of the potential barriers to cycle commuting.

5.1 Introduction

In the previous chapter a qualitative study was reported, which provided a deeper understanding of the social cognitions that influence cycle commuting behaviour. The findings suggested that individuals who were not currently cycling to work but considering the idea were less aware of some of the more immediate benefits of cycling, perceived greater challenges to cycling and in turn discussed fewer coping strategies than those who regularly cycle commuted. The way in which individuals perceive numerous challenges, which are in effect potential barriers to cycling may be a promising area of research that will help further our understanding of cycle commuting behaviour.

As highlighted in Chapter 2, theoretically, the concept of barriers or 'costs' is embedded in social cognitive and behaviour change theories such as the Transtheoretical Model of Behaviour Change (TTM), the Theory of Planned Behaviour (TPB) and the Health Action Process Approach (HAPA). Such theories propose that as perceptions of barriers

[5] The data from this study is currently under review in *Health Education* (see appendix F)

decrease, intention to change behaviour increases. The decisional balance component, which consists of weighing up the pros and the cons of changing a behaviour, has been adopted as part of the TTM but was originally proposed by Janis & Mann (1977). According to Janis & Mann (1977), decision making comprises the process of conflict resolution and avoidance behaviours. The way that an individual appraises and copes with the decision to change a particular behaviour leads to defective or effective information processing and decision making. With this in mind, it was of interest to try and gain more knowledge regarding how people perceive potential barriers to cycle commuting.

It is well established that perceived barriers negatively influence people's decisions to participate in physical activity (Bauman, Sallis, Dzewaltowski & Owen, 2002; Trost, Owen, Bauman, Sallis & Brown, 2002). Regardless of whether perceived barriers are objective or subjective there is a strong inverse correlation between perceived barriers and exercise participation (Sallis & Owen, 1999). Previous research into cycling, outlined in Chapter 3, indicates that barriers play a key role in intention formation and behaviour change (de Geus, et al., 2008; Gatersleben & Appleton, 2007; Shannon et al., 2006). However, there was no specific barrier that consistently emerged as most significant for cycle commuting. A review carried out into cycling and health cited danger on the roads as the main concern surrounding cycling (Cavill & Davis 2007). Other commonly cited factors that deter people from cycling are bad weather, lack of time, distance, lack of facilities and bike security (Bergstrom & Magnusson, 2003; Dickinson, Kingham, Copsey & Pearlman Hougie, 2003; Heinen et al., 2010; Mayes et al., 1996; Unwin, 1992; Wardman et al., 1997).

As outlined in Chapter 4, cycle commuting studies comparing groups of cyclists and non-cyclists have tended to analyse the concept of barriers as part of a larger framework of social cognitions, most commonly alongside perceived benefits and in some cases also including self-efficacy and/or social norms (Gatersleben & Appleton, 2007; de Geus et al., 2007; Shannon et al., 2006). Gatersleben & Appleton (2007) used the five

stages of change (see Figure 5.1) to investigate if there were more subtle stage-based distinctions between attitudes and perceptions of cycle commuting individuals. In support of the TTM, the authors have found that as people progress from pre-contemplation to maintenance stage, their attitudes towards cycling become less negative. Examining in detail the way that individuals perceive potential barriers to cycling commuting and variables that may influence these perceptions is therefore both novel and of value to understanding more about cycle commuting behaviour.

Figure 5.1: Descriptions of 'stage of change' categories in relation to cycle commuting based on the TTM (taken from Crawford et al., 2001; Mutrie et al., 2002)

Stage	Description
Precontemplator	No intention to start cycle commuting in the next six months
Contemplator	Thinking about starting to cycle commute in the next six months
Preparer	Infrequently cycle commuting (no more than once a week)
Actor	Started regularly cycle commuting in the last six months
Maintainer	Has been regularly cycle commuting for at least six months

5.1.1 The Present Study

The present research intends to build on an aspect of the qualitative findings to come from the first study by carrying out a larger-scale investigation into individuals' perceptions of potential barriers associated with cycling to work. This study aims to provide an original contribution to the current body of literature by carrying out a detailed analysis into perceptions of cycle commuting barriers within a cycle-friendly workplace.

In line with other studies that have investigated cycle commuting behaviour (Gatersleben & Appleton, 2007; Mutrie et al., 2002; Shannon et al., 2006) the stages of change component was included in the present study to help understand if people in different stages of readiness to change hold differing perceptions of barriers to cycling. Whilst the stages of change have been criticised for being somewhat arbitrary (see Chapter 2), they provide a valuable grouping aid to help identify how interventions can

effectively target individuals who are at different stages of behavioural readiness (Armitage, 2009b). Additionally, demographic variables of gender and occupational role (as an indicator of income-level) are understood to impact on health behaviours (Conner & Norman, 2005) and have also been included in the present investigation of perceived barriers associated with cycling. Based on what is currently known about barriers associated with cycling and physical activity in relation to people's intention to cycle, gender and socioeconomic status, three research predictions have been proposed to help focus the research direction.

1. People in the later stages of change hold more positive perceptions of barriers to cycle commuting than those in the earlier stages
2. Males hold more positive perceptions of barriers to cycle commuting than females
3. Higher earners hold more positive perceptions of the barriers of cycle commuting than lower earners.

5.2 Methods

5.2.1 Design and Procedure

A cross-sectional design was employed and data was collected using an on-line questionnaire-based survey (the Bristol On-line Survey). The questionnaire was piloted for face validity with 15 PhD students and minor adaptations were made prior to use. The on-line questionnaire, embedded in a cover letter inviting people to take part in the study (see appendix C), was distributed in mid-April by departmental administrators via the internal email system to a sub-section of employees and PhD students within a large university setting. Prior to dissemination, permission to distribute the questionnaire was gained by the university Human Resources Department. Two reminder emails were sent out in the following month after the questionnaire was disseminated in an attempt to maximise the response rate. On-line questionnaires are a valid method of data collection and due to their impersonal nature may be less prone to effects of socially desirable responses (Gray, 2004). However, it should be acknowledged that a response bias is inherent in the design as non-computer based staff (e.g. cleaners and security guards) did

not have the opportunity to partake in this study. Ethical approval was obtained from Moray House School of Education Ethics Committee in line with the University of Edinburgh's ethics procedures.

5.2.2 Participants

For the present study, twenty eight buildings from two university campuses were targeted because they were classified as cycle-friendly worksites in accordance with Cycling Scotland's Cycle-friendly Employer scheme. The worksites provided showers and changing rooms, storage space, cycle parking facilities, financial incentives for cycling (e.g. mileage allowances and discount schemes) and social support (e.g. promotional events. The questionnaire was sent to approximately 2000 individuals, either employees or PhD students, who ranged from 18 to 70 years old. Overall, 831 people responded to the questionnaire (42%).

5.2.3 The Questionnaire

A questionnaire (see appendix C) was adapted from measures used in previous studies (Crawford et al., 2001; Mutrie et al., 2002). It consisted of three parts, (i) demographic variables (ii) current cycle commuting behaviour and (iii) attitudinal questions relating to potential barriers of cycle commuting. Current cycle commuting behaviour was measured using a stage of change scale (see Figure 5.1). From the pilot work it was found that seasonal cyclists could not be categorised within the stages of change model therefore an extra stage was added to the scale stating 'I am a seasonal cyclist' to accommodate those who were only cycling to work for part of the year. Potential barriers were assessed using 18 common deterring factors (listed in Tables 5.2, 5.3 and 5.4) using a five point Likert scale (1 = 'not discouraging', 2 = 'slightly discouraging', 3 = 'moderately discouraging', 4 = 'very discouraging', 5 = 'stops me from cycling'). The specific barriers investigated in this study were adopted from a previously published questionnaire in the field (Crawford et al., 2001; Mutrie et al., 2002) (see appendix C).

5.2.4 Statistical Analyses

The statistical analysis was carried out using the software package, SPSS Statistics 17. Initially percentages were used to provide an overview of each stage of change in relation to gender, age, occupation and distance. For the inferential statistics, the independent variables were stage of change (five levels), gender and occupation (as an indicator linked to income). 'Seasonal' cycle commuters, who only cycled for part of the year, were excluded from the stages of change analyses to ensure conformity to the TTM. The dependent variables were the 18 potential barriers.

One-way ANOVAs were carried out to analyse whether perceptions of the barriers significantly differed between stages of change (see Table 5.2) and also between occupations (see Table 5.4). In the case of significant results, post hoc tests were used to identify differences in perceived barriers between individual stages. Post hoc Tukey tests were used for data that conformed to homogeneity of variance tests and Bonferroni tests were used in instances where the data violated the assumptions of homogeneity of variance (Field, 2009). Independent t-tests were used to determine whether there were any significant differences in perceptions of barriers between men and women (see Table 5.3). Finally, two-way ANOVAs were carried out to find out if there were any significant interactions between stages of change, gender and occupation with regard to perceptions of barriers. Effect sizes have also been reported alongside significance values, as they provide complementary information about the magnitude of reported differences (Field, 2009). Cohen's d tests have been used to measure effect sizes for t-tests and partial eta squared calculations have been used to measure effect sizes for ANOVAs (see Figure 5.2).

Figure 5.2: Cohen's d and partial eta squared tests and corresponding effect sizes

Cohen's D (d)	Effect size
≥.10	Small
≥.30	Medium
≥.80	Large

Partial eta squared (ηp^2)	Effect size
≥.01	Small
≥.06	Medium
≥.14	Large

5.3 Results

5.3.1 Demographics

Table 5.1 shows gender, age, job and distance variables in relation to stages of change. In terms of stages of cycle commuting behaviour there were 52% pre-contemplators, 9% contemplators, 4% preparers, 3% actors, 26% maintainers and an additional category was added to capture seasonal cyclists (6%). The participants comprised 54% men and 46% women. A chi-square analysis revealed a significant association between gender and stage of change (Chi-square = 25.2, df = 5, $p<0.001$). This association reflects the tendency for females to be categorised earlier on stages of change (i.e. less likely to be active cycle commuters) than men.

Most participants (84%) were between the ages of 18 to 50 years old. The spread between genders was evenly distributed across age except for in the oldest age category (60-70 years), comprising 4% of the overall sample, which exhibited a male bias. There was also a relatively even spread of participants across occupations: 29% academic staff, 22% support staff, 24% research staff, 24% PhD students and 2% other. At each end of the stage of change spectrum, differences between occupations were evident (Chi-square = 46.9, df = 12, $p<0.001$). More academic staff than support staff was in the maintenance stage and vice versa in the precontemplator stage. Although not displayed in Table 5.1, gender differences in occupations were also evident with a higher percentage of males (21%) than females (8%) in academic positions and a higher percentage of females (14%) than males (8%) in support staff positions (Chi-square = 50.9, df = 3, $p<0.001$). The majority of the sample (78%) lived within a five mile radius from the worksite.

Table 5.1: Demographic variables displayed by stage of cycle commuting behaviour (n = 831)

Demographic variables	PC	C	P	A	M	S	Total
Behaviour	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Stage	51.1% (433)	9.1% (76)	3.7% (31)	2.5% (21)	26.5% (220)	6.0% (50)	100% (831)
Gender							
Male	25%(208)	4.2% (35)	1.9% (16)	1.3% (11)	17.9% (149)	3.5% (29)	53.9% (448)
Female	27.1% (225)	4.9% (41)	1.8% (15)	1.2% (10)	8.5% (71)	2.5% (21)	46.1% (383)
Age							
18-30 years	16.5% (137)	2.9% (24)	1.4% (12)	1.7% (14)	9.6% (80)	1.6% (13)	33.7% (280)
31-40 years	17.2% (143)	3.2% (27)	1.0% (8)	0.7% (6)	7.1% (59)	2.5% (21)	31.8% (264)
41-50 years	9.1% (76)	1.4% (12)	1.3% (11)	0.1% (1)	5.8% (48)	0.8% (7)	18.7% (155)
51-60 years	7.2% (60)	1.4% (12)	0.0% (0)	0.0% (0)	3.4% (28)	0.7% (6)	12.8% (106)
61-70 years	2.0% (17)	0.1% (1)	0.0% (0)	0.0% (0)	0.6% (5)	0.4% (3)	3.1% (26)
Occupation							
Academic	13.2% (110)	2.4% (20)	1.3% (11)	0.0% (0)	9.9% (82)	2.5% (21)	29.4% (244)
Research staff	11.4% (95)	2.8% (23)	0.6% (5)	1.2% (10)	6.3% (52)	1.4% (12)	23.7% (197)
PhD students	11.9% (99)	1..7% (14)	1.2% (10)	1.0% (8)	6.7% (56)	1.2% (10)	23.7% (197)
Support staff	14.7% (122)	2.2% (18)	0.5% (4)	0.2% (2)	3.1% (26)	0.8% (7)	21.5% (179)
Other	0.8% (7)	0.1% (1)	0.1% (1)	0.1% (1)	0.5% (4)	0.0% (0)	1.7% (14)
Distance (one way)							
0-1 mile	9.9% (82)	1.3% (11)	1.1% (9)	0.4% (3)	3.2% (27)	0.7% (6)	16.6% (138)
1-2 miles	14% (116)	2.9% (24)	0.7% (6)	1.1% (9)	10.3% (86)	2.3% (19)	31.3% (260)
2-5 miles	12.5% (104)	4.0% (33)	1.4% (12)	1.0% (8)	9.0% (75)	2.2% (18)	30.1% (250)
5-10 miles	5.8% (48)	0.6% (5)	0.4% (3)	0.0% (0)	1.7% (14)	0.2% (2)	8.7% (72)
10miles +	10.0% (83)	0.4% (3)	0.1% (1)	0.1% (1)	2.2% (18)	0.6% (5)	13.4% (111)

Note. PC = precontemplators, C = contemplators, P = preparers, A = actors, M = maintainers, S = seasonal

5.3.2 Stages of Change

Looking at each stage of change separately, it is possible to discern which of the barriers to cycle commuting were perceived to be the most substantial (see Table 5.2). Precontemplators, contemplators and preparers all ranked 'danger on the roads', 'bad weather' and 'darkness' as the top three barriers associated with cycling to work. Actors' and maintainers' perceptions differed slightly. Actors ranked 'danger on the

roads', 'bad weather' and 'natural terrain' as the main barriers to cycle commuting and maintainers scored 'danger on the roads', 'bad weather' and 'manmade terrain' as the biggest barriers.

Table 5.2 shows statistically significant differences in perceived barriers (set above $p \leq 0.01$ to protect against type 1 errors) for 17 out of the 18 barriers as a function of stage of change. The most significant stage of change differences related to the perceived barriers of: danger on the roads ($F(4, 731) = 48.7$, $p < 0.001$, $\eta p^2 = 0.21$), physical effort involved ($F(4, 221) = 48.3$, $p < 0.001$, $\eta p^2 = 0.15$), and natural terrain such as hilliness ($F(4, 225) = 47.8$, $p < 0.001$, $\eta p^2 = 0.17$). This reveals that although there is some agreement between stages of change about which barriers are the most important, there are evident 'stage' differences in the perceived strength of these barriers. Post hoc Tukey tests demonstrated that consistently precontemplators, and to a lesser extent contemplators, perceived higher levels of barriers than those individuals experienced in cycle commuting (maintainers).

Table 5.2: Differences in perceived barriers between the stages of change

Potential Barriers	PC mean (SD)	C mean (SD)	P mean (SD)	A mean (SD)	M mean (SD)	df	F	*P*	Post hoc	ηp^2
Danger on the roads	4.03 (1.21)	3.42 (1.28)	3.00 (1.36)	3.14 (1.01)	2.63 (1.18)	4, 731	48.658**	<0.001	PC vs C PC vs P PC vs A PC vs M C vs M	0.21
Bad weather	3.21 (1.26)	3.12 (1.15)	3.68 (1.11)	3.38 (1.02)	2.33 (1.06)	4, 198	26.811²ª**	<0.001	PC vs M C vs M P vs M A vs M	0.11
Darkness	2.95 (1.37)	2.54 (1.16)	2.90 (1.27)	2.19 (0.93)	1.71 (0.91)	4, 184	43.552²**	<0.001	PC vs A PC vs M C vs M P vs M	0.17
Manmade terrain (poor roads)	2.59 (1.40)	2.01 (1.09)	2.23 (1.31)	2.14 (1.15)	1.97 (1.03)	4, 166	11.047²**	<0.001	PC vs M PC vs C	0.05
Natural terrain (hilliness)	2.80 (1.44)	2.42 (1.33)	1.94 (0.96)	2.29 (0.90)	1.54 (0.77)	4, 225	47.848²**	<0.001	PC vs P PC vs M C vs M	0.17
Exhaust fumes	2.71 (1.33)	2.08 (1.03)	1.83 (1.15)	1.76 (0.62)	1.78 (0.91)	4, 205	35.474²**	<0.001	PC vs C PC vs P PC vs A PC vs M	0.12
Distance from work	2.67 (1.73)	1.63 (1.07)	1.76 (1.06)	1.86 (1.19)	1.66 (0.96)	4, 192	33.482²**	<0.001	PC vs C PC vs P PC vs M	0.11
Carrying belongings	2.34 (1.35)	1.90 (1.06)	2.33 (1.27)	2.55 (1.10)	1.60 (0.80)	4, 146	17.177²**	<0.001	PC vs C PC vs M P vs M A vs M	0.08
Storage at home	2.36 (1.48)	2.35 (1.40)	1.61 (0.98)	1.89 (0.99)	1.47 (0.77)	4, 165	21.114²**	<0.001	PC vs M C vs M	0.09
School/nursery run	2.28 (1.76)	1.85 (1.41)	2.47 (1.88)	1.60 (1.35)	1.36 (0.82)	4, 60	6.520²**	<0.001	PC vs M	0.06
Time taken to cycle	2.46 (1.62)	1.77 (1.18)	1.50 (0.86)	1.81 (1.03)	1.26 (0.68)	4, 214	46.955²**	<0.001	PC vs C PC vs P PC vs M C vs M	0.14
Changing and showering facilities	1.91 (1.25)	1.89 (1.19)	1.81 (1.08)	1.68 (1.16)	1.46 (0.86)	4, 130	5.242²*	0.001	PC vs M	0.31
Physical effort involved	2.13 (1.30)	1.62 (0.97)	1.55 (0.85)	1.43 (0.68)	1.15 (0.39)	4, 221	48.340²**	<0.001	PC vs C PC vs P PC vs A PC vs M C vs M	0.15
Storage at work	1.75 (1.09)	1.75 (1.09)	1.71 (1.10)	1.94 (1.14)	1.50 (0.93)	4, 635	2.093	0.080		0.011
Expense of buying a bike	1.97 (1.24)	2.20 (1.35)	1.00 (0.00)	1.60 (0.88)	1.23 (0.59)	4, 662	20.627²**	<0.001	PC vs P PC vs M C vs P C vs M	0.11
Casual clothing	1.77 (1.19)	1.57 (0.92)	1.75 (1.00)	1.70 (0.92)	1.27 (0.59)	4, 148	9.611²**	<0.001	PC vs M	0.05
Health problems	1.65 (1.26)	1.16 (0.71)	1.37 (1.01)	1.50 (0.94)	1.38 (0.89)	4, 107	4.092²*	0.004	PC vs C	0.02
Lack of waterproof clothing	1.60 (1.00)	1.59 (0.98)	1.36 (0.91)	1.63 (0.83)	1.29 (0.63)	4, 148	4.011²*	0.004	PC vs M	0.02

Note. PC = precontemplators, C = contemplators, P = preparers, A = actors, M = maintainers, df = degrees of freedom, F = ANOVA score, p = significance level, * ≤ 0.01, ** ≤ 0.001, Post hoc = Tukey or Bonferroni test with a significance value set at $p \leq 0.05$, ηp^2 = partial eta squared (effect size), ² = Levene's test for homogeneity of variance has been violated ($p = \leq 0.05$) so the Brown-Forsythe test (adjusted F and residual degrees of freedom) has been used instead.

5.3.3 Gender

Both males and females classified danger on the roads, bad weather and darkness as the biggest barriers to cycle commuting. However, Table 5.3 reveals there were significant gender differences ($p \leq 0.01$) in the strength of perceptions for 13 of the 18 barriers between males and females. The most significant gender differences related to perceived barriers of darkness (t = 7.3, df = 733, $p < 0.001$, d = 0.54), natural terrain such as hilliness (t = 7.2, df = 661, $p < 0.001$, d = 0.56), and perceived danger on the roads (t = 6.8, df = 732, $p < 0.001$, d = 0.50). This indicates that although there is agreement amongst men and women about what barriers are the most important, there are marked gender differences in the perceived strength of these barriers. Where gender differences were identified, females consistently perceived higher levels of barriers than males.

Table 5.3: Differences in perceived barriers between males and females

Potential barriers	Female mean (SD)	Male mean (SD)	df	T	*P*	d
Danger on the roads	3.82 (1.23)	3.18 (1.38)	732	6.759[a]**	<0.001	0.50
Bad weather	3.21 (1.21)	2.80 (1.24)	739	4.608**	<0.001	0.34
Darkness	2.90 (1.33)	2.24 (1.25)	733	7.299**	<0.001	0.54
Manmade terrain (poor road surfaces)	2.54 (1.29)	2.14 (1.24)	723	4.265**	<0.001	0.32
Natural terrain (hilliness)	2.69 (1.38)	2.00 (1.19)	661	7.224[a]**	<0.001	0.56
Exhaust fumes	2.56 (1.29)	2.10 (1.16)	690	4.752[a]**	<0.001	0.36
Distance from work	2.34 (1.58)	2.06 (1.42)	695	2.501[a]**	<0.001	0.19
Carrying belongings	2.29 (1.26)	1.89 (1.13)	678	4.422[a]**	<0.001	0.34
Storage at home	2.25 (1.47)	1.89 (1.18)	549	3.106[a]*	0.002	0.27
School/nursery run	2.48 (1.80)	1.66 (1.29)	270	4.979[a]**	<0.001	0.61
Time taken to cycle	2.08 (1.42)	1.90 (1.40)	728	1.723	0.085	0.13
Changing and showering facilities	1.81 (1.18)	1.77 (1.14)	630	0.640	0.522	0.01
Physical effort involved	1.96 (1.21)	1.55 (0.99)	654	5.263[a]**	<0.001	0.41
Storage at work	1.72 (1.08)	1.71 (1.09)	638	0.070	0.944	0.01
Expense of buying a bike	1.85 (1.20)	1.61 (1.04)	581	2.621[a]*	0.009	0.22
Casual clothing	1.84 (1.16)	1.41 (0.83)	543	5.431[a]**	<0.001	0.50
Health problems	1.63 (1.23)	1.43 (1.00)	447	1.948[a]	0.052	0.20
Lack of waterproof clothing	1.59 (1.02)	1.44 (0.81)	554	1.903[a]	0.058	0.20

Note. df = degrees of freedom, t = t-test score, *p* = significance level, d = Cohen's d (effect size), [a] = Levene's test for homogeneity of variance has been violated ($p = \leq 0.05$) * ≤ 0.01, ** ≤ 0.001.

5.3.4 Occupation

Academic, support and research staff all ranked danger on the roads, bad weather and darkness as the top three barriers associated with cycling to work. PhD students and the miscellaneous groups' perceptions differed slightly. PhD students ranked danger on the roads, bad weather and natural terrain as the greatest barriers to cycle commuting and the miscellaneous group scored danger on the roads, bad weather and manmade terrain as the biggest barriers.

Table 5.4 shows statistically significant differences in perceived barriers ($p \leq 0.01$) for 12 out of the 18 barriers as a function of occupation. The most significant occupation differences related to perceived barriers of the expense of buying a bike ($F(4, 700) = 10.6$, $p < 0.001$, $\eta p^2 = 0.05$) darkness ($F(4, 780) = 10.1$, $p < 0.001$, $\eta p^2 = 0.05$), and exhaust fumes ($F(4, 781) = 9.1$, $p < 0.001$, $\eta p^2 = 0.05$). This reveals that whilst the occupational groupings share a common view of the greatest barriers, there are differences between occupational groups in their perceptions of barriers. Most commonly these differences exist between academic and support staff with the support staff consistently holding the most negative perceptions.

5.3.5 Interactions

Two-way ANOVA were carried out between all of the independent variables in relation to the 18 dependent variables to search for any interactions between stage of change, gender and occupation. The analyses showed there were no significant interactions between any of the independent variables in relation to the 18 potential barriers examined in this study ($p \leq 0.01$).

Potential barriers	Academic mean (SD)	Support mean (SD)	Research mean (SD)	PhD mean (SD)	Other mean (SD)	df	F	*P*	Post hoc	ηp^2
Danger on the roads	3.39 (1.33)	3.84 (1.40)	3.37 (1.32)	3.34 (1.33)	3.43 (1.45)	4, 781	3.991*	0.003	S vs A S vs R S vs PhD	0.02
Bad weather	2.74 (1.17)	3.26 (1.33)	3.07 (1.23)	2.95 (1.24)	3.00 (1.11)	4, 786	4.572**	0.001	S vs A	0.02
Darkness	2.49 (1.24)	3.07 (1.50)	2.40 (1.26)	2.26 (1.22)	2.43 (1.16)	4, 780	10.067[a]**	<0.001	S vs A S vs A S vs PhD	0.05
Manmade terrain (poor roads)	2.22 (1.20)	2.74 (1.43)	2.22 (1.18)	2.19 (1.27)	2.15 (1.21)	4, 769	5.649[a]**	<0.001	S vs A S vs R S vs PhD	0.03
Natural terrain (hilliness)	2.11 (1.24)	2.76 (1.54)	2.19 (1.25)	2.29 (1.23)	2.43 (1.60)	4, 771	5.813[a]**	<0.001	S vs A S vs R S vs PhD	0.02
Exhaust fumes	2.14 (1.10)	2.82 (1.51)	2.24 (1.01)	2.14 (1.18)	2.21 (1.31)	4, 781	9.055[a]**	<0.001	S vs A S vs R S vs PhD	0.05
Distance from work	2.01 (1.36)	2.57 (1.72)	2.18 (1.47)	2.02 (1.39)	2.79 (1.85)	4, 788	4.197[a]*	0.003	S vs R S vs R	0.02
Carrying belongings	2.01 (1.13)	2.22 (1.30)	2.10 (1.18)	1.98 (1.21)	2.50 (1.61)	4, 772	1.288[a]	0.280		0.01
Storage at home	1.77 (1.12)	2.10 (150)	2.24 (1.39)	2.15 (1.31)	2.00 (1.35)	4, 686	3.307[a]	0.012		0.02
School/nursery run	2.12 (1.57)	2.37 (1.84)	1.82 (1.45)	1.43 (1.11)	1.88 (1.46)	4, 372	3.974[a]*	0.005	S vs PhD	0.04
Time taken to cycle	1.87 (1.32)	2.55 (1.68)	1.89 (1.27)	1.66 (1.18)	2.50 (1.95)	4, 721	8.531[a]**	<0.001	S vs A S vs R S vs PhD	0.05
Changing and showering facilities	1.61 (1.00)	1.93 (1.34)	1.75 (1.09)	1.87 (1.22)	2.15 (1.41)	4, 669	1.999[a]	0.100		0.01
Physical effort involved	1.55 (0.93)	2.08 (1.30)	1.72 (1.14)	1.66 (1.01)	2.14 (1.61)	4, 782	4.982[a]*	0.001	S vs A S vs R S vs PhD	0.03
Storage at work	1.65 (1.01)	1.71 (1.15)	1.80 (1.15)	1.73 (1.01)	1.42 (0.70)	4, 676	0.667[a]	0.615		0.00
Expense of buying a bike	1.36 (0.75)	1.84 (1.24)	1.76 (1.12)	2.04 (1.27)	1.38 (0.87)	4, 700	10.581[a]**	<0.001	S vs A R vs A PhD vs A	0.05
Casual clothing	1.53 (0.87)	1.77 (1.23)	1.59 (1.05)	1.53 (0.92)	1.64 (1.08)	4, 731	1.461[a]	0.217		0.01
Health problems	1.33 (0.87)	1.75 (1.30)	1.46 (1.07)	1.56 (1.15)	2.30 (1.70)	4, 539	2.897[a]	0.032		0.03
Lack of waterproof clothing	1.27 (0.60)	1.66 (1.01)	1.59 (0.99)	1.62 (0.99)	1.36 (0.67)	4, 671	5.812 [a]**	<0.001	S vs A R vs A PhD vs A	0.03

Note. df = degrees of freedom, F = ANOVA score, *p* = significance level, * ≤ 0.01, ** ≤ 0.001, Post hoc = Tukey or Bonferroni test with a significance value set at $p \leq 0.05$, ηp^2 = partial eta squared (effect size), [a] = Levene's test for homogeneity of variance has been violated ($p = \leq 0.05$) so the Brown-Forsythe test (adjusted F and residual degrees of freedom) has been used instead, S = support staff, A = academic staff, R = research staff, and PhD = PhD student.

5.4 Discussion

The current study was designed to find out: if people in the later stages of change held more positive perceptions of barriers to cycle commuting than those in the earlier stages; if males held more positive perceptions of barriers to cycle commuting than females; and if higher earners held more positive perceptions of the barriers of cycle commuting than lower earners.

5.4.1 Demographics

The results revealed, in support of other studies, that more men than women cycle commute (Department for Transport, 2007; Dickinson et al., 2003; Troped et al., 2001; Unwin, 1992, 1995). A larger percentage of academic staff members were regularly cycling to work in comparison to the support staff, who were more likely not to cycle to work. In accordance with this result, De Geus et al. (2008) found higher education to be associated with more cycling to work. In the present study, proportionally, more women worked as support staff and more men as academic staff so it is possible that gender could also play an influencing role within the effect found here.

5.4.2 The Biggest Barriers

Overall, regardless of the way in which the participants were grouped (stage, gender or occupation), danger on the roads posed the biggest barrier to cycle commuting in each instance. In the case of stages of change, whilst all individual stages viewed danger on the road to be the greatest barrier, precontemplators perceived danger on the roads more strongly than maintainers. Stinson & Bhat (2004) found similar results between cyclists and non-cyclists and suggested that non-cyclists may hold misconceptions regarding the dangers of cycling. This is a plausible explanation but such statements should be made with caution. Daley et al. (2007) also found that danger was a significant barrier for occasional and non-cyclists who had lower levels of skills than regular riders. It is possible that inexperienced cyclists may be at higher risk on the roads in comparison to experienced cyclists, who are likely to have developed skills and confidence with

exposure to cycling in traffic. There is also evidence to the contrary, finding no significant differences in perceptions of danger between cyclists and non-cyclists (de Geus, et al., 2008). This contradiction in findings may relate to the environmental context of the research as de Geus et al. (2008) carried their research out in a Belgian town with a basic cycle infrastructure available in most places.

In terms of gender, women perceived danger on the roads to be a greater barrier than men in the present study, as has been found previously (Davies et al., 1997; Department for Transport, 2007; Krizek, Johnson & Tilahun, 2005;Tilahun, Levinson & Krizek, 2007). This is likely to stem from established gender differences in risk taking (Byrnes et al., 1999). In relation to occupation, those who are working as support staff perceived danger on the roads to be a bigger barrier than all academic and research staff and PhD students. It can be inferred from the occupation data that the support staff are likely to be the lowest paid members of staff in the cohort and they are also likely to be the least educated group in comparison to other staff and PhD students in the university setting. Whilst there is no previous literature relating to perceptions of danger and cycling for either the variables of income or education, more generally research into the uptake of cycling does suggest that people with lower levels of education are linked to lower cycle use (de Geus et al., 2008; Plaut, 2005; Reynolds, Harris, Teschke, Cripton & Winters, 2009). As discussed earlier in this chapter, perceived barriers to physical activity have been found to negatively influence people's decisions to participate (Bauman et al., 2002; Trost et al., 2002).

The weather posed the second biggest challenge overall. Mayes et al., (1996) found bad weather to be a common barrier for people who do not cycle and suggested this is an excuse that non-cyclists hide behind. The present results showed that not only non-cyclists but infrequent and new cyclists also perceive the weather to be a significantly bigger challenge than experienced cyclists. A possible explanation is that cyclists develop strategies to cope with weather conditions over time (e.g. buying the appropriate waterproof clothing). As indicated in the previous chapter (Chapter 3), people who

regularly cycle to work use more problem-focussed coping strategies than emotion-focussed coping strategies (Lazarus & Folkman, 1984). It may well be the case that those who are not regularly cycle commuting use more emotion based coping strategies.

Women perceived weather to be more of a challenge than men. This may also stem from women's aversion to risk taking (Byrnes, Miller & Williams, 1999) as inclement weather can increase danger on the roads from poor visibility and wet surfaces. Another possible reason is that women often have more complex needs, in relation to their physical appearance (hair and make up) than men and poor weather conditions can adversely affect appearance. Support staff also perceived weather to be a bigger barrier than academic staff. As a large proportion of support staff in this study are likely to work in administrative and clerical roles, their more formal dress code and appearance (in comparison to PhD students and other university staff) may play a role. As there is no other obvious explanation for this result it may be possible, as discussed above, that the difference in perception between occupations stems from the type of coping strategy one uses.

5.4.3 Where the Differences in Perceptions Lie

This study found significant perceptual differences for 17 out of the 18 potential barriers between the differing stages of change. The results consistently revealed that the perceptions of barriers that people in the later stages held were lower than those in the earlier stages of change. This finding lends support to the first research prediction as well as to the TTM. The model posits that as an individual progresses through the stages of change, their views of the barriers associated with an activity decrease. This finding confirms that as Bull (2001) states in the early stages of behaviour change individuals cannot see past the difficult aspects. It is therefore important to examine which are true barriers and which are 'excuses' or 'misperceptions' and what possible solutions can be found.

The precontemplator group held the highest perceptions of barriers to cycling. Whilst some of these may be realistic (e.g. amongst those who live a greater distance from work), other perceived barriers may be exaggerated, due to lack of experience, and are likely to be amenable to change. For example, exhaust fumes, weather and danger on roads were perceived as stronger barriers among precontemplators than by individuals in all the other stages. As these factors are in reality likely to apply fairly equally to most people cycling to the university, this suggests a subjective, psychological, component to perceptions of barriers that could be the target of intervention work. The precontemplators comprised the largest single group (51% of sample), reflecting the current large numbers of non-cyclists. Even if interventions only encouraged a small proportion of this group to engage in cycling, this could significantly increase overall cycling numbers.

Contemplators voiced a number of concerns but not as many or as strongly as precontemplators. As contemplators have the intention to start cycle commuting, it may be more cost effective to focus on moving these individuals closer to action. According to Marcus & Forsyth (2003), this can be done by carrying out an individual barriers assessment, and providing suggestions and action plans for overcoming barriers. Taster sessions are also recommended (Biddle & Mutrie, 2001). Rose & Marfurt (2006) assessed the impact of a 'Ride to Work Day' and found that 27% of first time riders participating in the event were still cycling five months after the event. Such events may help to overcome misperceptions relating to issues such as time taken to cycle, nature of terrain en route and the physical effort involved, each of which has been identified in the current study as being a significantly greater perceived barrier amongst those in the contemplation stage than in the maintenance stage. Cycle skills training may also be appropriate at this stage to help cue action. Telfer, Rissel, Bindon & Bosch (2006) found cycle training to be effective in increasing people's cycle behaviour by providing, knowledge, skills and increasing self-confidence.

Preparers held less significant negative perceptions than contemplators. As preparers are already infrequently cycle commuting, it is likely that there will be very specific barriers holding them back from regularly cycling to work. In the HAPA model, the pre-action volitional stage, equivalent to the preparation stage of the TTM, includes the mediators of action planning and coping planning. These types of planning aim to overcome the gap between intention and action (Schwarzer, 2008). In the current study, the significant differences between those in the preparation stage and those in the maintenance stage related to perceptions of barriers due to bad weather, darkness and carrying belongings. Potentially, receiving advice and strategies from experienced cyclists about how to overcome such barriers may help those in the preparation stage to progress into regular cycle commuters. Informal social support networks may facilitate such links and have been recommended for preparers (Marcus & Forsyth, 2003). Workplaces could set up bicycle user groups to create supportive social networks for the cycling community.

The results for actors and maintainers reveal that although both of these groups are regularly cycling to work, actors are more deterred by some perceived barriers than maintainers. These two groups differed significantly in their perceptions of bad weather and carrying belongings. It is possible that those in the maintenance stage have developed strategies to overcome such barriers. It is therefore important that individuals who have recently started cycle commuting receive support to help them maintain their behaviour. Social support from the workplace and encouragement to join networks and events is recommended (Marcus & Forsyth, 2003).

There are clear differences in perceptions of barriers between men and women. Females perceived 13 out of the 18 barriers to be significantly more discouraging than males. This supports the second prediction of the present study and is an important finding as few studies have explored women's perceptions of barriers to cycling in detail (Garrard et al., 2006). In the current study, women did not just hold heightened perceptions of risk orientated barriers, but also of more general barriers such as: natural terrain; distance to work; carrying belongings; storage at home; the school run; physical effort

involved; the expense of buying a bike; and wearing casual clothing. These findings suggest that women may benefit from receiving a higher level of support than men when making decisions about cycling to work. Previous studies indicate that complex trip characteristics (such as shopping and child responsibilities) may partially explain why fewer females cycle commute (Dickinson et al., 2003; Pooley & Turnbull, 2000).

Garrard et al. (2006) proposed that social and environmental factors underpin women's uptake of cycling stating "female participation in cycling appears to be an indicator of a cycling friendly culture and environment with each contributing to the other interactively" (Garrard et al., 2006, p.6). The current study found that all of the 18 perceived barriers, gender and stages of change act independently of each other. This finding suggests that although women might hold relatively heightened perceptions of barriers than men, as they progress through the stages of change their perceptions of barriers decrease. This indicates that individual (psychological) support also has an instrumental role to play in encouraging women to cycle. Daley et al., (2007) found that females were attracted to cycling as it is a low impact form of exercise; therefore, if the necessary support is in place, cycle commuting would be appealing to women.

In relation to occupation, differences in perceptions were reported for 12 out of 18 of the potential barriers to cycle commuting, with support staff holding the most negative perceptions of all and academics the most positive perceptions. This provides a substantial degree of support towards the third and final prediction made in relation to this study. Uniquely, this is the first quantitative study to report differential effects of occupation on cycle commuting barriers. These novel findings indicate that support staff, which includes administrative and secretarial positions, are more deterred from cycling than those individuals that are involved in research and academic positions. Whilst proportionally, more support staff were female and non-cyclists compared to academic staff, there were no interactions between any of the individual-level variables of stage of change, gender and occupation. This suggests that the type of job position you hold and presumably factors associated with this such as level of education and

income and potentially the social identity and culture surrounding the type of work play a role in an individual's perceptions around cycling.

In most cases the differences in perceptions were found between the support staff and other groups but interestingly, the two potential barriers that involve a financial element, expense of buying a bike and lack of waterproof clothing, were viewed significantly more negatively by support staff, research staff and PhD students in comparison to academics. A possible explanation is that buying a bike and the necessary clothing (which can be a considerable financial output) may pose more of a financial obstacle to those who are earning less than an academic's wage. As the lowest earning group, PhD students ranked buying a bike as the biggest barrier; relative to the other job groupings it is likely to be the case that for those earning lower incomes, costs associated with cycling are a bigger consideration. The other alternative is that academics may value cycling more as a mode of transport and in turn prioritise investing money into cycling equipment but there is no further data to come from this study to support such a statement.

These findings suggest that when developing interventions to promote cycle commuting, specific characteristics relating to occupational roles such as: income; level of education; social identity; work culture; and dress code may also need to be taken into account. Attention should be paid to providing financial support and resources (such as bicycle loan schemes and discount schemes) and also to providing more educational and informational resources about cycle commuting to encourage cycle use for people who are on lower incomes.

5.4.4 The Environmental Context

As this research was carried out in working environments that provided adequate support of cycling it was also of interest to examine how people perceived the potential barriers associated with their place of employment. Workplace cycle facilities were

generally not considered to be a substantial barrier to cycle commuting in this study. It is likely that this result was due to the cycle-friendly facilities available to all participants. However, precontemplators were significantly more discouraged than maintainers by their perceptions of the showers and changing facilities available. This may simply reflect lack of awareness towards some of the available cycle facilities and highlights the importance of ensuring that cycle facilities are widely communicated to maximise their use and to dispel inaccurate perceptions.

Whilst the most important barriers reported in this study relate to aspects of the physical environment that are not within the control of an individual, the significant perceptual differences between individuals at differing stages of change indicate that the way people perceive these environmental barriers may be amenable to change. This supports the findings reported in Chapter 4. However, environmental barriers such as danger on the roads and manmade terrain remain strong deterrents to cycling. It is therefore crucial to provide better environmental support for cyclists in terms of infrastructure and provision. Wardman et al. (2007) suggest that in order for large numbers of people to start cycle commuting in the UK, adequate infrastructure needs to be in place.

5.4.5 Limitations

There were a number of limitations within this study. Firstly, data was collected via a self-report, with no objective measures in place. The response rate (42%) was good for a survey of this nature. However, this study may have underrepresented manual workers due to the nature of the on-line data collection method used. Additionally, the research was carried out in a workplace providing adequate cycle facilities; therefore some findings would not apply to workplaces that do not provide suitable cycle provision for employees. It is also acknowledged that cycle environments vary between places and cultures so findings from this study, regarding environmental barriers, which confirm other research evidence (Crawford et al., 2001; Daley et al, 2007; Unwin, 1995), should be interpreted in context.

5.5 Chapter Summary and Conclusions

This chapter has outlined a cross-sectional questionnaire-based investigation that was carried out to examine employees' perceptions of some of the common, potential barriers associated with cycle commuting behaviour. The research was undertaken in cycle-friendly worksites in a university setting and overall, 831 participants took part in the study. The study used 18 barriers as dependent variable and three individual-level factors (stage of change, gender and occupation) as the independent variables to investigate if there were any differences in an individual's perceptions of potential barriers to cycle commuting.

The results revealed that danger on the roads and bad weather were perceived as the two strongest barriers to cycling overall. Significant differences in perceptions for the majority of potential barriers were found as a function of stage of change, gender and occupation. The stage of change variable revealed the most differences with 17 out of the 18 barriers being significant. Individuals at earlier stages of change perceive stronger barriers to cycle commuting than those individuals who engage in the behaviour. Furthermore, women and support staff commonly perceive relatively higher barriers than men and academic staff. Individual-level interventions to promote cycle commuting that focus on barrier reduction could benefit from taking into account stage of change, gender and occupational characteristics in order to enhance effectiveness and facilitate behaviour change.

5.6 Thesis Implications

The overall findings presented in this chapter indicate that perceived barriers play a significant role in cycle commuting behaviour and whilst some of these barriers are objective phenomena, they appear to be mediated by social cognitions. As discussed earlier in this chapter and in Chapter 2, perceived barriers form a constituent part of social cognitive and behaviour change theories. In order to both test established theory

and to better understand the importance that the role that perceived barriers play within cycle commuting behaviour the subsequent chapter (Chapter 6) investigates key variables encompassed within the Transtheoretical Model of Behaviour Change. Perceived benefits, perceived barriers and self-efficacy will be examined in relation to cycle commuting behaviour. The significant role that perceived barriers appear to play in the decision to cycle to work is also an important finding that has implications for the development of a psychologically-orientated intervention aimed at encouraging cycle commuting, which is documented later in this thesis (see Chapter 8).

Chapter 6

Study 3: The Transtheoretical Model, Gender and Occupation in Relation to Cycle Commuting Behaviour

Aims of the Chapter

This chapter aims to test key psychological variables encompassed in the Transtheoretical Model of Behaviour Change and individual factors previously found to be associated with cycle commuting within a cohort of employees based at cycle-friendly worksites across Scotland. Perceived benefits and barriers, self-efficacy and decisional balance were examined in relation to cycle commuting behaviour, as well as gender and occupation to discover if these factors help to explain and predict cycle commuting behaviour. Additionally, investigating this set of psychological factors provides insight into the applicability of the Transtheoretical Model of Behaviour Change for use in intervention work that aims to encourage cycling to work.

6.1 Introduction

Literature reviewed in Chapter 3 indicates that psychological factors play an important role in cycle commuting behaviour (de Geus et al., 2008; Heinen et al., 2010). So far, within this thesis, the two previous studies presented (Chapter 4 and 5) have found evidence to support the important role that social cognitions play within cycle commuting behaviour. Study 1 (Chapter 4) adopted a qualitative, exploratory approach to examine individuals' perceptions and attitudes towards cycle commuting behaviour within a supportive workplace setting. It was found that perceptions of benefits and barriers, and the way in which people coped with the potential barriers they faced played a part in their decision to cycle commute.

Study 2 (Chapter 5), a larger-scale quantitative study, investigated individual's perceptions of barriers using the stages of change construct, which categorises people with regard to their level of intention or action towards a specific behaviour. Perceptions of barriers were also examined in relation to gender and occupation. The results

indicated that people in differing stages of change held significantly different perceptions of cycle commuting, with those in the earlier stages reporting higher perceptions of barriers than those in the later stages of change. This was also the case, to a lesser degree, for gender and occupation, with females and lower earners reporting higher perceptions of barriers than males and higher earners.

Whilst the two previous studies presented in this thesis so far have helped to provide a better understanding of some of the psychological factors associated with cycling to work, the scope of this thesis was not to generate any new theories *per se*. Rather the aim here was, by carefully considering and critiquing a number of the relevant theoretical models in the field (see Chapter 2) and by inductive investigation (see Chapter 4), to identify an existing theoretical framework that would be applicable to use for understanding the psychological variables involved in cycle commuting. Identifying a relevant theory would also have implications for intervention work in this area.

In the first qualitative study (Chapter 4) the main variables that have been inductively identified as playing an important role in cycle commuting align with two of the most commonly identified behavioural predictors in health and exercise psychology, which are: outcome expectancies (perceived benefits and challenge/barriers) and self-efficacy (linked to the concept of coping). As illustrated in Chapter 2, the high degree of theoretical convergence that is present in social cognition models and behaviour change theories means that these two variables are common in numerous theories such as the Transtheoretical Model of Behaviour Change (TTM), the Theory of Planned Behaviour (TPB), and the Health Action Process Approach (HAPA).

The TPB is the most widely tested and robust theory in the field of exercise research but it does little to help explain what underlying processes mediate the uptake of behaviour. The HAPA is also an attractive theory to apply to cycle commuting behaviour due to its explicit recognition of the role of coping as part of the mediating process between intention and action. However, the HAPA also includes the variable of risk perception

that would be more appropriate for reducing harmful behaviours such as smoking or sedentary living as opposed to choosing active forms of transportation, which may not necessarily be only targeting sedentary individuals.

The TTM has raised some controversy with regard to the authenticity of the stages of change component and the validly of the model (Biddle & Mutrie, 2008). Nevertheless, the TTM has become arguably the most popular psychological model within health promotion due to the inclusion of the stages of change construct (Conner & Norman, 2005). Whilst social cognition models such as TPB can be viewed as diagnostic in nature and help us to identify the psychosocial factors that influence behaviour, by contrast, behaviour change theories such as the TTM show how behaviour changes over time (Darnton, 2008). According to Darnton (2008), behaviour change theories are more pragmatic in nature and have been developed to support interventions in changing behaviours as opposed to purely predicting behaviours *per se*. The previous study (Chapter 5) exemplifies that the stages of change are an effective way of understanding the different profiles that exist between differencing levels of intention and behaviour. Taking into account the practical use that the stages of change has in understanding behaviour the TTM was the theory of choice to be used to investigate psychological variables associated with cycle commuting presented in this chapter.

To recap, according to the TTM, as individuals progress though the stages of change their perceptions of benefits and barriers related to the decisional balance will shift more positively, along with increases in self-efficacy for that particular behaviour (Prochaska & DeClimemte, 1982). As the qualitative results from Study 1 (Chapter 4) and the quantitative findings from Study 2 (Chapter 5) indicate that these variables play an important role in cycle commuting it was deemed valuable to carry out a quantitative study to verify these findings on a larger sample. Whilst studies have used aspects of the TTM in relation to active commuting behaviour (Gatersleben & Appleton, 2007; Mutrie et al., 2002; Shannon et al., 2006) none have reported results on both the decisional balance (benefits and barriers) variables and self-efficacy for cycle commuting.

6.1.1 The Present Study

The present study is designed to help clarify if the decisional balance variable (comprising perceptions of benefits and barriers) and self-efficacy, which all form part of the TTM are appropriate indicators of cycle commuting behaviour, and if so, which variable is most influential on behaviour. In addition to testing TTM variables, results from the previous study (see Chapter 5) suggested that gender and occupation may also play a role in the decision to cycle commute. Therefore these two demographic factors of gender and occupation were also deemed worthy of further investigation in relation to cycle commuting behaviour. This study is original in that it is the first study to specifically report findings regarding TTM variables in relation to cycle behaviour, gender and occupation. Based on the tenets of the TTM and empirical evidence, a set of predictions are presented to guide this study:

1. Individuals will be more likely to cycle to work if they have a more positive decisional balance score, which involves having higher perceptions of benefits and lower perceptions of barriers associated with cycle commuting.
2. Individuals will be more likely to cycle to work if they have higher levels of self-efficacy associated with cycle commuting.
3. Men will have more positive attitudes towards cycling to work and will be more likely to cycle commute than women.
4. Individuals in higher earning occupations will have more positive attitudes towards cycling to work and will be more likely to cycle to work than those in lower earning occupations.

6.2 Methods

6.2.1 Design and Procedures

A cross-sectional design was employed for this study and data was gathered using a self-report, on-line questionnaire (the Bristol On-line Survey). The study was carried out in a large-sized public sector organisation during February across four of its cycle-friendly worksites based in Scottish cities (Edinburgh and Glasgow). All of these worksite

buildings provided the necessary facilities to support commuter cycling such as secure cycle storage, showers and changing facilities. The questionnaire was piloted amongst a small number of PhD students and stakeholders (n = 12), which led to some minor edits prior to use. The online questionnaire was distributed via an internal electronic newsletter (see appendix D). All staff members that had access to a computer across the four sites were invited to take part in the 'How Do You Commute Questionnaire'. Prior to the questionnaire being published online, permission to distribute the questionnaire was gained by the host organisation's union and ethical approval was granted by the Moray House School of Education Ethics Committee.

6.2.2 Participants

The questionnaire was made available to approximately 3000 employees. Overall 340 people responded to the questionnaire and after data cleaning, 337 participants (11%) were included in the study. The response rate may appear small but the survey only featured on the worksites intranet for two days, therefore, it is questionable as to how many people were actually exposed to the questionnaire. Taking this into account, the response rate could potentially have been substantially more than indicated. All 337 participants were included in the descriptive analysis phase. However, it was decided that those living more than 10 miles away would be removed from further analysis on the grounds that TTM is based on the assumption that the behaviour is achievable for all (Prochaska 1994). This decision was supported by previous cycle commuting studies, for instance Gatersleben & Appleton (2007) removed participants from their analysis who lived over five miles away from the workplace.

6.2.3 Questionnaire

A questionnaire for this study was based on a previously published measure (Crawford et al., 2001; Mutrie, et al., 2002) (see appendix C). Each participant completed one questionnaire that comprised three sections: demographic questions, current cycle commuting behaviour questions and attitudinal (benefits and barriers) and self-efficacy

questions. The demographic questions asked about age, gender, occupation, distance from work, and mode of transport to work (see Table 6.1).

Cycle commuting behaviour was assessed by the stages of change scale, which asked participants to tick one of the statements provided that they felt best represented their current attitudes/behaviour towards cycle commuting (see Figure 5.1). As in the previous study, an additional statement was added for seasonal cyclists that stated 'I am a seasonal cyclist'. Feedback from a small number of participants from Study 2 (Chapter 5) led to the inclusion of a sub-stage between precontemplator and contemplator, which stated 'I do not cycle part or my entire journey to work but I am interested in the idea of cycle commuting'. This decision was supported by previous studies that have suggested the presence of sub-groups within the stages of chance component (Gorely & Bruce, 2000; McKenna & Francis, 2003). This newly included sub-stage was termed 'precontemplation with interest' and the original precontemplation stage was renamed 'precontemplation without interest'. The newly included precontemplation with interest grouping differs from the contemplation group in the levels of intention they exhibit. The contemplation group have an intention to start cycling with the next six months whereas the precontemplation with interest only state an interest with no definitive time-frame for when they plan to start cycling themselves.

The attitudinal questions comprised 12 sub-questions relating to factors that were deemed as beneficial and encouraging towards cycle commuting, and 15 sub-questions about factors that were deemed as potential barriers and that could discourage cycling (listed in appendix C). Five questions relating to self-efficacy associated with cycling to work were also asked (listed in appendix C). In line with the previously established measure (Crawford et al., 2001; Mutrie et al., 2002) that these questions were adapted from, the attitudinal questions were assessed using a five-point Likert scale (1 = 'not discouraging/ encouraged', 2 = 'slightly discouraging/encouraged', 3 = 'moderately discouraging/ encouraged', 4 = 'very discouraging/encouraged', 5 = 'stops me from cycling/extremely encouraged'). The self-efficacy questions were assessed using a four

point likert scale (1 = ‘not at all confident’, 2 = ‘fairly confident’, 3 = ‘confident’, 4 = ‘very confident’).

6.2.4 Data Reduction and Analysis

Cronbach’s alpha and correlation tests were carried on the sub-sets of questions for each of the three variables. At this stage, one sub-question from the benefits sub-set (“availability of workplace facilities”) and two from the barriers sub-set (“physical effort involved” and “necessity of taking children to from school/nursery”) were removed on the grounds of low correlation scores (<.3) (Field, 2009). The remaining sub-questions Cronbach’s alpha coefficient scores indicated high internal consistency between each sub-set of questions (see Table 6.1). As the Cronbach’s values were high for each sub-set, composite scores for each variable were created by adding up each sub-question score in a set and dividing the total score by the number of sub-questions included.

Table 6.1: Summary of cognitive variable correlation scores and Cronbach's alpha scores of sub-sets

Scale composition	Response category	Cronbach's α	Total item correlation
Potential benefits		.87	
Cost saving over other transport methods	Five point likert		.404
Shortened journey time to workplace	Five point likert		.516
Minimal contribution to pollution	Five point likert		.539
No necessity for car parking	Five point likert		.527
Improvements to physical health/fitness	Five point likert		.623
Improvements to psychological wellbeing/mood	Five point likert		.668
Getting some fresh air	Five point likert		.638
A sense of freedom and flexibility	Five point likert		.722
A sense of enjoyment	Five point likert		.732
The social side of cycling	Five point likert		.570
Availability of workplace facilities	Five point likert		.395
Potential barriers		.87	
Nature of natural terrain (e.g. hilliness)	Five point likert		.642
Nature of manmade terrain (poor cycle infrastructure)	Five point likert		.586
Danger from motor traffic	Five point likert		.551
Bad weather including darkness	Five point likert		.643
Distance to workplace	Five point likert		.549
Lack of time	Five point likert		.494
Breathing in exhaust fumes	Five point likert		.575
Lack of waterproof clothing	Five point likert		.482
Expense of buying a bicycle	Five point likert		.528
Lack of storage space for your bike at home	Five point likert		.530
Disabilities/injuries or health problems	Five point likert		.346
Having to wear less formal clothes	Five point likert		.488
Carrying your belongings to/from work	Five point likert		.567
Self-efficacy		.91	
You are tired	Four point likert		.843
You are in a bad mood	Four point likert		.817
You are pressed for time	Four point likert		.801
The weather is bad	Four point likert		.836
Your routine changes	Four point likert		.748

6.2.5 Statistical Analyses

Statistical analyses were carried out using the software package SPSS statistics 17. As with the previous study, seasonal cyclists were removed after the descriptive analysis as they did not fit into the stages of change concept. In accordance with the stages of change, the benefits score should be subtracted from the barriers score to provide a decisional balance score. This decisional balance score was included in the t-test and ANOVA analyses but was omitted from the later regression analysis due to its high correlation (>.8) with the perceived benefits and barriers variables, indicating multicollinearity (Field, 2009). Independent t-tests were carried out to test for differences between genders in relation to the dependent variables of benefits, barriers and self-efficacy and decisional balance. One way ANOVA's were employed to look for differences between stages of change and occupation in relation to benefits, barriers and self-efficacy and decisional balance. Two-way ANOVA's were carried out to identify any interactions that might exist between the independent variables of stages of change, gender and occupation in relation to benefits, barriers and self-efficacy and decisional balance.

Finally, a binary logistical regression analysis was used to test the predictive questions relating to cycle commuting behaviour. As the stage of change measure is arguably not a continuous scale, the participants were re-categorised into non-cyclists (precontemplators and contemplators) and cyclists (actors and maintainers). At this stage, preparers were removed as they were only a small group and did not fit well into either of the new categories. With the new binary category created for cycle commuting behaviour logistical regression was employed. For the regression analyses barriers, benefits, self-efficacy, gender, and occupation were all used as predictor variables.

6.3 Results

6.3.1 Demographics

Table 6.2 displays results for the variables gender, occupation and distance variables in relation to stages of change. The stages of change distribution was made up of 32% precontemplators without intention, 20% precontemplators with interest, 7% contemplators, 5% preparers, 1.5% actors, 27% maintainers and 7% seasonal cyclists. There was a noticeable gender imbalance with 63% of the participants being male and 37% female. A chi square revealed a significant association between stages of change and gender (Chi-square = 14.2, df = 6, p = 0.014), which stems from there being more females in the earlier stages of change than males and there being more males in the later stages of change than females. Most participants were aged between 21 and 50 years old (79%) and there were relatively even numbers of males and females in each age category. The majority of participants were line managers (60%) and gender was spread evenly across occupational roles. In terms of distance 66% of the sample lived 10 miles or less away from their workplace.

Table 6.2: Demographic variables displayed by stages of cycle commuting behaviour (n = 337)

Demographic variables	PC1 % (n)	PC2 % (n)	C % (n)	P % (n)	A % (n)	M % (n)	S % (n)	Total % (n)
Behaviour								
Stage	31.5% (106)	19.9% (67)	7.4% (25)	5.0% (17)	1.5% (5)	27.3% (92)	7.4% (25)	100% (337)
Gender								
Male	15.1%(51)	11.6% (39)	5.3% (18)	4.2% (14)	1.2% (4)	20.2% (68)	5.6% (19)	63.2% (213)
Female	16.3% (55)	8.3% (28)	2.1% (7)	0.9% (3)	0.3% (1)	7.1% (24)	6% (1.8)	36.8% (124)
Age								
16-20years	0.3 (1)	0% (0)	0% (0)	0% (0)	0% (0)	0% ()	0% (0)	0.3% (1)
21-30 years	4.2% (14)	4.7% (16)	0.9% (3)	0.9% (3)	1.0% (1)	3.6% (12)	0.3% (1)	14.8% (50)
31-40 years	8.3% (28)	5.0% (17)	2.7% (9)	2.1% (7)	1.2% (4)	11.0% (37)	3.0% (10)	33.2% (112)
41-50 years	9.5% (32)	5.0% (17)	10.0% (10)	0.9% (3)	0.0% (0)	8.3% (28)	3.9% (13)	30.6% (103)
51-60 years	8.6% (29)	4.7% (16)	0.9% (3)	0.9% (3)	0.0% (0)	4.5% (15)	0.3% (1)	19.9% (67)
61-70 years	0.6 %(2)	0.3% (1)	0.0% (0)	0.3% (1)	0.0% (0)	0.0% (0)	0.0% (0)	1.2% (4)
Occupation								
Band A	7.1% (24)	3.3% (11)	1.5% (5)	0.6% (2)	0.6% (2)	3.0% (10)	1.8% (6)	17.8% (60)
Band B	18.1% (61)	13.6% (11)	5.0% (17)	3.6% (12)	0.6% (2)	15.1% (51)	3.9% (13)	59.9% (202)
Band C	4.7% (16)	2.7% (9)	0.9% (3)	0.6% (2)	0.0% (0)	6.8% (23)	1.2% (4)	16.9% (57)
SCS	1.2% (4)	0.0% (0)	0.0% (0)	0.3% (1)	0.0% (0)	1.2% (4)	0.6% (2)	3.3% (11)
Other	0.3% (1)	0.3% (1)	0.0% (0)	0.0% (0)	0.3% (0)	1.2% (4)	0.0% (0)	2.1% (14)
Distance (one way)								
0-1 mile	1.2% (4)	0.9% (3)	0.6% (2)	0.3% (1)	0.0% (0)	0.6% (2)	0.6% (2)	14% (4.2)
1-2 miles	3.6% (12)	2.1% (7)	0.9% (3)	0.3% (1)	0.0% (0)	4.2% (14)	0.9% (3)	11.9% (40)
2-5 miles	5.0% (17)	8.0% (27)	3.0% (10)	1.2% (4)	0.6% (2)	13.4% (45)	3.0% (10)	34.1% (115)
5-10 miles	5.6% (19)	2.1% (7)	0.6% (2)	0.3% (1)	0.6% (2)	4.5% (15)	1.8% (6)	15.4% (52)
10-20 miles	7.7% (26)	3.3% (11)	1.2 (4)	0.9% (3)	0.0% (0)	2.1% (7)	1.2% (4)	16.3% (55)
20 miles +	8.3% (28)	3.6% (12)	1.2% (4)	2.1% (7)	0.3% (1)	2.7% (9)	0.0% (0)	18.1% (61)

Note. PC1 = precontemplators without intention, PC2 = precontemplators with interest, C = contemplators, P = preparers, A = actors, M = maintainers, S = seasonal, Band A = administrative staff, Band B = line managers, Band C = head of division, SCS = senior civil servant.

6.3.2 Differences Between Groups

Stages of Change

The four composite score variables of perceived benefits and barriers, self-efficacy and decisional balance associated with cycle commuting all varied significantly ($p < 0.001$) as a function of stages of change (see table 6.3). The most significant difference in

scores was in relation to perceived barriers (F (5, 54) = 36.1, p <0.001, $\eta p^2 = 0.5$). The precontemplator group (with no intention) held the most negative perceptions of barriers to cycle commuting and the maintainer group held the most positive. The perceived benefits variable (F (5, 49) = 13.0, p <0.001, $\eta p^{2\,=}$ 0.2) differed significantly across the stages of change, but to a lesser degree than the other dependent variables tested.

Table 6.3: Differences in perceived benefits and barriers, self-efficacy and decisional balance between the stages of change

Social cognitions	PC1 mean (SD)	PC2 mean (SD)	C mean (SD)	P mean (SD)	A mean (SD)	M mean (SD)	df	F	p	Post hoc	ηp^2
Benefits	2.86 (0.97)	3.26 (0.78)	3.69 (0.67)	3.81 (0.58)	3.89 (0.73)	3.84 (0.62)	5,49	12.961[a]**	<0.001	PC1 vs C PC1 vs P PC1 vs M PC2 vs M	0.25
Barriers	3.15 (0.87)	2.54 (0.67)	2.57 (0.58)	2.20 (0.72)	2.06 (0.58)	1.83 (0.51)	5, 54	36.093[a]**	<0.001	PC1 vs PC2 PC1 vs C PC1 vs P PC1 vs A PC1 vs M PC2 vs M C vs M	0.46
Self-efficacy	1.90 (1.00)	2.38 (0.95)	2.91 (0.84)	3.29 (0.68)	3.50 (0.61)	3.42 (0.70)	5, 74	29.680[a]**	<0.001	PC1 vs C PC1 vs P PC1 vs A PC1 vs M PC2 vs M	0.41
Decisional balance	-0.49 (1.61)	0.60 (1.11)	1.12 (0.99)	2.00 (0.89)	1.75 (1.26)	2.04 (0.75)	5, 39	32.461 [a]**	<0.001	PC1 vs PC2 PC1 vs C PC1 vs P PC1 vs A PC1 vs M PC2 vs M C vs M	0.46

Note. PC1 = precontemplators without intention, PC2 = precontemplators with interest, C = contemplators, P = preparers, A = actors, M = maintainers, df = degrees of freedom, F = ANOVA score, p = significance level, ηp^2 = partial eta squared (effect size),* ≤ 0.05, ** ≤ 0.01, [a] = Levene's test for homogeneity of variance has been violated (p = ≤ 0.05) so the Brown-Forsythe test (adjusted F and residual degrees of freedom) has been used instead, Post hoc = Tukey or Bonferroni test with a significance value set at $p \leq 0.05$.

Gender

Table 6.4 shows that significant differences were found for perceived barriers and self-efficacy associated with cycle commuting as a function of gender. The biggest differences between the men and women was found for self-efficacy (t = 5.02, df = 156, p < 0.001, d = 0.80). Women held more negative views than men including: higher perception of barriers; lower self-efficacy; and differences in decisional balance. Perceived benefits did not differ significantly as a function of gender.

Table 6.4: Differences in perceived benefits and barriers, self-efficacy and decisional balance between genders

Social cognitions	Men mean (SD)	Women mean (SD)	df	t	*p*	d
Benefits	3.52 (0.85)	3.45 (0.91)	143	0.71	0.550	0.12
Barriers	2.24 (0.82)	2.83 (0.96)	149	4.06[a]**	<0.001	0.67
Self-efficacy	3.04 (0.929)	2.33 (107)	156	5.02[a]**	<0.001	0.80
Decisional balance	1.23 (1.18)	0.55 (1.81)	126	3.01[a]**	0.003	0.54

Note. df = degrees of freedom, t = t-test score, *p* = significance level, d = Cohen's d (effect size), [a] = Levene's test for homogeneity of variance has been violated ($p = \leq 0.05$) * ≤ 0.05, ** ≤ 0.01

Occupation

Table 6.5 shows that perceived barriers, self-efficacy and decisional balance associated with cycle commuting differed significantly as a function of occupation. Lower earning occupations reported more negative perceptions of barriers and decisional balance variables and lower self-efficacy that those in jobs that earn higher salaries. The most significant difference was in self-efficacy (F (4, 36) = 4.3, $p = 0.006$, $\eta p^2 = 0.07$). The differences for both self-efficacy and perceived barriers were identified between the lower salary jobs and higher salary jobs. Both perceived benefits and decisional balance variables did not differ in relation to occupations once again.

Table 6.5: Differences in perceived benefits, barriers, self-efficacy and decisional balance between occupations

Cognitions	Band A mean (SD)	Band B mean (SD)	Band C mean (SD)	SCS mean (SD)	Other mean (SD)	df	F	*p*	Post hoc	ηp^2
Benefits	3.47 (0.82)	3.38 (0.87)	3.56 (0.84)	3.74 (0.80)	3.70 (0.16)	4, 207	1.121	0.348		0.02
Barriers	2.76 (1.02)	2.44 (0.85)	2.08 (0.60)	2.29 (0.86)	2.21 (0.49)	4, 40	3.793[a]**	0.010	A vs C	0.06
Self-efficacy	2.42 (1.02)	2.70 (1.09)	3.25 (0.77)	2.79 (0.98)	3.13 (0.81)	4, 36	4.284[a]**	0.006	A vs C B vs C	0.07
Decisional balance	0.47 (1.89)	0.89 (1.41)	1.15 (1.22)	1.67 (1.51)	1.67 (052)	4, 210	2.952*	0.021	A vs C	0.05

Note. Band A = administrative staff, Band B = line managers, Band C = head of division, SCS = senior civil servant, df = degrees of freedom, F = ANOVA score, *p* = significance level, ηp^2 = partial eta squared (effect size), * ≤ 0.05, ** ≤ 0.01, [2] = Levene's test for homogeneity of variance has been violated ($p = \leq 0.05$) so the Brown-Forsythe test (adjusted F and residual degrees of freedom) has been used instead, Post hoc = Tukey or Bonferroni test with a significance value set at $p \leq 0.05$.

6.3.3 Interactions

Two way ANOVAs were carried out between all of the independent variables (stage, gender and occupation) in relation to the four dependent variables (benefits, barriers, decisional balance and self-efficacy) to see if there were any interactions. No significant interactions were found between stage and gender, stage and occupation and gender and occupation in relation to benefits, barriers, decisional balance and self-efficacy.

6.3.4 Predictions

The regression model was statistically significant X^2 (5, n = 215) = 137.39, p < 0.001, and as a whole explained between 51% (Cox & Snell R squared) and 69% (Nagelkerke R squared) of variance of cycle commuting behaviour. As shown in Table 6.6, regression analyses revealed that participants who perceived lower barriers to cycle commuting were more likely to cycle to work than those who perceived more barriers (OR = 15.89, CI 95%, 5.18-50.00, *p* <0.001). People who reported higher levels of self-efficacy associated with cycle commuting were more likely to cycle to work than those who reported lower levels of self-efficacy (OR = 3.48 , CI 95%, 1.90-6.37, *p* <0.001). Participants who perceived more benefits associated with cycling to work were more likely to cycle commute than those who perceived fewer benefits (OR = 2.64, CI 95%, 1.27-5.50, *p* 0.010). Gender and occupation did not predict cycle commuting behaviour. Overall, the analysis indicated that perceived barriers had the most predictive power regarding the decision to cycle to work or not.

Table 6.6: Perceived benefits and barriers, self-efficacy, gender and occupation used to predict cycle commuting behaviour

Social cognition	B(SE)	Wald	*p*	OR	CI 95%
Benefits	0.97 (0.38)	6.691	0.010**	2.64	1.27-5.50
Barriers	-2.77 (0.58)	23.222	0.001**	15.87	5.18-50.00
Self-efficacy	1.25 (0.31)	16.381	<0.001**	3.48	1.90-6.37
Gender	-0.25 (0.53)	0.224	0.673	0.78	0.28-2.20
Occupation	0.08 (0.37)	0.050	0.824	1.08	0.53-2.22

Note. B = beta value, SE = standard error, *p* = significance level, * ≤ 0.05, ** ≤ 0.01, OR = odds ration, CI = confidence interval

6.4 Discussion

The present study investigated the psychological variables of perceived benefits and barriers, self-efficacy and decisional balance in relation to stages of chance, gender and occupation to examine if these variables could explain cycle commuting behaviour. This study also aimed to test the applicability of the TTM theory to cycle commuting behaviour.

6.4.1 Differences and Where They Lie

In line with the TTM, this study found that those in the latter stages of change associated with cycle commuting have lower perceptions of barriers, higher perceptions of benefits, higher self-efficacy and a more positive decisional balance score than those in the earlier stages of change. Therefore, in the context of cycle commuting, the present findings support the first two research predictions (see Section 6.1.1) and the TTM, which hypothesises that decisional balance and self-efficacy positively increase in relation to the stages of change component. Studies investigating exercise behaviour and active travel, along with the previous qualitative study documented in this thesis, have found similar results that support the TTM (Gorley & Gordon, 1995; Marcus & Owen, 1992; Shannon et al., 2006). Out of the psychological factors tested, the variable of perceived barriers was found to be the most important predictor of cycle commuting behaviour followed by self-efficacy.

Intervention recommendations based on the TTM suggest that intervention work looking to progress individuals from contemplation to action stage should first focus on increasing perceptions of benefits followed by decreasing perceptions of barriers. The present study indicates that whilst the role of benefits is important, paying more attention to decreasing perceptions of barriers may help to enhance the effectiveness of interventions aimed to promote cycle commuting behaviour. Shannon et al. (2006) similarly found that reducing specific barriers towards active travel is likely to be more effective than promoting the benefits. Furthermore, the present research also suggests that increasing individuals' self-efficacy towards cycle commuting is important to help

move people towards action. Self-efficacy related to cycle commuting can be linked to soft skills such as psychological training to develop coping strategies as well as hard skills such as developing physical cycling skills.

The decisional balance score, which takes into account an individual's positive and negative attitudes towards cycle commuting overall, revealed that in the precontemplation phase participants were in a state of ambivalence. As the present study split the precontemplation phase into those with and those without intention to cycle commute it is possible to identify more specifically that those who were in the precontemplation stage and had an interest to cycle commute experienced ambivalence. Prochaska et al., (1994) carried out research regarding the decisional balance across 12 different problem health behaviours. The authors found that for seven out of 12 behaviours ambivalence occurred in the contemplation phase, for four behaviours it occurred in the action phase, and for one behaviour ambivalence occurred in the preparation phase. In light of these findings the present study's results relating to cycle commuting behaviour would seem to be a little out of place as ambivalence occurred at an earlier stage than any of the 12 tested behaviours. One explanation for this is that having an overall positive attitude may not be enough to facilitate a shift in cycle commuting behaviour due to the important role that perceptions of barriers play. Those who were either infrequently or frequently cycling to work reported an average decisional balance score of plus two (see Table 6.3) suggesting that benefits need to be realised and barriers need to be substantially reduced before people change to commuting by bicycle.

Looking at the post hoc tests, it is clear that precontemplators with no intention to cycle commute hold more negative cognitions about cycling than the precontemplator group with an interest in cycle commuting. This implies that precontemplators with an interest in cycling to work are closer to action than those individuals with no intention to cycle commute. Previous studies into exercise and smoking behaviour that examined the stages of change using cluster analysis found sub-stages to exist (Gorely & Bruce, 2000;

Richard Reeds, 1999; Velicer et al., 1995). Similarly to the spilt within the precontemplation group made within present study, Richards Reed (1999) also identified two types of precontemplators, which were labelled non-believers and believers. As opposed to the existence of sub-groups weakening the stages of change construct, Velicer et al., (1995) and Gorley & Bruce (2000) see the existence of sub-groups adding strength to there being a true temporal order within the stages of change. The differences that have been revealed in the present study between the two sub-groups of precontemplators are important as this finding indicates that a substantial number of people categorised as precontemplators towards cycle commuting may be more receptive to taking part in interventions than initially thought.

Research documented in Study 2 (Chapter 5) identified some significant differences in perceptions of barriers associated with cycle commuting between both differing genders and occupations. In the current study, differences between gender and occupations were also found in relation to perceived barriers and self-efficacy. These findings in part support the latter two research predictions (see Section 6.1.1), that males and higher earners have more positive attitudes to cycle commuting. In line with the results from Study 2 (Chapter 5), females and those in jobs that earn a lower salary were more likely to perceive barriers associated with cycle commuting more negatively than males and those in higher paid jobs. This trend is also true for self-efficacy, with women and lower earners reporting lower self-efficacy that men and higher earners. The lack of significance found for perceptions of benefits for both gender and occupation is also very revealing. This suggests that gender and occupations do not influence people's understanding of the benefits cycle commuting brings. These results add strength to the important role that both barriers and self-efficacy play in the decision to cycle commute, which have been previously found in Studies 1 and 2 (Chapters 4 and 5).

6.4.2 Predictors of Cycle Commuting Behaviour

In this study, people reporting higher perceived benefits, lower perceived barriers and stronger levels of self-efficacy were more likely to cycle to work. These findings add strong support the first two research predictions (see Section 6.1.1). Although gender and occupation revealed differences in perceptions for self-efficacy and barriers as in Study 2, these two individual-level factors *per se*, did not predict cycle commuting behaviour. This finding implies that whilst gender and occupation may influence self-efficacy and barriers, they are not strong independent predictors of cycle commuting. Therefore, disproving in part the latter two research questions (see Section 6.1.1), with regards to men and higher earners being more likely to cycle commuting than women and lower earners.

Whilst perceived benefits, perceived barriers and task self-efficacy all significantly predicted cycling, perceived barriers were by far the most predictive variable. Studies 1 and 2 (Chapters 4 and 5) within this thesis as well as other studies carried out into physical activity and active travel have discussed the importance of barrier reduction in changing behaviour (Mutrie et al., 2002; Sallis & Owen, 1999; Shannon et al., 2006; Trost et al., 2002). The present findings indicate that perhaps more uniquely to cycle commuting behaviour, reducing the perceptions barriers should be a key aim of intervention work designed to enhance cycle commuting. The present study did not focus on identifying if the barriers associated with cycling were linked to objective or subjective factors. However, as noted by Lane & Potter (2007) social cognitions are understood to mediate perceptions of objective factors, thus subjective factors are likely to influencing perception formation. As found in Chapters 4 and 5, it is most plausible that both subjective and objective factors are intertwined in people's perceptions of barriers.

6.4.3 Limitations

There are a number of limitations to this study that require consideration. The data collected was self-reported and there was no objective measure used to verify this

information. The response rate (11%) indicates that this data may not be a true cross-sectional representation of the employees based within the four worksites used. As the data was collected online using a similar procedure to Study 2, those who are working in manual jobs and non-computer based jobs are likely to be underrepresented. The research was conducted in cycle-friendly worksites so the findings from this study may not be generalisable to workplaces that do not provide a good standard of cycle provision. The majority of this sample were male (63%), which also limits the generalisations that can be made. Therefore, the results from this study should interpreted with some caution.

6.5 Chapter Summary and Conclusions

This chapter has reported the results of a cross-sectional questionnaire-based study that was undertaken to test a set of cognitions (perceived benefits and barriers, self-efficacy and decisional balance) related to cycle commuting that feature in the TTM. The interest of this investigation was to find out if the cognitions under study would act in accordance to the principles of the TTM, and in turn discover if the TTM was a suitable theory to adopt for intervention work aimed to encourage cycle commuting. The research was carried out across four cycle-friendly worksites within Scotland that were all part of the same organisation and overall 337 participants took part in the study. Initially, the variables of perceived barriers and benefits, self-efficacy and decisional balance were examined in relation to stages of change, gender and occupation to identify if any differences in cognitions existed. Secondly, perceived barriers and benefits, self-efficacy, gender and occupation were used as predictor variables to identify if any of these could significantly predict cycle commuting behaviour.

The results indicated, in line with the TTM, that from the earlier to latter stages of change perceived cycle commuting barriers incrementally decrease and perceived cycle commuting benefits, self-efficacy and decisional balance scores incrementally increase. In relation to gender and occupation, females and those in lower income jobs perceive

significantly higher barriers and report lower self-efficacy than males and those in higher income jobs. Perceived benefits were not found to significantly differ between gender and occupation. The regression analysis revealed that people who have lower perceptions of barriers, higher perception of benefits and higher self-efficacy associated with cycle commuting are significantly more likely to cycle to work. Gender and occupation were not found to predict cycle commuting behaviour.

Throughout the analyses performed for this study, perceived barriers were consistently reported as the most powerful cognitive variable and perceived benefits, whilst often showing significance, was found to be the least powerful. This has important implications for psychological intervention work suggesting that reducing the perceptions of barriers should play a central role in promoting cycle commuting.

6.6 Thesis Implications

The findings from the present study add further support to the significant role that perceived benefits, barriers and self-efficacy play in the decision to cycle to work. This study has also shown that the Transtheoretical Model of Behaviour Change is an appropriate behaviour change theory to apply to cycle commuting behaviour. All three studies carried out so far (Chapter 4, 5 and 6) have supported the idea that social cognitions are influential in the decision to cycle to work. Therefore, the next stage of this thesis was to develop and trial a psychologically-orientated intervention aimed to encourage people to cycle commute within a supportive workplace setting. In the subsequent three chapters, a review of intervention literature (Chapter 7), the development of the intervention (Chapter 8) and the intervention evaluation (Chapter 9) will be presented.

Chapter 7

A Review of Interventions Designed to Increase Cycle Commuting

Aims of the Chapter

This chapter outlines relevant guidance documents and literature that will help to inform the development of a psychologically-orientated intervention aimed at encouraging cycle commuting within a workplace setting. Initially intervention guidance frameworks that provide best practice recommendations for planning, developing and evaluating health and physical activity promotion interventions are presented. Thereafter, relevant evidence from intervention studies and systematic reviews are discussed to further inform the design and development of the psychologically-orientated intervention study presented in chapters eight and nine of this thesis.

7.1 Introduction

The focus of the thesis so far has been to develop an understanding of cycle commuting behaviour. The initial chapter provided the rationale for promoting cycle commuting in workplaces and highlighted the political context in which the discourse of cycling for transport is situated. The following theoretical (Chapter 7), psychological literature review (Chapter 3) and empirical chapters (Chapters 4, 5 and 6) have presented relevant theory and empirical findings regarding social cognitions towards cycling and cycle commuting. Study 3 has revealed that the social cognitions of perceived benefits and barriers, and self-efficacy, encompassed in the Transtheoretical Model of Behaviour Change (TTM) play a significant role in explaining and predicting cycle commuting behaviour, with perceived barriers showing to be the most powerful influence on behaviour. Developing an understanding of the psychological factors that affect cycle commuting is valuable because this knowledge can then be used to promote cycling more effectively. Using the theoretical knowledge and evidence available, the next step

for this thesis is to encourage cycle commuting by planning, developing, trialling and evaluating a psychologically-orientated intervention aimed at encouraging cycle commuting in a workplace setting.

The present chapter discusses the relevant evidence on health promotion and cycling interventions. Initially key health promotion intervention guidance papers are discussed to establish best practice principles and lessons learned regarding intervention work. Thereafter, empirical data from cycling intervention studies and relevant systematic reviews are presented to provide a detailed review of the intervention evidence and recommendations.

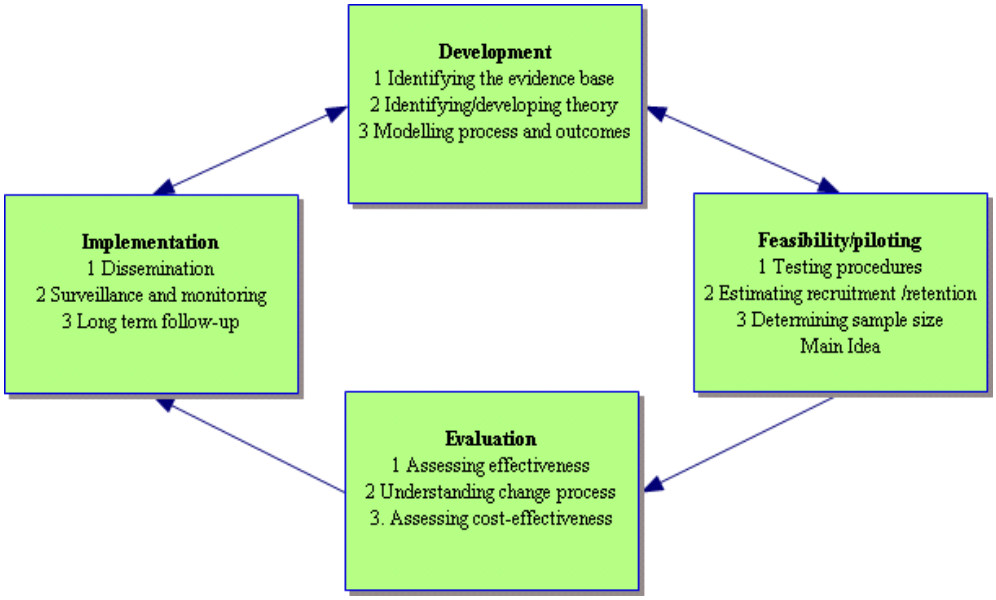
7.2 Health Behaviour Intervention Guidelines

In this section, three complementary sets of guidelines for developing and evaluating interventions are presented. The first set of guidelines discussed has been issued by the Medical Research Council (MRC) (Medical Research Council, 2000) to assist the development and evaluation process of complex health interventions. The second set of guidelines presented has been developed by the Scottish Physical Activity Research Collaboration (SPARColl) (Blamey, Gordon, Fitzsimons & Mutrie, 2008) and provides more pragmatic recommendations for physical activity initiatives. The third guidance paper to be discussed is the RE-AIM model (Glasgow, Vogt & Boles, 1999), which has been developed to enhance the practical application of health interventions within 'real world' settings. It should however be noted that a small-scale intervention, such as the one presented within this thesis has less scope to adhere to all of the guidance criteria outlined within these three guidance documents due to limited financial resources, human resources, and time. Therefore, whilst these guideline documents provide valuable advice and insight into intervention work, the procedures and protocols outlined have been used (where possible) in the upcoming intervention study in a steering as opposed to a strictly prescriptive sense.

7.2.1 MRC Guidance (Medical Research Council, 2000)

The MRC guidelines for complex interventions have been widely adopted in health promotion research (Medical Research Council, 2000). Whilst the psychologically-orientated cycle commuting intervention to feature in this thesis will primarily focus on encouraging cycling, the underlying concern is with health and exercise promotion. Therefore, the MRC guidance has informed the development and evaluation of the intervention work in this thesis. These guidelines identify four key stages involved in the development and evaluation of health interventions: development, feasibility/piloting, evaluation and implementation (see Figure 7.1).

Figure 7.1: MRC guidance on the key elements of the intervention development and evaluation process (taken from Medical Research Council, 2000)



Initially, the 'development' stage encompasses identifying the evidence base, identifying/developing appropriate theory and modelling processes and outcomes. Secondly, the 'feasibility' stage involves examining and testing the proposed intervention to understand the feasibility of implementation, delivery, compliance recruitment and retention. Thirdly, the evaluation stage includes assessing effectiveness,

understanding change processes and assessing cost-effectiveness. Assessing effectiveness is concerned with the nature of the evaluation method use. The MRC recommends considering randomisation experimental designs as they are considered the most robust method of preventing biases relating to participant selection. It is however acknowledged that such a design is not suitable in all circumstances. A second aspect of effectiveness is the choice of outcome measures. Careful development work is recommended to identify suitable outcome measures. Economic evaluations are also considered useful to find out if the costs of the study are outweighed by the potential benefits. The fourth and final stage outlined in the development and evaluation of interventions is the implementation phase which encompasses dissemination, surveillance and successful monitoring. Dissemination is concerned with getting research translated into policy and practice.

7.2.2 SPARColl Guidance (Blamey et al., 2008)

The Guidance framework is based on the review of six key physical activity programmes funded by the Scottish Government. The document provides recommendations on programme planning, monitoring and evaluation. Whilst SPARColl's recommendations for planning and monitoring evaluations have some overlap with the MRC intervention guidelines, SPARColl provides significant complementary information. There are seven key recommendations for planning interventions:

1. Developing and identifying short, intermediate and long term outcomes as opposed to focussing on process and delivery outputs
2. Identifying anticipated levels of change feasible within the timescales
3. Creating realistic aims and objectives that relate to funding recourses and timescales
4. Providing clearer details on population health and demographic status
5. Providing information about adaptations made to the individuals involved and the context

6. Being aware of the tensions between target group size and intensity and duration of the intervention
7. Providing more information on the strength of the claims made from the existing evidence base

The document also lists five linked recommendations for monitoring intervention evaluations:

1 Collecting baseline information
2 Reporting short, intermediate and long term outcomes as opposed to focussing on process and delivery outputs
3 Stronger focus on the applicability and validity of answering key questions
4 Understanding the limitations of self-report data
5 Providing more information on the contextual factors that may have influenced the outcomes

Whilst the guidance above is aimed to strengthen intervention planning and monitoring, SPARColl also highlight the need to be realistic and to balance what is feasible to achieve within the limitations and challenges faced in delivering a program. The use of tools such as logic models and results chains, which outline the key processes of an intervention to understand how to produce intended outcomes, have been recommended to support the increased focus on 'outcome focussed planning'.

7.2.3 RE-AIM Guidance (Glasgow et al., 1999)

The RE-AIM model was proposed for evaluating the impact of public health interventions (Glasgow et al., 1999) and both the MCR and SPARColl guidelines advocate using this model. RE-AIM represents five evaluative dimensions: reach efficacy, adoption, implementation and maintenance. The model was developed to help enhance the external validity of interventions.

As outlined in the MRC guidance outlined above, randomised experimental trials are viewed as the most robust method for evaluating interventions. In the field of medicine and health research, randomised control trials have been labelled the gold standard of experimental design within a hierarchy of evidence framework (Grossman & Mackenzie, 2005; Petticrew & Roberts, 2003) as they provide high levels of internal validity. The prominence of randomised control trials stems from concerns regarding type 1 errors, in which, for example, success can be undermined by inadequate control measures being taken (Green & Tones, 1999). However, favouring internal validity over external validity can result in non-representative participants and settings (Starfield, 1998).

More recently, a shift towards a holistic view in intervention research has lead to a more inclusive range of study designs (Dugdill, Brettle, Hulme, McCluskey, & Long, 2008) and a growing awareness of the tensions and trade-offs between establishing both internal and external validity (Estabrooks & Gyurcsik, 2003; Glasgow et al., 1999). According to Green and Glasgow (2006) "the evidence-based health practice literature seems to have lost focus on external validity. The irony of this seems lost on many of those who wonder why science has such difficulty achieving application and widespread adoption of evidence-based practice" (Green & Glasgow, 2006, p. 129). The RE-AIM model aims to raise awareness to the impact that an intervention will have in the real world setting. The five dimensions that should be considered when looking to strengthen external validity are described in Figure 7.2 along with the level that each dimension addresses. The RE-AIM dimensions are discussed further in the intervention development chapter (Chapter 8).

Figure 7.2: RE-AIM evaluation dimensions (taken from Glasgow et al., 1999)

Dimension	Description	Level
Reach	Proportion of the target population that participated in the intervention	Individual
Efficacy	Success rate intervention in terms of desired outcomes	Individual
Adoption	Proportion of organisations that will adopt this intervention	Organisation
Implementation	Extent to which the intervention is implemented as intended in the real world	Organisation
Maintenance	Extent to which a program is sustained over time	Individual & organisation

7.2.4 Summary of Generic Intervention Guidelines

The intervention guidelines discussed provide valuable insight and important guidance for carrying out intervention work within health and physical activity promotion. The MRC guidelines chronologically outline four key stages, and within each stage the processes that strengthen the internal and external validity and reliability of evaluating intervention. The more pragmatic SPARColl guidelines build on the MRC guidance, discussing the importance of clarity, transparency and critical thinking throughout the intervention process. The RE-AIM guidance provides five criteria that can be used to appraise and strengthen the external validity of interventions. Overall, the key recommendations for intervention work to come from the three guidelines are to:

- Critically evaluate the evidence base using a theoretical framework
- Develop clear outcomes
- Use valid measures and where possible an experimental design
- Be realistic about the trade offs and limitations of a proposed intervention
- Consider the feasibility of the intervention within the real world
- Pilot the intervention
- Report on the findings and context transparently
- Consider opportunities for impact within policy and practice

7.3 Psychologically-Orientated Cycle Commuting Interventions

Developing a critical understanding of previous relevant intervention studies that have been carried out is crucial in order to recognise the strengths and weaknesses of tried and tested components and intervention techniques. Three psychologically-orientated intervention studies have been identified that aimed to increase employees' cycle commuting behaviour within a workplace setting (Gatersleben & Appleton, 2007; Mutrie et al., 2002; Wen et al., 2005). Gatersleben & Appleton (2007) focussed solely on encouraging cycle commuting. Mutrie et al.,(2002) more broadly focussed on increasing walking and cycling to work and Wen et al. (2005), included the promotion of walking, cycling and public transport for commuting purposes. Each study is discussed below.

7.3.1 Contemplating Cycling to Work: Attitudes and Perceptions in Different Stages of Change (Gatersleben & Appleton, 2007)

Gatersleben & Appleton (2007) carried out the only published psychologically-orientated intervention study that solely focused on increasing cycle commuting in a workplace. The study was based in a university setting in Surrey. The intervention was developed using theoretical rationale from the TTM, which involved providing feedback, social support and reinforcement to encourage new cycle commuters to continue cycling to work. The intervention comprised of willing participants, who had not cycle commuted beforehand, agreeing to cycle to work for a two week period. In order to incentivise people to take part participants were able to use, and later win, one of 10 bicycles. From an initial questionnaire administered to staff members and advisements targeting the student population, 22 individuals agreed to take part in the study.

The evaluation was qualitative in nature, comprising pre- and post-intervention interviews in which participants discussed their expectations and experiences of cycling, and a travel diary where participants recorded their experiences over the two-week trial period. In the initial interview participants were asked questions about what they

anticipated would be enjoyable, pleasant and unpleasant about taking up cycle commuting. These questions were repeated in the second post-intervention interview. In the diaries participants were asked to note what they found most and least pleasurable about cycling to work.

Qualitative results from pre- and post-intervention interviews found fitness improvements, having fun, being outdoors and flexibility were the main benefits recorded and inconveniences and traffic safety were discussed as negative aspects. The travel diary data was analysed using content analysis, in which three categories for pleasant experiences (the cycle activity itself, nice weather and flexibility of journey) and four for unpleasant experiences (bad weather, feeling tired, traffic related issues and bike related problems) emerged. After the two-week intervention, 13 out of the 22 participants said they had enjoyed cycle commuting and only one said he had not. Most participants found cycling to work easier and more relaxing than they had expected and overall, perceptions of danger decreased. Out of 22 respondents, eight said they would continue cycling regularly and ten indicated that they would continue cycling but not on a daily basis due to other commitments.

The study highlighted the difficulties of getting people to participate in intervention research of this nature. The authors suggested that a lack of safe cycle facilities may also impact on psychological interventions aimed to increase cycle commuting but any such impact would be difficult to substantiate without a control group. The study shows that supporting people to trial cycle commuting has a positive effect on cycle uptake. However, the small-scale qualitative pre- and post-test study design has a number of limitations (e.g. no control group, no valid measurement tool, and no longer-term follow up data). Therefore whilst the qualitative data can suggest tentative positive effects, no robust conclusions regarding the explanation or causality of behaviour can be drawn from this study.

7.3.2 "Walk in to Work Out": A Randomised Controlled Trial of a Self-Help Intervention to Promote Active Commuting (Mutrie et al., 2002)

Mutrie et al. (2002) carried out a Glasgow-based individual-level, self-help intervention designed to increase active travel behaviour in a workplace setting. The intervention was based on the TTM. The intervention comprised a pack called 'Walk in to Work Out,' which included an interactive written booklet; local information about distances; routes and safety information; an activity diary; wall charts; contacts for relevant organisations and cycle retailers; and reflective safety accessories. The intervention targeted employees who were considering cycle commuting, classified as being in the 'contemplation' or 'preparation' stage of change (see Chapter 5, Figure 5.1), and was carried out over a 12 month period.

The intervention was evaluated using a randomised-control trial and follow-up focus groups. The study was advertised by email, internal mail and via salary slips to the employees of three large public sector workplaces situated in the same area of the city. Initially, employees completed a screening questionnaire to identify their stage of change for active commuting. All identified contemplators and preparers (n = 333) were sent the baseline questionnaire. Participants (n = 295), of which 64% were female and 36% male, were randomly assigned to either the intervention or control group. The control group was given the intervention pack six months after the intervention group. Participants received follow-up questionnaires at six and 12 months that repeated the baseline outcome measures. In the final 12 month follow up the response rate was 56% (n=166 across case and control groups).

The evaluation questionnaire measured demographic and outcome variables. The main outcome variables were stage of change; processes of change; perceived motivations and barriers (adapted from Marcus, Eaton, Rossi & Harlow,1994); physical activity levels adapted from the seven day recall of physical activity measure, (Lowther, Mutrie, Loughlan, & McFarlane, 1999); and perceived physical and mental health functioning adapted from the Short Form 36 scale, (Ware & Sherbourne, 1992). Paired t-tests,

analysis of variance (ANOVA), analysis of covariance (ANCOVA) and stepwise logistic regression were used to analyse the data.

Results revealed that the intervention increased walking to work over a six month period. A significantly larger percent ($p < 0.05$) of the intervention group (49% compared with 31% of the control group) progressed to a higher stage of change for active commuting. The seven day recall of physical activity for those walking to work, revealed an average increase of 125 minutes per week for contemplators and 27 minute per week for preparers. In comparison to the control walking group the intervention walking group were almost twice as likely to report walking after six months (OR 1.93, 95% CI 1.06-3.52). However, the intervention was not successful at increasing cycle commuting. Only 18 participants in total (nine control and nine intervention participants) reported cycling to work at six months with no differences in weekly minutes reported between the groups.

Overall, sex, age and distance did not significantly affect the results. There were no differences in the utilisation of processes of change between control and intervention groups. The most frequently used processes of change for both groups were self-liberation; counter conditioning; and self re-evaluation. The least used were stimulus control and helping relationships. In terms of physical and mental health, the intervention group had significantly higher scores on three out of eight sub-scores of the SF-36: General Health, Vitality and Mental Health. Those who progressed in their stage of change for active commuting reported significantly higher perceived motivations than those who regressed but there were no significant differences in perceived barriers between those who progressed and those who regressed.

Qualitative focus groups revealed little difference in specific motivations and barriers between those who progressed and regressed their stage of change in active commuting. However, those who had progressed to active commuting had developed coping strategies to help them overcome the barriers (e.g. buying waterproofs and a rucksack

and walking in the evening as opposed to the morning when the time pressure was less). The cycle commuter participants discussed specific structural barriers relating to the workplace and the wider environment.

Mutrie et al. (2002) suggested environmental factors may underpin the lack of success this intervention has with encouraging cycling. However, more recent studies (discussed in Chapter 3) have evidenced the important role of social cognitions in cycle commuting behaviour (de Geus et al., 2008; Heinen, et al., 2010). Taking a more critical view of Mutrie et al.'s (2002), study, it is possible that providing intervention material that focuses generally on active travel (walking and cycling) such as the 'Walk in to Work Out' booklet may not be 'behaviour specific' enough to influence the mediating cognitive variables that affect cycle commuting behaviour (Baranowski, Anderson & Carmack, 1998; Giles Corti et al., 2005). An overall limitation of this study is that the majority of participants were female and from economically advantaged backgrounds so generalisations are limited.

7.3.3 Promoting Active Transport in a Workplace Setting: Evaluation of a Pilot Study in Australia (Wen et al., 2005)

Wen et al. (2005) carried out an intervention study that used individual and social marketing strategies to encourage active commuting (including public transport) within a medium to large workplace setting in Sydney, Australia. Social marketing strategies in the form of campaign messages were developed via an initial focus group to raise awareness of active transport across all employees. These messages were disseminated through a series of four awareness raising events, posters, banners and fridge magnets. An individualised marketing strategy, (akin to psychological means of promoting behaviour) was delivered in three stages: an interview regarding travel arrangements, a tailored transport plan and a meeting with a project worker to explain and further personalise the transport plan. The individualised marketing formed the basis of the evaluation and was delivered to a randomly selected cohort of employees (n = 68).

The evaluation comprised pre- and post-intervention structured interviews. The face validity and reliability of the structured interviews were examined in a pilot group (n = 10) and the correlation coefficients were >0.7 for all measures. The structured interview measures related to changes in awareness; knowledge and attitudes towards active transport options; stage of change; and mode of transport both to work and outwith work. The pre- and post-intervention structured interviews were identical and were conducted face-to-face with participants before and after the 12-month intervention period. The paired t-tests, McNemar's test for paired proportions and the Marginal Homogeneity test were used to analyse data.

Following the intervention, awareness of active travel had significantly increased ($p < 0.05$) from 28% to 71%, five out of six attitudinal items showed a significant positive shift. Positive changes in stages of change towards decreasing car use were also found revealing a 13% reduction in people who intended to drive to work. There were no statistical differences in staff reporting the use of active travel as their main form of commuting transport but there was a significant 20% reduction in the number of participants who reported driving to work suggesting an increase in the use of public transport.

Wen et al., (2005) suggest that the intervention was, to some extent, effective at increasing active travel and decreasing car use. However, it is difficult to pinpoint the components of the intervention that effected change as there were numerous elements. Additionally, there was no control group so it is possible that factors outwith the scope of the intervention and evaluation could also have effected the reported changes. As the study did not measure stages of change in relation to active travel but rather car use it is impossible to accurately report increases in either walking or cycle commuting. Regardless of the weaknesses identified in this study, some of the social marketing strategies and individualised strategies featured in this intervention have been tested more generally in relation to cycling for transportation and have been shown to be successful in changing travel behaviours (e.g. Sustrans 2004a, 2004b, 2004c).

7.3.4 Overview of Workplace Cycle Commute Interventions

The intervention research carried out on increasing cycle commuting via psychological techniques in a workplace setting shows inconclusive results. None of the studies discussed above were able to clearly demonstrate significant increases in cycle commuting behaviour. However, this lack of clear evidence would largely appear to stem from the studies' designs. Whilst Gatersleben & Appleton (2007) showed promising findings that 19 out of the 22 participants planned to continue cycle commuting either daily or less frequently as a result of the intervention, the study lacked both a control group, and a post-test follow-up stage. Thus, the findings failed to confirm that a participant's intentions to cycle would translate into continued action. Mutrie at al (2002) carried out a robust intervention study but as their intervention material was more generally focussed on walking and cycling to work, and only a small number of cyclists (n = 18) participated the study had little impact on cycle commuting. Wen et al.'s (2005), study took an even broader scope including cycling, walking and public transport and whilst the results revealed positive changes in attitudes and decreases in car use, both lack of cycle-specific measures and a control group prevent any specific conclusions regarding cycling to be drawn.

Two out of the three studies theoretically based their interventions on the TTM (Gatersleben & Appleton, 2007; Mutrie et al., 2002) and targeted contemplators and/or preparers. The remaining study, whilst not reporting any theoretical basis for their intervention, did incorporate components of the TTM into their evaluation (Wen et al., 2005). Whilst it is positive to find that two of these interventions were informed by theory, only the 'Walk in to Work Out' study (Mutrie et al., 2002) adopted the theory in its entirety. In sum, what these three studies highlight is that to gain clear evidence of the effectiveness of psychological interventions aimed to increase cycle commuting, future studies may benefit from targeting cycle commuting as a behaviour in its own right. Some of the recommendations to come from the intervention guidance (discussed above) such as employing control groups and longer-term follow up data collection would strengthen future studies.

7.4 Selected Cycling and Physical Activity Systematic Reviews

In accordance with guidance recommendations discussed above (Medical Research Council, 2000), to develop a strong evidence base for intervention work, systematic review findings should inform the development and planning stage. It was not within the scope of this thesis to carry out a systematic review. However, there are a number of previously published reviews, some cycle-specific and others more generally regarding physical activity and the workplace, that provide valuable insight into developing interventions aimed to encourage cycle commuting in a workplace setting.

7.4.1 Cycle-Specific Systematic Reviews

Three literature reviews that focus on promoting cycling for transport have been identified to help inform the intervention planning and development stage for this thesis (Ogilvie, Egan, Hamilton, & Petticrew, 2004; Pucher, Dill, & Handy, 2010; Yang, Sahlqvist, McMinn, Griffin & Ogilvie, 2010). Each review is separately summarised below.

Promoting Walking and Cycling as an Alternative to Using Cars: Systematic Review (Ogilvie et al., 2004)

This high quality systematic review assessed intervention studies that aimed to promote a shift from car use to walking and cycling in adults. The authors included 22 studies in the review, which not only included peer reviewed journal publications but also grey literature such as policy documents and unpublished documents. Studies included in the review were split up into categories of targeted behaviour change programmes; publicity campaigns and agents of change; engineering measures; financial incentives; and providing alternative services. It was concluded that that a few good quality studies documenting targeted behaviour change programmes (psychological techniques) evidenced a modest shift in travel behaviour towards walking and cycling in motivated sub-groups. The available evidence regarding publicity campaigns and agents of change, engineering measures, financial incentives, and providing alternative services found such interventions not to be effective. Whilst there were promising results regarding

effective targeted behaviour change programmes, none included in this review target cycle commuting specifically, except for the 'Walk in to Work Out' study (Mutrie et al., 2002), which only included small numbers of cyclists and was unsuccessful in promoting cycle commuting (as outlined above).

Due to the wide variation in quality, design and outcome measures of the included studies, the review was unable to synthesise evidence and derive generalised estimates of effect size. Therefore the interventions or effects in this review are not necessarily giving generalisability at a population level. It was suggested that the heterogeneity of intervention studies promoting walking and cycling, and the difficulty of finding relevant evidence may relate to the differing perspectives of health and transport fields. In conclusion the authors proposed that it's difficult to change longstanding and complex behaviours and that targeted behaviour change programmes that engage people and address factors that are of personal relevance are more effective than interventions that only aim to raise awareness or change physical and economic environments. The review did not include any evidence to support taking a combined and integrated approach to promoting active travel but nevertheless this was a recommendation to come from the review. Recently available results from a continuing UK study that has adopted an integrated approach to promoting cycling support this recommendation showing a 27% increase in active travel over a 3 year period (Sloman et al., 2010).

Infrastructure, Programs and Policies to Increase Bicycling: An International Overview (Pucher, et al., 2010)

This review was carried out on the effectiveness of interventions that directly encourage cycling. The criterion was that studies had to have a quantitative element to measuring an outcome related to bicycling. Peer-reviewed and non-peer-reviewed research, policy documents, conference proceedings and other sources were included in the review and in total 139 studies were identified (including 14 case studies of cities). The majority of these focussed on adult populations. The review aimed to provide evidence of the impacts of a wide range of bicycling interventions internationally. The interventions

ranged from individual-level studies to whole town case studies. The authors stated that most of the interventions included in the review found positive effects on bicycle use. The most effective interventions implemented integrated strategies to increase bicycling. The studies reviewed suggest comprehensive approaches have a much greater impact, due to synergic effects, than single, stand alone interventions. However individual interventions were still deemed valuable.

> Some individual interventions can increase bicycling to varying degrees but the increases are not usually large. That does not mean that individual interventions are not important, but they are most effective as part of a comprehensive effort (Pucher et al., 2010, p. S122).

Overall, these results are not consistent with Ogilvie et al.'s (2004) results, the two reviews had different foci, different inclusion and assessment criteria, and were different in quality. For example, Ogilvie et al.'s (2004) review process adopted more rigorous standards of internal and external validity criteria. Acknowledging some of the weaknesses of their review, Pucher et al. (2010) discuss the difficulty in generalising the effects of bicycle interventions due to large variations in intervention types, designs, locations and timings. Some studies included in the review do not explain measures or methods adequately. As most studies were classified as falling short of robust research designs (e.g. not involving pre- and post-intervention data and control groups) the direction of causality could not be addressed. The authors also suggest that lack of peer reviewed studies limit the quality of the overall review. In light of the lack of robust evidence identified through their review, Pucher et al. (2010) recommend collecting pre- and post-intervention data to facilitate measuring effectiveness. Several factors relating to the international context of the review were thought to potentially moderate the effects of bicycle interventions such as differences in planning and policy; relative levels of cycling at the onset of interventions; and cultural norms relating to cycle use.

Interventions to Promote Cycling: Systematic Review (Yang et al., 2010)

This robust systematic review aimed to determine what interventions were effective in promoting cycling and if there were any associated physical activity benefits. The authors included 25 studies, which fitted the criteria of being controlled, before and after experimental or observational studies. Data was sourced from databases, websites, reference lists, existing reviews and experts in the field. The included studies ranged from intensive individual support to community-level environmental infrastructure improvements. Whilst some studies were specifically focussed on increasing cycling, others were more generally concerned with increasing environmentally friendly modes of transport.

The findings suggest that the overall evidence, which is of limited quality and validity, shows relatively modest increases in cycling at a population level. Much of the evidence was derived from community-wide relatively large-scale interventions with multiple components suggesting that such studies have a greater potential effect on the population than individual-level interventions. Links between increases in cycling and increases in physical activity and health were not evident from this review. However, previous research has established a positive link between cycling and health (Andersen et al., 2000; De Hartog et al., 2010). A key strength of this review is that it only included control trial studies. This was done to try and eliminate biases, however, concerns of bias were still raised stemming from the high numbers of self-reported measures that in many cases had unknown validity and reliability. Due to the inclusion of only controlled studies the overall findings, which are more modest than those of Pucher et al.'s (2010) were deemed to be a more realistic portrayal of the behavioural effects of specific interventions.

7.4.2 Relevant Physical Activity Systematic Reviews

There is a large body of review evidence regarding physical activity promotion (Conn, Hafdahl, Cooper, Brown, & Lusk, 2009; Corti & Bull, 1998; Dishman, Oldenburg &

Shephard, 1998; Dugdill, Brettle, Hulme, McCluskey, & Long, 2008; Foster, Hillsdon, & Thorogood, 2009; Hillsdon, Foster, Cavill, Crombie, & Naidoo, 2005; Kahn et al., 2002; Marshall, 2004; Proper, Koning, van der Beek, Hildebrand, Bosscher et al., 2003; Rhodes & Pfaeffli, 2010; Shephard, 1996; Trost et al., 2002). Evidence from some of the studies cited above has been documented earlier in this thesis (see Chapter 1). In this section, only one physical activity review that explicitly reviewed the evidence relating to active travel workplace interventions is summarised (Dugdill et al., 2008).

Workplace Physical Activity Interventions: A Systematic Review (Dugdill et al., 2008)

Dugdill et al. (2008) carried out a systematic review of workplace physical activity promotion interventions that were intrapersonal and interpersonal in nature, excluding modifications to built and natural environments. The review included a specific section on active travel, in which only three studies were included (Gatersleben & Appleton, 2007; Mutrie et al., 2002; Wen et al., 2005). These three studies have already been discussed in detail above (see Section 7.3.1). The studies were graded following NICE protocol for quality of internal validity (NHS Centre for Reviews and Dissemination, 2001). Studies were awarded ++ or + if classified as high or good quality and - or -- if classified as low quality.

Out of the three active travel studies to feature in this review, only Mutrie at al.'s (2002) 'Walk in to Work Out' intervention study was graded as having good internal validity whilst both Wen et al.'s (2005) and Gatersleben & Appleton's (2007) studies were graded as having low internal validity. In summary, the authors of the review were only able to draw conclusions from Mutrie et al.'s (2002) study, that there is evidence that written health materials can increase employees' walking in economically advantaged women. The authors recognised a reliance on self-report measures in the studies included in the overall review and suggested that verifying subjective measures with objective measures would increase the quality of the evidence reviewed. They also

recommended that studies include not only a measure of intervention physical activity but also overall levels of physical activity.

7.4.3 Overview of Systematic Review Literature

Critically examining the review level evidence it would seem that both individual-level interventions that are educational and/or psychological in focus and community-level interventions that focus on infrastructure change are likely to have a modest positive impact in increasing cycling. Ogilvie et al., (2004) found evidence that well conducted behaviour change programmes resulted in modest increases in active transport in motivated sub-groups. Pucher et al. (2010), found evidence that overall, the majority of individual and infrastructure interventions aimed to increase cycling had positive effects. However, the quality of this review evidence has been questioned due to the broader inclusion of less robust studies (e.g. lacking baseline measures and control groups). Yang et al., (2010) reported evidence of modest increases in cycling to come from a range of interventions that targeted individuals and whole communities. Finally, Dugdill et al., (2008) was not able to make any evidence statements regarding cycle commuting workplace interventions due to the lack of robust studies.

The majority of the reviews (Ogilvie et al., 2004; Pucher et al., 2010; Yang et al., 2010) suggest that taking an integrated approach to increasing cycling by using multiple interventions that address differing levels may be the most effective approach. A key point that resonates across all reviews is the need for stronger research designs to be adopted when carrying out intervention evaluations. In both Ogilvie et al.'s (2004) and Dugdill et al.'s (2008) reviews, the Walk in to Work Out intervention by Mutrie et al., (2002) is very influential within the evidence statements made. This is because of the robust experimental design that was achieved; something that appears very hard to accomplish within active travel and specifically cycling research.

7.7 Chapter Summary and Conclusions

This chapter has discussed guidance literature and empirical evidence that will be used to inform the development, implementation and evaluation of a psychologically-orientated workplace intervention to encourage cycle commuting. Initially three intervention guidance papers were presented. These guidelines were complementary in nature and illuminated the importance of taking a considered and systematic approach to intervention development and evaluation. These guidelines argue for developing internal and external validity, reliability as well as clarity, transparency and critical thought throughout the intervention development and evaluation process.

The three cycle commuting workplace intervention studies that were reviewed revealed inconclusive findings, exemplifying some of the weaknesses within the research designs. Lack of cycle commuting participants, control groups, and adequate measures negatively affected the validity of the findings. Positive findings that indicated potential increases in cycling were not robust enough to be able to draw any kind of strong conclusion. In health sciences parsimony is usually endorsed. However, producing more generic psychological intervention material for walking and cycling (and public transportation) may be detrimental to promoting and identifying changes in cycle commuting behaviour. All three studies used either the TTM proper or components of the model to inform and/or evaluate their interventions. This is encouraging to find that cycling interventions are being underpinned with theory but the extent to which theory is being utilised in two out of the three studies is questionable.

The systematic literature reviews outlined in this chapter provided evidence that both individual-level (psychological and education) and community-level (infrastructure improvements) interventions aimed to increase cycling have a modest positive impact. An overarching view was that interventions that are more integrative, which use numerous multiple methods to target both individuals and communities are likely to be the most effective way of promoting cycling effectively. However, if we are to develop a

clearer understanding of interventions of this nature, the consensus opinion was that intervention studies need to employ more robust research designs.

In light of the evidence outlined in the present chapter and previous chapters, the next phase of this thesis involves the development and trial of a psychologically-orientated intervention aimed to encourage cycle commuting in a supportive workplace setting. Adhering to the intervention guidelines outlined in this chapter, the following chapter (Chapter 8) provides a step-by-step account of the processes involved in the development of the intervention. The intervention trial results are reported in Chapter 9.

Chapter 8

The Intervention Study Development Process

Aims of the Chapter

This chapter is the first of two linked chapters describing the development and evaluation of a work-place intervention called Cycle to Work. This chapter aims to document the planning and development phases of the psychologically-orientated workplace intervention. Taking into account empirical findings, literature and guidelines presented earlier in the thesis, different aspects of the rationale for the intervention are discussed within this chapter. Chapter 9 will then present the systematic evaluation of the intervention.

8.1 Introduction

The previous chapter outlined intervention guidelines for health and physical activity initiatives along with empirical evidence from individual studies and literature reviews regarding cycling and workplace interventions. This chapter follows on to document the developmental processes of a psychological intervention aimed to encourage cycle commuting in a workplace setting called Cycle to Work. The intervention is based on TTM principles and comprises a one hour lunchtime workshop made up of a DVD and psychological exercises, accompanied by a complementary booklet. The intervention specifically targets a motivated sub-group of people who have an interest in cycle commuting. The evaluation of Cycle to Work will be presented in Chapter 9.

The present chapter initially explains the rationale for developing a psychological intervention and identifies an appropriate underpinning theoretical framework and theoretical change processes underlying cycle commuting behaviour. Next, the intervention research aims are outlined, followed by a description of how the intervention was aligned with a larger multi-component workplace cycle promotion scheme. Thereafter, the content and design of the intervention are discussed followed by

the pilot study and finally the feasibility issues of implementing the intervention into wider practice.

8.2 Intervention Rationale

Before developing an intervention it is important to establish the evidence base in order to find out if the proposed intervention is both necessary and likely to be effective (Medical Research Council, 2000). The empirical studies reported in this thesis so far (Chapters 4, 5 and 6), have provided a valuable insight into some of the key psychological variables that are involved in cycle commuting behaviour. These findings, whilst important in their own right, also provide a rationale for the development and use of psychological intervention strategies as a method of promoting cycle commuting in a workplace setting. Studies 1 and 2 (Chapter 4 and 5) reported differences in perceptions between non-cyclists and cyclists that are potentially amenable to change via the use of psychological (and educational) intervention work. Study 3 (Chapter 6), whilst providing more general findings, adds support to what has been found in the two previous studies.

Although the empirical research reported in Chapters 4, 5 and 6 provides a good rationale for the use of psychological intervention work to promote cycle commuting, it is also important to take into account the wider body of literature that exists in this field. According to a recent systematic review into cycle promotion (Yang et al., 2010), the workplace is an important setting for promoting cycle commuting, but is presently an under-researched area. The limited and inconclusive empirical evidence regarding cycle commuting promotion in workplaces outlined in Chapters 3 and 7 highlights that there is a gap in knowledge regarding interventions of this type, thus, indicating the need for further intervention work in this area. Whilst inconclusive evidence could relate to the ineffectiveness of psychological interventions in this context, a more critical examination revealed that inconclusive findings stem from methodological limitations as opposed to efficacy issues *per se.*

In support of the efficacy of psychological and educational interventions within the context of cycling and active travel behaviour, key review papers suggest that such interventions are able to produce modest effects in increasing cycling (Ogilvie et al., 2004; Yang et al., 2010). The empirical research documented in previous chapters (Chapters 4, 5 and 6) along with the wider body of evidence indicates that psychological interventions aimed to increase cycle commuting are likely to positively influence attitudes and behaviours. In light of the collective evidence there is regarding intervention work in this area and the lack of workplace-based studies, it was deemed viable to develop and trial a psychological intervention to encourage cycle commuting in a workplace setting.

Reviews carried out into cycle promotion and active travel promotion commonly suggest that taking a more integrated approach to intervention work (targeting individual, social and environmental levels), may provide a greater impact (Ogilvie et al., 2004; Pucher et al., 2010; Yang et al., 2010). Pucher et al., (2010) propose the reason for this is that an intervention will experience synergic effects from complementary interventions within the same overarching program. This sentiment of integrating interventions has been echoed by other researchers in this area (Crawford et al., 2001; Davies et al., 1997; Mutrie et al., 2002). Therefore, to optimise practical impact it was deemed important to design an intervention that could easily be integrated into a larger comprehensive support system aimed at increasing cycle commuting within workplaces (see Section 8.5 for more details).

8.3 Identifying Appropriate Theory and Change Processes

During the planning stage of an intervention it is also important to identify an appropriate theoretical framework in order to increase likelihood of success (Medical Research Council, 2000; Foster et al., 2005). As discussed in Chapter 2, 4 and 6 of this thesis a number of psychological theories have been discussed that encompass variables suitable for informing cycle promotion interventions such as the Transtheoretical Model

of Behaviour Change (TTM), the Theory of Planned Behaviour (TBP) or the Health Action Process Approach (HAPA). In this instance, the TTM was chosen as a suitable theory to underpin the proposed intervention. The TTM was chosen over other theories as the available evidence regarding active travel interventions highlights the TTM as a suitable framework for behaviour change programs (Kiloran, et al., 2006). The TTM focuses more on supporting interventions in changing behaviour by providing clear, stage-based guidance and intervention materials, than social cognition theories, which focus principally on predicting behaviour (Darnton, 2008). Studies one and three also support the tenets of the TTM as an appropriate psychological theory to understand cycle commuting as it encompasses relevant variables involved in this behaviour (e.g. benefits, barriers, self-efficacy and stages of change). Although the TTM has received some criticisms within the discourse of health and exercise psychology, critical remarks relating to efficacy have, in large, been directed to poor application and understanding of the theoretical principles.

It is also important to gain a theoretical understanding of the change processes that play a role in particular behaviours (Medical Research Council, 2000). Study 1's (Chapter 4) results shed light on some of the change processes that are likely to occur in the transition from considering cycling to initiating cycling to work. Developing effective coping strategies (intrinsically linked to barrier reduction and self-efficacy) such as planning and gaining knowledge and skills was shown to play a key role in the change process from contemplation to action. The findings from Study 1 also indicate that raising awareness of some of the benefits of cycling as well as the local facilities and support available may also function as change processes. Whilst the TTM does not explicitly draw on the concept of 'coping strategies' there are a number of processes of change (e.g. increasing knowledge, increasing healthy opportunities and comprehending benefits) within the model that can be aligned with some of the coping strategies reported in Study 1 (Chapter 4) that can help people progress from one stage to the next.

8.4 Developing Research Aims

The research aims are based on the TTM principles (see Figure 8.1). In accordance with SPARColl guidance, the research aims were designed to be realistic (Blamey et al., 2008). The evidence base for similar interventions indicates modest changes in behaviour are likely. Time, financial and human resources limitations of the planned intervention study were also factored into the aims of the study. It was decided that the intervention's aims would focus on short and medium term changes in cognitions and stage of change progression as opposed to actual behaviour change. Cognitions and stages of change are the most proximal measure of the intervention, thus reducing the likelihood of type 2 errors occurring (Green & Tones, 1999). The five research aims relate to each component of the TTM. Taking into account findings outlined in previous chapters, within the intervention content more weight was given to the third aim, which addresses decreases in perceptions of barriers, as this has consistently been shown in this thesis to be the most influential cognition for progressing individuals towards action.

Figure 8.1: Aims of the Cycle to Work intervention

Intervention Aims
Progress individuals to the next stage of change (attitudinal and/or behavioural)
Increase individual's perceptions of benefits associated with cycle commuting
Decrease individual's perceptions of barriers associated with cycle commuting
Increase level of self-efficacy associated with cycle commuting
Increase individual's use of the processes of change

8.5 Integrating the Intervention into Existing Practice

As discussed above (in Section 8.2), it was deemed appropriate to integrate the proposed psychological intervention into a larger existing framework that supports cycle commuting within workplaces in order to optimise its impact in practice. Prior to the intervention development, contact was made with policy makers and practitioners from the Scottish Government, NHS Health Scotland, Healthy Working Lives and Cycling Scotland to discuss potential opportunities for collaboration. After meeting each potential stakeholder, it was decided that Cycling Scotland would provide the best

opportunities for integration and dissemination of the proposed intervention. Cycling Scotland was keen to support the development and implementation of a psychological intervention as they felt there was a current gap in their existing Cycle-friendly Employer (CFE) scheme.

The CFE is a supportive scheme that awards employers who provide adequate cycling infrastructure, incentives and promotions (see Figure 8.2) for their staff. Employers that apply for, and meet, the CFE criteria are classified as 'cycle-friendly' and receive a CFE award, which is run in conjunction with the Healthy Working Lives awards (an NHS Health Scotland Scheme). However, once organisations are cycle-friendly, this does not always translate into a large uptake in cycling. Therefore, Cycle Scotland offers cycle-friendly workplaces continuing support to encourage staff members to cycle, in the form of a cycle commuting training course, which teaches participants physical riding skills to develop their confidence to cycle in traffic. As well as providing hard skills training, Cycling Scotland were also looking to incorporate a psychological intervention that provides soft skills training to help positively change employees' attitudes and perceptions of cycling to further encourage the uptake of cycle commuting.

Figure 8.2: Examples of differing workplace provision, which are required for the CFE award (adapted from Cycling Scotland, 2009)

Provision	Examples
Infrastructure improvements	Cycle parking, showers, lockers and changing facilities
Incentives	Mileage allowance, pool bikes and Cycle to Work schemes
Promotion	National Bike Week, staff cycle training and setting up a Bicycle User Group (BUG)

Therefore planned psychological intervention was designed as a standalone psychological intervention to encourage cycling in cycle-friendly workplaces with the scope to fit well into Cycling Scotland's larger, integrated approach to workplace cycle promotion. The intervention was designed, developed and is copyrighted by the author of this thesis with the guidance and support of her supervisory team. Cycling Scotland's

involvement consisted of providing practical advice, contacts to potential host organisations for trialling the intervention, financial assistance for developing some of the intervention materials and assistance with delivering the intervention trial.

8.6 Intervention Design and Content

In line with the development process so far, the design and content of the intervention was based on a combination of complementary empirical evidence presented in Chapters 4, 5 and 6 and TTM theoretical principles. Study 1 (Chapter 4) indicated that, with regards to people considering cycling to work, there is scope to: develop an awareness of more immediate and experimental benefits associated with cycle commuting; develop an understanding of how to overcome the more common challenges associated with cycling to work; and improve people's knowledge of workplace resources available to cyclists. Study 2 (Chapter 5) indicated that there were significant differences in perceptions of barriers between the different stages of change associated with cycle commuting. This highlighted both the importance of reducing the perceptions of barriers as well as the value of tailoring interventions to specific stages of change as opposed to developing a more universal intervention. Study 3 (Chapter 7) supported the findings from Study 1 and 2 (Chapters 4 and 5), which indicated that perceived benefits, perceived barriers and self-efficacy play a significant role in cycle commuting behaviour. In sum, the three previous studies have provided consistent evidence that the variables of perceived benefits, perceived barriers (linked to coping strategies) and self-efficacy are central to psychological intervention work aimed at encouraging cycle commuting.

Prior to the onset of the intervention, in accordance with SPARColl guidelines (Blamey et al., 2008), a basic logic model was created to help identify the inputs and activities required to produce the anticipated outputs and outcomes to come from the study (see Figure 8.3). Initially, a suitable design for delivering intervention materials needed to be identified. Physical activity promotion literature indicates that written material or one to one consultations offer the best possibility for long-term individual physical activity

behaviour change (Biddle & Mutrie, 2001, 2008). More specifically, for workplace-based physical activity interventions, events, structured-classes or workshops have been recommended (Marcus & Forsyth 2003).

Figure 8.3: Logic Model for the Cycle to Work psychological intervention

Inputs	Activities	Outputs	Immediate Outcome	Three Month Outcome	One Year + Outcome
Time • Researcher • Supervisory guidance • Cycling Scotland • Ethics committee • Host organisations • Other stakeholders Financial Support • Developing materials • Printing materials	Intervention Planning o ID evidence base o ID theory o Develop aims o Choose study design o Use RE-AIM o Identify measures Intervention Development o DVD production o Workbook production o Workshop and PPT production o Design and validate questionnaires o Design invite letters o Submit Ethics form Pilot Intervention 1. Liaise with host organisation o Set up pilot workshop (send out baseline questionnaire, ID participants etc.) o Run Workshop o Analyse feedback o Apprise and modify Set up Intervention Trial 1. Liaise with host organisation 2. Send out baseline questionnaire 3. ID participants 4. Randomise and split into groups 5. Book venues 6. Run workshops 7. Send out follow-up questionnaires	To be Distributed • Workshop • Exercise sheets • Workbooks • DVD • Questionnaires To be Collected 1. Pilot Data 2. Intervention trial data o Baseline o Immediate follow-up o 3 month Follow up	Individual • Positive attitudinal changes o Benefits o Barriers • Self-efficacy increase • Increased knowledge about workplace resources Organisational • Provide a supportive component in a drive to promote cycling and health	Individual • Positive attitudinal changes o Benefits o Barriers • Self-efficacy increase • Increased knowledge about workplace resources • Increase in utilisation of change processes • Stage of Change increase (cognitive and/or behavioural) Organisational • More demand for cycle facilities • More demand for workshops	Individual • Changes in travel modes • Increases in health and wellbeing Organisational • Changes in travel culture • Less demand for parking • Less absenteeism • Higher work productivity

After discussions with Cycling Scotland, it was decided that a classroom-based workshop session, involving a DVD and three psychological exercises (see Figures 8.4, 8.5 and 8.6) would make up the core components of the intervention, which would be accompanied by a complementary booklet (see appendix E). Acknowledging the tension between maximising group size versus the intensity and duration of an intervention (Blamey et al., 2008), a workshop was deemed most suitable: as such a format is able to deliver some of the hands on support that a one-to-one consultation can offer whilst providing a larger reaching and cost effective option for employers seeking some support for their employees. A one-hour intervention of this nature may be less effective than a higher intensity intervention (Hutchinson et al., 2009). However, it was necessary to find a balance between a robust intervention, its practical applicability and the resources available. The workshop was designed to target motivated people with an existing interest in cycle commuting, as review level evidence (see Chapter 7) indicates that using a tailored intervention approach that targets motivated sub-groups is an effective strategy to adopt (Kiloran et al., 2006; Ogilvie et al., 2004).

8.6.1 Workshop Overview

The workshop was designed to facilitate between 10 and 15 participants. Initially the workshop was piloted as a two-hour session but later in the development process it was reduced to one hour so that it could be more feasibly implemented in workplaces as a lunchtime workshop. The workshop content draws on three stage-matched themes: increasing awareness of benefits (Biddle & Mutrie, 2001, 2008; Bull, 1999; Marcus & Forsyth, 2003), decreasing perceptions of barriers (Marcus & Forsyth, 2003) and planning and preparation (Gollwitzer, 1999; Marcus & Forsyth, 2003). During the workshop, each theme is briefly discussed by the workshop tutor (see appendix E), and elaborated on by watching a short DVD chapter (developed specifically for the intervention) and carrying out a psychological exercise. At the end of the workshop, information about available workplace cycle resources is provided, which aligns with the change processes of increasing knowledge and increasing healthy opportunities (see Figure 3.3). As a consequence of reducing the intervention to a one-hour session, only

two out of the three exercises remained in the main body of the workshop. The third exercise, which was deemed the least relevant, in terms of stage appropriateness, was made available in the complementary booklet as an optional exercise for participants to complete in their own time.

Figure 8.4: Exercise one: Benefits and challenges (decisional balance-sheet)

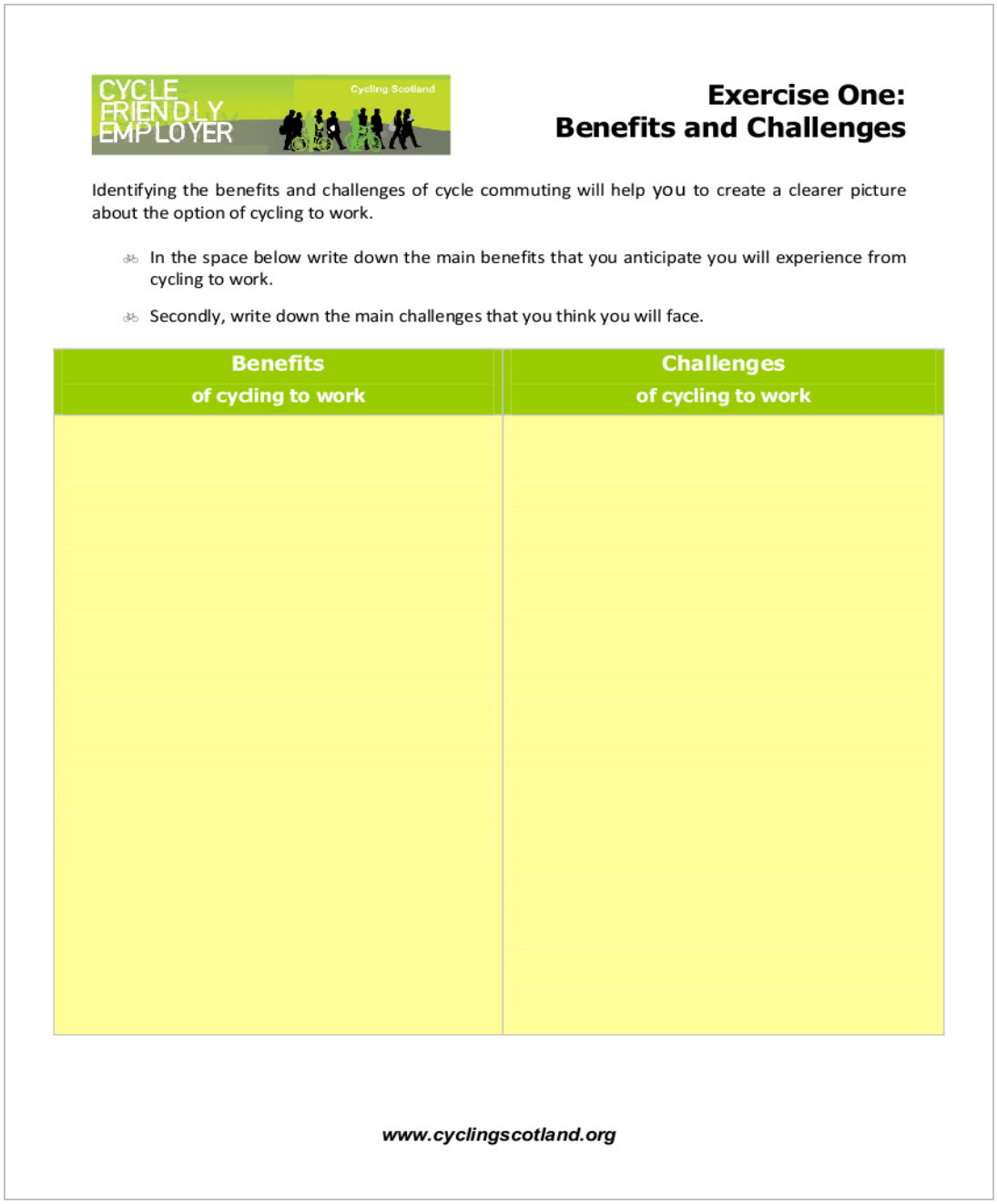


Figure 8.5: Exercise two: Challenges and solutions

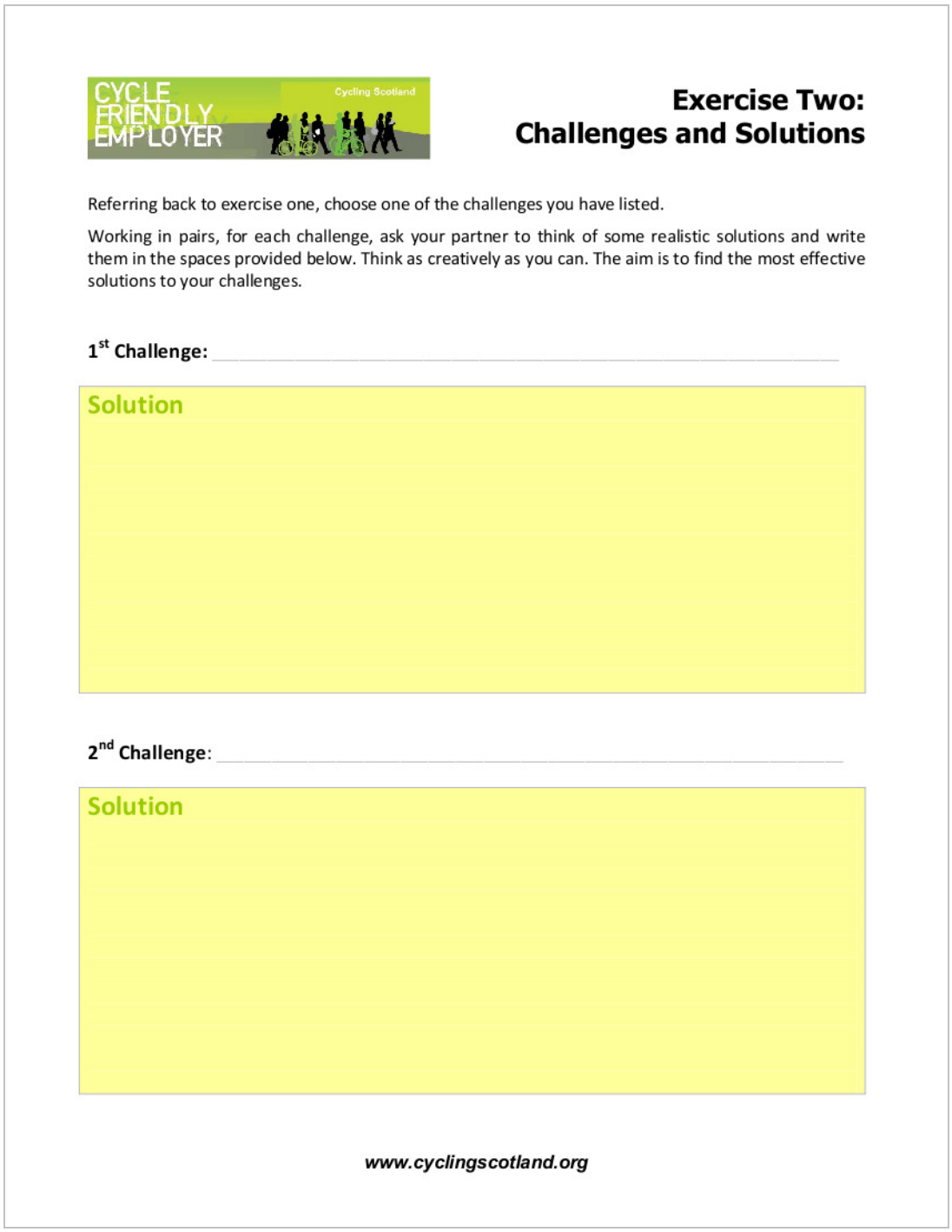


Figure 8.6: Exercise three: Action planning

Action Planning

Making plans helps you to put your thoughts into actions. You are much more likely to achieve a goal if you decide in advance, **WHEN**, **WHERE**, and **HOW** it will be achieved.

To make your own cycle commuting action plan:

1. Choose a time frame for your action plan (e.g. six weeks) and then write down your cycle commuting goal for that period of time. Try to think realistically about what you can achieve in your chosen time period. Your goal may be gaining confidence to cycle on the roads, starting to cycle commute or it could be as simple as doing some research into cycling in your local area.
2. Once you have decided on your goal, think of some actions you can carry out that will help you to reach your goal.
3. Once you have decided on your actions, as clearly and specifically as possible, write down when, where and how you will achieve your actions.

Here is an example to illustrate:

My Action Plan

Time Frame: Six weeks

My Goal: To start cycle commuting three days per week.

Action One: Try out my cycle route to work.

When: Next Sunday Morning at 10am if it's not raining, or Monday evening at 8pm.
Where: Along the main road, cutting down Black Street and through Royal Park.
How: I will cycle the whole journey.

Action Two: Buy a new bike (that is more suitable than my old mountain bike) for commuting.

When: I will purchase a bike at the end of the month when I get paid.
Where: I will go to 'Mikes Bikes' because through my workplace I can get a 10% discount there.
How: I need to 'Google' the shop to check out its location. If it's where I think it is, I'll get the bus up there.

8.6.2 DVD

The Cycle to Work DVD was created as a documentary-style film comprising three themed chapters that follow the three main themes of the workshop (benefits, overcoming challenges, and planning and preparation). The DVD film was developed and produced by the author of the thesis to support the workshop, in which it plays an integral role. The DVD was professionally produced in collaboration with the University of Edinburgh Communications and Marketing department and Cycling Scotland, and their partner organisation Healthy Working Lives, who provided partial funding towards the costs of producing the DVD. The script was produced by the author and all of the footage was filmed locally in Edinburgh city centre. The main body of the DVD features interview clips from Edinburgh-based cycle commuters talking about their own experiences of cycling to work. The aim of the DVD footage is: to reinforce empirically and theoretically-based messages regarding cycle commuting; to increase the persuasive power of the information being presented by using realistic role models (Foster, et al., 2005); and to increase the impact of the information being presented by the use of new media (Biddle & Mutrie, 2008).

The first DVD chapter focuses on the benefits of cycle commuting. It was designed to last for six minutes and includes seven main benefits: maintaining and improving fitness and health; time saving; enjoyment/being outdoors; cost saving; freedom and flexibility; and social/environmental benefits. These benefits were identified through Study 1 in this thesis (Chapter 4) and from other cycle commuting research (Crawford et al., 2001; Gatersleben & Appleton, 2007; Mutrie et al., 2002).

The second DVD chapter focuses on overcoming some of the common challenges of cycle commuting. It was designed to last for 10 minutes and includes eight common challenges and the strategies that cycle commuters adopt to overcome these challenges. These challenges are: danger from traffic; bad weather and darkness; hilly terrain; looking presentable; exhaust fumes; carrying belongings; lack of cycle storage at home;

and the school run. The strategies discussed in this chapter link in with the concepts decreasing perceptions of challenges by promoting effective coping strategies and increasing self-efficacy associated with cycle commuting. These specific challenges addressed by the DVD were derived from studies one, two and three of this thesis (Chapters 4, 5 and 6) and from other cycle commuting research (Crawford et al., 2001; Mutrie et al., 2002).

The third DVD chapter focuses on planning and preparing to start cycle commuting. It was designed to last for four minutes and includes three main points: establishing a routine; useful items to carry; and ways of building confidence to cycle to work. These planning and preparation points link in with the concepts of developing coping strategies and self-efficacy and stem from the findings of Studies 1 and 3 in this thesis (Chapters 4 and 6).

8.6.3 Psychological Exercises

The three psychological exercises included in the intervention (see Figures 8.4, 8.5 and 8.6) were matched to contemplation and preparation stages of behaviour change and involved elements of the TTM theory. Exercises were included in the intervention as evidence indicates that engaging people in a participative process that increases personal relevance towards specific factors is likely to be more effective than purely raising awareness (Ogilvie et al., 2004). Each exercise is discussed below separately.

The first exercise to feature in the workshop is the decisional balance exercise (see Figure 8.4). This exercise ties in with the first workshop theme, which addresses raising awareness of benefits. The decisional balance exercise was first proposed by Janis & Mann (1977) for individuals contemplating behaviour change. The exercise involves identifying the anticipated benefits and challenges of carrying out a particular behaviour. This is done by making two lists, one for the benefits and one for the challenges, of the behaviour in question. The decisional balance exercise was proposed as a powerful

schema for making sense of both cognitive and motivational aspects of anticipated future actions Janis & Mann (1997). Carrying out the exercise also enables a person to contextualise the behaviour in question into their bigger life picture. The notion of weighing-up the pros and cons of a behaviour fits in with the process of making high-quality decisions termed as vigilant design making (Janis & Mann, 1977). The decisional balance exercise has been recommended as part of psychological interventions in physical activity to promote stage movement from contemplation to preparation (Biddle & Mutrie, 2001) and has been used previously in the field of active travel promotion (e.g. Mutrie et al., 2002).

The second psychological exercise, 'Challenges and Solutions', focuses on identifying personal challenges associated with cycling to work and solutions to these (see Figure 8.5). This exercise fits in with the second theme of the workshop, which focuses on overcoming barriers associated with cycle commuting. The exercise was adapted from a behaviour change strategy called IDEA (identify, develop, evaluate and analyse) and is recommended for both contemplators and preparers within physical activity promotion (Marcus & Forsyth, 2003). The exercise requires individuals to focus on two key challenges they have previously identified from the earlier decisional balance exercise. Individuals are then paired up with another participant and asked to discuss potential solutions to their challenges together. This concept of searching for potential solutions can also be viewed as a component of vigilant information processing that leads to high-quality decision making and effective coping patterns (Janis & Mann, 1977). Thinking through, and exploring viable solutions also has the scope to enhance self-efficacy and draws on change processes (e.g. increasing knowledge and substituting alternatives).

The third exercise entails making specific action plans and is based on the principles of Implementation Intentions (Gollwitzer, 1999), which involves developing self-regulatory strategies that identify when, where and how an action will take place (see Figure 8.6). The aim of such an exercise is to help bridge the gap between intention and action by automating the link between environmental cues and behaviour (Gollwitzer,

1999). The concept of Implementation Intentions can also be liked more implicitly with some processes of change (e.g. increasing knowledge, comprehending benefits and committing oneself) within the TTM (Armitage, 2006, 2009a; Armitage & Arden, 2008). Making clear action plans could also enhance self-efficacy. Action planning is best suited for moving individuals from preparation to action. Research indicates that the automating links between environmental cues and behaviour is an effective means of overriding habitual behaviour patterns thought to moderate the intention-behaviour gap (Gollwitzer & Sheeran, 2006). This may be an important issue promoting travel behaviour change as previous travel research has found that where habits are involved, intention is not strong enough alone to initiate behaviour change (Bamberg, 2000).

8.6.4 Information Booklet

The workbook that accompanies the workshop provides a summary of the information discussed in the workshop and DVD along with a list of useful cycling websites (see appendix E). It was written by the author of this thesis under the guidance and support of her supervisors. The final published booklet also includes the third action planning exercise (which was removed from the workshop) as a recommended optional activity. Cycling Scotland provided the funding for 200 copies of the booklet to be professionally produced and published. Prior to publication the booklet underwent review and received minor edits by Cycling Scotland and Healthy Working Lives (a partner organisation of Cycling Scotland).

8.6.5 Evaluation Tools

In accordance with intervention guidance (see Chapter 7) the intervention study aimed to carry out a pre-test, post-test randomised-control trial evaluation (Blamey et al., 2008; Medical Research Council, 2000). As Mutrie et al.'s (2002) Walk into Work Out intervention study has been held in high regard within the discourse, the impending intervention study to feature in this thesis aimed to replicate their methodological design. Although the results of the evaluation are discussed in Chapter 9 the evaluation approach

and process of developing the evaluation tools is described here. It was initially proposed, in line with MRC recommendations that a qualitative process evaluation would be carried out to gain more in-depth information into the change processes at play (Medical Research Council, 2000). However, in the intervention trial proper (documented in Chapter 9), due to constraints imposed by the host organisation participating in the study, it was not possible to randomise participants or to carry out the process evaluation. Therefore, questionnaire was the sole evaluation method used within a pre-test, post-test controlled trial study design.

Based on the findings to come from Studies 1, 2 and 3 (Chapters 4, 5 and 6), the pre- and post-test questionnaire was designed to measure the TTM core cognitions (benefits, barriers and self-efficacy), stage of change, and processes of change, which link the research aims and the intervention material at three time phases. It would have strengthened the study to include more direct measures of cycle commuting behaviour and questions regarding physical activity and health. However, in order to keep the questionnaire germane to the research aims and to a reasonable length, TTM-based questions were prioritised and more direct behavioural and health questions weren't included. Where any increases in behaviour are found (through the stages of change scale) health benefits from cycle commuting can feasibly be inferred from previous evidence (Yang et al., 2010).

In order to optimise the validity of the proposed questionnaire, questions were used from established measures that had previously been used to monitor physical activity and active travel within worksite interventions. The questions to feature in the pre- and post-test questionnaire primarily came from two existing measures (Marcus et al., 1992c; Mutrie et al., 2002) (see appendix C) and needed no or very minimal adaptations to be made. The main body of the questionnaires used to evaluate the intervention (excluding the processes of change) have previously been tested for reliability and face-validity in Study 4 (Chapter 6). The questionnaires are discussed further in Chapter 9, which documents the intervention trial evaluation.

8.7 Pilot Study

A small pilot study of the Cycle to Work intervention was carried out at a university with a subsection of employees and PhD students based in a cycle-friendly campus. Participants from a previous questionnaire study carried out at the university (see Study 2, Chapter 4), who indicated that they would be willing to be re-contacted to take part in further research, were invited to take part in the pilot workshop (contemplators, n = 57 and preparers, n = 27). In total 10 individuals participated in a workshop. In retrospect, it is likely that three main factors contributed to the relatively low level of interest. First, the study was not advertised and only a limited number of people, identified through the previous questionnaire (n = 84), were invited to take part in the workshop, limiting the reach. Second, the pilot workshop was run during the month of July, which in an academic setting is a notorious summer vacation period, meaning many staff and students would be on holiday. Third, the piloted workshop was two hours long. Feedback from some individuals who did not take part in the workshop but who noted an interest indicated that taking two hours out of a working day to attend a workshop of this nature may not be very feasible. This finding influenced the decision to reduce the length of the actual workshop to one hour.

The author of the thesis took the role of the workshop tutor. There were two cancellations prior to the workshop and two individuals didn't turn up on the day, which meant in total, eight participants took part in the pilot study (six women and two men). As the number of participants taking part was too small to be able to test the questionnaire, it was decided that the pilot study would be used to appraise the process of carrying out the workshop (a dry run if you like) and to gain feedback on the content and style of the workshop. To gain participants' feedback from the workshop a descriptive evaluation feedback form was constructed for the pilot study.

The evaluation form was adapted from an existing evaluation form that had previously been used to evaluate an ESRC funded knowledge exchange seminar at the University of Edinburgh (see appendix E). The form comprised 17 questions in total that related to

how well the workshop met its objectives the participants views on the delivery of the workshop and the materials used (see appendix E). There were 12 closed questions, which used five point likert scales. All eight participants of the pilot study indicated that the workshop met its specified objectives: to provide an insight into the benefits of cycle commuting; to raise awareness about how to overcome challenges that cyclists face; to provide support about planning and preparing to cycle to work; and to provide information about workplace cycling resources. The workshop tutors delivery, the DVD content, quality of the DVD, the workshop exercises and the overall workshop all received scores ranging from 'good' to 'excellent' by all participants. The length of the DVD and the length of the overall workshop were viewed as "just right" by everyone. The length of the workshop exercises were viewed as "just right" by six of the participants and "long" by two.

The four open answer questions were used to identify what participants liked about the workshop and DVD and what they felt could have been improved upon. The general consensus was that the workshop was relaxing, informative and encouraging and provided participants with a chance to hear other people's issues (from the DVD and other participants). It was deemed valuable to be able to bring various concerns about cycling to work together as a whole and consider solutions for them. There was only one comment made by one participant in relation to improving the workshop. This comment suggested that it would be helpful to provide more details about the available cycle programs and support services at the workplace (e.g. bike repair sessions and cycle commuter training courses). In the final version of the booklet additional information sources were added as a result. The participants wrote very similar comments regarding what they liked about the DVD. They felt it was nice, encouraging or valuable to hear real world people speaking about their own experiences, especially in relation to overcoming challenges associated with cycle commuting. There were no comments made with regards to how the DVD could be improved.

The final question asked participants to circle descriptive words from a list provided that most closely described their opinion about the DVD and its content. The words provided were: useful; unsupportive; relevant; irrelevant; relaxing; interesting; boring; stressful; too short; reassuring; confusing; supportive; well paced; poor insight; motivating; too long; discouraging; OK; de-motivating; informative; clear; ambiguous; useless; and good insight. The overall response was very positive and the most commonly circled words were "supportive", "interesting", "informative" and "clear" (see Table 8.1).

Table 8.1: Words chosen to describe the DVD and its content

Descriptive words	Number of participants
Useful	6
Relevant	6
Relaxing	3
Interesting	7
Reassuring	5
Supportive	8
Well Paced	4
Motivating	5
Informative	7
Clear	7
Good Insight	5

8.8 Practical Application of the Cycle to Work Intervention

Using the knowledge and experience gained from setting up and running the pilot study, the intervention was critiqued for its practical applicability and value using the RE-AIM model (Glasgow et al., 1999) comprising the criteria of: reach, efficacy, adoption, implication and maintenance. As discussed in Chapter 7, the RE-AIM proposes to evaluate the impact an intervention has in the real world. As the pilot study was only small-scale and did not test the intervention's efficacy using the developed questionnaire, the five RE-AIM criteria have been discussed generally to help gain a clearer understanding of the intervention's likely impact in practice. The practical value of an intervention can also be gauged by using a cost effectiveness assessment (Medical

Research Council, 2000). However, since the costs of developing the intervention were relatively low and the pilot study did not provide enough data to infer a tangible level of resultant benefits from the intervention no formal cost assessment was undertaken.

Initially the interventions 'reach', in terms of the scope for population inclusion was examined. As the workshop specifically targets motivated individuals with an interest in cycle commuting, the workshop is only suited for a sub- section of any given population. In the pilot study only contemplators and preparers (as defined in Figure 5.1) were identified as suitable candidates. However, findings from Chapter 6 indicate that in the case of cycle commuting behaviour, there is a large sub-section of precontemplators that also have an interest in cycle commuting and they would also be potential suitable candidates for the intervention. Therefore, to optimise the reach, it was decided that in the main intervention trial (Chapter 9), precontemplators with an interest, along with contemplators and preparers would also be invited to take part in the workshop. As discussed earlier in this chapter (see Section 8.6), the workshop duration was reduced to one hour in order to make it more 'user friendly', extending the potential reach with regards to both employers and employees.

The efficacy of the intervention, which relates the success rate of desired outcomes, could not be gauged from the pilot study in a robust manner as the participant sample was too small to test the evaluation questionnaire. However, immediate post-test, descriptive feedback to come from the pilot study indicated that the workshop had fulfilled its specified objectives in terms of: raising awareness to the benefits; how to overcome some of the challenges; providing support and information about planning and preparing to cycle; and informing participants of workplace cycle resources. This suggests the workshop had been efficacious in the sense that some immediate positive changes in attitude seem to have taken place.

Adoption refers to gauging how many organisations would adopt this intervention after the trial study has taken place, if the intervention proves successful. At this stage in the

intervention development process it was not possible to gain a precise forecast of how many workplaces would adopt the intervention. However, Cycling Scotland's involvement and interest to implement the intervention nationally provides a clear pathway for widespread dissemination. Cycling Scotland has a growing cohort of organisations that have received the CFE award. Initial enquiries made with a number of these organisations indicated that a lunchtime workshop session would be much more popular than the current cycle commuting training course currently offered due to its lower costing and lower time input.

Issues of implementation relate to the extent to which an intervention is implemented as intended in the real world. Implementation then raises the issues of treatment fidelity, which pertains to how accurately a program is reproduced across different setting. In order to increase the treatment fidelity of the intervention, once the format and materials had been finalised, a step-by-step protocol guide was developed (see appendix E). This was created so that anyone intending to deliver the workshop following the trial would have a detailed overview of how to run the session. Additionally, a workshop PowerPoint presentation was created including accompanying notes, which provide detailed scripting of the tutor's role (see appendix E).

Maintenance applies to both individuals and organisations and is understood as the extent to which an intervention is sustained over time. On an individual-level, the pilot study only gathered immediate post-test feedback from participants, therefore, no information about the longer-term effects of the intervention on individuals are available at this stage. However, the workshop is administered as a one off session so there are fewer issues relating to attrition of the intervention than if trialling a longitudinal intervention program. In terms of the organisational level, it is not possible to accurately forecast how the intervention will be applied in practice (e.g. whether CFE organisations will only offer the workshop once or whether it will be run on an annual or biannual basis for new staff). There are a number of supportive events that cycle-friendly workplaces hold annually, such as bike week, cycling breakfasts and cycle commuting

training courses so there is scope for the workshop to be carried out on an annual basis alongside other cycle promotion events.

At this stage, the RE-AIM criteria highlight that there are a number of uncertainties regarding the intervention's practical impact. They also show that throughout the development process of the Cycle to Work intervention efforts have been made to increase the feasibility of implementing the intervention in a workplace setting. What became clear within the development and piloting process of the intervention was the tension that exists between creating scientific rigour and practical viability. Aspects of the RE-AIM model will be revisited again later in Chapter 9 of this thesis.

8.9 Chapter Summary

This chapter has outlined the developmental process that took place for the creation of the Cycle to Work intervention, which aims to increase cycle commuting in a workplace setting via psychological means. Initially, the rationale for embarking on an intervention of this nature was presented that drew on findings presented in the previous chapters of the thesis. The TTM was identified as a suitable theoretical framework to be used to underpin the intervention. Whilst there are a number of social cognition models that would also potentially provide suitable frameworks for an intervention of this nature, the TTM was chosen on the grounds of existing active travel intervention recommendations. Findings from Study 4 (Chapter 6) confirmed that the TTM is well-suited to explain cycle commuting behaviour.

Realistic research aims that align with the elements of the TTM were presented. Taking into account the constraints of the study, and the available evidence, the focus of the aims centred on changing cognitions and stages of change as opposed to behaviour change *per se.* In accordance with the evidence base, the intervention has been designed to integrate into a larger multi-component cycle promotion program run by Cycling Scotland called The Cycle-friendly Employer Scheme. In light of physical activity

promotion recommendations, the intervention has been designed as a workshop that involves a DVD and psychological exercises, accompanied by a complementary booklet. The intervention material content has been based on findings from Study 1, 2 and 3 (Chapters 3, 4 and 5) and the TTM. To evaluate the intervention a questionnaire has been developed using existing measures to enhance validity. The content of the questionnaire links directly to the research aims.

The findings of a small-scale pilot study were also presented and the RE-AIM model was discussed to provide a clearer picture of the strengths and weakness of the Cycle to Work intervention in terms of its practical application. Whilst the pilot was too small to provide clear insight into a number of the issues raised within the RE-AIM criteria, what was highlighted were the efforts that have been made throughout the developmental process to increase the impact of the intervention within practice. The following chapter (Chapter 9) leads on from the present one to document the quasi-experimental trial of the Cycle to Work workshop, which was carried out in Edinburgh-based worksites.

Chapter 9
Study 4: A Controlled Trial of the Cycle to Work Intervention

Aims of the Chapter

This chapter aims to describe the quasi-experimental evaluation of the Cycle to Work psychological intervention. Perceived benefits and barriers, self-efficacy, stage of change and processes of change are examined at three time phases over a five-month period. The intervention and control groups are used to identify any significant positive changes in cognitions and behaviours that occurred as a consequence of the intervention.

9.1 Introduction

The previous chapter discussed the planning and development processes involved in creating the Cycle to Work intervention, which has been designed to encourage cycle commuting in workplace settings. The present chapter documents the intervention evaluation trial that was carried out to establish whether or not the intervention was successful at encouraging cycling to work in a large organisation. The literature discussed in the thesis so far has paved the way for the Cycle to Work intervention study to be developed and trialled. As a preamble to the intervention evaluation, the main messages embedded in the thesis are synthesized below.

9.1.1 The Story so Far

Within the UK approximately 2% of people cycle to work (Department for Transport, 2007; Scottish Executive, 2009b). Currently in Scotland only 33% of women and 45% of men meet the current recommendations of 30 minutes of moderate physical activity on most days of the week (Scottish Government, 2009). Physical inactivity is associated with numerous health problems such as CHD, obesity, type II diabetes, some cancers and depression (Scottish Executive, 2003). There is evidence to suggest that regular cycle commuting can be beneficial for health and fitness levels (Andersen et al., 2000; de Geus et al., 2008; Hendriksen et al., 2000; Oja et al., 1998). Whilst there are some

risks associated with cycling, overall, at a public health level, positive behaviour shifts towards cycle commuting would translate into health benefits that would far outweigh any risks related to injury and pollution exposure (de Hartog et al., 2010; Hillman, 1992). In the last two decades, both transport and health policies have increasingly focussed on supporting the uptake of cycling as a form of transport due to associated individual and societal benefits.

Evidence suggests there are a whole host of factors stemming from individual, social and environmental levels that impact on cycling behaviour (Heinen et al., 2010; Giles-Corti & Donavon 2002). Currently in the field of active travel there is a strong drive towards ecological theories, which often focus on the wider environmental factors that influence cycling. However, psychological factors have also been found to play an important role in cycle commuting (Heinen et al., 2010) with some studies finding psychological factors to be more predictive than environmental ones (de Geus et al., 2008; Lemieux & Godin, 2009). To date, there has been limited psychological research carried out into cycle commuting.

As there is no one dominant social cognition or behaviour change theory that has been applied to cycling research, this thesis considered and critiqued a number of relevant social cognition and behavioural theories, and psychological variables. The Transtheoretical Model of Behaviour Change (TTM) and the Theory of Planned Behaviour (TPB) have been used in some instances but most commonly research has focussed on understanding the influence of variables such as motivations and barriers. Initially, an exploratory qualitative study (Study 1, Chapter 4) was carried out in a cycle-friendly workplace to gain a deeper understanding of the social cognitions that influence cycle commuting behaviour. The findings indicated that cycling is a complex and effortful behaviour. Potential cyclists were less aware of the range of benefits associated with cycling to work, and discussed more barriers and fewer coping strategies than regular and experienced cycle commuters. Coping strategies were understood as processes that facilitated change. Whilst the study was inductive in nature, the findings

suggest that social cognitive variables involved in cycle commuting behaviour (benefits, barriers and coping strategies) could be aligned with a number of social cognitive and behaviour change theories.

The second and third studies (Chapters 5 and 6) were similar in design and used cross-sectional questionnaires to further investigate social cognitions associated with cycle commuting behaviour in relation to stage of change, gender and job role. Both investigations were carried out in workplaces that supported cycling. The second study (Chapter 5) focussed on investigating potential barriers to cycle commuting. The findings highlighted the important role that perceptions of barriers play in cycle commuting behaviour and the subjective element involved. Study 3 built on the previous two studies' findings and examined social cognitive variables encompassed in the TTM, benefits, barriers and self-efficacy. The findings indicated that perceived barriers and benefits, and self-efficacy associated with cycle commuting were all significant predictors of cycle commuting behaviour, with barriers being the most powerful.

Reviewing the intervention literature, only three psychological interventions designed to increase cycle commuting in a workplace setting were identified (Gatersleben & Appleton, 2007; Mutrie et al., 2002; Wen et al., 2005). These studies showed inconclusive results, which were largely attributed to methodological issues and lack of specificity as opposed to the efficacy of such an intervention *per se*. The workplace has been identified as an important setting for promoting cycle commuting that is under-researched (Hosking, Macmillan, Connor, Bullen & Ameratunga 2010; National Institute for Health and Clinical Excellence, 2008b; Yang et al., 2010). More general psychological/educational cycle promotion interventions have been found to have modest effects at increasing cycling behaviour (Ogilvie et al., 2004; Yang et al., 2010). Evidence reviews suggest that multi-component interventions that integrate numerous differing interventions together will have a greater impact on cycle promotion than individual interventions alone. It was decided that there was enough evidence to suggest that it would be feasible to develop and test a psychological intervention specifically

focussed on encouraging cycle commuting in a workplace setting, which could be integrated into a larger cycle promotion scheme. This study is novel as it is the first study of its kind to trial a psychological intervention specifically designed to promote cycle commuting in a supportive workplace setting using a quantitative evaluation.

9.1.2 The Present Study

The purpose of carrying out this evaluation study was to establish if a psychological intervention based on the TTM could encourage cycle commuting within a workplace setting. The intervention targeted those interested in taking up cycle commuting (precontemplators with interest and contemplators) and those who were irregularly cycling to work (preparers). Selected employees in a large-sized workplace were invited to take part in the Cycle to Work intervention, which involved a one hour lunchtime workshop, comprising two psychological exercises (see Figures 8.5 and 8.6) and a DVD. Participants were also given a complementary booklet (see appendix E) at the end of the workshop containing written material that was covered in the workshop and an optional psychological exercise. The intervention materials (exercises, DVD and workbook) included sections on increasing awareness of the benefits of cycling, overcoming challenges, developing self-efficacy and encouraging the use of some of the processes of change within the TTM (e.g. increasing knowledge, substituting alternatives and reminding oneself), and other areas suggested by previous research (e.g. coping strategies such as preparation and planning, and learning about ways to cycle safely).

In line with the intervention aims outlined in Chapter 8 (see Figure 8.2), a set of predictions were established for the intervention evaluation. It was predicted that:

1. The intervention will progress individuals to the next stage of change
2. The intervention will increase individuals' perceptions of the benefits associated with cycle commuting.
3. The intervention will decrease individuals' perceptions of barriers associated with cycle commuting.

4. The intervention will increase individuals' self-efficacy associated with cycle commuting.
5. The intervention will increase individuals' use of some of the processes of change such as increasing knowledge, substituting alternatives and reminding oneself.

9.2 Methods

9.2.1 Design and Procedures

The evaluation of the Cycle to Work intervention study comprised a quasi-experimental design involving a pre-intervention, post-intervention, controlled trial (see Figure 9.1). The intervention was held in a large-sized public sector organisation across two sites based in Edinburgh (site A and site B). Three workshops were organised to run in mid-April, two at site A and one at site B. Initially, it was planned that an advertisement for the study, including a link to the on-line pre-intervention questionnaire, would be published on the organisation's internal internet system in late January. However, due to constraints later posed by the organisation the recruitment of participants was carried out internally by the host organisation, which limited the study's reach. Prior to the onset of the study ethical approval was granted by the Moray House Ethics Committee within the University of Edinburgh (see appendix E).

The relevant stage of change information that formed the criteria for participants (see Figure 5.1) was provided to the host organisation and using existing in-house travel and sustainability survey data, potential participants were identified. The participants invited to take part in the workshop were provided with an information sheet, which covered all of the information necessary for informed consent (see appendix E). Those willing to take part in the study but who were unable to attend one of the workshop dates were assigned to the control group and the remaining individuals who volunteered to take part were assigned to either a workshop group or the control group. The original plan was for the control group to be a delayed control, receiving the intervention at a later date but it was decided by the host organisation that the control group would not receive the intervention at a later point. However, core aspects of the intervention material were

made accessible to all participants after the trial had been carried out via the Cycling Scotland website.

Three electronic questionnaires were administered during the study via staff email addresses. One week prior to the workshops, all participants were sent, and filled out, a baseline questionnaire. Immediately after the workshops had been run (on the same day) a follow up questionnaire was distributed. The final follow-up questionnaire was distributed three months after the workshops had been run. Due to existing confidentiality contracts between participants and their employer, the questionnaires were distributed using the host organisation's own survey software. The questionnaire data was collected and anonymised by their in-house research unit prior to being made available for this study.

9.2.2 Participants

Power calculations carried out suggest that, with a medium effect size ($\eta p^2 = 0.6$) alpha = 0.05 and Power =0.8, a minimum sample of 34 participants overall is required to identify between group interactions and within group differences. In total, 34 participants took part in the study (intervention, n = 17, control, n = 17) from two cycle-friendly worksites. These participants comprised precontemplators with intention (n = 18), contemplators (n =11) and preparers (n = 5). During the course of the intervention evaluation the study lost four participants, leaving a total of 30 at the final follow-up stage. Whilst the sample size fell below the recommended power calculations, general guidelines for psychological statistics suggest that it is valid to carry out inferential statistics on a minimum sample of 12 participants per group (Greene & D'Oliveirs, 1982). The 30 participants that completed the study ranged from 21 to 60 years old, comprising 17 males and 13 females. Participants varied in their job role and the distance that they lived from the workplace (ranging from below one mile to over 20 miles). Those living longer distances away were intending to cycle only part of their

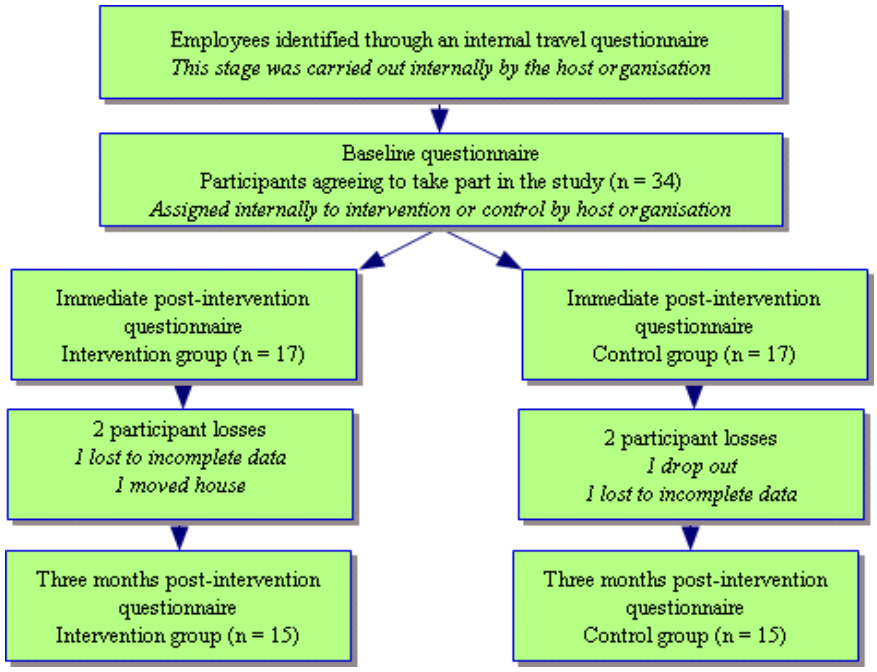
journey to work. The two chosen sites provided the necessary facilities to support cycle commuting such as access to secure cycle storage, showers and changing facilities.

9.2.3 Questionnaires

A Cycle to Work questionnaire was developed based on exiting measures (as discussed in Chapter 8) and measured demographic variables and perceived benefits and barriers, self-efficacy and stage of change related to cycle commuting (Marcus et al., 1992c; Mutrie et al., 2002), and the processes of change (Marcus et al., 1992b). The measures relating to perceived barriers, perceived benefits and self-efficacy were all tested for reliability using Cronbach's alpha tests in Study 3 (Chapter 6), which indicated high internal consistency between the sub-scales of questions used (see Table 6.1). Following protocol from Study 3 (Chapter 6), the precontemplator category in the stage of change question was split into two groups, those with no intention to cycle commute and those with an interest. A set of 12 sub-questions was used to measure benefits, 15 sub-questions were used to measure barriers, five questions were used to measure self-efficacy and only one question was used to measure stage of change. The 10 processes of change comprised four sub-questions each, equalling 40 sub-questions in total.

The main body of the questionnaire was tested previously for reliability and face validity prior to use in this intervention study (see Chapter 6). The full questionnaire was disseminated at baseline prior to the intervention (see appendix E) and three months after the intervention with minor adaptations (see appendix E) to look for any change in social cognitions, behaviours and change processes that may have occurred over time. A shortened version of the questionnaire (that omitted the processes of change questions) was administered immediately after the intervention to look for any immediate changes in social cognitions that may have come about as a result of the intervention (see appendix E).

Figure 9.1: Flow of participants throughout the intervention trial



9.2.4 Statistical Analyses

Statistical analyses were carried out using the software package SPSS Statistics 17. Two way mixed model ANOVAs were used to identify any differences in pre- to post-intervention changes between groups for all variables examined. As the sample size dropped slightly below the minimum number of participants outlined in the power calculation it was deemed suitable to carry out further exploratory statistics. This was done to help diminish the possibility of type two errors occurring, which can result from studying too few participants. Therefore, one-way repeated ANOVAs were used to measure the variables in relation to each group separately (within subjects) over the time phases. Independent t-tests were used to look for any differences that may exist between the groups (between subjects) at each time phase.

9.3 Results

9.3.1 Demographics

Table 9.1 displays stage of change, gender, age, job category and distance variables in relation to the intervention group and control group at the baseline of the study. The majority of participants were either precontemplators with interest or contemplators (84%). There was a relatively even spread between males (57%) and females (43%) within and between the groups. Most commonly, participants were working as line managers (63%) and lived between two and five miles away from the workplace (60%). Chi Squared tests were carried out for all demographic variables in relation to the intervention and control groups and revealed no significant differences.

Table 9.1: Demographic variables displayed by intervention group at baseline (n = 30)

Demographic variables	Control group % (n)	Intervention group % (n)	Total % (n)
Stage of Change			
Precontemplation with interest	40% (6)	73% (11)	57% (17)
Contemplation	40% (6)	13% (2)	27% (8)
Preparation	20% (3)	13% (2)	17% (5)
Gender			
Male	60% (9)	40% (6)	57% (17)
Female	53% (8)	47% (8)	43% (13)
Age			
21-30 years	7% (1)	7% (1)	7% (2)
31-40 years	20% (3)	60% (9)	40% (12)
41-50 years	53% (8)	27% (4)	40% (12)
51-60 years	20% (3)	7% (1)	13 (4)
Job Category			
Band A	13% (2)	7% (1)	10% (3)
Band B	47% (7)	80% (12)	63% (19)
Band C	35% (6)	13% (2)	27% (8)
Distance			
0-1 mile	0% (0)	7% (1)	3% (1)
1-2 miles	0% (0)	0% (0)	0% (0)
2-5 miles	60% (9)	60% (9)	60% (18)
5-10 miles	7% (1)	13% (2)	10% (3)
10-20 miles	13% (2)	13% (2)	13% (4)
20 miles +	20% (3)	7% (1)	13% (4)

Note. Band A = administrative staff, Band B = line managers, Band C = head of division.

9.3.2 Stage of change

A two-way ANOVA with repeated measures showed no main effect of intervention versus control group (F (1, 28) = 0.137, $p = 0.714$, $\eta p^2 = 0.00$); a main effect of pre- to post-intervention change (F (2, 27) = 6.334, $p = 0.006$, $\eta p^2 = 0.32$); and no interaction between group and pre- to post-intervention change (F (2, 27) = 2.983, $p = 0.068$, $\eta p^2 = 0.18$). Subsequent one-way repeated measures ANOVAs (see Table 9.2) revealed that the intervention group significantly progressed their stage of change score (F (2, 19) = 7.27, $p = 0.019$, $\eta p^2 = 0.29$), with a large effect size. Post-hoc tests revealed significant changes evident between baseline and immediate post-intervention, and between baseline and three-month post-intervention scores. A closer look at the pre- and three months post-intervention mean scores for the interventions group revealed that in 40% of the cases behaviour change took place, as indicated by progression to a preparation or action stage (see Figure 9.2). There were no significant shifts in stages of change for the control group. Independent t-tests for stage of change and group showed no significant differences between intervention and control group at any time-phase.

Table 9.2: Control and experimental group: Differences in perceived benefits, barriers, self-efficacy and stage scores, pre-intervention and post-intervention

Predictor variables	Phase 1 mean (SD)	Phase 2 mean (SD)	Phase 3 mean (SD)	Df	F	*p*	Post hoc	ηp^2
Control group								
Benefits	3.18 (0.71)	3.19 (0.26)	3.04 (0.47)	2, 28	0.638	0.536		0.00
Barriers	2.50 (0.94)	2.51 (0.77)	2.47 (0.63)	2, 20	0.025[a]	0936		0.00
Self-efficacy	2.16 (0.52)	2.03 (0.62)	2.00 (0.65)	2, 20	0.746[a]	0.455		0.07
Stage of change	2.80 (0.78)	2.80 (1.26)	3.13 (1.36)	2, 28	0.854	0.437		0.06
Intervention group								
Benefits	3.39 (0.78)	3.32 (0.80)	3.13 (0.72)	2, 28	1.277	0.295		0.08
Barriers	2.57 (0.54)	2.27 (0.46)	2.31 (0.50)	2, 28	5.99*	0.007	S1 & S2 S1 & S3	0.30
Self-efficacy	2.00 (0.59)	2.04 (0.54)	1.96 (0.73)	2, 28	0.231	0.795		0.02
Stage of change	2.40 (0.74)	3.13 (0.99)	3.53 (1.25)	2, 19	7.27[a]*	0.019	S1 & S2 S1 & S3	0.29

Note. Phase 1 = baseline data, Phase 2 = immediate post-intervention data, Phase 3 = three month post-intervention data, df = degrees of freedom, F = ANOVA score, *p* = significance level, ηp^2 = partial eta squared (effect size), * ≤ 0.05, ** ≤ 0.01, [2] = Sphericity has been violated ($p = \leq 0.05$) so the Huynh-Feldt test score has been used instead, Post hoc = Tukey or Bonferroni test (dependent on sphericity) with a significance value set at $p \leq 0.05$.

Table 9.3: Pre- and post-intervention stage progression reported by the intervention group

Participant	Phase 1 (baseline)	Phase 3 (three months post intervention)	Stage Movement
1	Precontemplation with interest	Contemplation	+1
2	Contemplation	**Action**	+2
3	Precontemplation with interest	Precontemplation with interest	0
4	Precontemplation with interest	Precontemplation with interest	0
5	Precontemplation with interest	Precontemplation with interest	0
6	Precontemplation with interest	Contemplation	+1
7	Precontemplation with interest	Precontemplation with interest	0
8	Precontemplation with interest	**Action**	+3
9	Precontemplation with interest	**Action**	+3
10	Precontemplation with interest	Contemplation	+1
11	Preparation	Preparation	0
12	Precontemplation with interest	Contemplation	+1
13	Precontemplation with interest	**Action**	+3
14	Contemplation	**Preparation**	+1
15	Preparation	**Action**	+1

Note. Phase 1 = baseline data, Phase 3 = three month post-intervention

9.3.3 Benefits, Barriers and Self-efficacy

For benefits, barriers and self-efficacy, composite scores were created from the sets of questions for each variable. These composite measures have been previously tested, showing strong internal consistency (see Study 3, Chapter 6). Two-way ANOVAs with repeated measures showed no main effect of intervention versus control group for benefits (F (1, 29) = 0.79, p = 0.381, ηp^2 = 0.03), for barriers (F (1, 29) = 0.01, p = 0.924, ηp^2 = 0.00) and for self-efficacy (F (1, 29) = 0.13, p = 0.725 ηp^2, = 0.00); no main effect of pre- to post-intervention change for benefits (F 2, 28) = 1.31, p = 0.285, ηp^2 = 0.09), for barriers (F (2, 28) = 1.17, p = 0.324, ηp^2 = 0.08) and for self-efficacy (F (2, 28) = 0.13, p = 0.875, ηp^2 = 0.01), and no interaction between group and pre- to post-intervention change for benefits (F (2, 28) = 0.28, p = 0.761, ηp^2 = 0.02), for barriers (F (2, 28) = 0.55 p = 0.585, ηp^2 = 0.04) and for self-efficacy (F (2, 28) = 0.45, p = 0.640, ηp^2 = 0.03).

Subsequent one-way repeated measures ANOVAs (see Table 9.2), revealed the intervention group significantly reduced their perception of barriers over time (F (1, 28) = 5.99, p = 0.007, ηp^2 = 0.30), with a large effect size. A post-hoc test revealed significant reduction in perceived barriers in the intervention group between baseline and immediate post-intervention, and between baseline and three-month post-intervention. Repeated measures ANOVAs were carried out on each barrier sub-question that makes up the composite score to try and identify if any specific barriers were most amenable to change. However, no one barrier revealed significant differences across time. As shown in Table 9.2, there were no significant differences within the intervention group for either perceived benefits or self-efficacy and no significant differences within the control group for any of the social cognitions (for benefits, barriers or self-efficacy) over any of the time phases. Independent t-tests for each social cognition (benefits, barriers and self-efficacy) and group showed no significant differences between intervention and control group at any time-phase.

9.3.4 Processes of change

For processes of change, composite scores were created from the sets of questions for each variable. Two-way ANOVAs with repeated measures were carried out on all 10 processes of change. Only two processes of change, namely increasing knowledge and rewarding oneself, revealed any significance. Increasing knowledge showed no main effect of intervention versus control group (F (1, 27) = 0.45, p = 0.510, ηp^2 = 0.02); no main effect of pre- to post-intervention change (F (1, 27) = 0.66, p = 0.424, ηp^2 = 0.02); and an interaction between group and pre- to post-intervention change (F (1, 27) = 6.22, p = 0.019, ηp^2 = 0.19). Rewarding oneself showed no main effect of intervention versus control group (F (1, 26) = 0.00, p = 0.948, ηp^2 = 0.00); a main effect of pre- to post-intervention change (F (1, 26) = 8.23, p = 0.008, ηp^2 = 0.24); and no interaction between group and pre- to post-intervention change (F (1, 26) = 0.35, p = 0.560, ηp^2 = 0.01).

Subsequent one-way repeated measures ANOVAs (see Table 9.3) revealed significant increases in three of the processes of change for the intervention group between baseline

and three month post-intervention data: increasing knowledge (F (1, 13) = 5.28, p = 0.039, ηp^2 = 0.29); increasing healthy opportunities (F (1, 14) = 39.74, p <0.001, ηp^2 = 0.75); and enlisting social support (F (1, 12) = 6.31, p = 0.027, ηp^2 = 0.35). All three processes of change show large effect sizes. As shown in Table 9.3, there were no significance changes in any of the 10 processes of change for the control group. Independent t-tests showed that there were no significant differences in processes of change between intervention and control group at either baseline or 3 month follow-up.

Table 9.4: Control and experimental group: Differences in processes of change scores, pre-intervention and post-intervention

Predictor variables	Pre-test mean (SD)	Post-test 2 mean (SD)	df	F	p	ηp^2
Control group						
Increasing knowledge	2.37 (0.62)	2.10 (0.73)	1, 14	1.466	0.246	0.10
Being aware of risks	2.13 (0.83)	2.27 (1.02)	1, 14	2.221	0.645	0.02
Caring about consequences	2.05 (0.77)	2.05 (0.81)	1, 14	0.000	1.000	0.00
Comprehending benefits	2.55 (0.77)	2.61 (0.79)	1, 14	0.483	0.829	0.00
Increasing healthy opportunities	2.80 (0.92)	2.75 (0.80)	1, 14	0.034	0.856	0.00
Substituting alternatives	1.95 (1.21)	2.25 (1.31)	1, 14	0.737	0.405	0.05
Enlisting social support	1.75 (0.86)	1.80 (0.73)	1, 14	0.019	0.873	0.00
Rewarding oneself	1.58 (0.96)	1.90 (1.06)	1, 14	0.752	0.083	0.12
Committing oneself	2.73 (0.92)	2.91 (0.91)	1, 14	0.222	0.558	0.03
Reminding oneself	1.59 (0.76)	1.53 (0.55)	1, 14	0.222	0.755	0.01
Intervention group						
Increasing knowledge	2.16 (0.94)	2.69 (1.14)	1, 13	5.276*	0.039	0.29
Being aware of risks	2.28 (1.09)	2.35 (0.80)	1, 13	0.934	0.765	0.01
Caring about consequences	2.16 (1.09)	2.22 (1.01)	1, 13	0.039	0.847	0.00
Comprehending benefits	2.60 (0.99)	2.65 (0.95)	1, 14	0.561	0.816	0.00
Increasing healthy opportunities	2.79 (0.92)	3.33 (0.99)	1, 13	39.739**	<0.001	0.75
Substituting alternatives	1.58 (0.96)	2.17 (1.17)	1, 14	3.877	0.069	0.22
Enlisting social support	1.64 (0.73)	2.06 (1.07)	1, 12	6.313*	0.027	0.35
Rewarding oneself	1.48 (0.47)	1.96 (0.96)	1, 12	4.545	0.054	0.28
Committing oneself	2.64 (0.85)	3.00 (1.25)	1, 14	2..312	0.151	0.14
Reminding oneself	1.30 (0.49)	1.75 (1.21)	1,14	2.023	0.177	0.13

Note. Pre-intervention Phase 1 = baseline data, post-intervention Phase 2 = immediate post-intervention data, post-intervention Phase 3 = three month post-intervention data, df = degrees of freedom, F = ANOVA score, p = significance level, * ≤ 0.05, ** ≤ 0.01, ηp^2= partial eta squared (effect size).

9.4 Discussion

This chapter set out to investigate whether the Cycle to Work intervention based on the TTM, was able to encourage cycle commuting in a cycle-friendly workplace. Although the number of participants was relatively small for a study of this nature, the evaluation indicates that the intervention was successful at encouraging cycle commuting in terms of both attitudinal and behavioural change. The pre- and post-intervention findings revealed that on average individuals who had participated in the intervention progressed to the next stage of change, decreased their perception of barriers and increased their use in some of the processes of change. The findings support three out of five of the research predictions (see Section 9.1.2). The stage progression resulted in 40% (n = 6) of the intervention group increasing their cycle commuting behaviour (see Figure 9.2). Whilst the workshop contained materials aimed to enhance perceptions of benefits and self-efficacy associated with cycle commuting, these social cognitions were not influenced by the intervention immediately after or three months post-intervention. These findings reject the remaining two research predictions (see Section 9.1.2).

9.4.1 Immediate Changes

The findings indicate that the workshop promoted an immediate reduction in perceptions of barriers. There was also an immediate change evident in the intervention participants' reported stage of change towards cycle commuting, indicating that the decrease in perceptions of barriers may have positively influenced people's intentions to cycle to work. The overall decrease in perceptions of barriers was relatively small suggesting that even small changes can have a significant impact on stage progression. The important role that barriers play in promoting cycle commuting was also found in Study 3 (Chapter 6), indicating that people with reduced perceptions of barriers are over 15 times more likely to cycle to work than those who perceive higher barriers. Interestingly, there were no individual barriers identified as being significantly influential in the overall composite score used within the study to assess perceptions of barriers associated with cycle commuting. Therefore this indicates that the reduction in perceptions of barriers post workshop stems from a culmination of incremental small decreases in perceptions

of many barriers. This result is supported by findings from Study 1 (Chapter 4), which through qualitative enquiry documented the complex nature of cycling behaviour and the need to negotiate an array of potential barriers.

This thesis acknowledges that environmental factors play a role in influencing cycle commuting behaviour. However, the present study has found that perceptions of barriers can be significantly reduced by means of psychological intervention alone over a short period of time, within a supportive workplace setting. The immediate decrease reported in perceptions of barriers after participants had attended the workshop highlights the existence of a subjective psychological element involved in the formation of perceptions of barriers associated with cycle commuting. This supports the perspective that both subjective and objective barriers play an influential role in cycling behaviour (Cavil & Davis, 2007) and more generally, in physical activity participation (Sallis & Owen, 1999). Study 2 (Chapter 5) also supports the existence of a subjective psychological component involved in the perception of barriers. For instance, it was found that precontemplators hold significantly more negative perceptions than maintainers about bad weather, which objectively is not likely to differ among participants of the research.

Whilst the workshop material was designed to increase awareness of benefits, decrease perceptions of barriers, develop self-efficacy associated with cycle commuting and promote the use of some processes of change, there was no evident change in participant's perceptions of benefits or self-efficacy. This was unexpected as Study 3 (Chapter 6) and similar studies of this nature (De Geus et al., 2008; Gatersleben & Appleton, 2007) have found some benefits and self-efficacy scores to be higher in cyclists than non-cyclists. However, both Crawford et al., (2001) and Gatersleben & Appleton, (2007) found that individuals were universally aware of the health benefits incurred by cycling regardless of their stage of change. Therefore, it may be the case that most people are already aware of the associated positive health impacts and providing information on benefits related to cycling is unnecessary. Another possible explanation, as found in Study 1, is that the more immediate benefits of cycling such as providing

relaxation, flexibility, speed and enjoyment may only be realised through building up actual experience of cycling itself as opposed to psychological intervention alone. It was also found in Study 1 that people who regularly experience cycling to work were more confident than those considering cycling, therefore, self-efficacy may also be something that develops with cycling experience.

9.4.2 Longer-term Changes

Three months after the intervention had been carried out the decrease in perceptions of barriers that had occurred immediately after the workshop was still evident, indicating that a longer-term stable change in social cognitions has been achieved. It was also evident that the intervention group individuals continued progressing in their stage of change related to cycle commuting over the three-month period post-intervention. This continued change coincided with increases in three processes of change (increasing knowledge, increasing healthy opportunities, and enlisting social support), suggesting that these processes of change may be instrumental in promoting cycle commuting.

The ten processes of change within the TTM describe specific processes that help to progress individuals from one stage to the next (Biddle & Mutrie, 2001; Marcus & Forsyth, 2003). The change process of increasing knowledge relates to individual efforts to find out information, gain feedback, and to develop an understanding and awareness about cycle commuting. The change process of increasing healthy opportunities pertains to increasing awareness of the available support and encouragement regarding cycle commuting that stems from individuals, organisations and society. Finally, the change process of enlisting social support refers to trusting and accepting support from others during attempts to change behaviours to cycle commuting. These three processes of change align with some of the coping strategies discussed by potential cyclists in Study 1 (Chapter 4) such as seeking information from colleagues and from the internet thus, adding support to the relevance of these change processes in relation to cycle commuting. The most significant increase in changes process was found for increasing

healthy opportunities, which attending the workshop in itself may have contributed to. Additionally, workshop exercises and information provided to participants about the workplace cycle resources may have facilitated this change process further.

Whilst the control group reported no significant changes in any of the measured variables, there was a small and insignificant increase in their average stage of change score evident at the final three months post-intervention phase. As the study was held from April to August, it is possible that a slight seasonal effect may have occurred. Additionally, there were other incentives such as the tax exemption scheme for purchasing a commuting bike and other cycle promotion events such as the cycle commuting training courses running during the time that the intervention was carried out. In light of the seasonal improvements and the additional cycle promotion programs running at the workplace it would seem reasonable to expect some progression in stage of change to occur within the control group. What is of interest is that such little change appears to have occurred in these favourable conditions. As the sample group within this study is relatively small it would be difficult to draw any conclusions about the entire workplace population. However, this finding does raise concerns about the challenges of effectively promoting cycling as a viable mode for commuting to work without the element of a psychological intervention.

9.4.3 Theoretical Implications

The TTM has been recommended as a suitable theory for active travel and physical activity promotion interventions (Kiloran et al., 2006; Mutrie, et al., 2002). Study 3 (Chapter 6) also supported the use of the TTM within cycle commuting promotion. However, the present study has found that only decreases in perceptions of barriers and three processes of change are likely to have had a positive impact on stage progression related to cycle commuting. Therefore, recommended psychological exercises such as the decisional balance, designed to enhance motivation, may not be appropriate for tailored interventions aimed at people who already have an interest in cycle commuting.

Additionally, the processes of change identified in the present study, that are understood to further promote stage progression differed from the processes of change commonly understood to be used in physical activity stage progression (Biddle & Mutrie, 2001). Intervention strategies for promoting physical activity based on the TTM encourage the use of increasing knowledge and being aware of risks to progress individuals from precontemplation to contemplation. Moreover, comprehending benefits is suggested to help progress individuals from contemplation to preparation (Biddle & Mutrie, 2001). Out of these three processes of change associated with physical activity, the present study found that only one, increasing knowledge, was instrumental in the context of cycle commuting. Findings from Study 1 (Chapter 4) indicate that there are a number of change processes underpinning cycling behaviour that are not found in the ten processes of change to feature in the TTM. Therefore, the applicability of the current TTM processes of change to cycle commuting behaviour should be questioned. Mutrie et al., (2002) support this sentiment, suggesting that further research is needed to investigate the underlying processes of change that influence the adoption of active travel.

The potentially important role that psychological interventions focussing on reducing perceptions of barriers has on stage progression versus the potentially insignificant role that psychological intervention focussing on increasing awareness of benefits appears to have on stage progression also throws the concept of decisional balance into question. The unequal weighting attributed to perceived benefits and barriers associated with cycle commuting and the differences found in the use of processes of change between promoting general physical activity and cycle commuting highlight the importance of understanding the idiosyncrasies involved in various forms of physical activity. Although in this study the TTM was able to shed light some of the variables that influence cycle commuting intentions and behaviours, other variables were redundant.

9.4.4 Practical Implications

In the context of practice the RE-AIM model (discussed in Chapters 7 and 8) has been briefly revisited to highlight some of the tensions that existed between adhering to scientific principle and operating in practice. Whilst the host organisation involved in the present study made substantial efforts to facilitate a robust research design for the Cycle to Work intervention, workplace policies reduced aspects of reach and efficacy by impeding a mass recruitment strategy and randomisation of participants. Taking on board the recommendations to come from systematic reviews in this field, for stronger research designs, it would seem that carrying out a randomised control trial in a practice setting is a huge challenge. From the experience gained from carrying out the present intervention study, securing strong support from key figureheads within host organisations is recommended.

The evidence to come from this study indicates that psychological interventions targeting motivated sub-groups in supportive workplaces that focus on reducing perceptions of barriers, and relevant processes of change (increasing knowledge, increasing healthy opportunities and enlisting social support) have scope to encourage individuals to start cycling to work. On a more general level this study exemplifies the importance of tailoring interventions to very specific behaviour types. The present study also indicates that if we are to effectively promote cycling we still have a lot to learn about cycling behaviour and the processes that underpin it. As this study was only small-scale, the Cycle to Work intervention needs to be tested in larger populations, in differing settings in order to demonstrate more generalisable findings. Additionally, carrying out the study over a longer time-frame would help to identify the longevity of the changes that result from the intervention.

9.4.4 Limitations

The findings to come from this study solely relied on self-report questionnaires, with no objective measures in place. Whilst the study had a strong design including pre- and post-intervention measures, and a control group, it would have been strengthened if

there had been scope to randomise the participants. The questionnaire lacked detailed measures of cycle commuting behaviour and measures of physical activity and health. Whilst these were more distal indicators of the intervention they would have provided valuable information. As this study was conducted in a cycle-friendly workplace, the findings are contingent on the supportive pro-cycling environment in which the intervention was carried out. The present study revealed no significant differences between control and intervention participants indicating that the increases in stage of change found in the intervention group were not significantly different form the control group *per se*. However, in such a small sample it is promising that significant changes occurred across time-phases for the intervention group in terms of stage progression and reductions in perceptions of barriers, which yielded large effect sizes.

9.5 Chapter Summary and Conclusions

This chapter has reported the evaluation of the Cycle to Work intervention. The purpose of the study was to establish if a psychosocial intervention based on the TTM could encourage motivated individuals to cycle to work in a supportive workplace setting. The intervention comprised a one hour lunchtime workshop that included a DVD, two psychological exercises and an information booklet. The evaluation took the form of a quasi-experimental, pre-intervention, post-intervention controlled trial, which included three time phases for data collection. The study was carried out at two Edinburgh-based sites of a large-sized workplace. In total, 34 participants took part in the study comprising 18 precontemplators with interest, 11 contemplators and five preparers. During the course of the Study 4 participants were lost to follow up. A questionnaire was used as the sole method of data collection. The outcome measures were: perceived benefits, perceived barriers, self-efficacy, stages of change and processes of change.

The study found that whilst there were no significant interactions reported between the control group and the intervention group, the intervention group did report significant positive cognitive, and in some cases behavioural changes, between pre- and post-

intervention phases, thus indicating that the intervention has been successful at encouraging cycle commuting. The intervention group reported significant decreases in perceptions of barrier and stage progression at the immediate post-intervention phase. The significant decrease in perceptions of barriers was still evident at the three month post-intervention phase. Stage progression continued to increase during this period and participants also reported increases relating to three change processes: increasing knowledge, increasing healthy opportunities and enlisting social support. No increases in either perceived benefits or self-efficacy were reported at any phase.

The findings to come from this study have both theoretical and practical implications. Theoretically the TTM may only be partially applicable in the context of cycle commuting behaviour. In this study, the unequal weighting attributed to perceived benefits and barriers throws the concept of the decisional balance into question. Additionally, the 10 processes of change associated with the TTM may not be best suited to understanding cycle commuting behaviour. On a practical level, the present study exemplified some of the difficulties of carrying out research in a real world setting and the tensions that exist between adhering to scientific principles and operating in practice. Practical implications to come from the findings are that using psychological intervention that focuses on barrier reduction and promotes the use of change processes such as increasing knowledge and health opportunities and enlisting social support have scope to be an effective and low cost means of increasing cycle commuting. More generally, the study has highlighted the importance of understanding the idiosyncrasies of specific behaviours and tailoring psychological interventions accordingly.

The following chapter (Chapter 10) synthesises and discusses the implications of the findings that have been reported within the four empirical studies documented in this thesis (Chapter 4, 5, 6 and 9). The aim of the subsequent chapter is not to replicate previous discussions but rather to provide a more complete overall picture of what we have learnt about the psychological factors under investigation in relation to cycle commuting behaviour.

Chapter 10
General Discussion and Conclusions

Aims of the Chapter

The aim of this chapter is to provide an overarching discussion of the collective findings from the four studies that have been presented in Chapters 4, 5, 6 and 9 of this thesis. This chapter initially synthesises the key empirical findings that have emerged from this thesis highlighting aspects of novel data and, where relevant, making links to existing literature. After which, theoretical, practice and policy implications are discussed along with directions for future research and the weaknesses and limitations of this thesis.

10.1 Introduction

To date there is little research that has looked in any detail at the psychological dimensions of cycle commuting behaviour. Therefore, the purpose of this thesis was to gain a deeper understanding of some of the key psychological factors that affect adult cycle commuting behaviour and to investigate if psychological intervention has scope to effectively encourage cycle commuting. This was achieved through a series of empirical studies using exploratory qualitative interviews and cross-sectional questionnaires, which informed the development and quasi-experimental trial of the Cycle to Work intervention targeting motivated employees.

As acknowledged previously, health behaviours can be explained most comprehensively by taking into account individual, social and environmental factors. Therefore, the findings from this thesis do not claim to present a complete picture of cycle commuting behaviour, rather they provide valuable insight into the psychological dimensions of cycle commuting. It is not possible to examine psychological factors in complete isolation but in an attempt to reduce social and environmental constraints, and to more

effectively target cycle-related cognitions, all four studies undertaken were carried out in cycle-friendly workplaces in central, easily accessed, areas of Edinburgh.

10.2 Synthesis of Findings

Looking collectively at the results to come from the four empirical studies, perceived benefits, perceived barriers, self-efficacy, and change processes have all been found to play an influential role in cycle commuting behaviour. Whilst not all of the results from each study were wholly consistent, there are some strong messages that can be taken away from this thesis. Within this section, the psychological concepts listed above are separately addressed by first discussing their role within psychological discourse followed by a summary of the key findings.

10.2.1 Perceived Benefits

The concept of perceived benefits aligns broadly with motivation. Perceived benefits together with perceived barriers form the composite variables of attitude, outcome expectancy, and decisional balance, found within social cognition and behaviour change theories. From a social-cognitive perspective, perceptions of benefits are a function of both beliefs and values towards a specific behaviour (Ajzen & Fishbein, 1980). Perceived benefits equate to 'why' people take human action (Biddle & Mutrie, 2001, 2008). The commonly held theoretical premise is that as people's perceptions of benefits towards a specific behaviour increases so do their intentions to initiate that behaviour. Within transport literature, benefits can be understood as instrumental (e.g. cost and time efficiency) or affective (e.g. relaxation and enjoyment) (Anable & Gatersleben, 2005). This thesis and other research have found that both instrumental and affective benefits can be gained from cycling as a form of transport (Daley, et al., 2007; Davies, et al., 1997; Garrard, et al., 2006).

The findings from this thesis provide evidence that increases in perceptions of benefits positively influence behaviour change with regard to cycle commuting behaviour. This

has been found previously by Gatersleben & Appleton (2007) who showed that positive attitudes increase incrementally as individuals' progress through the stages of change in cycle commuting behaviour. Study 3 of this thesis revealed that people with more positive views of the benefits associated with cycle commuting were significantly more likely to cycle to work than those with less positive views. Study 3 also investigated differences in perceptions of benefits of cycle commuting between genders and between different job roles but found no differences; indicating that the variables of gender and job role do not moderate the relationship between perceptions of benefits and cycle commuting stage progression. This has not been examined before and indicates that these potentially vulnerable sub-groups, women and lower earners, realise and aware of some of the key benefits to be gained from cycle commuting. Additionally, Study 1 found that regular cyclists were aware of a wider range of benefits associated with cycling to work than those considering cycle commuting. However there was a common acknowledgement from all participants in Study 1 of the important potential health and fitness gains cycling could incur, which formed the key motivation for most people.

The Cycle to Work intervention evaluation documented in Study 4 comprised stage-matched material, part of which aimed to increase people's awareness and knowledge of a range of benefits associated with cycle commuting. Whilst the intervention was successful at increasing stage progression with regard to cycle commuting behaviour, it was not effective at changing their perceptions of benefits. Increases in stage seemed linked to decreases in perceptions of barriers and the use of specific change processes rather than increases in perceived benefits. What can be drawn from this study is that, contrary to theoretically-based recommendations in physical activity literature (Biddle & Mutrie, 2001, 2008; Marcus & Forsyth, 2003), raising awareness of the benefits may not be effective at promoting behaviour change in individuals with an existing interest in cycle commuting (e.g. contemplators). Such promotional material might be better suited to people who are not yet interested in cycle commuting, who exhibit low levels of motivation. Another important point to raise here also is that whilst perceived benefits and barriers are deemed as counterparts within composite variables such as attitude and

decisional balance perceived benefits seemed to have a smaller influence on the decision to cycle to work than perceived barriers (see also Shannon et al., 2006).

10.2.2 Perceived Barriers

The concept of perceived barriers is theoretically framed in a similar way to perceived benefits, forming the counterpart of perceptions of benefits in composite variables such as attitude, outcome expectancy and decisional balance within social cognition and behaviour change theories. The commonly held theoretical premise is that as a person's perceptions of barriers towards a specific behaviour decrease, their intentions to initiate that behaviour increase. However, the formation of perceptions of barriers is both complex and ambiguous in relation to cycle commuting. It has been proposed, in line with the social cognitive perspective, that in many instances both subjective and objective impressions are involved in an individual's perception formation (Conner & Norman, 2005). In travel behaviour research, objective indicators have been viewed as poor predictors of behaviour because people experiencing similar environmental factors can appraise the situation differently and therefore hold differing subjective perceptions and attitudes to the same environmental factors (Anable et al., 2006; Salomon & Mokhtarian, 1997; Koppelman, Bhat & Schofer 1993). Other psychological variables, in this instance self-efficacy and change processes, are understood to mediate perceptions of objective factors (Lane & Potter, 2007), thus impacting on the perception formation of barriers.

The overall findings of this thesis indicate that perceived barriers have a greater influence on the uptake of cycle commuting than perceived benefits and self-efficacy. The magnitude of these findings has not been reported in literature previously. Whilst all four studies carried out suggested that a consistently strong relationship exists between the decision to cycle commute and perceptions of barriers, in some instances it is difficult to unpick subjective (psychological and socially-constructed) influences from the more objective (environmental) ones. Nevertheless, this thesis has provided

considerable evidence to confidently support the idea that the perception formation of barriers involves a significant element of subjectivity, which can be potentially manipulated using psychological intervention.

The prominent role that perceived barriers play in influencing cycle commuting behaviour has been demonstrated most clearly in studies three and four of this thesis. In Study 3, individuals holding low perceptions of barriers were much more likely to cycle to work than those with high perceptions of barriers. In terms of the decisional balance construct used in Study 3 (the sum of benefits and barriers), stronger benefits than barriers did not translate into behaviour change, it was rather the consistent decreases in perceptions of barriers that facilitated uptake of cycling. Significant differences in perceptions were also evident between genders and between job roles revealing that both of these demographic variables moderate the relationship between perceptions of barriers and the decision to cycle commute. The intervention trial documented in Study 4 also highlights the strong influence that reducing perceptions of barriers has on increasing stage progression in cycle commuting.

10.2.3 Self-Efficacy

Self-efficacy and similar concepts such as perceived behavioural control and enabling factors are commonly found components of social cognition and behaviour change theories. Self-efficacy relates to the concept of agency, understood as an individual's sense that they can carry out an action successfully, which will help bring about an outcome or behaviour (Darnton, 2006). Within active travel research, self-efficacy has been more narrowly defined as a person's belief that they can cycle to work in a number of challenging circumstances such as being tired or busy (Crawford et al., 2001; Mutrie et al., 2002). Psychological factors such as self-efficacy do not just influence behaviour directly but also mediate perceptions of more objective environmental factors (Lane & Potter, 2007). For example, the perception of danger associated with cycling in traffic will be influenced by an individual's belief in their own cycle skills, which will affect

the way they appraise environment. Thus, self-efficacy not only plays a role in the decision to cycle commute but also in the perception formation of barriers associated with cycling and the way in which a person chooses to cope with such barriers.

The evidence presented in this thesis suggests that there is a significant relationship between task-specific self-efficacy and the decision to cycle commute, in line with de Geus, et al., (2008). Study 3 revealed that people with higher self-efficacy are more likely to cycle than those with lower self-efficacy. Uniquely, it was found that differences in levels of self-efficacy were evident between genders and between job roles indicating that with regard to cycle commuting, these two variables moderate the relationship between self-efficacy and stage progression in cycle commuting. More implicitly, Study 1 found regular cycle commuters expressed a stronger sense of agency than those considering cycling to work, which was discussed most directly in terms of confidence.

However, within Study 4, the intervention trial evaluation found evidence of stage progression without any reported increase in self-efficacy associated with cycle commuting. It is more difficult to draw conclusions regarding self-efficacy from the intervention study as the ways of promoting change in self-efficacy are less clear than changing perceptions of benefits and barriers. Material aimed at developing self-efficacy was included in the intervention such as advice about planning and preparing to cycle, which included ways to build up confidence. Nevertheless, it is difficult to say whether the intervention material did not address self-efficacy associated with cycle commuting adequately or whether the material did address self-efficacy associated with cycle commuting but was ineffective at influencing individuals who already have a level of motivation to cycle to work.

10.2.4 Change Processes

Change processes can be understood as the underlying mechanisms that explain how behaviour change occurs. In a practical sense they are strategies and techniques that individuals use to modify their behaviour (Marcus & Forsyth, 2003) Change processes are not so commonly discussed in social cognition and behaviour change theories although some theories such as the TTM and the HAPA do include change process variables. The integrity of the concept of change processes is based on the presence of agency and manifests in either thoughts or actions. Therefore, change processes are intrinsically linked to a person's self-efficacy towards cycle commuting and can be understood as mediating perception formation of benefits and barriers as well as linking directly to behaviour. Within active travel research there is very little currently known about the underlying change processes and mechanisms that affect behaviour change.

This thesis has uniquely uncovered a number of specific change processes associated with cycle commuting that have the potential to effectively increase intention or initiate and maintain action. Study 1 provided rich qualitative information regarding some of the change processes of cycle commuting behaviour. Whilst there were many different strategies that individuals employed to facilitate cycling to work, the majority of change processes participants discussed involved the negotiation of challenges or potential barriers. Thus, in relation to cycle commuting change processes are best understood as forms of coping, which are efforts to manage demands that tax one's resources (Lazarus & Folkman, 1984). As mentioned in Chapter 4, the Transactional Model of Stress and Coping categorises coping responses as either problem-focused or emotion-focused (Lazarus & Folkman, 1984). Problem-focused coping is used where situations are perceived as controllable, and efforts will be made to overcome the demands. Emotion-focussed coping is used when situations are perceived as not amenable to change and involves regulating emotional responses towards the demands.

Novel findings from Study 1 indicate that those who regularly cycle commute see the challenges involved in cycling to work as within their control to change and employ

strategies similar to problem-focused coping responses such as gathering information, developing their own skill set, and time management through use of routines. Those who were not yet cycle commuting were aware of some of these more problem-focused strategies but were not actively implementing them. In some instances non-cyclists actively voiced their concerns about challenges they faced such as cycling on busy roads, which they perceived as uncontrollable. Verbalising concerns could be seen as an emotion-focussed coping response that helps to regulate the situation and to reinforce the original appraisal that took place.

Study 4 incorporated change processes identified in Study 1 into the intervention material as well as some of the processes of change from the TTM, however, only the TTM processes were measured in the outcome evaluation. The processes of increasing knowledge, increasing healthy opportunities and enlisting social support were found to be instrumental in encouraging cycle commuting behaviour. These three change processes have not been reported before in relation to cycle commuting and could be understood as problem-focussed coping strategies. Increasing knowledge and increasing healthy opportunities are both cognitive strategies that help to empower people through gaining knowledge and facilitating a more positive appraisal of cycle commuting. Enlisting social support is a behavioural strategy that proactively involves individuals seeking support to help them initiate cycle commuting. Therefore, the findings from the intervention study lend further support to the proposition in Study 1 that processes of change underpinning cycle commuting behaviour align with the concept of problem-focused coping.

10.2.5 Overview of the Findings

Taking a broader look at the synthesised findings, agency and motivation emerge as the two underlying psychological factors that influence cycle commuting behaviour. Developing a sense of agency throughout the entire process of behaviour change is important in order to negotiate the numerous challenges that cycle commuting presents,

whereas, it would seem that developing motivation is something that occurs most significantly at an early stage of intention formation. Perceptions of barriers are complex as cycle commuting presents some barriers that are not always perceived to be in one's volitional control, which goes some way to explaining their elevated role in the decision to cycle commute. These propositions have both theoretical and practical implications for predicting and promoting cycle commuting behaviour.

10.3 Implications of the Findings

The main findings of the studies undertaken have numerous implications. The mixture of research methodologies used within this thesis alongside the close collaboration with a top-level practitioner has resulted in implications spanning theory, policy and practice. These implications are discussed separately below.

10.3.1. Theoretical Implications

According to Darnton, (2007), theories applied to behaviour are designed to provide a relatively crude and parsimonious way of organising and ordering lots of information so that, more general, theoretical statements can be made. In this light, the collective findings provide a general level of support for the application of the TTM, and other social cognition and behavioural theories that include variables akin to perceived benefits, perceived barriers and self-efficacy associated with cycle commuting. Whilst parsimony is deemed advantageous within social cognition models and behaviour change models, if we are to make substantial inroads into better understanding how to effectively promote important health behaviours such as cycle commuting, a deeper knowledge of specific behaviours and contexts is needed (Giles-Corti et al., 2005; Pikora et al., 2003). Commonly, cycle commuting is treated in the same way as more general physical activity; however, this thesis would argue that these behaviours have distinctions. Therefore, the idiosyncrasies identified with regard to cycle commuting, in terms of the sequencing and the strength of specific psychological variables, have been

contextualised with existing theories to highlight how we could better understand this behaviour.

Idiosyncrasies of Cycle commuting

From the synthesis of findings presented above three main points of distinction emerged with regard to cycle commuting behaviour and existing theories. First, the patterning of composite variables such as attitude, outcome expectancies and decisional balance found in Transtheoretical Model of Behaviour Change (TTM), the Theory of Planned Behaviour (TPB) and the Health Action Process Approach (HAPA) do not fully reflect cycle commuting behaviour. The relationship between the counterparts of perceived benefits and perceived barriers is not an equal one as is assumed by these theoretical models. For instance, the decisional balance within the TTM assumes that when the benefits and barriers counterbalance each other a person will be close to action (Prochaska et al., 1994). This was not found to be the case with cycle commuting. For example, in Study 3, when stronger perceived benefits than barriers were reported this did not translate into action. On the contrary, perceptions of benefits were found to exceed barriers even at a very early stage (precontemplation) suggesting that strong motivations do not equate to behaviour change. Rather the change stems from substantial reduction in perception of barriers, which alone were found to increase intention and initiate action. Therefore, with regard to theory, it may be pertinent to look more closely at the counterparts of attitude, outcome expectancies and decisional balance. The Health Belief Model is one of the few existing theories to address perceived benefits and barriers individually. Taking this approach will enable us to better identify whether it is motivations or barriers that effect change so that interventions can be tailored appropriately to different behaviour types.

Second, for the theories that encompass change processes such as the TTM and the HAPA, problem-focussed coping strategies are not acknowledged adequately enough to represent the sequence of processes involved in cycle commuting behaviour. The TTM defines 10 processes of change that are understood to be employed at different stages.

However, these processes were designed to function in relation to preventative health behaviours such as smoking cessation and alcohol use reduction. Therefore some of the processes, for example, awareness of risks (relating to risks associated with carrying out unhealthy behaviours as opposed to risks of carrying out healthy behaviours) are not well suited to cycle commuting behaviour. Although one could argue there is an associated risk of cycle commuting is inactivity, it is also possible that people considering cycle commuting take part in other forms of physical activity. As suggested by Mutrie et al., (2002) the 10 processes of change need further attention to identify a modified version of processes that may be more applicable to active travel.

The HAPA does explicitly acknowledge the role of coping in behaviour but not substantially enough to accommodate the role it is thought to play in cycle commuting behaviour. Within the HAPA, coping is only hypothesised to function in the volitional and actional stage of behaviour when someone is either preparing or carrying out the target behaviour. However, HAPA is a relatively new model that has been tested primarily in studies looking at diet, dental hygiene, breast examination, seat belt use and physical activity, (Luszczynska & Schwarzer, 2003; Renner, Kwon, Yang, Parik, Kim, et al., 2008; Scholz, Sniehotta, & Schwarzer, 2005; Schuz, Sniehotta, & Schwarzer, 2007; Schwarzer, Schuz et al., 2007) and not active travel.

The findings from this thesis indicate that the use of problem-focused coping strategies are likely to be instrumental across all stages of cycle commuting including the intentional stage (precontemplation and contemplation) as some barriers need to be reappraised or negotiated early on in the behavioural change process. For example, Study 2 (Chapter 5) reported that precontemplators perceived weather as a stronger barrier than individuals in all the other stages of change. However, weather conditions are likely to apply fairly equally to people living in Edinburgh and the surrounding area. Problem-focussed strategies such as purchasing suitable clothing, ensuring your bike has mudguards or simply talking with cyclists about how they view and deal with bad weather would help to reduce precontemplators' negative perceptions of the weather.

Third, theories such as the TRA and the Health Belief Model assume that intention or motivation is predictive of behaviour. For many health behaviours, including cycle commuting, having the volition to act does automatically imply that behaviour change will occur. As discussed in Chapter 2, the TPB, which now largely supersedes the TRA, includes the additional variable of perceived behavioural control to account for behaviours that are only partially under ones volitional control. However, the TPB does not adequately address the intention-behaviour gap (also known as the volitional stage), which is more explicitly acknowledged in some theories and concepts such as HAPA and Implementation Intentions, and more implicitly within the TTM.

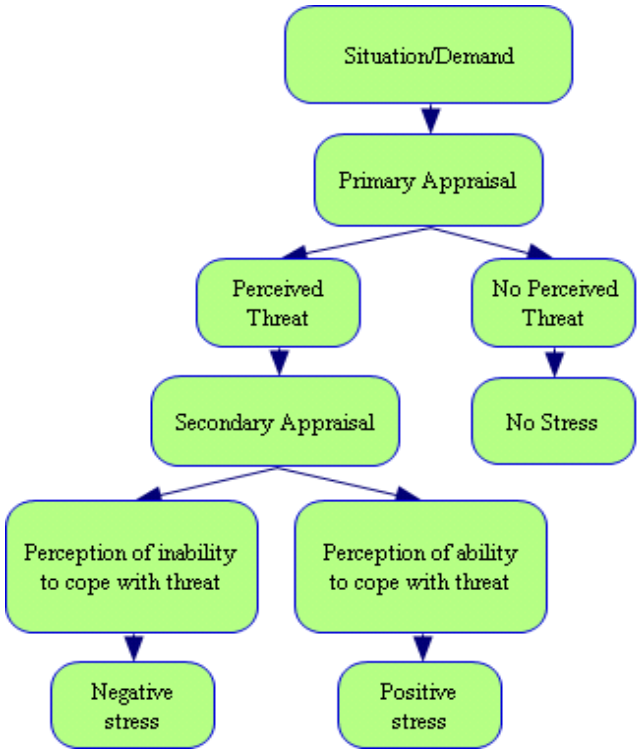
Previously, with regard to cycling for transport, habit has been discussed as a moderator of the intention-behaviour gap (de Bruijn et al., 2009; Eves et al., 2003; Gardner, 2008; Lemieux & Godin, 2009). From the evidence found within this thesis, it is proposed that, other than habit, there are a number of potential reasons why the intention-behaviour gap in cycle commuting needs to be addressed. First, in some instances the decision to cycle to work may be not be perceived as completely volitional as people may have to search for solutions to overcome environmental constraints. In this thesis, it was found through qualitative investigation in Study 1 that cycling is a complex and effortful behaviour and that a number of problem-focused coping strategies are used to bridge the gap between intention and behaviour. Second, social-cognitive theory such as the TPB work on the premise that behaviour is based on a rational decision making process. However, there is some evidence within this thesis to suggest, in line with Brawley, Martin & Gyursik (1998), that barriers do not always accurately reflect a logical appraisal of reality. Whilst perceived to be legitimate they are deeply rooted in skewed beliefs of irrational or faulty reasoning such as lack of knowledge, cultural norms and social stigma. These two issues highlight the importance of including a volitional component into models that address cycle commuting.

A Direction Change in Theory

So far this thesis has not deviated too far from the trodden path when it comes to applying theories to cycle commuting behaviour, with discussions revolving around commonly used social cognition and behaviour change theories. However, taking into account the important role that perceptions of barriers play in the decision to cycle commute, understanding more about change processes that help to negotiate potential barriers should be prioritised. Taking a more process-orientated direction is supported by Brawley et al., (1998) who recommend that researchers of physical activity spend more time understanding the social cognitive processes related to perceiving and generating barriers rather than simply naming these barriers.

Therefore, it may be time to adopt a less commonly applied theory in physical activity, the Transactional Process Model of Stress and Coping (see Figure 10.1). The Transactional Process Model does not focus on quantified predictions of variables associated with cycle commuting behaviour as social cognitive theories primarily do. Rather it focuses on the qualitative processes of how people react and then act to internal and external stressors. Whilst this theory may be inappropriate for some health behaviours, some of the findings in this thesis indicate that it may be appropriate for cycle commuting; where negative psychological and socially-constructed representations and environment challenges lead to a degree of stress. Using such a theory in cycle commuting research would potentially augment our understanding of how to more effectively promote this behaviour.

Figure 10.1: Transactional Process Model of Stress and Coping (taken from Lazarus & Folkman, 1984)

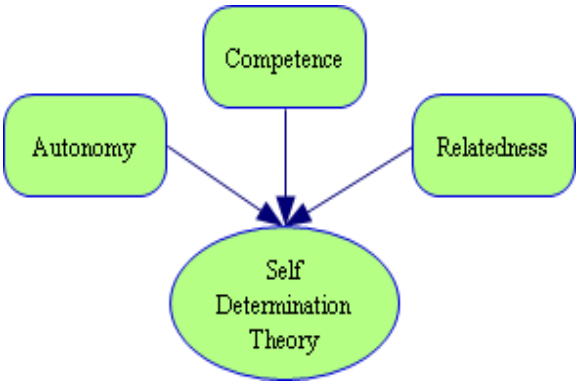


The Transactional Process Model involves the antecedent process of appraising the situational demands. Initially, primary appraisal involves the question, 'what is at stake for me here?' The secondary appraisal is concerned with 'what can I do about the stressor?' This involves weighing up the demands of the situation against a person's resources (Folkman, 1992). This appraisal process determines the nature of the demand and in turn influences the coping response (Hardy, Jones & Gould, 1996). If the demand is perceived as uncontrollable it is likely that an individual will employ emotion-focussed coping, if perceived as controllable it is likely that an individual will use problem-focussed coping. However, this is not always the case. Studies carried out into elite performance and coping (Gould et al., 1993a, 1993b) have found that coping behaviour is a complex and dynamic process and can not so easily be categorised within the simplistic problem-focused and emotional-focused dichotomy proposed by Lazarus and Folkman (1984). Initially, qualitative research informed by the Transactional Model

of Stress and Coping would need to be carried out to identify how individuals at differing stage of change cope with the challenges presented by cycle commuting. It is likely that gaining a better working understanding of coping and stress associated with cycle commuting would help to explain people perceptions of cycle commuting barriers and associated self-efficacy or perceived behaviour control.

In light of the findings to come from this thesis, another psychological theory that may also prove useful for understanding cycle commuting behaviour is Self-Determination Theory (SDT, Deci & Ryan 1985). The SDT is a theory concerning self-motivation or intrinsic motivation. The SDT proposes that a person's motivation will be more self-determined when they participate in activities that provide feelings of autonomy, competence, and relatedness (see Figure 10.2). Autonomy refers to agency; having the power to make your own choices. Competence refers to having the ability to effectively manage the environment in which one is acting in. Finally, relatedness refers to the feeling of social connectedness. As discussed earlier in this chapter, agency, which aligns with autonomy within the SDT appears to play an important role in cycle commuting behaviour. Additionally competence aligns with the concept of coping, which has also been found to play an important role in cycle commuting behaviour. Qualitative enquiry into SDT and cycling behaviour would be able to highlight the utility of the theory within this behavioural context.

Figure 10.2: Self Determination Theory (taken from Deci & Ryan, 1985)



10.3.2 Policy Implications

Whilst this thesis was more practically and theoretically driven than policy orientated, insight gained from reviewing literature and the empirical research carried out indicates that policy has a role to play in the way that people form cognitions towards cycle commuting. For example non-cyclists hold significantly stronger perceptions of danger on the roads than cyclists, suggesting it may be somewhat stigmatised. According to Horton (2007), fear commonly underlies people's negative views of cycling. Fear is understood as an emotional barrier that extends far beyond the fear of road accidents to fear of: being on view; using one's body; public spaces; and ridicule and harassment from strangers. In countries with low bicycle use, cycling for transport seems to have attracted a social stigma. Previous research has found that people view cycling as dangerous, masculine, unsightly and lacking in status (Davies et al., 1997; Garrard et al., 2006; Unwin 1992, 1995). Many of these fears can be attributed to the car culture that UK policy has embraced and is arguably still embracing. As a nation we have grown used to moving around in cars, we have moved away from community life on street and now experience travel in a sedentary manner in isolated, enclosed, seemly protected machines.

> In many respects, the UK and the USA have given the green light to the private car, almost regardless of its economic, social and environmental costs. In sharp contrast, cycling has prospered in the Netherlands, Germany and Denmark over the past three decades precisely because these countries have given the red light, or at least the yellow warning light, to private cars (Pucher & Buehler, 2008, p. 498).

Horton (2007) argues that whilst fear of cycling on the roads may be appropriate, it has been constructed through a number of policy initiatives such as road safety campaigns, cycle helmet campaigns and segregation of cyclists and cars, which focus on presenting cycling on the roads as unsafe, placing the onus of responsibility on cyclists as opposed to car drivers. This is in stark contrast to the policy approach taken in the Netherlands, the safest cycling country in the world (Pucher & Buehler, 2008), where laws for cycling helmets are opposed and less than 1% of adult cyclists and only 3–5% of child cyclists wear helmets (FietsBeraad, 2006; Netherlands Ministry of Transport, 2006). In the

Netherlands, the duty of care is placed on car drivers. For example, in the 1990s a strict liability law was introduced in Holland, making drivers responsible for any collision that occurs between a moving car and a bicycle. The Dutch law assumes that even if a cyclist makes an unexpected manoeuvre, a car driver should be travelling slowly enough and acting vigilantly enough to be able to avoid colliding with the cyclist.

Policy initiatives that elevate cycling to a more powerful and respected position on the roads in the UK would very much challenge a number of the values and cultural norms and stigmas that our society holds. Such policies would also help to overcome some of the current environmental constraints experienced in the UK. Although, over the last two decades governmental policy in the UK has become increasingly supportive of using cycling as a means of transport, other than the production of strategy documents and well intended recommendations there has been little done on a societal level to counteract the dominance of the car. The government is currently sending out mixed messages regarding its commitment to supporting cycling as a viable transport option. Whilst its strategy documents hail active transportation as an answer to obesity, carbon emissions and road congestion, recent governmental financial cuts include the abolition of Cycling England, the current national body and authority for cycling.

10.3.3 Practice Implications

The findings within this thesis have already had an impact on Cycling Scotland's current practice and have numerous implications for more general promotion of cycle commuting in supportive workplace settings. The strong collaborative links with Cycling Scotland that were made during the development and trial of the Cycle to Work intervention have paved the way for national level dissemination of the intervention materials. After the quasi-experimental trial had been carried out for the Cycle to Work intervention, Cycling Scotland adopted the materials as part of their Cycle-friendly Employer Scheme, exemplifying evidence-based practice. Whilst the intervention needs further trialling to gain a clearer picture of how the intervention could be best modified

to optimise its effectiveness, it nevertheless has been shown to significantly increase people's intentions and in some cases facilitate the uptake of cycle commuting.

More generally, there are some key implications to come from this thesis that practitioners promoting cycle commuting in supportive workplaces should consider. Within groups of employees who already have a degree of interest in cycle commuting, concentrating on overcoming barriers is paramount. Focus should be placed on how people can effectively find solutions to cope with some of the common challenges cyclists face such as: how to negotiate cycling in traffic safely; the types of clothing required for cycling in inclement weather; providing information about local cycling resources and where additional cycling information can be found; endorsing the use of panniers to carry heavy belongings and a laptop; how to look presentable for work; advice on planning your journey and your routine; and providing information about availability of social support such as Bicycle User Groups. Barrier reduction should be especially emphasised in programmes that target females and people in administrative jobs who are relatively low earners as their perception of some common barriers has been shown in this thesis to be elevated.

Providing information on the benefits of active transport has been a popular strategy to date. However, this thesis suggests that messages promoting health and fitness benefits may only be useful in moving those people not currently interested in cycle commuting to a stage where they may be more amenable to cycling. Promoting the benefits of cycling may be a relatively redundant strategy for those contemplating or preparing to cycle to work. This also highlights the importance of tailoring promotion programs and messages to specific stages of change. Findings within this thesis indicate that using a psychological promotional approach along with other initiatives aimed at changing socially and culturally constructed norms and improving infrastructure would be most effective at promoting cycle commuting.

Experiences gained from designing and carrying out the empirical research included in this thesis has lead to a number of recommendations for how to optimise the practical impact of research. Initially, the foundations and rationale of an intervention need to be strong. Using intervention guidance such as the documentation published by the Medical Research Council (Medical Research Council, 2000), the Scottish Physical Activity Collaboration (Blamey et al., 2008) and the RE-AIM guidance (Glasgow et al., 1999) will help to optimise both the internal and external validity of both an intervention evaluation. Strong internal validity will lead to robust and valid evaluation data, which will support the value of practical implementation. Strong external validity will define the parameters for effective dissemination of intervention material and research into practice. Additionally, making links with national schemes and practitioners at an early stage of intervention development may also help to facilitate research into practice.

10.3.4 Overview of Implications

Theoretically, this thesis highlights that if we want to find out how to effectively change current transport practices the one size fits all aspiration of social cognition models may be better exchanged for a 'horses for courses' approach, which looks to match the characteristics of the behaviour with the most applicable theoretical variables. Whilst this thesis was more practice and theory focussed than policy orientated, the subjective and objective barriers that are understood to manifest as a consequence of policy decisions are likely to play a key role in cycle commuting behaviour. Therefore polices should look to act in ways that help empower and protect cyclists. Some of the research findings and materials in this thesis have already been implemented into practice through close connections with a national-level cycling body. The findings also have scope to enhance other cycle promotion programs that target cycle commuting in supportive workplaces.

10.4 Limitations

This thesis has presented substantial findings regarding the psychological dimensions of cycle commuting but it is important to make clear the limits of these findings. Overall, the studies in this thesis were carried out in centrally-located, medium and large-sized workplaces that were classified as cycle-friendly. Therefore, the findings can only be generalised to individuals in similar contexts and settings. As the four studies undertaken employed a variety of methods and samples sizes, the limitations for Study 1, Studies 2 and 3, and Study 4 are reiterated separately below.

Study 1 comprised a small-scale qualitative investigation. The implication of this type of research method is that empirical generalisable and more universal knowledge (which would involve larger sample groups) has been traded for an in-depth context-specific analysis. This study employed a purposive sample of 15 participants, selected on the basis of them being either active cycle commuters or having an interest in cycle commuting. All participants worked at a single city centre site which had Cycle-friendly Employer status. The type of generalisation that can be made from this study would be more analytical in nature, involving a reasoned judgement about the extent to which the findings from one study can be used as a guide to what might occur in another situation (Kvale, 2007). Future complementary research should be carried out on samples in different contexts to examine whether some of the findings that emerged within this study would be revealed in other populations.

Studies two and three were very similar in nature, comprising cross-sectional questionnaires that followed similar protocols. Although these studies involved a number of limitations that have implications on the veracity of the findings, the sample sizes of both studies were substantial providing strong statistical results (n = 831 and n = 337). Both studies involved the collection of self-reported data, with no objective measures in place. As objective and subjective factors are understood to influence cognitions, it would prove challenging but valuable to supplement self-report data with observational data. The way in which data was collected in both studies may have

created a social class bias relative to the workplace populations. Data was collected via the internet so employees working in manual, non-computer based jobs are likely to have be underrepresented. These two studies were carried out in practice-based setting and whilst the response rate for Study 2 (42%) was strong and for Study 3 (11%) acceptable, this data may not provide a true cross-sectional representation of the employees based within the four worksites used. However, these studies did not try to infer anything about the character of these populations, but rather were interested to identify stages of change by which comparisons could be made.

The final investigation, Study 4, took the form of a small-scale quasi-experimental evaluation, which involved data collection over three time periods. Questionnaires were the sole form of data collection method and there were no objective measures in place to verify the data provided. Whilst the study had a strong design including pre- and post-test measures, and a control group, it would have been strengthened if there had been scope to randomise the participants. The sample size for this study was small (n = 34) but still involved enough participants to be able to carry out inferential statistics. The questionnaire lacked a measure of quantified increases in cycling behaviour (e.g. minutes cycled) and more general measures of physical activity and health. For the nature of the study, these were classified as more distal indicators and only proximal measures were prioritised. Nevertheless, the inclusion of these more distal measures would have provided additional valuable information. Although the study did not find any significant increases in stage of change in the intervention group, significant differences were found pre- and post-test for the intervention group. In such a small sample group it is promising that there were significant findings of stage progression, reductions in perceptions of barriers, and increases in the use of some change processes, which yielded large effect sizes.

10.5 Recommendations for Future Research

There are a number of recommendations for future research that can be suggested for the findings presented in this thesis. As highlighted earlier in the synthesised findings, both perceptions of benefits and self-efficacy did not produce consistent findings in relation to cycle commuting behaviour. This indicates that we need to scrutinise further the role and influence that motivation and self-efficacy have in the decision to cycle commute at different stages of change. The intervention demonstrated that providing information and insight into the benefits of cycling to work, and advice and support about how to build confidence and cycle safely was not effective at elevating either perceptions of barriers and self-efficacy. Therefore, the material used in the intervention should also be examined and trialled further.

Understanding more about the way in which people address and deal with some of the potential barriers associated with cycle commuting requires further investigation. Such research will help to establish the interplay that exists between individual and environmental factors that affect behaviour. This is an area of research that others are also keen to learn more about (Panter & Jones, 2010). Although this thesis has uncovered important findings in relation to change processes, additional qualitative research should be carried out to identify more specifically what change processes occur at the differing stages of readiness to change. Using the transactional perspective of coping as a complementary explanatory theory for qualitative work is also recommended.

Finally, more research is needed to further test the effectiveness of the interventions study in larger samples and across different settings. Although all of the measures used were taken from established measures, the questionnaire used would benefit from further psychometric testing as for some questions (e.g. the processes of change measures) small modifications were made. Carrying out a process evaluation, which included qualitative research such as interviews, focus groups and travel diaries would provide a more comprehensive understanding of the mechanisms at play and therefore strengthen

future evaluation work. Additionally, the inclusion of observational methods would add an extra dimension to evaluation data generated.

10.6. Concluding Remarks

This thesis has contributed to the limited body of research that exists regarding the role that psychological factors play in cycle commuting behaviour. Using a range of methodologies, the four studies presented in this thesis have found that perceived benefits, perceived barriers, self-efficacy associated with cycle commuting and change processes broadly aligning with problem-focussed coping all play a significant role in people's decision to cycle to work. More uniquely to cycle commuting behaviour, the collective findings have reported that perceptions of barriers play a more prominent role in cycle commuting behaviour than perceived benefits. In turn, the change processes that people employ to help overcome and negotiate perceived barriers have also been found to play a key role in cycle commuting behaviour.

The findings reported in this thesis have important implications for both theory and practice. The results indicate that when applying social cognition models and behaviour change theories to cycle commuting behaviour, these models and theories should be tailored more specifically to accommodate the crucial role that perceived barriers play in the decisional process. Additionally, on a theoretical level, more attention needs to be paid to the underlying change processes involved in initiating and maintaining cycle commuting to better understand and predict this behaviour. In practical terms, some perceived barriers have a strong subjective element and are therefore amenable to change. This finding has promising implications, suggesting that psychological interventions play a crucial role in encouraging cycle commuting.

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APPENDIX A

VARIABLES THAT FEATURE IN CHAPTER 3, SECTION 3.2.1

Measures that Feature in Cycle Commuting Studies

de Geus et al. (2008)

Psychosocial
- Social influence
- Social support
- Modelling
- Social support: accompany
- Social support: encourage

Self-efficacy
- Internal self-efficacy
- External self-efficacy

Perceived Benefits
- Physical wellbeing
- Psychosocial
- Ecological-economic awareness
- Body image

Perceived Barriers
- Lack of skills and health
- Lack of time
- Lack of interest
- External obstacles

Gatersleben & Appleton (2007)

Attitudes
- Like cycling
- Don't want to
- Environmental
- Healthy

Personal Barriers
- Not fit
- Uncomfortable
- Uncharacteristic

Structural Barriers
- Unsafe
- No lanes
- Parking
- Showers

Stinson & Baht (2004)

Deterrents
- Unpleasant weather
- Other personal reasons (too busy or tired)
- Not enough daylight to ride safely
- An injury or illness
- Stolen or broken bike
- Unsafe neighbourhoods

Reasons
- Fitness/health concerns
- Pleasure/enjoyment
- Environmental concerns relating to automobile use
- Convenience/speed
- Avoid driving in congested conditions
- Avoid relying on public transport
- Limited auto parking

Crawford et al. (2001)

Barriers
- Bad weather, including fog ad darkness
- Danger from motor traffic
- Distance to work
- Lack of time
- Breathing in exhaust fumes
- Lack of chaining/showering facilities at workplace
- Nature of terrain – poor road/pavement surface
- Nature of terrain - hilliness
- Necessity of taking children to and from school by car
- Expense of buying a bicycle
- Lack of waterproof clothing
- Necessity of wearing less formal clothes
- Physical effort involved

Motivations
- Availability of dedicated cycle routes
- Dedicated cycle lanes on vehicular roads
- Secure cycle parking
- Changing/showering facilities
- Traffic light priority for cyclists
- No necessity for car parking
- Minimal contribution to pollution
- Sense of independence in journey/enjoyment

- Cost saving over other transport methods
- Increased difficulty in car parking
- Shortened journey time to workplace
- Subways beneath vehicular roads
- Vehicle speed reduction – road humps
- Increased parking charges
- Vehicle speed reduction – road narrowing/chicanes
- Business mileage payments at rates comparable to those for cars
- Distribution of health education material discussing health benefits of physical activity
- Availability of interest-free cycle purchase loan
- Opportunity to have the health benefits of cycling measured by researchers

Stages of Change Construct Criteria

Gatersleben & Appleton (2007)

Stage	Description
Precontemplator	Unaware of problems, no intention to change
Contemplator	Unaware of problems, thinking about change
Preparer	Intention to change in the next 6 months
Actor	Action being taken
Maintainer	Has maintained action for 6 months or more

Crawford et al., (2001)

Stage	Description
Precontemplator	No intention to start cycle commuting in the next six months
Contemplator	Thinking about starting to cycle commute in the next six months
Preparer	Infrequently cycle commuting (no more than once a week)
Actor	Started regularly cycle commuting in the last six months
Maintainer	Has been regularly cycle commuting for at least six months

APPENDIX B

STUDY 1 RESEARCH MATERIALS

Invitation Letter

The Moray House School of Education
The University of Edinburgh
St Leonard's Land
Holyrood Road
Edinburgh EH8 8AQ

An Invitation to Take Part in a Research Interview Relating to Cycle Commuter Behaviours

Dear [title and surname]

I am currently carrying out a PhD research project at the University of Edinburgh which is concerned with gaining a person-centred insight into cycle commuting behaviour.

For this project I will be working with a cycling organisation called 'Cycling Scotland'. The aim of the project is to try and increase the presently limited knowledge base about cycle commuting behaviour. It is hoped that developing an understanding from commuters' personal perspectives will create a greater insight into the reasons why people choose to cycle or choose not to cycle as a means of transport. It is expected that the findings from this inquiry will be used to encourage and support cycle commuting on a wider scale within Scotland.

PwC in Edinburgh has kindly agreed that I may approach you to invite you to help with this research.

I am looking to carry out approximately 15 to 20 individual interviews with staff that either cycle commute or commute using motorised forms of transport (but who are interested to consider cycle commuting). Prospective interview candidates, who do not currently cycle, must foresee cycling as a feasible option for all or part of their commuting journey to Erskine House. People who volunteer for this project will be asked to take part in one informal interview/chat with myself, which will last approximately 45 – 60 minutes. The interview will be held at Erskine House, at a time convenient to you.

The research interview will be friendly and informal by nature. This will be a great opportunity for you to have your say and to talk openly about your commuting journeys. I will have an interview schedule prepared with a number of questions that will relate to your personal experiences, thoughts and feelings about commuting in Edinburgh (please see the separate document 'Summary of Interview Themes' for more details). As it is your opinions and views I am most interested in, these questions will only provide a flexible and tentative framework for conversation. The interview should be an enjoyable experience and your participation will help to develop cycle commuting in Scotland.

All of the information discussed during the interview will remain anonymous. You will receive a copy of the 'Informed Consent Document' via email, to read over prior to the interview. Additionally, I will bring a copy of the informed consent agreement with me on the day of the interview for both parties to sign; prior to the commencement of the interview conversation. It is anticipated that the findings from these interviews will provide valuable knowledge that will help PricewaterhouseCoopers, the University of

Edinburgh, Cycling Scotland and other transport, health or environmental agencies involved in encouraging cycling for transport.

If you have any queries about this project, please contact me direct or speak to David Wardrop-White, Director in Advisory PIC (750-2236). If you would prefer not to take part, please let me know. I aim to make contact to arrange interviews within the next two to three weeks.

Thank you for your time and your help.

Yours sincerely,

Miss Jenny van Bekkum
The University of Edinburgh
Email j.e.van-bekkum@sms.ed.ac.uk
Telephone 0131 651 4110
Mobile 07811 111 268

Study 1 Pre-Interview Letter

The Moray House School of Education
The University of Edinburgh
St Leonard's Land
Holyrood Road
Edinburgh
EH8 8AQ

Summary of Interview Themes

The interview conversation will be informal and flexible by nature. Conversation will be based on the key themes listed below.

- Describing your journey to work
- Why you choose your current mode of transport for commuting
- Positive and negative aspects of your commuting experiences
- Perceptions of the Edinburgh environment for cycling
- Ideas about what could encourage cycle commuting for others
- Positive or negative health impacts relating to cycle commuting (either perceived or personally experienced)

Study 1 Informed Consent Letter

The Moray House School of Education
The University of Edinburgh
St Leonard's Land
Holyrood Road
Edinburgh
EH8 8AQ

Informed Consent Document

In accordance with the University of Edinburgh's policy regarding ethical issues surrounding data collection, it is required that participants give their consent before they engage in any research.

Research Title
Understanding Cycle Commuting Behaviour in a Scottish Workplace Setting: A Realist Investigation

Research Aim
This academic research, in the form of individual interviews, aims to advance the evidence-based knowledge of cycle commuting by developing a person-centred understanding of commuting behaviour.

Principal Investigator
Miss Jenny van Bekkum, Ph.D. student,
Moray House School of Education, The University of Edinburgh.

The Purpose of the Form
The purpose of this 'consent document' is to give you the information that you will need to help you to decide whether you want to participate in the research project. Please read the form carefully, and please feel free to ask questions about any aspect of this form and the research project that are not made clear, or that you would like more detailed information about. When all your questions have been answered, you can decide whether you want to take part in this study or not. This process complies with the notion of 'informed consent'. You will be given a copy of this form for your records.

Participant Involvement
The data-collection process comprises individual semi-structured interviews. You are invited to take part in this research, on a voluntary basis, because of your interest and/or involvement in cycling as a mode of transport for commuting to work and back. If you choose to participate, you will be one of approximately 15-20 interviewees taking part in the research. Data collection will be arranged at times suitable for participants. If you agree to take part in an interview, you will have the right to withdraw from the process at any time. I will ask you questions about your perceptions, thoughts and experiences/intentions relating to cycle commuting. Please note that you are not obliged to answer any questions that you are uncomfortable with. These interviews will be voice-recorded, and later made into transcripts for analysis (please see the 'Confidentiality' section below)**.** Your time involved in this procedure will be brief. The interview is anticipated to take between 45-60 minutes.

Risks
There are no known risks in participating in this research.

Benefits
You will contribute to the knowledge base relating to cycle commuting and active travel behaviour. It is anticipated that knowledge gained from these interviews will be used to inform a cycle-specific cognitive-behavioural intervention, aimed to support and encourage people who would like to start cycle commuting.

Confidentiality
This research adheres to: The University of Edinburgh ethical guidelines; the British Educational Research Association ethical guidelines; the University of Edinburgh guidelines on data protection; and the Freedom of Information Act.

If you choose to participate in this research project, any notes or recordings made during the interview process will not contain your name; it will be replaced with an identity number (e.g. staff member No.3). No data that I gather for this research, other than this informed consent form, will contain your true identity. If your ideas or comments are used in my dissertation or any published articles, your identity number will be replaced with a coded name (pseudonym).

The interviews will be recorded and transcribed for later analysis. Interviews will be digitally recorded as wav files (the type of file that is stored on any commercially available music CD). In signing this form (below), you are agreeing to allow the interviews to be recorded. I will transcribe all interviews myself and I will have sole access to the data. Please note that as part of the examination process, original transcripts and recordings may be viewed by my research supervisors and external examiners; who are also bound by the confidentiality guidelines explained here. Participant data will be stored on a password-protected computer and any documents or CDs containing participant data (e.g. transcripts or recordings) will be kept in a locked filing cabinet to which I will have sole access.

Questions
Questions are encouraged. If you have any questions about this research project, please do not hesitate to contact: Miss Jenny van Bekkum

Email: vanbekks@hotmail.com

Tel: 07811 111 268

The Moray House School of Education
The University of Edinburgh
St Leonard's Land
Holyrood Road
Edinburgh
EH8 8AQ

Declaration of Consent

Your signature indicates that this research study has been explained to you, that you are aware that the interviews will be recorded and that your questions have been answered. You will receive a copy of this form for your records.

Participant Statement
I have read and understood the above and consent to participate in this study.

Participant's Name (printed):_____

Signature of Participant: _____

Researcher Statement
I have discussed the above points with the participant

Signature of Researcher: _____ Date: _____

Study 1 Interview Questions

Interview Questions

Simple Ice breaking (warm up) Questions

- How many miles do/would you commute by bicycle each day?
- How long would you say that it takes you on a one way journey to work by your regular mode of travel?
- How long have you been cycle commuting for? Have you ever cycle commuted previously?
- On average, how many times a week would you say you cycle commute? *
- What do you think would be the quickest mode of transport for commuting?
- Do you do participate in any other form of cycling

Main Interview Questions

1) Could you tell me about your current journey to work?

prompt:
◊ What kind of feelings do you have about it?

_____
_____
_____
_____

◊ For Pushing forward: What I hear you saying is……? It sounds to me that you…….? Is this correct?

2) Could you tell me a bit about the reasons why you choose/choose not to cycle commute?

prompts:
◊ This could relate to any motivating or beliefs you hold about cycling
◊ Could you tell me a little more about that?

_____
_____
_____
_____

◊ For Pushing forward: What I hear you saying is……? It sounds to me that you…….? Is this correct?

3) Could you talk to me about any negative aspects to/ thought you hold about cycle commuting?

prompts:
◊ It could be from personal experiences of relating to personal views or beliefs
◊Is there anything that deters you or prevents you from cycle commuting?

_____
_____
_____
_____

◊ For Pushing forward: What I hear you saying is……? It sounds to me that you…….? Is this correct?

4) Could you talk to me about any positive aspects (benefit) to/ thought you hold about cycle commuting?

prompts:
◊ What attracts you to cycle commuting?
◊ It could be from personal experiences of relating to personal views or beliefs

_____
_____
_____
_____
◊ For Pushing forward: What I hear you saying is……? It sounds to me that you …….? Is this correct?

5) What are do you think about Edinburgh's environment for cycle commuting?

prompts:
◊ If you have cycled in other cities, how does Edinburgh compare?
◊ What are your reasons for saying that?

_____
_____
_____
_____
◊ For Pushing forward: What I hear you saying is……? It sounds to me that you,…….? Is this correct?

6) Could you tell me about any health impacts you experience from cycle commuting.

prompts:
◊ This could be either physical, mental, emotional or spiritual
◊ This could relate purely to increased fitness of to more medical health

_____
_____
_____
_____
◊ For Pushing forward: What I hear you saying is……? It sounds to me that you…….? Is this correct?

7) For your final comments, can I ask, what stands out about cycling to you?

prompts:
◊ If you could tell me about anything that comes to mind, positive or negative
◊ It could just be a brief summary about your feelings towards cycle commuting

_____
_____
_____
_____
◊ For Pushing forward: What I hear you saying is……? It sounds to me that you …….? Is this correct?

APPENDIX C

STUDY 2 RESEARCH MATERIALS

Study 2 Invitation Letter

Travel to Work Project

The project aims to develop an understanding into staff member's and PhD student's views relating to commuting and especially the option of cycle commuting. In order to gather this information I have designed a brief, five minute on-line questionnaire (Link Here). I would be very grateful if you would take a few moments to complete this questionnaire, regardless of whether you cycle or not.

The Travel to Work project forms part of my PhD research. The project complements the University's active travel initiative 'Get Active Getting There!' and is being supported by Cycling Scotland and the University's Transport & Parking Office.

Everyone who completes the questionnaire will be entered into a free prize draw. Prizes include a trail rucksack as first prize and two thermos bottles (with optional bike mounts) as runner-up prizes. The prizes have been kindly donated by the Edinburgh Bicycle Cooperative.

Please complete the questionnaire on-line at: (Link Here)

If you have any questions about the project or the questionnaire please contact:

Jenny van Bekkum
jennifer.e.van-bekkum@education.ed.ac.uk
0131 6514110

Project Supervisors

Dr. Joanne Williams (School of Education)
Jo.Williams@ed.ac.uk
0131 651 6339

Dr. Paul Graham Morris (School of Health)
p.g.morris@ed.ac.uk
0131 6513956

Study 2 Questionnaire

"Travel to Work" Questionnaire

All of the information that you provide within this questionnaire will be treated in a confidential manner. Anonymity will be created and maintained by assigning each respondent with a code which will replace their name and contact details.

Name: _____	Department: _____
Email contact:_____	Telephone number: _____

For all of the following questions please either tick the appropriate box or circle the appropriate score for each one.

Section 1: Personal Details

Which role best describes your current position at the university?					
Administrative staff		Researcher		Support staff	
Professor		Secretarial/clerical staff		Postgraduate student	
lecturer		Managerial staff		Other	

Please indicate your gender			
Male		Female	

How old are you? Please tick the appropriate age category											
18-30 yrs		31-40 yrs		41-50 yrs		51-60 yrs		61-70 yrs		Other	

Your driving and cycling status.				
Can you drive a motorised vehicle?	Yes		No	
Do you own a motorised vehicle?	Yes		No	
Can you ride a bicycle?	Yes		No	
Do you own a bicycle?	Yes		No	

Section 2: Travelling to Work

Approximately how far away do you live from your workplace? If you regularly work at different locations please refer to the distance of the site that you most frequently work at.					
Less than 1 mile		Between 1 and 5 miles		Between 6 and 10 miles	
Between 11 and 20 miles		Over 20 miles			

Which method of transport do you most commonly use to travel to and from work?					
Train		Car		Motorcycle	
Bicycle		Walking		Bus	
Other (please specify): _____					
A combination of modes (please specify): _____					

Section 3: Cycling to Work

Your journey to work and cycling Please read through the categories below and tick one box that is most appropriate for you.	
I do not cycle part or all of the journey to work and I do not intend to do so in the next 6 months	
I do not cycle part or all of the journey to work but I am thinking about starting to do so in the next 6 months	
I sometimes cycle part or all of the journey to work but not more than once a week on average	
I regularly (2 days or more per week) cycle part or all of the journey to work but have only begun in the last 6 months	
I regularly (2 days or more per week) cycle part or all of the journey to work and have been doing so for longer than 6 months	

Past experience of cycling to work. Please note that this question includes your current job as well as all pervious jobs you have had.				
In the past have you ever cycled to work?	Yes		No	

Barriers related to cycling and work Please indicate how important you think each of the following factors would be in discouraging you from cycling as a method of travel to and from work. For each factor please circle the appropriate score: **1 = not at all discouraging, 2 = slightly discouraging 3 = moderately Discouraging, 4 = very discouraging,** **5 = would prevent me from cycling, N/A = not applicable**	
Nature of the natural terrain (e.g. hilliness)	1 2 3 4 5 N/A
Nature of the manmade terrain (e.g. poor road surfaces)	1 2 3 4 5 N/A
Bad weather	1 2 3 4 5 N/A
Darkness	1 2 3 4 5 N/A
Distance from workplace	1 2 3 4 5 N/A
Lack of time	1 2 3 4 5 N/A
Breathing in exhaust fumes	1 2 3 4 5 N/A
Physical effort involved	1 2 3 4 5 N/A
Necessity of taking children to/from school/nursery	1 2 3 4 5 N/A
Lack of waterproof clothing	1 2 3 4 5 N/A
Danger from motor vehicles	1 2 3 4 5 N/A
Lack of changing/showering facilities at the workplace	1 2 3 4 5 N/A
Expense of buying a bicycle	1 2 3 4 5 N/A
Lack of storage space for your bike at home	1 2 3 4 5 N/A
Lack of storage space for your bike at work	1 2 3 4 5 N/A
Disabilities/injuries or health problems	1 2 3 4 5 N/A
Having to wear less formal clothes	1 2 3 4 5 N/A
Carrying your belongings to/from work	1 2 3 4 5 N/A
Other factors (please specify): _____ _____	1 2 3 4 5 N/A
_____ _____	1 2 3 4 5 N/A

Thank you for taking the time to fill out this questionnaire.

Baseline Questionnaire from Mutrie et al., (2002)

TRAVEL AND WORK QUESTIONNAIRE (completion time 10 minutes)

THANK YOU FOR COMPLETING AND RETURNING THE INITIAL QUESTIONNAIRE. AS PART OF THAT PROCESS YOU HAVE BEEN CHOSEN TO PARTICIPATE IN THE MAIN STUDY. AT THIS STAGE WE ARE INTERESTED IN YOUR THOUGHTS CONCERNING THE ISSUES SURROUNDING YOUR TRAVEL TO AND FROM WORK. IF YOU RETURN THIS QUESTIONNAIRE YOU WILL BE ENTERED INTO A FREE PRIZE DRAW. ***Prizes include; 1st prize- £30 sports voucher, 2nd prize - £30 book token & 10 runner-up prizes.***

Please return to; ACTIVE COMMUTING PROJECT, 64 OAKFIELD AVE. EXT. 2884 E-MAIL ccarney@udcf.gla.ac.uk

We are concerned about maintaining confidentiality and anonymity so that you feel comfortable with providing answers that accurately reflect your situation. Therefore your name is not essential. This information you provide will be coded and entered onto computer as numbers.

SECTION 1 : PERSONAL DETAILS

Please complete the following questions by placing a tick (√) in the appropriate boxes below.

1.

Technical staff		Academic related administrative staff		Secretarial/clerical staff	
Professor/lecturing staff		Manual/ancillary staff		Other (please specify	
Other related staff		Research and analagous staff			

Please answer each section

2.	MALE FEMALE		**4.**	Can you ride a bicycle?	YES NO
3.	AGE		**5.**	Can you drive?	YES NO

6. I am interested in the approximate distance between your home and your workplace. Below are listed a range of distances please tick the box that reflects your journey distance from home to work.

Less than 1 mile		between 2 and 5 miles		between 11 and 20 miles	
between 6 and 10 miles		over 20 miles		between 1and 2miles	

7. NOTE; If you regularly work at a number of different locations, please give the distance to the site at which you work most frequently ; miles ☐

8. I would like some information about the method (s) of transport currently used by you to **travel to and from your workplace.** Please tick (√) the appropriate box (es) below to indicate which form of transport you most commonly use

Train/Underground		Cycling		Combination of cycling+Train/Underground	
Car		Motorcycle		Combination of Car +Train/Underground	
Walking		Bus		**Other please specify** _____	

9. If you generally travel by car, train/underground or bus, do you walk for more than 5 minutes at the beginning or the end of your journey to/from work? YES NO

SECTION 2 : BARRIERS AND MOTIVATIONS TO WALKING OR CYCLING TO WORK

10. Whether or not you currently walk or cycle to/from work, please indicate how important you think each of the following factors would be in discouraging you to use **walking or cycling as a method of travel to/from work and during the working day.** Please rate each factor on a scale of 1-5 and **circle** the appropriate number.

1= not important, 5=very important, N/A=not applicable

BARRIERS	CYCLING						WALKING					
Nature of terrain – hilliness	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Nature of terrain - poor road/pavement surface	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Bad weather, including darkness, fog	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Distance to workplace	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Lack of time	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Breathing in exhaust fumes	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Physical effort involved	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Necessity of wearing less formal clothes	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Necessity of taking children to and from school by car	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Lack of waterproof clothing	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Danger from motor traffic	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Lack of changing/showering facilities at workplace	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Expense of buying bicycle	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Other factors, please specify:_____ _____	1	2	3	4	5	N/A	1	2	3	4	5	N/A

11. Whether or not you currently walk or cycle to/from work, please indicate how important you think each of the following factors would be in encouraging you to use **walking or cycling as a method of travel to/from work and during the working day.** Please rate each factor on a scale of 1-5 and circle the appropriate number.

1= not important, 5=very important, N/A=not applicable

MOTIVATIONS	CYCLING						WALKING					
Cost saving over other transport methods	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Shortened journey time to workplace	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Minimal contribution to pollution	1	2	3	4	5	N/A	1	2	3	4	5	N/A
No necessity for car parking	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Improvements to health/fitness	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Availability of dedicated cycle/pedestrian routes	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Sense of independence in journey/enjoyment	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Getting some fresh air	1	2	3	4	5	N/A	1	2	3	4	5	N/A
Other factors, please specify:_____ _____	1	2	3	4	5	N/A	1	2	3	4	5	N/A

End of page 2

SECTION 3 PHYSICAL ACTIVITY

The Health Education Board for Scotland recommends that all adults should aim to accumulate 30 minutes of moderate activity on most days of the week- this is defined as regular physical activity. This can be built up in smaller repeated amounts of 5 and 10 minutes in the course of any day. Moderate activity includes using the stairs, cycling, house-work, bowling, dancing etc. - it does not need to be strenuous exercise.

12. With this message in mind, please read through all categories below and tick **one box** against the category which best describes you.

PHYSICAL ACTIVITY LEVELS	
I am not regularly physically active and do not intend to be so in the next 6 months	
I am not regularly physically active but am thinking about starting to become more active in the next 6 months	
I take part in some physical activity but not on a regular basis	
I am regularly physically active but have only begun in the last six months	
I am regularly physically active and have been so for longer than six months	

13. With regard to how you travel to work, please read through all categories below and tick **one box** against the category which best describes your travelling patterns. In each of these categories, "regular" means at least 2-3 times per week.

JOURNEY TO WORK	
I do not regularly walk or cycle part or all of the journey to work and do not intend to be so in the next 6 months	
I do not regularly walk or cycle part or all of the journey to work but am thinking about starting to do so in the next 6 months	
I sometimes walk or cycle part or all of the journey to work but not more than once per week	
I regularly walk or cycle part or all of the journey to work but have only begun in the last six months	
I regularly walk or cycle part or all of the journey to work and have been so for longer than six months	

14. How confident are you that you can walk or cycle some or all of the way to and from work when; *(please circle the most appropriate response)*

	not at all confident	***fairly confident***	***confident***	***very confident***
You are tired	**1**	***2***	***3***	***4***
You are in a bad mood	**1**	***2***	***3***	***4***
When you are pressed for time	**1**	***2***	***3***	***4***
When the weather is bad	**1**	***2***	***3***	***4***
When your routine changes	**1**	***2***	***3***	***4***

End of page 3 - yippee

SECTION 4 YOUR HEALTH

This next section asks for your views about your health. This information will help keep track of how you feel and how well you are able to do your usual activities. Answer every question by marking the answer as indicated. If you are unsure about how to answer a question, please give the best answer you can. Please circle a number

15. In general, would you say your health is;		**16. Compared to one year ago**, how would you rate your health in general **now**?	
excellent	1	Much better than one year ago	1
very good	2	Somewhat better than one year ago	2
good	3	About the same as one year ago	3
fair	4	Somewhat worse than one year ago	4
poor	5	Much worse now than one year ago	5

17. The following items are about activities you might do during a typical day. Does **your health now limit you** in these activities? If so how much?

ACTIVITIES	Yes, limited a lot	Yes, limited a little	No, not limited at all
Vigorous activities, such as running, lifting heavy objects, participating in strenuous sports	1	2	3
Moderate activities, such as moving a table, pushing a vacuum cleaner, bowling, or playing golf	1	2	3
Lifting or carrying groceries	1	2	3
Climbing several flights of stairs	1	2	3
Climbing one flight of stairs	1	2	3
Bending, kneeling, or stooping	1	2	3
Walking more than a mile	1	2	3
Walking half a mile	1	2	3
Walking one hundred yards	1	2	3
Bathing or dressing yourself	1	2	3

18. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the Time	A little of the Time	None of the Time
1	**2**	**3**	**4**	**5**

End of page 4

19. During the **past four weeks**, have you have had any of the following problems with your work or other regular daily activities **as a result of your physical health?**		
	YES	**NO**
Cut down on the amount of time you spent on work or other activities		
Accomplished less than you would like		
Were limited in the kind of work or other activities		
Had difficulty performing the work or other activities (for example it took extra effort)		

20. During the past four weeks, have you had any of the following problems with your work or other regular daily activities as a result of any emotional problems (such as feeling depressed or anxious)?		
	YES	**NO**
Cut down on the amount of time you spent on work or other activities		
Accomplished less than you would like		
Didn't do work or other activities as carefully as usual		

	Not at all	**slightly**	**moderately**	**quite a bit**	**extremely**
21. During the **past four weeks**, to what extent has your physical health or emotional problem interfered with your normal social activities, friends, neighbours, or groups?	**1**	**2**	**3**	**4**	**5**
22. During the past 4 weeks, how much did pain interfere with your normal work (including both work outside the home and housework)?	**1**	**2**	**3**	**4**	**5**

23. How true or false is each of the following statements for you?

	Definitely True	**Mostly True**	**Don't Know**	**Mostly False**	**Definitely False**
I seem to get ill more easily than other people	**1**	**2**	**3**	**4**	**5**
I am as healthy as anyone I know	**1**	**2**	**3**	**4**	**5**
I expect my health to get worse	**1**	**2**	**3**	**4**	**5**
My health is excellent	**1**	**2**	**3**	**4**	**5**

SECTION 4 YOUR HEALTH cont.

24. These question as are about how you feel and how things have been with you **during the past 4 weeks**. For each question, please give the one answer that comes closest to the way you have been feeling. How much of the time during the **past 4 weeks -**

	All of the Time	Most of the Time	A Good bit of the Time	Some of the Time	A little of the Time	None of the Time
Did you feel full of life?	1	2	3	4	5	6
Have you been a nervous person?	1	2	3	4	5	6
Have you felt so down in the dumps that nothing could cheer you up?	1	2	3	4	5	6
Have you felt calm and peaceful?	1	2	3	4	5	6
Did you have a lot of energy?	1	2	3	4	5	6
Have you felt downhearted and low?	1	2	3	4	5	6
Did you feel worn out?	1	2	3	4	5	6
Have you been a happy person?	1	2	3	4	5	6
Did you feel tired	1	2	3	4	5	6

25. During the past 4 weeks, how much of the time has your physical health or emotional problems interfered with your social activities (like visiting friends, relatives, etc.)?

All of the time	Most of the time	Some of the Time	A little of the Time	None of the Time
1	2	3	4	5

26. How much **bodily** pain have you had during the **past 4 weeks**?

None	Very mild	Mild	Moderate	Severe	Very severe
1	2	3	4	5	6

End of Page 6

FINISHED!!

THANK YOU FOR SPENDING TIME COMPLETING THIS QUESTIONNAIRE, IF YOU RETURN THIS QUESTIONNAIRE YOU WILL BE ENTERED INTO A FREE PRIZE DRAW WHERE THERE ARE NUMEROUS PRIZES Prizes include; 1st prize- £30 sports voucher, 2nd prize - £30 book token & 10 runner-up prizes.

APPENDIX D

STUDY 3 RESEARCH MATERIALS

Study 3 Invitation Letter

Scottish Government staff are invited to take part in research on how they travel to work, with particular emphasis on cycling.

The project, 'How do you commute?' is by the University of Edinburgh and Cycling Scotland and aims to gather information from all commuters, whether they cycle or not.

Ruth White, Head of Sustainable Travel Management explains: "Cycling Scotland asked us to take part in this survey following three of our buildings, Saughton House, St Andrew's House and Atlantic Quay, recently being awarded their 'Cycle Friendly Employer Awards'.

"Everyone's views are valuable and I hope that colleagues will take the time to share their opinions. This research will provide us with useful information on how we might support staff who are considering cycling to work but feel there are barriers to doing so at the moment."

The online questionnaire, is being run by lead researcher Jenny van Bekkum at Edinburgh University. It is quick and easy to complete and should take approximately five minutes.

All those who take part in the questionnaire will automatically be entered into a free prize draw. The prizes, donated by Cycling Scotland includes portable solar charger technology packs worth up to £55.

As a follow up to the questionnaire, you may be invited to take part in a lunchtime workshop on the benefits, challenges and planning strategies related to cycle commuting.

And would-be cyclists will shortly have an opportunity to make 40 per cent savings on buying a new bike through the Scottish Government's Bike Salary Sacrifice Scheme . The scheme runs twice yearly, in March and September. Watch this space for more details.

Study 3 Questionnaire

'How Do You Commute' Questionnaire

Name:_____ **Building/Site:**_____

To complete the following questions please **circle** the most appropriate answer.

1. Your Job Category	**A Band**	**B Band**	**C Band**	**SCS**

3. Your gender	**Male**	**Female**

4. Your age	**16-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**

5. The distance you live from your workplace. Please estimate your distance ONE WAY					
Under 1 mile	**1 to 1.9 miles**	**2 to 5.9 miles**	**6 to 10.9 miles**	**11 to 19.9 miles**	**Over 20 miles**

6. The means of transport you most commonly use to travel to and from work. Please circle only ONE of the categories.						
Train	**Car**	**Motorcycle**	**Bus**	**Bicycle**	**Walking**	**Other**
A combination of modes (please specify):						

7. With regard to how you travel to work, please read through all of the categories below and **tick** which ONE statement best describes your travelling patterns. In each of these categories 'regularly' means at least 2-3 times per week.

• I do not cycle part or all of the journey to work and I do not intend to do so	
• I do not cycle part or all of the journey to work but I am interested in the idea of cycle commuting	
• I do not regularly cycle part or all of the journey to work but am thinking about starting to do so in the next 6 months	
• I sometimes cycle part or all of the journey to work but not more than once per week	
• I regularly cycle part or all of the journey to work but have only begun in the last six months	
• I regularly cycle part or all of the journey to work and have been doing so for longer than six months	

8. Whether or not you cycle to work, please indicate the extent to which the following factors encourage you to cycle commute.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Benefits	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Cost saving over other transport methods	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Shortened journey time to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Minimal contribution to pollution	**1**	**2**	**3**	**4**	**5**	**N/A**
d. No necessity for car parking	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Improvements to physical health/fitness	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Improvements to psychological wellbeing/mood	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Getting some fresh air	**1**	**2**	**3**	**4**	**5**	**N/A**
h. A sense of freedom and flexibility	**1**	**2**	**3**	**4**	**5**	**N/A**
i. A sense of enjoyment	**1**	**2**	**3**	**4**	**5**	**N/A**
j. The social side of cycling	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Availability of dedicated cycle routes	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Availability of workplace facilities	**1**	**2**	**3**	**4**	**5**	**N/A**

9. Overall, how encouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

10. Whether or not you cycle to work, please indicate the extent to which the following factors discourage you from currently cycling commuting.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Challenges	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Nature of natural terrain (e.g. hilliness)	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Nature of manmade terrain (poor cycle infrastructure)	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Danger from motor traffic	**1**	**2**	**3**	**4**	**5**	**N/A**
d. Bad weather including darkness	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Distance to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Lack of time	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Breathing in exhaust fumes	**1**	**2**	**3**	**4**	**5**	**N/A**
h. Physical effort involved	**1**	**2**	**3**	**4**	**5**	**N/A**
i. Necessity of taking children to/from school/nursery	**1**	**2**	**3**	**4**	**5**	**N/A**
j. Lack of waterproof clothing	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Expense of buying a bicycle	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Lack of storage space from your bike at home	**1**	**2**	**3**	**4**	**5**	**N/A**
m. Disabilities/injuries or health problems	**1**	**2**	**3**	**4**	**5**	**N/A**
n. Having to wear less formal clothes	**1**	**2**	**3**	**4**	**5**	**N/A**
o. Carrying your belongings to/from work	**1**	**2**	**3**	**4**	**5**	**N/A**

11. Overall, how discouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

12. Whether or not you cycle to work, how confident are you that you can cycle commute when:

Please **circle** the most appropriate response.

Confidence	**Not at all confident**	**Fairly confident**	**Confident**	**Very confident**
a. You are tired	**1**	**2**	**3**	**4**
b. You are in a bad mood	**1**	**2**	**3**	**4**
c. You are pressed for time	**1**	**2**	**3**	**4**
d. The weather is bad	**1**	**2**	**3**	**4**
e. Your routine changes	**1**	**2**	**3**	**4**

13. Regardless of whether or not you cycle to/from work, please **circle** the most appropriate response for each of the questions below.

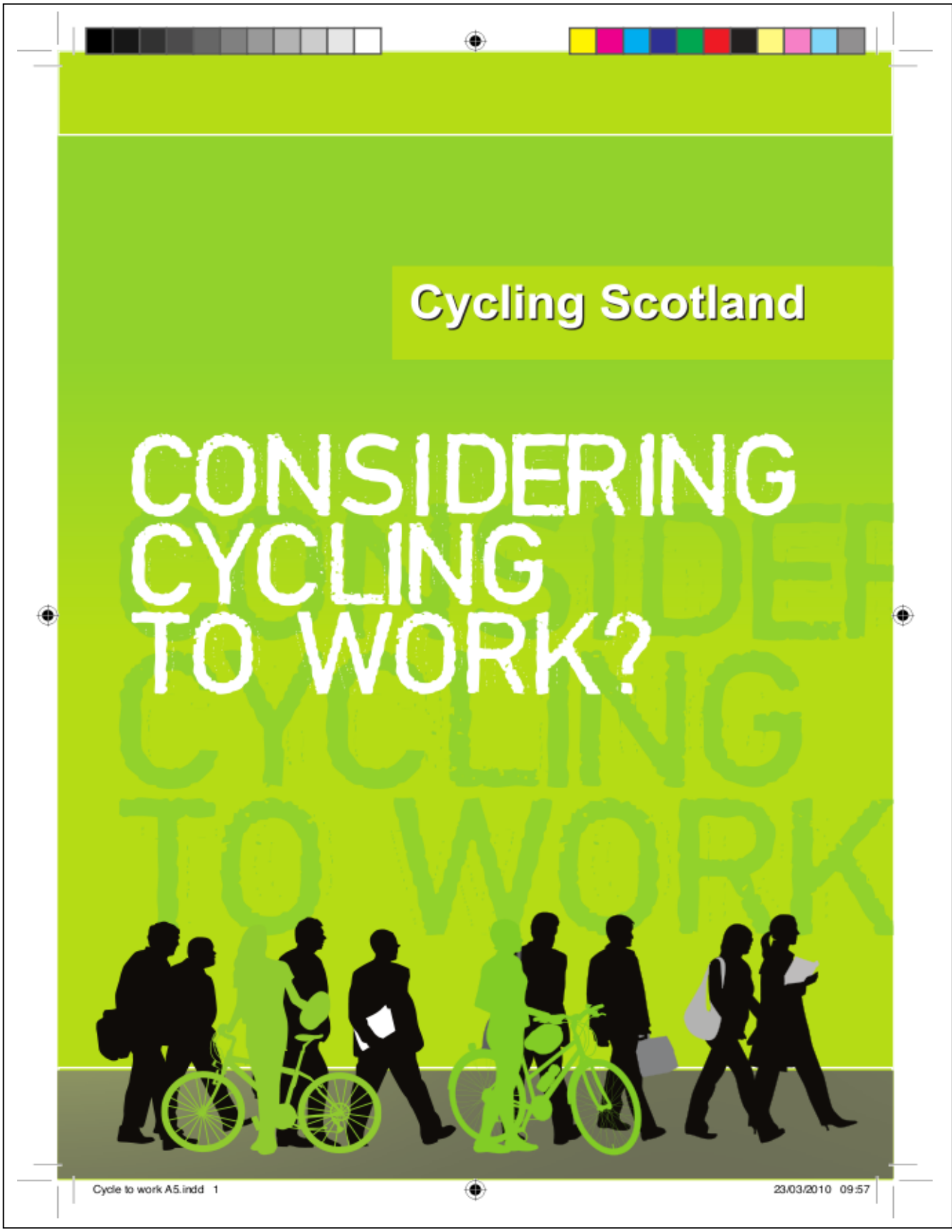
Planning, Preparation & Resources	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**
a. How important do you think preparation and planning are towards cycle commuting?	**1**	**2**	**3**	**4**	**5**
b. How prepared do you feel to cycle commute?	**1**	**2**	**3**	**4**	**5**
c. How informed do you feel about the cycle facilities and resources available at your workplace?	**1**	**2**	**3**	**4**	**5**

THANK YOU for completing this questionnaire!

APPENDIX E

STUDY 4 INTERVENTION AND RESEARCH MATERIAL

Study 4 Intervention Booklet



CONTENTS

The Benefits of Cycling to Work

There are numerous underlying reasons that motivate a person to consider cycling to work. Your reasons will relate to your personal preferences, beliefs, situation, and needs

Some of your reasons for considering cycling to work may be driven by daily rewards (e.g. having more free-time) and other reasons may result in long-term rewards (e.g. increased fitness).

Some people may also choose to cycle to work because of negative aspects of their current mode of travel (e.g. waiting for buses) or because they want to minimise long-term negative aspects of their current lifestyle (e.g. reducing CO^2 emissions).

The boxes below provide you with some examples of the benefits people can experience by choosing to cycle to work.

Advantages (short term)

- Feel good' factor e.g. improves mood, wakes you up, relaxing, releases endorphins etc.
- Time saving e.g. enabling a longer lie-in
- Freedom and flexibility
- Independence from others
- Enjoyment of being outside
- Enjoyment of cycling/speed
- Combining your daily exercise with your commuting journey

Advantages (long term)

- Health improvements/maintenance e.g. weight loss, healthy joints etc.
- Physical fitness improvements
- Being environmentally friendly
- Being a role-model e.g. to children, colleagues etc.
- Saves money on petrol and bus fares

Fewer disadvantages (short term)

- Reduces daily travel costs e.g. bus fare
- Reduces delays experienced in rush hour traffic e.g. getting stuck in traffic jams
- Less stress associated with rush hour driving
- Fewer travel and parking costs
- No more waiting at the bus stop

Fewer disadvantages (long term)

- Decreasing environmental harm by producing less CO^2 emissions
- Changing sedentary lifestyle and decreasing the risk of diseases associated with inactivity
- Decreasing expenses of season travel passes and car use e.g. car depreciation from clocking up extra miles

The Challenges of Cycle Commuting

When thinking about cycle commuting there are likely to be some aspects of the process that are challenging or daunting. These challenges might initially deter you from trying to cycle to work.

The boxes below provide you with some examples of challenges people can face when considering cycling to work.

Individual Challenges

- Confidence levels/fear of cycling in traffic
- Looking presentable for work
- Carrying lots of belongings
- Access to a bike
- The cost of buying a bike
- Lack of bike storage at home
- Negotiating stairs with a bike
- Bike security
- Fitness levels

Social/Family Challenges

- Family responsibilities e.g. school run
- Negative social stigma
- Poor driver attitudes
- Concern from family members about cycling on roads

Workplace Challenges

- Lack of showering and changing facilities
- Lack of bike storage facilities
- Bike security
- Lack of clothes storage facilities
- Lack of support and understanding
- Lack of information about cycling facilities and services

Environmental Challenges

- Lack of cycle provision e.g. paths, bike racks etc.
- Poorly maintained paths and roads
- Busy roads
- Hills
- Bad weather
- Darkness
- Exhaust fumes

Many of these challenges can be overcome with some consideration and planning.

Overcoming the Challenges

The following information aims to help you to overcome common challenges faced by people considering cycling to work.

The Risk of Accidents

As with all forms of transport there are some risks associated with cycling, but when acting appropriately as a cyclist, the risks are much lower than many people imagine. Evidence suggests that the risks of cycling are far outweighed by the health benefits you will experience from being more physically active.[1]

Lack of Confidence to Cycle in Traffic

Cycling in heavy traffic can be daunting. If you don't feel confident about cycling on busy roads, look for an alternative route to work that takes you on quieter streets and paths.

When cycling in traffic there are a number of basic principles that you can adopt to increase your safety on the roads:

- Remain alert at all times and be aware of your road positioning.
- On the road, position yourself about one meter away from the curb and keep a safe distance from parked cars, as car doors swinging open can be a potential hazard.
- Make sure you are visible to other road users. You may consider wearing bright reflective clothing to make yourself more visible.
- Cycle helmets are not compulsory by law but it is a good idea to wear a cycling helmet, particularly if cycling in traffic.
- At roundabouts, junctions, and traffic lights make eye contact with vehicle drivers around you so you can be sure that they have seen you. If in doubt about a driver's intentions, stay a safe distance behind them until you are clear about their actions.
- Don't take any risks in traffic. If you feel unsafe at any time you always have the option to get off your bike and push it on the pavement.

Exhaust Fumes

It has been found that pedestrians and cyclists inhale lower levels of exhaust fumes in comparison to people travelling in motorised vehicles. If breathing in exhaust fumes concerns you, then cycling face masks can be used to reduce the amount of pollution you inhale. Another option is to plan a route that does not expose you to large volumes of traffic.[2]

[1] Cavill, N. & Davis, A. (2007). Cycling and Health: What's the Evidence? London, Cycling England
[2] Nauc, S. Nieuwenhuijsen, M.J. & Colville, R.N. (2007). Fine Particulate Matter and Carbon Monoxide Exposure Concentrations in Urban Street Transport Microenvironments. Atmospheric Environment, 41, 4781-4810.

Bad Weather and Darkness

If you are really put off by the idea of bad weather and darkness then an option is to become a seasonal cyclist, cycling only on sunny days during the summer months.

For all-year-round cycle-commuting, waterproof clothing will protect you from wet weather. A lightweight, breathable, waterproof jacket and over-trousers will keep you warm and dry. On wet rainy days, remember to be more careful. Cycle at a slower pace and don't break too quickly, as this can cause skidding. As a cyclist your hands are always exposed to the weather conditions so gloves are recommended. There are some extreme weather conditions such as snow, ice and gales that are deemed unsafe cycling conditions and on these occasions you should take an alternative form of transport.

In poor light, fog and darkness, reflective clothing or reflective strips make you more visible to other road users. There is a legal requirement for cycles to have lights displayed during the hours of darkness. Powerful, efficient, and re-chargeable bicycle lights that are quick and easy to fit onto your bike can be obtained for a reasonable cost.

Carrying Belongings

Pannier bags come in different shapes and sizes and are a great way of transporting your belongings by bike. There are now special briefcase style pannier bags designed for carrying laptops. Most pannier bags are detachable, meaning that you can clip them easily on and off your bike. You can also buy rucksacks designed for cycling, which have a built in system for preventing sweating on your back.

Hills

If the idea of cycling up hills is off-putting, first see if it is possible to plan your route so that you avoid some hilly sections on your journey. This may mean taking a slightly longer route, but it may be more pleasurable if it is flatter. Where hills are unavoidable, having a bike with a range of gears will make cycling uphill much easier. If the hill is very steep, you may consider getting off and pushing your bike for that specific section. The great thing about cycling uphill is 'what goes up must come down'.

The Cost of Buying a Bike and Bike Accessories

The initial investment in a bike and cycling accessories can really add up. If you are looking to buy a new bike, find out about payment schemes that are available through your workplace, for instance the Bike to Work scheme. The other option is to buy a cheap second-hand bike. You can pick up second-hand bikes quite easily. Have a look on notice boards, the internet, or in local second hand bike shops.

Looking Presentable

How you choose to deal with looking presentable for work will very much depend on the type of clothes you are required to wear for work and the distance you will be cycling.

If you are travelling a short distance and cycle at an easy pace, you could cycle in your work clothes. Trouser clips will stop your trouser legs getting caught in the chain. If you are travelling longer distances or are required to wear very formal office wear that is restrictive to move in, then you should consider changing and showering at work. Not all work buildings have showering facilities so you may need to do a bit of investigation to find out if there is a shower in another building nearby that you can use.

You may opt to leave some clothing (e.g. shirts and a blazer) and perhaps a towel and toiletries at your workplace. If so, you will need to consider the logistics of getting things to the office and where to store them. It is a good idea to ask a colleague or friend who cycles for advice about these matters. Another option is to carry your change of clothes with you on a daily basis. Folding and then rolling clothes can prevent them from getting creased.

Bike Storage and Security

Your employer should provide some bicycle storage facilities for staff. Many employers will provide secure, sheltered bike parking or standard bike racks. However, sometimes bike storage and security at work can present a challenge. When leaving your bike somewhere that is not secure, use your intuition. If you are unsure about the location (e.g. it's a very isolated place) look for somewhere more suitable. Avoid locking your bike out of sight or in dark places, for your own safety. Invest in a good lock and make sure you use it at all times – even if you are just nipping somewhere for a minute or two. Cycling organisations recommend using two different brands of locks for extra safety. Ask for advice about locks at your local bike shop or read up about them on the internet at:

visit: www.whycycle.co.uk

Storing a bike at home can also present a challenge. If there is no obvious place to store your bike there are a number of things you could consider:

- Buy a cheap second hand bike for commuting and chain it up somewhere outside your home, then if it were to get stolen or rusts, your loss would be minimal.
- Invest in a folding bike, which can be easily stored inside your home and workplace.
- If you want to keep your bike indoors you can buy wall mounts and bike stands that take up minimal space.
- If you have a garden you could consider buying a cheap shed to store your bike in.

Fitness Levels

Cycling is not just a commuting option for 'sporty people', it is for everyone. If you haven't exercised for a while it is important to start slowly. If you have any health conditions that might be affected by exercise, then seek advice from your GP before starting to cycle.

- You could try cycling into work for one day a week, building up the number of days you cycle as your fitness levels increase.
- You can also choose what speed you want to travel at, so start off at a pace that suits you. Don't make it an unpleasant experience by pushing yourself too hard.

Initially you may find that you perspire quite a lot, but this will decrease within a few weeks as your body adapts to your new, more active routine.

Childcare Responsibilities

If you are responsible for taking children to school or nursery it is not always feasible to cycle to work, but in some instances there can be ways around this.

- One option is to share child care responsibilities with a partner/family member.
- You can also consider buying a child seat for your bike or cycling with your children on their own bikes.

Preparing and Planning to Cycle Commute

Before you start to cycle to work, some preparation and planning will go a long way in helping you to adjust to a new commuting routine that really works for you.

Do Some Research:

If you are unfamiliar with cycling provisions and services in your area, do a little bit of research. Speak to people who cycle for advice and check on the internet for information.

Browse Before You Buy:

If you are looking to invest in a new bike, visit a bike shop. Have a look around at the bikes on offer and ask for some advice about the type of bike that would suit your needs. Also look into the payment schemes your workplace offers.

Plan Your Route:

Spend a little bit of time planning which route you are going to take. Look on a map or on the internet to find out your different options.

Try Out Your Route:

Before you start cycling to work, try your route out on a weekend or evening when it is quieter on the roads and you are not under time pressure to get to work. By testing out your route first you can work out how long your cycle ride will take and you will also get a chance to practice negotiating the junctions at a quieter time of day.

Plan When You Will Cycle:

It may not be possible to cycle into work every single day so at the beginning of the week sit down and make a clear plan about which days you are going to cycle into work.

Pack Your Bag in Advance:

Pack your bag the night before with all of the items you will need for the next day so you can just get up and go.

Always Carry The Basics:

In order to be prepared for all eventualities, it is a good idea to keep your cycling accessories (e.g. your lock, lights, trouser clips, gloves and waterproofs) in your bike bag so that they are at hand when you need them. And don't forget to carry a cycle repair kit at all times.

Improve Your Cycle Skills:

There are cycle commuter training courses that are available for people who are looking to increase their skills and confidence to cycle on the roads. Check with your employer to see if there are any free cycle training courses available to you through your workplace or through local cycling groups (see the useful websites section on page 14).

Ride With An Experienced Cyclist:

You could initially try cycling with an experienced cyclist if you are feeling nervous about cycling on the roads. There may be a bike buddy scheme at your workplace. Alternatively, you may be able to go cycling with a friend or family member who is an experienced on-road cyclist.

Maintain Your Bike:

If your equipment is in good working order it will make you feel more comfortable about cycling. If your bike is well used you should consider getting it serviced to make sure it is road-worthy. You may also consider signing up for a bike maintenance course so you can learn how to do it yourself. Remember to check brakes and tyres regularly, and oil your chain when required.

Action Planning

Making plans helps you to put your thoughts into actions. You are much more likely to achieve a goal if you decide in advance, **WHEN**, **WHERE**, and **HOW** it will be achieved.

To make your own cycle commuting action plan:

1. Choose a time frame for your action plan (e.g. six weeks) and then write down your cycle commuting goal for that period of time. Try to think realistically about what you can achieve in your chosen time period. Your goal may be gaining confidence to cycle on the roads, starting to cycle commute or it could be as simple as doing some research into cycling in your local area.

2. Once you have decided on your goal, think of some actions you can carry out that will help you to reach your goal.

3. Once you have decided on your actions, as clearly and specifically as possible, write down when, where and how you will achieve your actions.

Here is an example to illustrate:

My Action Plan

Time Frame: Six weeks

My Goal: To start cycle commuting three days per week.

Action One: Try out my cycle route to work.

When: Next Sunday Morning at 11am if it's not raining, or Monday evening at 8pm.
Where: Along the main road, cutting down Black Street and through Royal Park.
How: I will cycle the whole journey.

Action Two: Buy a new bike (that is more suitable than my old mountain bike) for commuting.

When: I will purchase a bike at the end of the month when I get paid.
Where: I will go to 'Mikes Bikes' because through my workplace I can get a 10% discount there.
How: I need to 'Google' the shop to check out its location. If it's where I think it is, I'll get the bus up there.

Useful Websites

Websites that provide useful information about cycle commuting include:

- www.cyclingscotland.org
- www.britishcycling.org.uk
- www.chooseanotherway.com
- www.ctc.co.uk
- www.cyclefriendlyemployers.org.uk
- www.sustrans.org.uk
- www.whycycle.co.uk

First Scotrail trains have racks for taking a limited number of bikes free of charge. For details visit:

- www.scotrail.co.uk

Health guidelines recommend that adults do a minimum of 30 minutes of moderate intensity excercise five days of the week. Making a 15 minute cycle journey (about two miles) twice a day, to work and back, is an ideal way to achieve this.

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Healthy Working Lives

Cycling Scotland

THE UNIVERSITY OF EDINBURGH

Study 4 Intervention PowerPoint and Script Notes

INTRODUCTION (Jenny)

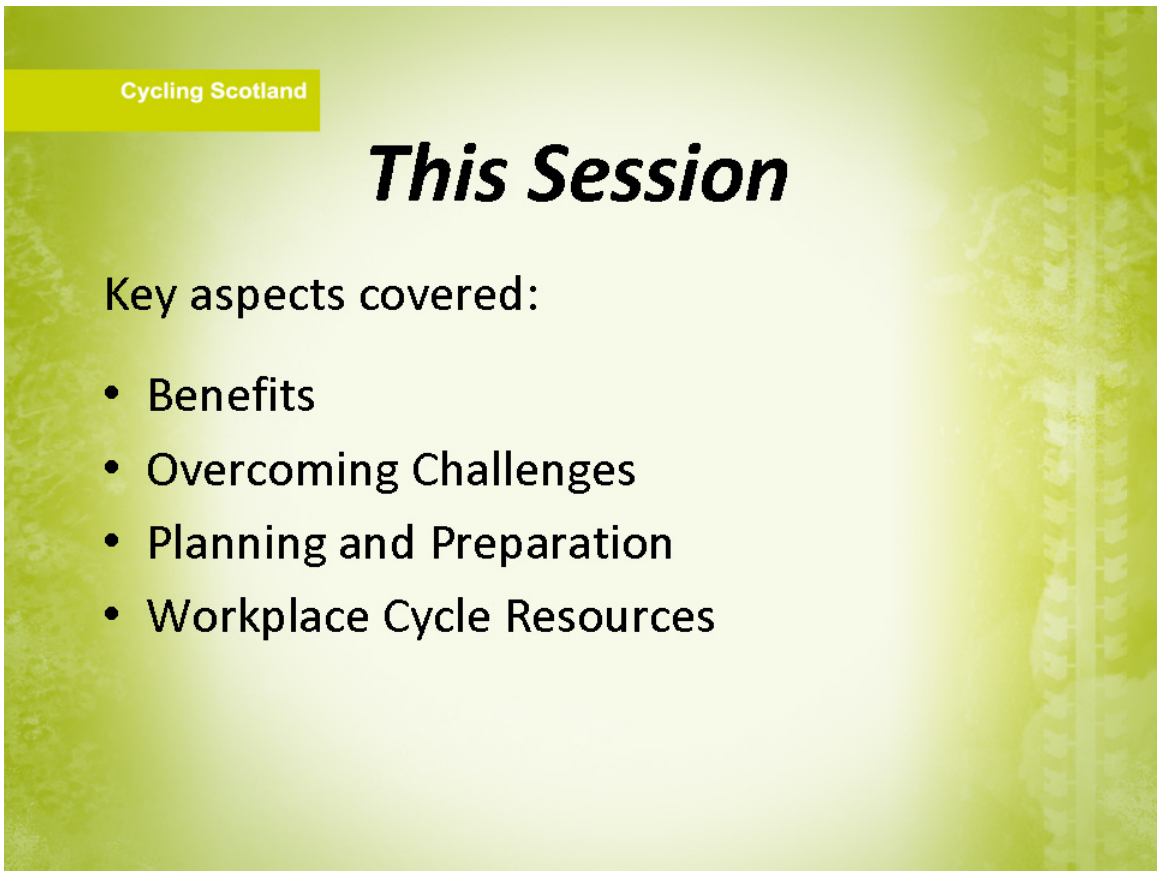
WELCOME
Hello, I'd like to welcome you all to the 'Cycle to Work' lunchtime workshop session.

NAME
My name is Jenny van Bekkum and I will be running this workshop along with Christopher Johnson from Cycling Scotland.

PERSONAL CYCLE COMMUTING EXPERIENCE
I currently cycle commute everyday, my journey is about 2 kilometres each way and I cycled here today.
Chris: (Insert information).

WHO IT'S FOR
The workshop is designed for people who are not currently cycle commuting but have some interest in the idea.

PURPOSE
The session has two main purposes.
1. To provide you with some ideas and support that may encourage you further to take up cycle commuting.
2. To help you engage with the aspects involved in cycle commuting so you can consider how you might effectively fit it into your daily routine.



OUTLINE WORKSHOP (Jenny)

CONTENT
During the session we will look at:

- Some of the benefits of cycling to work,
- Raise some of the challenges that people face in relation to cycle commuting and look at how to overcome these, &
- In terms of planning and preparation, consider some of the things you can do to make the transition to cycle commuting easier.

Instead of us standing here for the next hour telling you about these aspects, we have three video clips to do this job. In the clips you will hear from a range of cycle commuters based in Edinburgh, talking about their own experiences of cycling to work.

During the session there will also be two short exercises to carry out, and finally, we will run through the workplace cycle resources that are available to you at your workplace.

MENTION HANDOUTS
There are two handouts for you to take away at the end, a copy of the workplace resources list and a booklet that includes all of the points we will discuss today.

MENTION QUESTIONS
If you have any questions please feel free to ask them as we are going along. Although we've got a lot to cover in a little amount of time we'll try to leave a few minutes at the end for questions

INTRODUCE ‘BENEFITS’ SECTION (Jenny)
Initially we are going to start by looking at the benefits you can experience by choosing to cycle to work.

AKNOWLEDGE PREVIOUS KNOWLEDGE & EXPLAIN VALUE
It’s likely you will already be aware of some of these benefits, nevertheless, it’s always helpful to be reminded of some of these as it’s very easy to focus in on the negatives and you never know, there might also be some benefits mentioned that you hadn’t really associated with cycling.

LINK TO VIDEO CLIP - BENEFITS
So without further-a-do I’ll play the first video clip.

VIDEO CLIP ONE: BENEFITS OF CYCLING TO WORK

EXERCISE ONE (Christopher)

LEAD OUT FROM VIDEO CLIP - BENEFITS
I'm not suggesting that all of the benefits mentioned in the clip will apply to everyone but it's likely that there will be a few that will apply to each of you.

EMPHASISE SOME KEY BENEFITS
I think there are some points that are important to emphasise here.
1. Cycling to work benefits your health, the environment, and long term, your finances.
2. Cycle commuting also takes less time than many people would estimate. Taking into account that cycling is door to door, with relatively few delays, in a city like Edinburgh cycling within a four mile radius of the town centre is often the quickest and most flexible way of getting around.

USE SOME EXAMPLES (Christopher, this is my example but please insert your own here instead)
For me, I spend a lot of my working day in front of a computer screen so the biggest drivers are that I can get some exercise and fresh air into my daily routine and I can also get across town quickly to do errands at lunchtime and meet friends for dinner on the evening.

INTRODUCE EXERCISE ONE
We are now going to carry out a short exercise, with the aim to build a clearer picture of the benefits and challenges you anticipate that you will personally face when considering the idea of cycling to work. So, in a way it's like making a list of the pros and cons.
I would like you all to take a few minutes to write down your benefits and challenges on the sheet provided. Once you've done this I'm going to invite some of you to share some examples with the group.

CARRY OUT EXERCISE (3 minutes)
GET EXAMPLES FROM AUDIENCE & SUMMARISE (2 minutes)

INTRODUCE ‘OVERCOMING CHALLENGES’ SECTION (Christopher)
So now you all have your own list of challenges, the next thing we are going to do is to have a look at how to overcome some of these.

ACKNOWLEDGE DIFFFICULTIES PEOPLE MAY HAVE
I appreciate that not all of the challenges that you have written down are all going to be easy to overcome (example). However, with some consideration many of these can be negotiated, (example).

INTRODUCE VIDEO CLIP – OVERCOMING CHALLENEGES
We are going to take a look again at a video clip to see how our group of cycle commuters deal with some of the more common challenges that cycling to work can present.

VIDEO CLIP TWO: OVERCOMMING CHALLENGES OF CYCLING TO WORK

EXERCISE TWO (Jenny)

LEAD OUT FROM THE VIDEO CLIP – OVERCOMING CHALLENGES
You may have already thought about some of the suggestions made in the video and if so that's great but hopefully it's also given some of you a few new ideas.

As mentioned, not all challenges can be easily overcome but with some consideration and planning, it's possible to find solutions to many of these.

INTRODUCE EXERCISE TWO
So what we are going to do now is carry out the second exercise. This involves choosing two of your challenges from the list you have made. Then working in pairs, ask your partner to come up with solutions for these". You have five minutes to do this and then I would like each pair to share one of their examples with the group.

CARRY OUT EXERCISE (5 minutes)

GET ONE EXAMPLE FROM EACH PAIR (10 minutes)

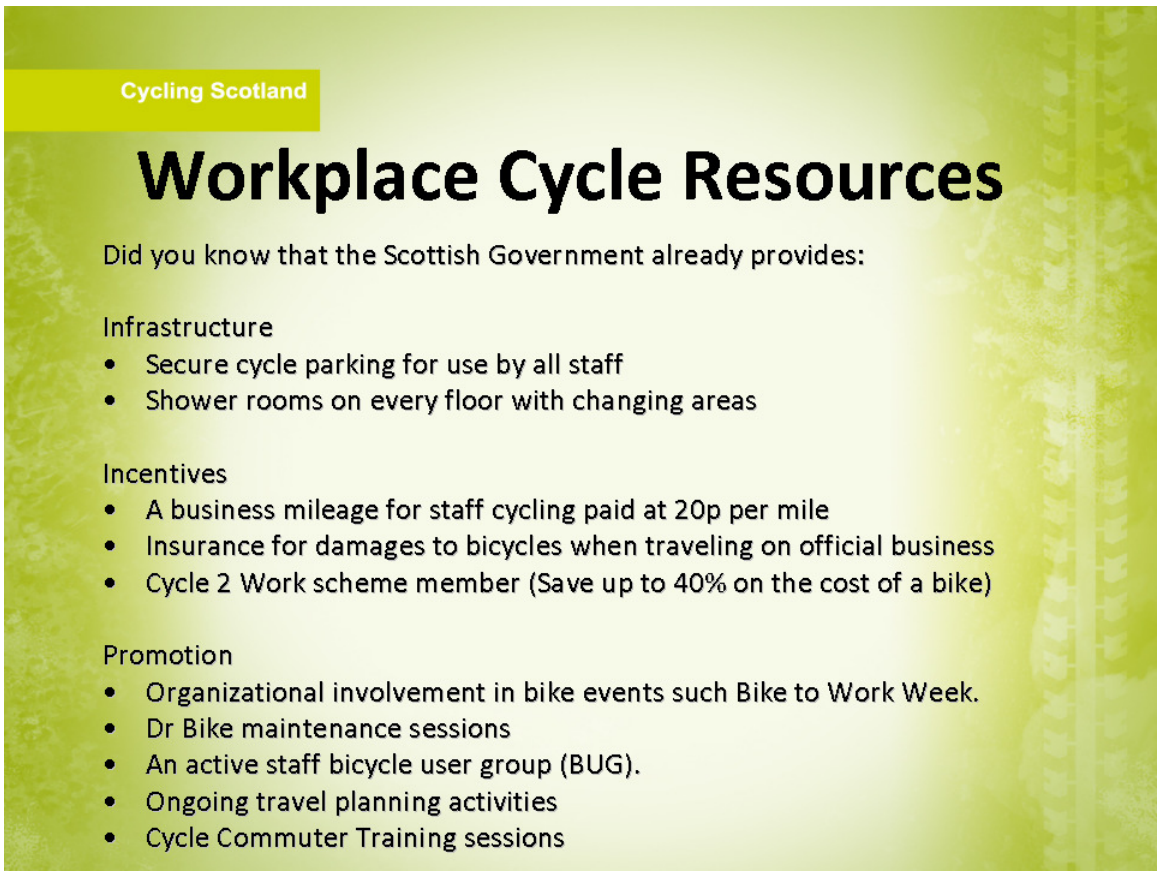
SUMMARISE EXERCISE
So as you can see there are some interesting ideas here. Sometimes you just have to think outside of the box a little bit.

PROVIDE A PIECE OF ADVICE
One really useful tip is to ask someone who cycle commutes for advice on some of the challenges you are facing. It's likely that they will have first hand experience with some of your issues and it could save you a lot of trial and error trying to find solutions by yourself – BUG.

INTRODUCE ‘PLANNING & PREPARATION’ SECTION (Jenny)
Leading on from finding ways of overcoming challenges we are now going to look at ways you can plan and prepare to start cycling to work.

INTRODUCE VIDEO CLIP – P & P
We will now watch the last video clip in which our cycle commuters discuss some of the things they did in preparation to start cycle commuting and some of the things they rely on to make cycling fit effectively into their daily routine.

VIDEO CLIP THREE: PLANING AND PREPARATION



LEAD OUT OF DVD – P & P (Christopher)
As you can see the DVD ended on a height note there, but I hope its been useful in highlighting some of the things you can do to make cycling a viable transport option.

INTRODUCE RESOURCES
So we are nearly at the end of the session and the final point I want to cover is to briefly run through a list of the cycle facilities available at your workplace. You might be surprised at how many there are for you to take advantage of if you decide to.

READ RESORCES LIST (2 MINUTES)

CLOSE WORKSHOP (Christopher)

HANDOUT RESOURCE SHEET AND BOOKLETS
I have a handout here with the workplace cycle resources information for you to take away. As mentioned at the beginning of the session I also have a small booklet to give you which covers the main points mentioned in the workshop.

OPPORTUNITY FOR QUESTIONS
Does anyone have any questions they would like to ask before we finish? The contact details of myself and Jenny are on the screen so if you have any questions you would like to ask either of us at a later date please take down our contacts and don't hesitate to get in touch.

SUMMARY
Thank you all for coming along today. We hope the video clips have given you some new ideas and that the workshop overall has provided you with the opportunity to positively reflect upon the option of cycling to work in a little more detail. I would recommend you to take a look at the booklet in your own time. We are confident in the benefits of cycle commuting and we hope that this workshop has encouraged you to give it a go.

Evaluation Form used as a Template for Pilot Study

Evaluation

360 Degrees on Overseas Youth Expeditions Knowledge Exchange

Seminar Evaluation

We would very much welcome your views on the seminar and appreciate any comments that you may wish to feedback.
Please circle the appropriate score for each question.

1. Seminar Outcomes	Not Well	Acceptable	OK	Well	Very Well
1.1. How were the objectives and aims of the event communicated to you?	**1**	**2**	**3**	**4**	**5**
1.2. How did the workshop meet its aims:					
• To raise awareness towards cross-sector collaboration initiatives	**1**	**2**	**3**	**4**	**5**
• To develop an understanding into practice	**1**	**2**	**3**	**4**	**5**
• To develop an understanding into policy	**1**	**2**	**3**	**4**	**5**
• To develop an understanding into research	**1**	**2**	**3**	**4**	**5**
• To exchange knowledge across sectors	**1**	**2**	**3**	**4**	**5**

2. Seminar Organisation	Poor	OK	Good	Very Good	Excellent
2.1. How did you find the pre-event arrangements? (bookings, reminders etc…)	**1**	**2**	**3**	**4**	**5**
2.2. How did you find the balance between the presentations and the discussions?	**1**	**2**	**3**	**4**	**5**
2.3. How did you find the length of the presentations?	**1**	**2**	**3**	**4**	**5**
2.4. How would you rate the range of speakers?	**1**	**2**	**3**	**4**	**5**
2.5. How did you find the length of the discussion sessions?	**1**	**2**	**3**	**4**	**5**
2.6. How would you rate the range of discussion questions?	**1**	**2**	**3**	**4**	**5**
2.7. How would you rate the venue? (facilities, access etc…)	**1**	**2**	**3**	**4**	**5**
2.8. How would you rate the hospitality? (catering, information available etc…)	**1**	**2**	**3**	**4**	**5**

2.9. Do you have any suggestions how the event may be improved?

Please turn over

3. Overall Reaction

3.1. Please circle the sector that best describes your job? **Academic** **Policy** **Practice** **Other**

	No	Not Really	Uncertain	Yes	Definitely
3.2. Did you enjoy the overall event?	**1**	**2**	**3**	**4**	**5**
3.3. Was the event relevant to your work?	**1**	**2**	**3**	**4**	**5**
3.4. Will you implement what you have learnt during this event into your workplace?	**1**	**2**	**3**	**4**	**5**
3.5. Were there opportunities for questions to be asked?	**1**	**2**	**3**	**4**	**5**
3.6. Were questions answered sufficiently?	**1**	**2**	**3**	**4**	**5**
3.7. Were there any topics that needed less emphasis	**1**	**2**	**3**	**4**	**5**

If so, please state:
_____

_____

3.8. Were there any topics that needed more emphasis? **1** **2** **3** **4** **5**

If so please state: _____

_____

3.9. Do you have any suggestions regarding what future events should address? _____

_____

_____

Please circle the words that most closely describe your experience of the overall event?

useful	**exciting**	**relevant**	**need more time**	**interesting**
well-paced	**inspiring**	**too long**	**boring**	
unfocussed	**clear**	**well organised**	**weak presentations**	**engaging**
good discussions	**strong presentations**	**unorganised**	**ambiguous**	
OK	**irrelevant**	**poor discussions**	**excellent**	

Please add any additional comments here:

Thank you for taking the time to fill out this questionnaire.

Study 4 Pilot Study Evaluation Form

Cycle to Work
Evaluation Form

Please circle the appropriate score for each question

1. Did the workshop meet its aims to:	No	Not Really	Unsure	Yes	Definitely
1.1 Provide an insight into the benefits of cycle commuting	1	2	3	4	5
1.2.Raise awareness about how to overcome some of the challenges that cycle commuters face	1	2	3	4	5
1.3. Provide support about how to plan and prepare to start cycle commuting	1	2	3	4	5
1.4. Inform you about the cycling resources available at your workplace	1	2	3	4	5

2. How would you rate the:	Poor	OK	Good	Very Good	Excellent
2.1. Workshop tutors delivery	1	2	3	4	5
2.2. DVD content	1	2	3	4	5
2.3. DVD quality	1	2	3	4	5
2.4. Workshop exercises	1	2	3	4	5
2.5. Overall workshop	1	2	3	4	5

3. How did you find the length of the:	Too Short		Just Right		Too Long
3.1. DVD	1	2	3	4	5
3.2. Workshop exercises	1	2	3	4	5
3.3. Overall workshop	1	2	3	4	5

4.1. What did you like about the workshop? _____

_____

_____

_____

4.2. What could be improved upon in the workshop? _____

_____

_____

_____

5.1. What did you like about the DVD? _____

_____

_____

_____

5.2. What could be improved upon in the DVD? _____

_____

_____

_____

5.3. Please circle the words that most closely describe your opinion about the DVD and its content.

Useful	Unsupportive	Relevant	Irrelevant	Relaxing
Interesting	Boring	Stressful	Too Short	Reassuring
Confusing	Supportive			
Well Paced	Poor Insight	Motivating	Too Long	Discouraging
OK				
De-Motivating	Informative	Clear	Ambiguous	Useless
Good Insight				

6.1.Please add any additional comments you have about the workshop and/or DVD here:

_____

_____

_____

_____

Thank You!

Tutor Resource

Draft Programme

Time	Session	Title
12.00	1	Introduction & welcome
12.05	2	Chapter 1 – Benefits
12:25	3	Chapter 2 - Challenges
12:50	4	Chapter 3 – Planning and Resources
13:00	5	Close

Session Ref No CTW1	**Time:** 5 minutes
Session Title: Welcome and Introduction	
Suggested location type for training: Classroom environment	
Session outcomes: By the end of this session clients will be able to: - State the course objectives - Participate in the course	
Suggested session content: - Introduce the themes and purpose. - Provide house keeping briefing. - Complete registration form (if required)	
Tutor notes: (and updates from previous reviews)	
Suggested resources: - Multimedia projector and laptop - Computer with software to support Microsoft PowerPoint presentation - Audio equipment for DVD sound - Cycle to Work DVD (or chapters embedded in presentation) - PowerPoint presentation - CS Course resources - Information sheet outlining Employers resources to support cycle commuting.	

Session Ref No CTW2	**Time:** 20 minutes
Session Title: The Benefits of Cycling	
Suggested location type for training: Classroom	
Session outcomes: By the end of this session clients will be able to: - Discuss the benefits of cycling - Identify personal challenges to cycling	
Suggested session content: - Introduction to the DVD; acknowledge repeat messages - Play DVD chapter 1 – the benefits of cycling - Tutor reinforce key benefits: Health; Environmental; Financial; Enjoyment - Complete exercise 1 – participants make individual lists of the benefits most relevant to them and the challenges they face. - Tutor uses exercise 1 responses to acknowledge popular benefits and challenges - Refer group to resource for future reference.	
Tutor notes: (and updates from previous reviews)	
Suggested resources: - Multimedia Projector, - PowerPoint slideshow: - DVD Chapter 1 - Exercise Sheet 1	

Session Ref No CTW 3	**Time:** 25 minutes
Session Title: Challenges and Solutions	
Suggested location type for training: Classroom environment	
Session outcomes: By the end of this session clients will be able to: - Discuss various challenges towards cycle commuting - Identify solutions to overcome or lessen the impact of challenges - Demonstrate awareness of supporting interventions and resources	
Suggested session content: (Manage time carefully during this session) - Tutor leads on from challenges identification to introduce 2nd video; - Play DVD chapter 2 – overcoming challenges - Tutor lead out from video clip and introduce Exercise two - Participants complete Exercise 2 in pairs (5mins) - Each pair volunteers one challenge and their solution - Summarize Exercise - Offer piece of advice – e.g. learn from others through joining established BUG	
Tutor notes: (and updates from previous reviews)	
Suggested resources: - Multimedia Projector, - PowerPoint slideshow: - DVD Chapter 2 - Exercise Sheet 2	

Session Ref No CTW 4	**Time:** 10 minutes
Session Title: Planning and Preparation	
Suggested location type for training:- Classroom environment	
Session outcomes: By the end of this session clients will be able to: ▪ Discuss planning and preparation tips ▪ Identify the various resources for cycling commuting provided by their employer ▪ Draft a personal action plan to support cycle commuting.	
Suggested session content: ▪ Tutor introduces final video clip 'Planning and Preparation' ▪ Play DVD chapter 3 ▪ Lead out of DVD ▪ Introduce resources provided by employer to support cycle commuting ▪ Distribute session resource booklet 'Considering Cycling to Work?' and Employer resources sheet (if available). Draw attention to 'Action Plan' in the end of the booklet ▪ Provide opportunity for Questions	
Tutor notes: (and updates from previous reviews) The resource sheet will focus on the Infrastructure, Incentives and Promotion which the Employer has displayed in support of their Cycle Friendly application. This information can be provided by the workplace 'cycling champion'.	
Suggested resources: Multimedia Projector, PowerPoint slideshow: DVD Chapter 3 Considering Cycling to Work? A5 Booklets Information sheets outlining Employer's resources to support cycle commuting (see tutor notes above)	

Study 4 Ethics Committee Approval Letter

Research Support Office
MORAY HOUSE SCHOOL OF EDUCATION

The University of Edinburgh
Old Moray House
Holyrood Road
Edinburgh EH8 8AQ

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http://www.ed.ac.uk

Ms. Jenny Van Bekkum
PESLS
St Leonard's Land

15th January 2010

Dear Jenny

Encouraging Cycle Commuting in a Scottish Workplace setting

The School of Education Ethics Sub-Committee has now considered your request for ethical approval for the studies detailed in the your application.

This is to confirm that the Sub-Committee is happy to approve the application and that the research meets the School Ethics Level 2 criterion. This is defined as"covering novel procedures or the use of atypical participant groups – usually projects in which ethical issues might require more detailed consideration but were unlikely to prove problematic".

A standard condition of this ethical approval is that you are required to notify the Committee, of any significant proposed deviation from the original protocol. The Committee also needs to be notified if there are any unexpected results or events once the research is underway that raise questions about the safety of the research.

Yours sincerely

Dr K McCulloch
Convener, School Ethics Sub-Committee

Study 4 Invitation Letter

'Cycle to Work' Project Information Sheet

Research Title
Encouraging Cycle Commuting in a Workplace Setting

Principal Investigator
Miss Jenny van Bekkum, The University of Edinburgh

Introduction
You are being invited to take part in the 'Cycle to Work' research project. This sheet provides you with the information that you will need to help you decide whether you want to participate in this project. Please read the sheet carefully and feel free to ask questions about any aspect of the research project that may be unclear to you. This process complies with the notion of informed consent.

Purpose of the Project
The project is being carried out to evaluate the effectiveness of a one hour classroom-based workshop session, aimed to support and encourage staff members, who are interested in the idea of cycling to work, to start cycling commuting. The workshop provides information and support about the option of cycling to work. Using questionnaires, attitudes and cycle commuting behaviour will be monitored to discern any changes that may occur as a result of the workshop.

Your Involvement
You will either be assigned to a workshop group, in which you will attend a lunchtime workshop session at your workplace or a control group, in which you will not receive the workshop. Participants in both the workshop group and the control group will be required to fill out three questionnaires over a four month time period.

Risks
There are no known risks foreseen in participating in the project. The workshop endorses a safe and sensible approach to cycling to work.

Benefits
The workshop will provide you with information, ideas and support regarding cycle commuting.

Confidentiality
This research adheres to: the University of Edinburgh ethical guidelines; the British Educational Research Association ethical guidelines; the University of Edinburgh guidelines on data protection; and the Freedom of Information Act. The questionnaire data that you provide will be collected by Governmental in-house researchers. Anonymised data will be provided to the project researcher and supervisors for the purpose of data analysis.

Project Results
The data obtained from the project will be analysed using SPSS statistical software to look for any differences in attitudes and behaviours between the workshop groups and the control group. The results of the project will be written up in a report that will be available to all government staff. The results will form part of a PhD project (see biography for more details) and may be included in academic journal articles.

Questions
If you have any questions about the project please contact:

Miss Jenny van Bekkum
Email: jenny.vanbekkum@ed.ac.uk
Tel: 0131 651 6360

Dr Joanne Williams
Email: Jo.Williams@ed.ac.uk
Tel: 0131 651 6339

Researcher Biography

Name
Jenny van Bekkum

Position
PhD researcher based in Moray House School of Education, The University of Edinburgh

Thesis Title
Understanding and Encouraging Cycle Commuting in a Workplace Setting

Research Topic
My study is orientated towards health psychology and I work interdepartmentally with supervisors from the School of Education and the School of Health in Social Science. My interest is to gain a deeper and more complex understanding into the psychological factors that affect cycle commuting in order to effectively promote this behaviour.

Research Design
My research comprises a mixed method research design carried out in two phases. Initially, semi-structured interviews and questionnaires have been conducted to gain a better understanding of the benefits, challenges and facilitators that are related to cycle commuting. The second phase of research comprises a pre-test, post-test intervention control trial. The intervention consists of a workshop and DVD that I designed and developed with the support of Cycling Scotland. The intervention trial is being carried out at two worksites within the Scottish Government.

Background
I am Dutch by origin but I have lived most of my life in the UK. I was brought up to cycle for both transport and leisure and cycling has become a way of life that I enjoy. Before attending University I spent three winters living and working in the French Alps as a snowboard instructor. I took my undergraduate degree at the University of Edinburgh in Applied Sports Science and completed with first class honours. During my undergraduate study I started to carry out research into cycle commuting and have continued to pursue my research interest in cycling from that point onwards. In my free-time I cycle for fitness and leisure and I enjoy cycle touring in the UK and Europe.

Professional Experience
I have been liaising with Cycling Scotland from the onset of my PhD in 2007. During this time I have been employed by Cycling Scotland to redevelop their 'Cycle Friendly Employer' literature, produce the 'Cycle to Work' DVD. I have also been voluntarily working with them to develop the 'Cycle to Work' workshop and written material.

Throughout my PhD I have lectured, tutored and supervised undergraduate students on a part-time basis. I was also involved in the organisation of an Economic and Social Research Council knowledge transfer event and was responsible for the impact evaluation of this.

Study 4 Pre-Intervention Questionnaire

Cycle to Work' Questionnaire One

To complete the following questions please **circle** the most appropriate answer.

1. Your Job Category	**A Band**	**B Band**	**C Band**	**SCS**

3. Your gender	**Male**	**Female**

4. Your age	**16-20**	**21-30**	**31-40**	**41-50**	**51-60**	**61-70**

5. The distance you live from your workplace. Please estimate your distance ONE WAY					
Under 1 mile	**1 to 2 miles**	**2 to 5 miles**	**5 to 10 miles**	**10 to 20 miles**	**20 miles +**

6. The means of transport you most commonly use to travel to/ from work. Please circle only ONE category						
Train	**Car**	**Motorcycle**	**Bus**	**Bicycle**	**Walking**	**Other**
A combination of modes (please specify):						

7. With regard to how you travel to work, please read through all of the categories below and **tick** which ONE statement best describes your travelling patterns. In each of these categories 'regularly' means at least 2-3 times per week.

• I do not cycle part or all of the journey to work and I do not intend to do so	
• I do not cycle part or all of the journey to work but I am interested in the idea of cycle commuting	
• I do not regularly cycle part or all of the journey to work but am thinking about starting to do so in the next 6 months	
• I sometimes cycle part or all of the journey to work but not more than once per week	
• I regularly cycle part or all of the journey to work but have only begun in the last six months	
• I regularly cycle part or all of the journey to work and have been doing so for longer than six months	

8. Whether or not you cycle to work, please indicate the extent to which the following factors encourage you to cycle commute.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Benefits	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Cost saving over other transport methods	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Shortened journey time to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Minimal contribution to pollution	**1**	**2**	**3**	**4**	**5**	**N/A**
d. No necessity for car parking	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Improvements to physical health/fitness	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Improvements to psychological wellbeing/mood	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Getting some fresh air	**1**	**2**	**3**	**4**	**5**	**N/A**
h. A sense of freedom and flexibility	**1**	**2**	**3**	**4**	**5**	**N/A**
i. A sense of enjoyment	**1**	**2**	**3**	**4**	**5**	**N/A**
j. The social side of cycling	**1**	**2**	**3**	**4**	**5**	**N/A**

k. Availability of dedicated cycle routes	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Availability of workplace facilities	**1**	**2**	**3**	**4**	**5**	**N/A**

9. Overall, how encouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

10. Whether or not you cycle to work, please indicate the extent to which the following factors discourage you from currently cycling commuting.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Challenges	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Nature of natural terrain (e.g. hilliness)	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Nature of manmade terrain (poor cycle infrastructure)	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Danger from motor traffic	**1**	**2**	**3**	**4**	**5**	**N/A**
d. Bad weather including darkness	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Distance to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Lack of time	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Breathing in exhaust fumes	**1**	**2**	**3**	**4**	**5**	**N/A**
h. Physical effort involved	**1**	**2**	**3**	**4**	**5**	**N/A**
i. Necessity of taking children to/from school/nursery	**1**	**2**	**3**	**4**	**5**	**N/A**
j. Lack of waterproof clothing	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Expense of buying a bicycle	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Lack of bike storage space at home	**1**	**2**	**3**	**4**	**5**	**N/A**
m. Disabilities/injuries or health problems	**1**	**2**	**3**	**4**	**5**	**N/A**
n. Having to wear less formal clothes	**1**	**2**	**3**	**4**	**5**	**N/A**
o. Carrying your belongings to/from work	**1**	**2**	**3**	**4**	**5**	**N/A**

11. Overall, how discouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

12. Whether or not you cycle to work, how confident are you that you can cycle commute when:

Please **circle** the most appropriate response.

Confidence	**Not at all confident**	**Fairly confident**	**Confident**	**Very confident**
a. You are tired	**1**	**2**	**3**	**4**
b. You are in a bad mood	**1**	**2**	**3**	**4**
c. You are pressed for time	**1**	**2**	**3**	**4**
d. The weather is bad	**1**	**2**	**3**	**4**
e. Your routine changes	**1**	**2**	**3**	**4**

13. Regardless of whether or not you cycle to/from work, please **circle** the most appropriate response for each of the questions below.

Planning, Preparation & Resources	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**
a. How important do you think preparation and planning are towards cycle commuting?	**1**	**2**	**3**	**4**	**5**
b. How prepared do you feel to cycle commute?	**1**	**2**	**3**	**4**	**5**
c. How informed do you feel about the cycle facilities and resources available at your workplace?	**1**	**2**	**3**	**4**	**5**

14. The following experiences can affect the commuting habits of some people. Think of any similar experiences you may currently have or have had during the past month. Then rate how frequently the event occurs.

Please **circle** the response that best describes your answer for each experience.

Experiences	**Never**	**Seldom**	**Occasionally**	**Often**	**Repeatedly**
a. Instead of remaining to use my current commuting mode I engage in some cycle commuting	**1**	**2**	**3**	**4**	**5**
b. I tell myself I am able to cycle commute if I want to	**1**	**2**	**3**	**4**	**5**
c. I put things around my home to remind me to cycle commute	**1**	**2**	**3**	**4**	**5**
d. I tell myself that if I try hard enough I can cycle commute	**1**	**2**	**3**	**4**	**5**
e. I recall information people have personally given me on the benefits of cycle commuting	**1**	**2**	**3**	**4**	**5**
f. I make commitments to cycle commute	**1**	**2**	**3**	**4**	**5**
g. I reward myself when I cycle commute	**1**	**2**	**3**	**4**	**5**
h. I think about information from articles and advertisements on how to make cycle commuting a regular part of my life	**1**	**2**	**3**	**4**	**5**
i. I keep things around my place of work that remind me to cycle commute	**1**	**2**	**3**	**4**	**5**
j. I find society changing in ways that make it easier to cycle commute	**1**	**2**	**3**	**4**	**5**
k. Warnings about health hazards of inactivity effect me emotionally	**1**	**2**	**3**	**4**	**5**
l. Dramatic portrayals of the evils of inactivity affect me emotionally	**1**	**2**	**3**	**4**	**5**
m. I react emotionally to warnings about an inactive lifestyle	**1**	**2**	**3**	**4**	**5**
n. I worry that inactivity can be harmful to my body	**1**	**2**	**3**	**4**	**5**
o. I am considering the idea that regular cycle commuting would make me a healthier, happier person all around	**1**	**2**	**3**	**4**	**5**
p. I have someone that I can depend on when I am	**1**	**2**	**3**	**4**	**5**

having problems with cycle commuting					
q. I read articles about cycle commuting in an attempt to learn more about it	**1**	**2**	**3**	**4**	**5**
r. I try to set realistic cycle commuting goals for myself rather than set myself up for failure by expecting too much	**1**	**2**	**3**	**4**	**5**
s. I have an experienced cyclist friend who encourages me to cycle commute when I don't feel up to it	**1**	**2**	**3**	**4**	**5**
t. When I cycle commute I tell myself that I am being good to myself by taking care of my body	**1**	**2**	**3**	**4**	**5**
u. The time I spend cycle commuting is my special time to relax and recover from the day's worries, not a task to get out of the way	**1**	**2**	**3**	**4**	**5**
v. I am aware of more and more people encouraging me to cycle commute these days	**1**	**2**	**3**	**4**	**5**
w. I do something nice for myself for making efforts to cycle commute more	**1**	**2**	**3**	**4**	**5**
x. I have someone who points out my rationalisations for not cycle commuting	**1**	**2**	**3**	**4**	**5**
y. I have someone who provides feedback about my cycle commuting	**1**	**2**	**3**	**4**	**5**
z. I remove things that contribute to me not cycle commuting	**1**	**2**	**3**	**4**	**5**
aa. I am the only one responsible for my health and only I can decide whether or not I will cycle commute	**1**	**2**	**3**	**4**	**5**
bb. I look for information related to cycle commuting	**1**	**2**	**3**	**4**	**5**
cc. I avoid spending long periods of time in environments that discourage cycle commuting	**1**	**2**	**3**	**4**	**5**
dd. I feel that I would be a better role model for others if I were regularly cycle commuting	**1**	**2**	**3**	**4**	**5**
ee. I think about the type of person I will be if I cycle commute	**1**	**2**	**3**	**4**	**5**
ff. I notice that more businesses are encouraging their employees to cycle commute by offering cycle facilities and services	**1**	**2**	**3**	**4**	**5**
gg. I wonder how not engaging in cycle commuting affects those who are close to me	**1**	**2**	**3**	**4**	**5**
hh. I realise that I might be able to influence others to take up cycle commuting if I would cycle commute more	**1**	**2**	**3**	**4**	**5**
ii. I get frustrated with myself when I don't cycle commute	**1**	**2**	**3**	**4**	
jj. I am aware that many workplaces now provide cycle purchase discount schemes for their employees	**1**	**2**	**3**	**4**	**5**
kk. Some of my close friends might cycle commute more if I would	**1**	**2**	**3**	**4**	**5**

ll. I consider the fact that I would feel more confident in myself if I were regularly to cycle commute	**1**	**2**	**3**	**4**	**5**
mm. When I feel tired I make myself cycle commute anyway because I know I will feel better afterwards	**1**	**2**	**3**	**4**	**5**
nn. When I'm feeling tense I find cycle commuting a great way to relieve my worries	**1**	**2**	**3**	**4**	**5**

THANK YOU for completing this questionnaire!

Study 4 Immediate Post-Intervention Questionnaire

'Cycle to Work' Questionnaire Two

1. How useful did you find each aspect of the workshop session?

Please **circle** the most appropriate answer for each aspect

Your Views on the Workshop	**Not at all**	**A bit**	**Moderately**	**Very**	**Extremely**
a. The DVD	**1**	**2**	**3**	**4**	**5**
b. The exercises	**1**	**2**	**3**	**4**	**5**
c. The group environment	**1**	**2**	**3**	**4**	**5**
d. Addressing the 'benefits' of cycle commuting	**1**	**2**	**3**	**4**	**5**
e. Addressing how to 'overcome the challenges' of cycle commuting	**1**	**2**	**3**	**4**	**5**
f. Addressing 'preparation and planning' to cycle to work	**1**	**2**	**3**	**4**	**5**
g. Information about your workplace cycle resources	**1**	**2**	**3**	**4**	**5**
h. The overall workshop	**1**	**2**	**3**	**4**	**5**

2. With regard to how you travel to work, please read through all of the categories below and **tick** which ONE statement best describes your travelling patterns. In each of these categories 'regularly' means at least 2-3 times per week.

• I do not cycle part or all of the journey to work and I do not intend to do so	
• I do not cycle part or all of the journey to work but I am interested in the idea of cycle commuting	
• I do not regularly cycle part or all of the journey to work but am thinking about starting to do so in the next 6 months	
• I sometimes cycle part or all of the journey to work but not more than once per week	
• I regularly cycle part or all of the journey to work but have only begun in the last six months	
• I regularly cycle part or all of the journey to work and have been doing so for longer than six months	

3. Whether or not you cycle to work, please indicate the extent to which the following factors encourage you to cycle commute.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Benefits	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Cost saving over other transport methods	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Shortened journey time to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Minimal contribution to pollution	**1**	**2**	**3**	**4**	**5**	**N/A**
d. No necessity for car parking	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Improvements to physical health/fitness	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Improvements to psychological wellbeing/mood	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Getting some fresh air	**1**	**2**	**3**	**4**	**5**	**N/A**

h. A sense of freedom and flexibility	**1**	**2**	**3**	**4**	**5**	**N/A**
i. A sense of enjoyment	**1**	**2**	**3**	**4**	**5**	**N/A**
j. The social side of cycling	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Availability of dedicated cycle routes	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Availability of workplace facilities	**1**	**2**	**3**	**4**	**5**	**N/A**

4. Overall, how encouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

5. Whether or not you cycle to work, please indicate the extent to which the following factors discourage you from currently cycling commuting.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Challenges	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Nature of natural terrain (e.g. hilliness)	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Nature of manmade terrain (poor cycle infrastructure)	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Danger from motor traffic	**1**	**2**	**3**	**4**	**5**	**N/A**
d. Bad weather including darkness	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Distance to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Lack of time	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Breathing in exhaust fumes	**1**	**2**	**3**	**4**	**5**	**N/A**
h. Physical effort involved	**1**	**2**	**3**	**4**	**5**	**N/A**
i. Necessity of taking children to/from school/nursery	**1**	**2**	**3**	**4**	**5**	**N/A**
j. Lack of waterproof clothing	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Expense of buying a bicycle	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Lack of storage space from your bike at home	**1**	**2**	**3**	**4**	**5**	**N/A**
m. Disabilities/injuries or health problems	**1**	**2**	**3**	**4**	**5**	**N/A**
n. Having to wear less formal clothes	**1**	**2**	**3**	**4**	**5**	**N/A**
o. Carrying your belongings to/from work	**1**	**2**	**3**	**4**	**5**	**N/A**

6. Overall, how discouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

7. Whether or not you cycle to work, how confident are you that you can cycle commute when:

Please **circle** the most appropriate response.

Confidence	**Not at all confident**	**Fairly confident**	**Confident**	**Very confident**
a. You are tired	**1**	**2**	**3**	**4**
b. You are in a bad mood	**1**	**2**	**3**	**4**

c. You are pressed for time	**1**	**2**	**3**	**4**
d. The weather is bad	**1**	**2**	**3**	**4**
e. Your routine changes	**1**	**2**	**3**	**4**

8. Regardless of whether or not you cycle to/from work, please **circle** the most appropriate response for each of the questions below.

Planning, Preparation & Resources	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**
a. How important do you think preparation and planning are towards cycle commuting?	**1**	**2**	**3**	**4**	**5**
b. How prepared do you feel to cycle commute?	**1**	**2**	**3**	**4**	**5**
c. How informed do you feel about the cycle facilities and resources available at your workplace?	**1**	**2**	**3**	**4**	**5**

Study 4 Three Months Post-Intervention Questionnaire

'Cycle to Work' Questionnaire Three

To complete the following questions please **circle** the appropriate response.

1. Have you increased the amount of cycling in your journey to/from work in the last three months?	**Yes**	**No**
1.b. If **yes** then please specify your cycle commuting increase in terns of **how many days on average over one week**:		

2. Has your MAIN method of transport to/from work changed over the last three months? If **Yes** please go to question 3, if **No** then please go straight to question 4	**Yes**	**No**

3. Which means of transport do you most commonly use to travel to/from work? Please **circle** ONE of the categories below.

Train	**Car**	**Motorcycle**	**Bus**	**Bicycle**	**Walking**	**Other**
A combination of modes (please specify):						

4. Has the distance you travel to/from work changed over the last three months? If **Yes** please go to question 5, if **No** then please go to question 6.	**Yes**	**No**

5. How far away do you live from your workplace? Please estimate your distance ONE way.

Under 1 mile	**1 to 2 miles**	**2 to 5 miles**	**5 to 10 miles**	**10 to 20 miles**	**20 miles +**

6. With regard to how you travel to work, please read through all of the categories below and **tick** which ONE statement best describes your travelling patterns. In each of these categories 'regularly' means at least 2-3 times per week.

• I do not cycle part or all of the journey to work and I do not intend to do so	
• I do not cycle part or all of the journey to work but I am interested in the idea of cycle commuting	
• I do not regularly cycle part or all of the journey to work but am thinking about starting to do so in the next 6 months	
• I sometimes cycle part or all of the journey to work but not more than once per week	
• I regularly cycle part or all of the journey to work but have only begun in the last six months	
• I regularly cycle part or all of the journey to work and have been doing so for longer than six months	

7. Whether or not you cycle to work, please indicate the extent to which the following factors encourage you to cycle commute.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Benefits	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Cost saving over other transport methods	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Shortened journey time to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Minimal contribution to pollution	**1**	**2**	**3**	**4**	**5**	**N/A**
d. No necessity for car parking	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Improvements to physical health/fitness	**1**	**2**	**3**	**4**	**5**	**N/A**

f. Improvements to psychological wellbeing/mood	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Getting some fresh air	**1**	**2**	**3**	**4**	**5**	**N/A**
h. A sense of freedom and flexibility	**1**	**2**	**3**	**4**	**5**	**N/A**
i. A sense of enjoyment	**1**	**2**	**3**	**4**	**5**	**N/A**
j. The social side of cycling	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Availability of dedicated cycle routes	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Availability of workplace facilities	**1**	**2**	**3**	**4**	**5**	**N/A**

8. Overall, how encouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

9. Whether or not you cycle to work, please indicate the extent to which the following factors discourage you from currently cycling commuting.

Please rate each factor on a scale of 1-5 and **circle** the appropriate response.

Challenges	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**	
a. Nature of natural terrain (e.g. hilliness)	**1**	**2**	**3**	**4**	**5**	**N/A**
b. Nature of manmade terrain (poor cycle infrastructure)	**1**	**2**	**3**	**4**	**5**	**N/A**
c. Danger from motor traffic	**1**	**2**	**3**	**4**	**5**	**N/A**
d. Bad weather including darkness	**1**	**2**	**3**	**4**	**5**	**N/A**
e. Distance to workplace	**1**	**2**	**3**	**4**	**5**	**N/A**
f. Lack of time	**1**	**2**	**3**	**4**	**5**	**N/A**
g. Breathing in exhaust fumes	**1**	**2**	**3**	**4**	**5**	**N/A**
h. Physical effort involved	**1**	**2**	**3**	**4**	**5**	**N/A**
i. Necessity of taking children to/from school/nursery	**1**	**2**	**3**	**4**	**5**	**N/A**
j. Lack of waterproof clothing	**1**	**2**	**3**	**4**	**5**	**N/A**
k. Expense of buying a bicycle	**1**	**2**	**3**	**4**	**5**	**N/A**
l. Lack of storage space from your bike at home	**1**	**2**	**3**	**4**	**5**	**N/A**
m. Disabilities/injuries or health problems	**1**	**2**	**3**	**4**	**5**	**N/A**
n. Having to wear less formal clothes	**1**	**2**	**3**	**4**	**5**	**N/A**
o. Carrying your belongings to/from work	**1**	**2**	**3**	**4**	**5**	**N/A**

10. Overall, how discouraged do you presently feel to cycle to work?	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**

11. Whether or not you cycle to work, how confident are you that you can cycle commute when:

Please **circle** the most appropriate response.

Confidence	**Not at all**	**Fairly**	**Confident**	**Very confident**

	confident	confident		
a. You are tired	**1**	**2**	**3**	**4**
b. You are in a bad mood	**1**	**2**	**3**	**4**
c. You are pressed for time	**1**	**2**	**3**	**4**
d. The weather is bad	**1**	**2**	**3**	**4**
e. Your routine changes	**1**	**2**	**3**	**4**

12. Regardless of whether or not you cycle to/from work, please **circle** the most appropriate response for each of the questions below.

Planning, Preparation & Resources	**Not at all**	**Slightly**	**Moderately**	**Very**	**Extremely**
a. How important do you think preparation and planning are towards cycle commuting?	**1**	**2**	**3**	**4**	**5**
b. How prepared do you feel to cycle commute?	**1**	**2**	**3**	**4**	**5**
c. How informed do you feel about the cycle facilities and resources available at your workplace?	**1**	**2**	**3**	**4**	**5**

13. The following experiences can affect the commuting habits of some people. Think of any similar experiences you may currently have or have had during the past month. Then rate how frequently the event occurs. Please **circle** the response that best describes your answer for each experience.

Experiences	**Never**	**Seldom**	**Occasionally**	**Often**	**Repeatedly**
a. Instead of remaining to use my current commuting mode I engage in some cycle commuting	**1**	**2**	**3**	**4**	**5**
b. I tell myself I am able to cycle commute if I want to	**1**	**2**	**3**	**4**	**5**
c. I put things around my home to remind me to cycle commute	**1**	**2**	**3**	**4**	**5**
d. I tell myself that if I try hard enough I can cycle commute	**1**	**2**	**3**	**4**	**5**
e. I recall information people have personally given me on the benefits of cycle commuting	**1**	**2**	**3**	**4**	**5**
f. I make commitments to cycle commute	**1**	**2**	**3**	**4**	**5**
g. I reward myself when I cycle commute	**1**	**2**	**3**	**4**	**5**
h. I think about information from articles and advertisements on how to make cycle commuting a regular part of my life	**1**	**2**	**3**	**4**	**5**
i. I keep things around my place of work that remind me to cycle commute	**1**	**2**	**3**	**4**	**5**
j. I find society changing in ways that make it easier to cycle commute	**1**	**2**	**3**	**4**	**5**
k. Warnings about health hazards of inactivity effect me emotionally	**1**	**2**	**3**	**4**	**5**
l. Dramatic portrayals of the evils of inactivity affect me emotionally	**1**	**2**	**3**	**4**	**5**
m. I react emotionally to warnings about an inactive	**1**	**2**	**3**	**4**	**5**

lifestyle					
n. I worry that inactivity can be harmful to my body	**1**	**2**	**3**	**4**	**5**
o. I am considering the idea that regular cycle commuting would make me a healthier, happier person all around	**1**	**2**	**3**	**4**	**5**
p. I have someone that I can depend on when I am having problems with cycle commuting	**1**	**2**	**3**	**4**	**5**
q. I read articles about cycle commuting in an attempt to learn more about it	**1**	**2**	**3**	**4**	**5**
r. I try to set realistic cycle commuting goals for myself rather than set myself up for failure by expecting too much	**1**	**2**	**3**	**4**	**5**
s. I have an experienced cyclist friend who encourages me to cycle commute when I don't feel up to it	**1**	**2**	**3**	**4**	**5**
t. When I cycle commute I tell myself that I am being good to myself by taking care of my body	**1**	**2**	**3**	**4**	**5**
u. The time I spend cycle commuting is my special time to relax and recover from the day's worries, not a task to get out of the way	**1**	**2**	**3**	**4**	**5**
v. I am aware of more and more people encouraging me to cycle commute these days	**1**	**2**	**3**	**4**	**5**
w. I do something nice for myself for making efforts to cycle commute more	**1**	**2**	**3**	**4**	**5**
x. I have someone who points out my rationalisations for not cycle commuting	**1**	**2**	**3**	**4**	**5**
y. I have someone who provides feedback about my cycle commuting	**1**	**2**	**3**	**4**	**5**
z. I remove things that contribute to me not cycle commuting	**1**	**2**	**3**	**4**	**5**
aa. I am the only one responsible for my health and only I can decide whether or not I will cycle commute	**1**	**2**	**3**	**4**	**5**
bb. I look for information related to cycle commuting	**1**	**2**	**3**	**4**	**5**
cc. I avoid spending long periods of time in environments that discourage cycle commuting	**1**	**2**	**3**	**4**	**5**
dd. I feel that I would be a better role model for others if I were regularly cycle commuting	**1**	**2**	**3**	**4**	**5**
ee. I think about the type of person I will be if I cycle commute	**1**	**2**	**3**	**4**	**5**
ff. I notice that more businesses are encouraging their employees to cycle commute by offering cycle facilities and services	**1**	**2**	**3**	**4**	**5**
gg. I wonder how not engaging in cycle commuting affects those who are close to me	**1**	**2**	**3**	**4**	**5**
hh. I realise that I might be able to influence others to take up cycle commuting if I would cycle commute more	**1**	**2**	**3**	**4**	**5**

ii. I get frustrated with myself when I don't cycle commute	**1**	**2**	**3**	**4**	
jj. I am aware that many workplaces now provide cycle purchase discount schemes for their employees	**1**	**2**	**3**	**4**	**5**
kk. Some of my close friends might cycle commute more if I would	**1**	**2**	**3**	**4**	**5**
ll. I consider the fact that I would feel more confident in myself if I were regularly to cycle commute	**1**	**2**	**3**	**4**	**5**
mm. When I feel tired I make myself cycle commute anyway because I know I will feel better afterwards	**1**	**2**	**3**	**4**	**5**
nn. When I'm feeling tense I find cycle commuting a great way to relieve my worries	**1**	**2**	**3**	**4**	**5**

THANK YOU for completing this questionnaire!

APPENDIX F

PUBLICATIONS

PAPER 1:

van Bekkum, J. E., Williams, J. & Morris, P. G. (in press). Employees' perceptions of cycle commuting:
A qualitative study. *Health Education*.

PAPER 2:

van Bekkum, J. E., Williams, J. & Morris, P. G. (under review). Cycle commuting barriers: Stages of change and gender. *Health Education*.

Emerald Health Education

Employees Perceptions of Cycle Commuting: A Qualitative Study

Journal:	*Health Education*
Manuscript ID:	HE-Mar-2010-0007.R2
Manuscript Type:	Original Article
Keywords:	Cycle, Commuting, Employees, Qualitative

Abstract

Purpose - This study aimed to gain an in-depth individual level understanding of the psychological factors that affect cycle commuting.

Design/methodology/approach - A total of 15 participants (eight cycle commuters and seven potential cycle commuters) from a 'cycle friendly' employer based in a UK city took part in the study. Semi-structured interviews and Interpretative Phenomenological Analysis (IPA) were used to collect and analyse data.

Findings - The present study found that cyclists are more aware of the benefits of cycle commuting than potential cyclists. Those who did not currently cycle to work displayed a heightened awareness of the challenges of cycling to work, whereas cyclists reported more coping strategies for negotiating or overcoming the challenges involved in cycle commuting. These individual cognitions are potentially modifiable through psychological interventions.

Research limitations/implications - Future research should be carried out on samples in different contexts to examine whether some of the findings would be supported in other populations.

Practical applications - The findings from this paper suggest that psychological interventions based on challenging perceptions of the benefits and barriers to cycling may have a valuable role to play in enhancing cycle commuting rates.

Originality/value - This study uses IPA to explore the complexities of perceptions in relation to cycle commuting. It also brings to light, the types of coping strategies used to enable cyclists to overcome some of their challenges associated with cycle commuting.

Introduction

Physical inactivity poses a major public health challenge in western societies (Chief Medical Officer, 2005). Presently in Scotland, 67% of women and 55% of men are not meeting the current recommendations of 30 minutes of moderate exercise on most days of the week, with inactivity accounting for over a third of deaths from heart disease (Scottish Government, 2009).

On a national level cycling has been receiving heightened attention due to its potential to improve public health (Cavill and Watkins, 2007; Cavill and Davis, 2007; Wardman *et al.,* 2007). Cycling is a sustainable, healthy, transport option that can improve physical and psychological health and decrease carbon emissions (Cavill and Davis, 2007). Cycle commuting fits into daily life and provides the working population with an opportunity to be physically active (Vuori *et al.,* 1994) and travelling through green space promotes self-esteem and enhances mood (Barnton and Pretty, 2010). Although there is some debate surrounding the associated dangers of cycling, Hillman (1993) has suggested that the benefits outweigh the risks by 20 to one. More recently, de Hartog *et al*. (2010) reported more modest findings that the benefits of cycling are seven times larger than the risk involved in the UK context. Furthermore, the risks of road traffic accidents among cyclists, although higher than car users are lower than for pedestrians (Cavill and Davis, 2007).

Despite the benefits of cycling, only a small sector of the population cycle to work. Currently around 2% of people in Scotland cycle commute (Scottish Executive, 2009), which reflects UK figures of cycling for transport (Department for Transport,

2008). Studies in the UK have found that over 85% of respondents would be interested in cycling more often (Scottish Executive, 2009; Department for Transport, 2002).

Environmental factors such as danger from motor traffic, poor infrastructure and bad weather are commonly cited as key challenges deterring people from cycling (Crawford *et al.,* 2001; Scottish Executive 2009; Unwin, 1992). A recent UK study suggested that the environmental context has an important role to play in people's choice to cycle or not (Cavill and Watkins, 2007). However, providing a supportive physical environment alone is insufficient to increase cycling (Giles-Corti and Donovan, 2002; Wardman *et al.,* 2007). To effectively promote cycling coordinated action is needed that addresses individual and social change, organisational change and environmental measures (Davies *et al.,* 1997; Giles-Corti *et al.,* 2005). The complex task of understanding cycling behaviour is also dependent on the journey type (Anable and Gatersleben, 2005).

Some people regularly cycle to work despite environmental challenges. A Belgian study found individual factors had a stronger influence on cycle commuting behaviour than environmental ones (de Geus *et al.,* 2007). Research addressing individual factors (e.g. perceptions, attitudes and beliefs) is therefore crucial to understanding uptake of cycling and is also of value because individual factors are frequently more modifiable than environmental ones. Several questionnaire studies have addressed psychological factors related to cycling such as motivations and barriers (Crawford *et al.,* 2001; Anable and Gatersleben, 2005; Shannon, *et al*., 2006; Gatersleben and Appleton, 2007). However these quantitative surveys may overlook some of issues that are of importance in determining cycling behaviour and qualitative exploratory research that focuses on

individual perceptions and experiences is sparse (Cavil, 2007; Davies *et al.,* 1997; McKenna and Whatling, 2007).

A range of intervention approaches to increase rates of commute cycling have been developed and piloted. These include hard measures, such as infrastructure changes within the workplace and the wider environment, and softer measures such as incentives, social marketing techniques and psychological techniques (e.g. Cleary and McClintock, 2000; Mutrie *et al*., 2002; Wen *et al*., 2005; Gatersleben and Appleton, 2007). Sloman *et al.* (2009) found that a combination of hard and soft intervention approaches in six demonstrations towns in the UK has led to an 27% increase in cycling over a three-year period.

There are very few published psychological intervention studies that have aimed to increase cycle commuting. One such study, based on the transtheoretical model of behaviour change (Prochaska and DiClemente, 1982), tailored its intervention to employees in the contemplation and preparation stages of cycling and walking to work (Mutrie *et al.*, 2002). The intervention achieved success for walking but not for cycling. The study concluded that it is more difficult for cyclists to overcome environmental and workplace barriers than it is for walkers. Follow-up qualitative research found that although many people perceived similar environmental barriers, the individuals who were successful at walking and cycling developed coping strategies to overcome their own perceived barriers (Crawford *et al.,* 2000; Mutrie *et al*., 2002). Further research on psychological approaches will add to the momentum of success achieved in promoting cycling by explaining how individual variables interact with other factors to predict cycling.

McKenna and Whatling (2007) suggest that more in-depth qualitative research that focuses on the individual may offer a fresh view on how to support and encourage cycle commuting. Their findings reveal a range of perceptions of barriers and motivations for commute cycling. Uniquely their work also highlights the power relations between the dominance of car users and the marginalisation of cyclists on the roads.

The aim of the present study is to explore people's perceptions and lived experiences of cycle commuting and the influences that underlie their decision of whether to cycle to work or not. The research focus is on discerning a greater understanding of commonalities and differences of opinion regarding cycle commuting between a group of cycle commuters (CC) and a group of potential cycle commuters (PCC) who are interested in the idea of cycling to work. This work is original in a number of respects. Firstly, this study adopts a qualitative methodological approach to a field that is largely explored using quantitative surveys and interventions. Secondly, the focus purely on people's perceptions and experiences of cycle commuting allows the opportunity to explore the complexities of this behaviour. Thirdly, the qualitative nature of the study facilitates closer consideration of the impact of context on cycle commuting.

Method

This research used semi-structured interviews alongside interpretative phenomenological analysis (IPA) to gain a more ideographic and detailed examination of participants' lived experiences with regard to cycle commuting (Smith and Osborn, 2003). IPA is an increasingly popular form of qualitative analysis (Reid, Flowers, and Larkin, 2005). The strength of IPA is the concern with individuals' subjective perceptions of a topic, referred

to as the 'insider perspective' as opposed to trying to produce objective statements (Smith, Jarman, and Osborn, 1999).

In IPA the emphasis is placed on both the researcher's commitment to gain an in-depth understanding into the participant's world whilst also taking a step back and trying to learn something common about the group (Smith and Eatough, 2007). It is acknowledged that participants' thoughts are not always immediately visible from their accounts as they try to make sense of their world. Rather, by engaging in an analytical process the researcher can cautiously interpret a participants cognitions (Smith, Jarman and Osborn, 1999).

Participants

A purposive sample of 15 participants took part in the study. All participants were employees of a workplace based in central Edinburgh, UK. The workplace held a Cycle Friendly Employer Certificate for providing good cycle facilities and support. These included, introduced or improved: showers and changing rooms; and storage space and cycle parking facilities. The company also offered financial incentives for cycling (e.g. milage allowances and discount schemes) and social support (e.g. promotional events). It was anticipated that using a centrally based, cycle friendly employer would reduce organisational and environmental barriers to cycling and therefore facilitate a clearer understanding of the psychological factors that affect cycle commuting.

Participants were selected on the basis of fulfilling the criteria of being either regular cycle commuters (n=8) or potential cycle commuters (n=7). Potential cycle commuters stated an interest in cycle commuting and were contemplating the idea of

cycling to work. Potential cycle commuters were chosen as opposed to all non-cycle commuters because interventions to increase cycle commuting are more likely to be successful if focused on this group. Four women and 11 men took part, aged from 21 to 65 (see Tables 1 and 2). The daily commute made to work by CC participants ranged from two to nine miles. The PCC participants commuting journeys ranged from two to 16 miles. However, those travelling longer distances planned to cycle only a part of their commuting journey. The CC participants' routes varied widely in terms of the actual paths and roads they take, as well as the surrounding landscape. Some journeys primarily consisted of quiet off-road cycle paths, green space and countryside. In contrast, others cycled their entire journey on busy main roads, using shared cycle lanes, advisory on-road cycle lanes and, in some instances, no designated cycle lanes.

Table 1: Demographic information for commute cyclists (CC)

Pseudonym	Gender	Cycle commuting experience	Distance to work (one-way)	Age category
Andrew	Male	3-4 years	8 miles	31-40 years
Burt	Male	40+ years	4 miles	61-70 years
Carl	Male	2 months	3.5 miles	31-40 years
Dan	Male	4 years	5 miles	31-40 years
Ed	Male	2 years	3 miles	31-40 years
Fred	Male	14 years	9 miles	51-60 years
Guy	Male	5 years	2 miles	31-40 years
Helen	Female	8 years	2 miles	41-50 years

Table 2: Demographic information for potential commute cyclists (PCC)

Pseudonym	Gender	Commuting transport mode	Distance to work (one-way)	Age category
Amy	Female	Bus	5 miles	31-40 years
Belle	Female	Train	16 miles	31-40 years
Dawn	Female	Bus	2 miles	51-60 years
Euan	Male	Bus or walking	3 miles	31-40 years
Felix	Male	Walking	1.5 miles	21-30 years
Grant	Male	Bus or car	3 miles	21-30 years
Harry	Male	Bus and car	11 miles	41-50 years

Interviews

Semi-structured interviews were used which lasted between 30 minutes and one hour. A flexible interview guide was designed whereby questions could be ordered differently and novel areas could be explored if deemed helpful in addressing the research aims (Bryman, 2004). A similar interview schedule was developed for the two groups with small modifications to attend to their different behaviours. The questions were designed to identify the individual perceptions of personal, organisational and environmental factors relating to cycle commuting. A list of follow-up questions and facilitative comments were developed in advance and were non-leading to encourage further elaboration of answers.

In an attempt to enhance the commitment to the participant's perspective the interviewer used the principle of bracketing, to identify and make explicit her own opinions and assumptions to encourage self-reflexivity (Langdridge, 2007). Emphasis was given to the participant's accounts and areas deemed important and salient to the participant's world. Each interview was audio-recorded and supplemented by filed notes of the interviewer's interpretations (Kvale, 2007).

Analysis

All interviews were transcribed word-for-word with pseudonyms assigned to each participant. Analysis guidelines were followed (Smith and Osborn, 2003) to ensure that a thorough analysis was carried out whilst paying attention to the original aims of the investigation. Throughout the transcription and analysis process a research journal was kept to document the researcher's ideas about tentative relationships and emerging themes within and between data sets. The CC and PCC groups were initially analyzed separately to facilitate a more idiographic and nuanced analysis. Emerging themes from the initial notes were written in the right hand margin allowing for theoretical connections whilst still grounded in the specifics of the accounts. The transcripts were then re-read, with a more critical focus. Through carrying out this process some small changes were made to the existing interpretations. The transcripts were then uploaded into NVivo, a qualitative software package, and analysis entailed clustering the emerging themes into overarching themes across the two participant groups systematically.

Care was taken to keep interpretations as close as possible to the data and not to over-interpret. This was achieved through an analytical audit was carried out on six

transcripts by all three authors. There was a high degree of concordance in the emergent themes and the few divergences were resolved through discussion.

Findings

Nine themes emerged from the interviews. These themes encompass beneficial, challenging and facilitating aspects of cycle commuting behaviour. The analysis attempts to strike a balance between the emic (insider perspective of the participant) and the etic (researcher's interpretation) by doing justice to the individual as well as emerging commonalities within the group (Reid, Flowers and Larkin, 2005). Within the themes commonalities and differences between the two groups are described.

Health and Wellbeing

All CC and PCC participants discussed how cycle commuting contributes to general health and wellbeing. Each individual spoke about the physical activity aspect of cycle commuting (e.g. aerobic fitness and weight management). For many this was a key contributing reason for cycling to work. Additionally, several participants highlighted that cycling to work was a convenient opportunity to exercise in an otherwise busy day. One of the cycle commuters, Carl, stated:

> From a point of view of cycling, it fits in to the extent of, for me, it's just dead time. ... it's half an hour twice a day that I do it and that's just my exercise done… whereas otherwise because of the family side of things, I don't have that time.

Whilst most of the CC participants highlighted the psychological wellbeing they experienced from their cycle journeys, this was rarely discussed by the PCC group. Only Dawn and Grant in the PCC group, who had previously cycle commuted, spoke in any detail about the psychological benefits of cycling. Most CC participants discussed how cycle commuting can 'clear your head', 'provide thinking time', 'help you to de-stress and unwind', and 'make you feel better'. Fred who cycle commutes through mixed terrain said:

> It means that on most days here [at the workplace] and at home I'm probably in a reasonably positive frame of mind… I have the unwinding space on the way home and the contemplative space on the way in, which gives some balance and order, if you like, to my day… I wouldn't get this coming to work any other way.

Most of the CC participants spoke of how they also cycled for leisure. When discussing the advantages of cycle commuting, some PCC participants showed awareness of the impact cycle commuting may have on increasing their recreational cycling. For example, Amy stated: "I think if I cycled more regularly into work we'd probably increase what we did as a family". Euan and Felix (PCCs) thought that if they purchased a bike for the purpose of commuting they would also use it to cycle at the weekend with family and friends.

Time and Cost

Everyone in the CC group said that cycling to work either saved them time or took a similar amount of time to alternative forms of transport. CC participants living nearer to the city centre acknowledged that 'door to door' cycling was by far the quickest and most reliable means of transport, especially during rush hour. Carl stated: "I can't take the bus trip any more. Sometimes it's double the amount of time it takes for me on a bike". By contrast, the view that cycling to work would save time was opposed by all, except one, of the PCC participants. Although some of the PCC participants provided a detailed estimate of the time their cycle journey would take them, Amy, Belle and Harry all thought that cycling would take longer than their current commute. Grant spoke of the more pleasant cycling route to work taking longer and therefore being "less appealing".

Over half of the CC group mentioned that cycling into work saves money in terms of bus fares, car parking, petrol, and the costs of owning and maintaining a car. Bert, who has cycled for many years and doesn't own a car, found there to be a significant cost saving involved. Whilst recognising costs associated with cycling, Carl took a long-term view that cycling was a financially viable option: "So its £1.10 per single on the bus every time I go… with all my gear and bike it was around about £500 I think to buy everything, so, couple of years, so that's, it's paid for itself". In comparison, only two of the PCC group thought that cycling would save them money and one PCC participant mentioned that the expense of purchasing a bike was a deterring factor.

Enjoying the Cycling Experience

All CC participants positively discussed aspects of being outdoors. For many, travelling by bike provided the opportunity to get some fresh air, although some questioned the

freshness of the air in the city centre. Fred, who cycles part of his route through the countryside said:

> There's something about being out in the open air and it doesn't really matter whether it's raining or windy or sunny or a combination of those things. ... it's something about a sense that you're enjoying, how would I best describe it, you enjoy the natural world… You're actually really feeling, you feel the sun, you feel the rain, let's say you enjoy the flowers, you smell the flowers and so on. … It's being out and in touch with the elements of the world.

In contrast, only Grant and Dawn from the PCC group, both with previous cycle commuting experience, spoke positively about enjoying being outdoors on their bikes. The other PCC participants did not speak in any detail about enjoying cycling.

Socially Responsible Behaviour

Both CC and PCC participants, who mentioned having young children, felt it was important to be healthy role models for them. Amy, a potential cycle commuter, stated: "I'd like my son to see that cycling was a viable choice of transport. He's too ready to jump into the car at every opportunity". Some CC and PCC participants mentioned environmentally friendly aspects of cycling into work, but this seemed a peripheral benefit. Fred, one of the cycle commuters said: "I am able to feel that I am doing something towards the environment".

Work and the Workplace

Many CC and PCC participants had to travel regularly within their work role and discussed the difficulty of cycling to work on these days. Carl, who cycled into work three days per week on average, said: "I work in Aberdeen a day; I'll be through in Glasgow, up and down to London so it's quite difficult to sort of work that all out". Working in different locations could also hinder cycle commuting the day before travelling as it was sometimes necessary to take large files and equipment home on the evening beforehand.

Within the CC group, those who carried their belongings in a backpack were more likely to view carrying their laptop as a barrier, whereas those who used panniers saw this as no problem. Of those in the PCC group who owned a bike, none of them used pannier bags and felt that carrying a laptop would create a barrier to cycling. Grant said:

> On some occasions I wouldn't have the option of leaving the laptop here [at the workplace] because I have some work at home… but I'm not going to carry six, seven, eight kilos on a back pack, do that as well as cycling up hill and over the cobbles. No, there's just no way that's going to happen.

The company dress code required participants to wear smart clothes. Most of the CC participants cycled to work in casual clothes and then got changed into their work attire. Getting their clothes to the office and getting changed was seen as a challenge for some. Dan stated:

> It's a hassle trying to get all of your stuff in the same place, because it's important in what we do to have a nice suit and be well presented so that's kind of hard work sometimes, and then, how do you get your shirts to and from work?

Their workplace had many cycle facilities including showers, secure and sheltered cycle parking, lockers and changing facilities. These facilities were commonly discussed in positive terms. However, some participants commented on difficulties in accessing the cycle parking and one CC participant mentioned that on occasion there were queues for the showers.

The two PCC participants who did not own bikes were the least aware of the facilities the workplace had to offer. Euan wasn't sure if there were any showers and was concerned about arriving "all sweaty" at his work station. Although the workplace had two showers available for employees to use, Felix thought there was only one shower and he was concerned about queuing, which deterred him from cycling to work.

Both groups considered that suitable workplace cycle facilities an essential pre-requisite for cycle commuting and generally viewed their workplace facilities positively. Amy, one of the potential cycle commuters said: "The firm's made it as easy as possible if you want to come in on a bike. There's the storage and the showers and the lockers and so there's no disadvantage".

Another positive factor discussed by both groups was social support. Their workplace had a strong pro-cycling ethos and an active cycle community as well as a senior figure seen as a 'cycle champion' who offered support and advice to colleagues.

Carl, who had recently started cycle commuting, talked about the impact that their cycle champion had on him:

> He has been really good at promoting it generally. And I guess it's just been chipping away at my collective thoughts for quite a while ... that I kind of know it's something that I should really try and do.

Additional forms of workplace support for cycling such as staff discounts at a local cycle shop, tax relief payment schemes for purchasing bikes, cycle training courses and cycling breakfasts were also discussed positively.

Roads and Paths

The overall view was that cyclists are vulnerable on the roads, though individuals varied widely with regard to how they personally felt about cycling there. Individuals from both groups who had more experience of cycling on the roads generally perceived them to be safer than those with less experience. Within the CC group, Andrew and Carl, who had the least exposure to busy roads during their commute, both commented on their anxieties. Carl said that: "If I had to cycle on the actual 'road' roads all the time then that would really put me off". In contrast, Helen, who travelled all of her journey to work on busy main routes, felt comfortable cycling on the roads:

> It isn't dangerous, cycling in town, I'm sure there are more accidents with cars than there are with cyclists and things. I guess the other hurdle to get over is the fact that if a cyclist does have an accident then it can be very serious.

Some of the road infrastructure was viewed negatively by both the PCC and CC group participants. The CC group acknowledged that the city roads varied in the quality and quantity of cycling provision available. Certain areas were considered as dangerous and challenging for inexperienced cyclists. Ed stated:

> I'm OK nowadays, but if you weren't a regular cyclist I think a lot of people would get quite scared to go on the roads. When you've got buses this close to you… some of it is just dangerous.

PCC participants mainly mentioned the lack of separate cycle lanes on the roads. They discussed infrastructure issues in relation to the current routes they travelled on, which all seemed to be via busy main roads. These would not necessarily be the only routes available to them if they were to cycle to work. Felix felt deterred from cycling due to the busy main roads but later mentioned that there may be alternative cycle friendly routes for him to travel on.

Over half of the CC group felt that cyclists were not respected enough by other road users. Bert spoke of drivers not giving enough road space to cyclists: "The worst sorts are not giving clearance and ... cutting in when the driver is not allowed, not being aware that a cyclist actually has got forward motion". Some PCC participants' concerns

also related to other road users' attitudes. Amy, Dawn and Belle spoke of their experiences of seeing cyclists interact with traffic from a bus or a car's perspective. Amy said:

> Having been a bus user, having seen a lot of times how little respect is paid to cyclists, how close buses get to them ... how easy it is not to see a cyclist coming up the side of a bus. You know I'd just be very conscious, unconfident in both my behaviour in those circumstances and the other drivers' behaviour.

Although busy main roads were viewed by some as challenging, off-road cycle paths and shared bus and cycle lanes were discussed positively by the CC group. In particular, the off-road cycle routes were seen as facilitating pleasant cycling experiences. This view was shared by two of the PCC participants, Grant and Dawn, who had previously cycle commuted. Andrew (CC) stated:

> I'm lucky with the route, and that is a big driver for me in terms of the cycling I do… You're cycling through forest effectively, by water so it's, it's a really nice place to be, it's relaxing.

Over half of the PCC participants reported that if there was a more cycle-friendly route or path that they could use, they would be more encouraged to cycle commute.

Bad Weather

Some of the PCC group were deterred from cycle commuting by inclement weather regardless of the workplace facilities such as showers and changing rooms. They voiced their dislike of being outside in poor weather condition. However, many of the CC group along with Dawn, a PCC participant with cycle commuting experience, highlighted that inclement weather conditions did not normally affect their decision to cycle. It was only more extreme weather conditions such as ice and snow that prevented them from cycling into work. Discussing inclement weather, Greg (CC) said: "That doesn't usually bother me too much either because unless it's really bad, we have all the facilities we need here".

Personal Challenges

The PCC group spoke about a variety of personal factors that they perceived as challenges when considering cycle commuting. In contrast, only self-motivation was discussed as a personal challenge by some of the CC group. PCC participants seemed less aware of the strategies that the CC group employed to overcome the daily challenges of cycling and perhaps consequently the PCC group seemed more concerned about these challenges.

The three PCC commuters with young children all spoke of the challenges of the school run. Amy and Belle felt that cycling into work may not be a feasible option until their children were slightly older:

> When you've got family and kids and it's just, your time is not really your own time you know to really make a choice and go for it… if I had to cycle I would probably

> leave a lot earlier you know, which wouldn't be too good for him (her son) ... But he's getting older so you never know, once they do their own thing and you've got your time you've got more choices.

Dawn and Felix (PCCs) perceived difficulties with bike storage and security. Both participants lived in flats within the city centre area. Living in a top-floor flat, Dawn spoke of the challenge she would face, having to carry her bike up and down the stairs each day. Felix, who did not own a bike, had nowhere to store one and would not like to leave a bike outside in the street.

It was interpreted that in some cases, PCC participants' lack of awareness of cycling and cycle facilities acted as a barrier to commute cycling. For instance, Felix, who discussed being deterred by busy roads, spoke of his general lack of awareness about cycling:

> I don't really pay attention to what cycling facilities there are. In terms of bike lanes and things like that, I just see kind of what's beside me or if I see people cycling and getting cut up by buses and I know that the bus lanes and cycle lanes are right beside each other. But other than that I don't really pay attention so there might be more out there that I'm not aware of.

In terms of initiating cycle commuting, two PCC participants, Dawn and Euan, both felt that lack of self-motivation played a detrimental role. Dawn said: "I think there's

an element of just laziness". Harry spoke in similar terms about discipline: "So you know, it probably is more just a case of kind of personally making that commitment and getting on and doing it". Some CC participants also discussed the motivational challenges they faced when working late, very tired, or if the weather was particularly inclement. However, it was only on rare occasions that CC participants' lack of motivation stopped them from cycling. Andrew spoke of the kind of things that de-motivated him:

> At the end of the day or if you're running late or whatever it's just thinking 'right, I've just got to get on this bike now and cycle for the next hour' but generally once you get going it's fine. But sometimes you had a hard day here and you've got to cart stuff with you… sometimes you're a bit like 'can I really be bothered?'

Although many challenges were discussed by the PCC participants, it was commented on by some of the PCC group that each individual challenge, and many environmental ones, did not make cycle commuting impossible rather, as a collective, these challenges did not make it an easy or straightforward option. Harry said: "I think there are a number of factors in there but none of those are insurmountable".

Coping Strategies

To negotiate some of the challenging factors involved in cycle commuting, all CC participants had developed a range of personal coping strategies, to help them to fit cycling more easily into their daily lives. Planning and preparation were crucial in initiating and maintaining cycle commuting behaviour. The CC group and one PCC

participant with previous experience of cycle commuting discussed the importance of developing a routine. They mentioned strategies such as: preparing the night before, planning which days of the week you are going to cycle into work in advance, obtaining the correct outdoor wear and cycle equipment and keeping clothes at the office.

Helen, one of the CC participants spoke about how she negotiates the school run. In her case, she was able to find ways of integrating the school run into her cycle commute by purchasing child seats for her bike and later buying her children their own bikes and cycling with them. When Greg (CC) felt unmotivated to cycle he reminded himself of the enjoyment he experienced from being outdoors. Similarly, Andrew (CC) overcame his lack of motivation for cycling by reminding himself of the limitations of his alternative journey:

> I could go and stand and wait for a bus for ten minutes. Then I'm going to be shoe-horned onto that and then, by the time I get to the other end I've got to walk up the hill anyway so, I might as well just cycle and I get home about the same time.

To minimise the risks of cycling on the roads, there was a strong consensus that cyclists need a high awareness level to counteract the low visibility cyclists have on the roads and the dangers posed by other traffic. Bert (CC) elaborated on the importance of developing what he termed 'road craft' to minimise the risks of cycling:

> I'm thinking not only of what's coming in front of me, but also people who may suddenly do a U turn in front of me or somebody coming from behind me that wants to cut me up… you've got to have a rubber neck, make sure you have eye contact with drivers at junctions... the key points are that other drivers are aware where you are and what your intention is.

Helen (CC) spoke about the strategies she employs to manage the traffic around her:

> You need to be assertive and demonstrate what your intentions are, make sure it's clear and carry those through, that's the way to control traffic I think. It's a lot safer if you can do that. I think it's having confidence.

In terms of initiating cycle commuting, some individuals from both the CC and PCC group spoke of preparatory plans and ideas that could be employed to overcome some of the initial hurdles and uncertainties related to starting to cycle. Plans and ideas were discussed such as: having a practice run by bike to work out a suitable route and how long it would take, investing in a suitable bike, panniers and clothing, seeking information from colleagues who cycled and from the internet, and going on a cycle training course to help build confidence to cycle in traffic.

Discussion

This study provides original insights into cycle commuting by qualitatively investigating both potential and regular cycle commuters' perceptions and experiences of

cycling to work alongside exploring the impact of the context in which the research is set. A synthesis of findings indicates that potential cyclists are less aware of the range of benefits associated with cycling to work than regular and experienced cycle commuters. Potential and regular cycle commuters' accounts also differed in the way they discussed personal coping strategies, perceptions of supportive workplace facilities and perceptions of cycling infrastructure within the local environment. Cycle commuters discussed fewer challenges and more coping strategies than potential cycle commuters, who generally spoke more about challenges and less about coping strategies.

This study also brings to light the complex nature of cycle commuting and the high level of effort needed to take part in this behaviour. Even in a supportive workplace context, numerous psychological and perceptual factors can still pose as challenges to cycle commuting. In sum, the findings show that whilst cycling to work is a complex and effortful behaviour choice, cycle commuters are more able to favourably adapt their social cognitions towards cycling by either offsetting the challenges against the benefits they experience or by finding effective ways to cope with the challenges they encounter.

Being Aware of the Benefits

As with previous studies, physical health benefits and the convenience of exercising as part of your daily routine were viewed by both groups as motivating factors (Crawford *et al.,* 2001; Unwin, 1995). The CC and PCC participants' views differed the most in relation to cycle journey times. Whilst the CC group viewed the journey time as being quicker or the same as other transport modes, the majority of the PCC group felt that cycling would extend their journey time. Previous research has suggested that non-cycle

commuters may inaccurately estimate the time that their cycle journeys would take (de Geus *et al.,* 2008). Although this may not always be the case, when promoting cycling, it would be valuable to provide information about average journey times by bike.

The CC group generally discussed more immediately experienced benefits associated with cycle commuting than the PCC group such as psychological wellbeing, relaxation, enjoyment of being outdoors and time and cost savings. Awareness of these immediate benefits may be more important than longer-term benefits (e.g. physical health) in promoting and maintaining cycling because behavioural decisions are more strongly influenced by immediate consequences (Gaterleben and Appleton, 2004). The present study found that the more immediate benefits associated with cycling to work were less recognised by potential cycle commuters. Although physical activity does not always confer emotional benefits (Backhouse et al., 2007) the majority of cycle group participants in this study highlighted this as a benefit for them. Emphasising the immediate benefits and explaining the direct gains one can experience may encourage more people to start cycle commuting.

Being environmentally friendly was discussed by few participants and viewed as a peripheral benefit. This contradicts previous research that found the environmentally friendly factor to be an important benefit of cycle commuting (de Geus *et al.,* 2008). The contrasting findings could relate to the differences in personal values, beliefs and cultures between the participant groups. Another beneficial but peripheral factor for those who had young children was being a positive role model. Although these may not form the key reasons for choosing to cycle, peripheral benefits add weight to the decision to start

cycling. Therefore, they should be viewed as valuable counterparts within the decision-making process.

Over half of the PCC group believed that starting to cycle commute would lead to increases in leisure cycling. For some people this increase in leisure cycling related purely to purchasing a bike but for others, starting to regularly cycle to work would be a catalyst to increasing their overall cycling behaviour. Promoting cycle commuting may therefore have wider benefits to people's health (Wen *et al.,* 2005) and potentially their families too, through increasing leisure cycling.

Overcoming the Challenges

It is clear that cycling to work is a complex and effortful behaviour, and that numerous challenges need to be negotiated in order to cycle commute. The CC group described a range of coping strategies, to help them to overcome a number of challenging factors, such as: planning, preparation, mental strategies, developing a routine and learning 'road craft' (skills and confidence to cycle in traffic). Relatively little was said about such coping strategies by the PCC group, presumably because they were not yet familiar with such strategies that they could use to overcome the daily challenges of cycle commuting.

According to Mutrie *et al*. (2002), the use of effective coping strategies plays a role for people who successfully adopt active travel behaviours. Research into coping theory has received attention in performance sport (Nicholls *et al*., 2007; Gould *et al*, 1993a; 1993b) but has not yet been discussed in detail in the context of cycle commuting. The Transactional Process Theory of coping (Lazarus and Folkman, 1984) proposes two main categories of coping: problem-focussed coping and emotion-focussed coping.

Problem focussed responses are associated with situations amenable to change; whereas emotion focussed responses are associated with situations not amenable to change. In this study the CC groups appeared to employ more problem-focussed coping strategies, (e.g. planning, problem solving and increasing efforts) than the PCC group. Potentially, problem-focussed coping strategies can be identified and developed through psychological interventions in a relatively short time period for a small cost. The coping strategies described by participants in this study could be easily incorporated into cycle commuting interventions. For instance: information about the use of panniers for carrying laptops, clear advice on how to deal with road traffic, suggestions on how to tackle lack of motivation, and tips on how to look presentable at work.

Preparatory plans and actions for initiating cycle commuting can also be understood as problem-focussed coping strategies that could help people considering cycle commuting to deal with uncertainties they may have about starting to cycle. In this study a number of the PCC group held uncertain or conflicting views towards aspects of cycling. According to Prochaska *et al*. (1994), individuals who are contemplating changing a particular behaviour are often in a state of ambivalence, which can prevent them from taking up a new behaviour. Plans and actions such as searching for information via the internet and by talking to peers, trying out prospective bike routes at quiet times, purchasing appropriate equipment and taking cycle training courses may all facilitate the transition from other modes of transport to cycling. Developing and carrying out such preparatory plans and actions could be capitalised upon in interventions by promoting the use of specific action plans and implementation intentions (Gollwitzer,

1999). These have proved successful in encouraging change in habitual stable travel behaviour such as commuting (Gardner, 2009).

As with previous studies, adequate cycle workplace facilities and social support at work for cycle commuting were seen as important for cycling to be a viable transport option (Cleary and McClintock, 2000; Wardman *et al.,* 2007). Workplaces should not only invest in cycle facilities but also ensure that they are user-friendly, accessible and known about by staff. Some PCC participants were deterred from cycling due to misconceptions about workplace facilities and lack of knowledge about cycle routes in the city. People who don't regularly cycle and do not view themselves as cyclists are more likely to overlook cycle related information in their environment. Targeted marketing and communications techniques could raise awareness of local cycling resources amongst potential cyclists.

It was commonly understood that improving the cycling infrastructure within the local environment is an important foundational requirement to overcome many of the safety concerns surrounding cycling. Similar suggestions have been made by previous studies (Cavill and Watkins, 2007; de Geus *et al.*, 2008; Wardman, *et al.,* 2007). However, infrastructure changes alone may not be sufficient to lead to behaviour change. Social Ecological Theories (e.g. Giles-Corti *et al.,* 2005) highlight the need to consider a complex range of diverse factors, including physical environment, social environmental and psychological variables that influence the up-take of cycle commuting and other forms of physical activity. Until the necessary infrastructure is created, cycle training courses are valuable resources that develop on-road cycling skills, safety and confidence towards road cycling.

Links to Theory and Intervention Implications

The present qualitative study was inductive by nature; however, the key findings parallel some of the main constructs found within social cognition theories. Within the Transtheoretical Model (TTM, Prochaska and DiClemente, 1982) and the Theory of Planned Behaviour (TPB, Ajzen, 1985), awareness of benefits and challenges mirrors the decisional balance (TTM) and the outcome expectancy (TPB) constructs. Coping strategies relate to the processes of change (TTM), self efficacy (TTM) and perceived behavioural control constructs (TPB). Indeed more social cognition theories could be mentioned in relation to the present findings as there is substantial convergence between constructs within numerous theories (Biddle and Mutrie, 2001).

More recent research into behaviour change has taken a more pragmatic, best fit approach, focussing on theory-linked behaviour change techniques that coincide with single constructs as opposed to entire theories (Abraham and Michie, 2008). The present study indicates that in relation to cycle commuting taking a 'bottom up' inductive approach does not contradict a more 'top down' theoretical approach. Rather, understanding specific psychological factors that most closely relate to cycling can be valuable in identifying the most appropriate constructs, theories and techniques required to effectively promote cycle commuting.

This study supports the view that psychological interventions designed to enhance understanding of the benefits of cycling to work, and develop more realistic perceptions of barriers to cycling commuting along with appropriate problem-focussed coping strategies are appropriate means of enhancing behaviour change. However, as previously

acknowledged psychological approaches should be used in conjunction with other interventions including changes to the physical and social environments. This study demonstrates that even in cycle friendly workplaces, where physical and social changes have already been made, there is still scope to enhance rates of commute cycling through psychological intervention.

Strengths and Limitations

In the present study, more empirically generalisable and universal knowledge, which would involve larger sample groups, has been traded for an in-depth analysis. IPA, in the context of this study, proved to be a useful tool for revealing the full complexities of the psychological reasoning invovled in choosing to commute cycle. This study employed a purposive sample of 15 participants, selected on the basis of them being either active cycle commuters or having an interest in cycle commuting. All participants worked at a single city centre site which had Cycle Friendly Employer status. The type of generalization that can be made here would be more analytical in nature, involving a reasoned judgement about the extent to which the findings from one study can be used as a guide to what might occur in another situation (Kvale, 2007). These findings are more likely to apply to individuals in similar settings in supportive cycle friendly environments. For example, in the current study participants did not discuss any security concerns which have been expressed by participants in studies based in other contexts (Cavill and Watkins, 2007). Future complementary research should be carried out on samples in different contexts to examine whether some of the findings that emerged within this study would be revealed in other populations.

Conclusions

This study describes the complexities of similarities and differences in perceived benefits, challenges and coping strategies of cycling to work between commute cyclists and potential commute cyclists. Potential cycle commuters perceived fewer immediate benefits of cycling and greater challenges. In contrast, commute cyclists described a range of coping strategies that counteracted these challenges and facilitated their cycling behaviour. Raising awareness amongst potential cycle commuters of the immediate benefits of cycle commuting and highlighting some of the coping strategies employed by existing cyclists may be useful in psychological interventions to promote cycle commuting.

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Cycle Commuting Barriers: Stages of Change and Gender

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Cycle Commuting Barriers:

Stages of Change and Gender

Introduction

In western countries sedentary living is causing severe health consequences (Sallis and Owen, 1999). Over reliance on motorised transport means that people walk and cycle less than in the past. Cycle commuting is recognised as a favourable activity because it provides an opportunity for regular physical activity within the working population (Vuori *et al*., 1994). In the UK cycling for transport is viewed as an important activity not only for health benefits but also for positive consequences to liveability, reducing congestion the protecting the environment (Department for Transport, 2004).

Despite the individual and societal benefits of cycling, only a small section of the British population cycle commutes. In the UK only around 2% of trips are made by bicycle (Department for Transport, 2008). A key barrier to cycling is the perception of danger on the roads (Cavill and Davis, 2007). Whilst cycle commuting does pose some actual risks, even with current road conditions, the chance of sustaining an injury is relatively small and far outweighed by the benefits (Hillman, 1992). Other commonly cited factors that deter people from choosing to cycle commute are traffic issues, bad weather, lack of time, lack of workplace facilities and bike security (Unwin, 1992; Mayes *et al.*, 1996; Wardman *et al.*, 1997; Bergstrom and Magnusson, 2003; Dickinson *et al*., 2003, Heinen *et al*., 2010). Studies have found that non-cyclists hold exaggerated negative perceptions about the feasibility and dangers of cycling (Stinson and Bhat,

2004), the time it takes to cycle (de Geus *et al*., 2007) and the British weather (Mayes *et al*., 1996, Crawford *et al*., 2001)

Perceived barriers to physical activity have a negative influence on peoples decisions to participate (Trost *et al.*, 2002, Bauman *et al*., 2002). Regardless of whether perceived barriers are objective or subjective there is a strong inverse correlation between perceived barriers and exercise participation (Sallis and Owen, 1999). Theoretically, the concept of barriers or 'costs' is embedded in behaviour change theories e.g. the health belief model (Becker *et al.*, 1977), the transtheoretical model of behaviour change (Prochaska and DiClemente, 1982) and the theory of planned behaviour (Ajzen, 1985). These theories propose that influencing perceptions of barriers may assist behaviour change.

To date, cycle commuting studies comparing groups of cyclists and non-cyclists have analysed the concept of barriers as part of a larger framework of attitudinal correlates (Gatersleben and Appleton, 2007, de Geus *et al*., 2007, Shannon *et al*., 2006) Gatersleben and Appleton (2007) used the stages of change (see Table 1) to investigate if there were more subtle distinctions between attitudes and perceptions towards cycle commuting. In support of the transtheoretical model of behaviour change (TTM), they found that as people progress from pre-contemplation to maintenance stage, their attitudes towards cycling become less negative. A more detailed analysis of perceptions of cycle commuting barriers may provide useful information towards understanding how to effectively increase the numbers of people who cycle to work.

[Insert Table 1 here]

Evidence also suggests that there are gender differences in perceptions towards barriers linked to cycle commuting. Females perceive higher safety risks and vulnerability from traffic than males (Krizek *et al*., 2005, Department of Transport, 2007, Davies *et al.*, 1997, Horton, 2007, Tilahun *et al*., 2007). Understanding gender differences in perceptions is an important issue in the UK and other countries with low rates of utilitarian cycling as women have been found to cycle less than men (Unwin, 1995, Unwin, 1992, Dickinson *et al*., 2003, Department for Transport, 2007, Troped *et al*., 2001).

The present study investigated perceptions of a range of potential barriers associated with cycle commuting. The aim was to determine how perceived barriers differed between individuals at various stages of change (see Table 1) and to evaluate any gender differences in perceived barriers. The investigation was carried out in a workplace that provided a good standard of cycle facilities for employees in order to evaluate perceived barriers amongst a population in which some of the physical barriers to cycling had been reduced. Lack of cycle parking and changing facilities at the workplace can deter people from cycling (Rose and Marfurt, 2007, Dickinson *et al.*, 2003) and it is becoming increasingly popular for workplaces to provide cycle provision.

Methods

Design and Procedure

A cross-sectional design was employed sampling males and females at all stages of change regarding cycle commuting behaviour. Data was collected using an on-line questionnaire based survey (using Bristol On-line Survey). The questionnaire was piloted

and adapted prior to use. The on-line questionnaire was distributed by departmental administrators via the internal email system to a sub-section of employees and PhD students within a large university setting. Prior to dissemination, permission to distribute the questionnaire was gained by the Human Resources Department. Two reminder emails were sent out in the following month after the questionnaire was disseminated in an attempt to maximise the response rate. Ethical approval was obtained following the Moray House School of Education guidelines, which forms part of the University of Edinburgh's Ethical Procedures.

Participants

For the present study, twenty eight buildings from two of the university campuses were targeted that were classed as 'cycle friendly'. These buildings provided the necessary facilities to support cycle commuting such as access to secure cycle storage, showers and changing facilities. The questionnaire was sent to approximately 2000 individuals, either employees or PhD students, who ranged from 18 to 70 years old. Overall, 831 people responded to the questionnaire (42%).

Instrument

A questionnaire was adapted from constructs used in previous studies (Crawford *et al*., 2001, Mutrie *et al*., 2002, Marcus *et al*., 1994). It consisted of three parts, (i) demographic variables (ii) current cycle commuting behaviour and (iii) attitudinal questions relating to potential barriers of cycle commuting. Current cycle commuting behaviour was measured using a traditional stages of change scale, with seasonal cyclists

asked to complete separate questions. Potential barriers were assessed using 18 common deterring factors (listed in Tables 3 and 4) using a five point Likert scale (1='not discouraging', 2='slightly discouraging', 3='moderately discouraging', 4='very discouraging', 5='stops me from cycling').

Statistical Analyses

The statistical analysis was carried out using the software package, SPSS statistics 17. Initially percentages were used to provide an overview of each stage of change in relation to gender, age, job role and distance (see Table 2). The rank orders of the 18 barriers are presented in relation to stages of change and gender (see Tables 3 and 4). For the inferential statistics, the independent variables were stage of change (five levels) and gender. 'Seasonal' cycle commuters, who only cycled for part of the year, were excluded from the stages of change analyses to ensure conformity to the TTM. The dependant variables were the 18 potential barriers. One-way ANOVAs were carried out to analyse whether perceptions of the barriers significantly differed between stages of change (see Table 3). In the case of significant results, post hoc Tukey tests were used to identify differences in perceived barriers between individual stages. Independent t-tests were used to determine whether there were any significant differences in perceptions of barriers between men and women (see Table 4). Finally, two-way ANOVAs were carried out to find out if there were any significant interactions between stages of change and gender with regard to perceptions of barriers.

Results

Demographics

Table 2 shows gender, age, job and distance variables in relation to stages of change. In terms of stages of cycle commuting behaviour there were 52% pre-contemplators, 9% contemplators, 4% preparers, 3% actors, 26% maintainers and an additional category was added to capture seasonal cyclists (6%). The participants comprised 54% men and 46% women. A chi-square analysis revealed a significant association between gender and stage of change (Chi-square=25.2, df=5, $p<0.001$). This association reflects the tendency for females to be categorised earlier on stages of change (i.e. less likely to be active cycle commuters) than men.

Most participants (84%) were between the ages of 18 to 50 years old. The spread between genders was evenly distributed across age except for in the oldest age category (60-70 years), comprising 4% of the overall sample, which exhibited a male bias. There was also a relatively even spread of participants across job roles: 29% academic staff, 22% support staff, 24% research staff, 24% PhD students and 2% other.

At each end of the stage of change spectrum, differences between job roles were evident with more academic staff than support staff in the maintenance stage and vice versa in the precontemplator stage. Although not displayed in table 2, gender differences between the job roles were also evident with a higher percentage of males (21%) than females (8%) reported in academic positions and a higher percentage of females (14%) than males (8%) reported in support staff positions. The majority of the sample (78%) lived within a five mile radius from the worksite.

[Insert Table 2 here]

Stages of Change

Looking at each stage of change separately, it is possible to discern which of the barriers to cycle commuting were perceived to be the most substantial (see Table 3). Precontemplators, contemplators and preparers all ranked 'danger on the roads', 'bad weather' and 'darkness' as the top three barriers associated with cycling to work. Actors and maintainers perceptions differed slightly. Actors ranked 'danger on the roads', 'bad weather' and 'natural terrain' as the main barriers to cycle commuting and maintainers scored 'danger on the roads', 'bad weather' and 'manmade terrain' as the biggest barriers.

[Insert Table 3 here]

Table 3 shows statistically significant differences in perceived barriers (set above $p \leq 0.01$ to protect against type 1 errors) for 16 out of the 18 barriers as a function of stage of change. The most significant stage of change differences related to the perceived barriers of danger on the roads ($F(4,731) = 48.7$, $p < 0.001$), darkness ($F(4,730) = 37.3$, $p < 0.001$), and natural terrain ($F(4,725) = 36.6$, $p < 0.001$). This reveals that although there is some agreement between stages of change about which barriers are the most important, there are evident 'stage' differences in the perceived strength of these barriers. Post hoc Tukey tests demonstrated that precontemplators, and to a lesser extent contemplators, perceived higher levels of barriers than those individuals experienced in cycle commuting (maintainers).

Gender

Both males and females classified 'danger on the roads', 'bad weather' and 'darkness' to be the biggest barriers related to cycle commuting. However, there were significant gender differences in the strength of perceptions for 13 of the 18 barriers between males and females (see Table 4). The most significant gender differences related to perceived barriers of darkness ($t = 7.3$, $df = 733$, $p < 0.001$) natural terrain ($t = 7.2$, $df = 661$, $p < 0.001$), and perceived danger on the roads ($t = 6.8$, $df = 732$, $p < 0.001$). This indicates that although there is agreement between men and women about what barriers are the most important, there are marked gender differences in the perceived strength of these barriers. Where gender differences were identified, females consistently perceived higher levels of barriers than males. Two-way ANOVAs showed there were no significant interactions between the stages of change and gender for each of the barriers ($p \leq 0.01$).

[Insert Table 4 here]

Discussion

The present study examined 18 potential barriers associated with cycle commuting in relation to stages of change and gender to try and identify differences in perceptions that may affect an individual's decision to cycle commute. The results show that perceptions significantly differed as a function of both stage of change and gender for many of the barriers, with precontemplators and females holding the most negative perceptions overall. The results highlight the important role that perceptions of barriers play in the

decision to cycle commute, and the need to tailor interventions to specific subgroups of the population.

Examining the demographics of cycle commuting behaviour within the sample, in support of other studies, more men than women cycle commute (Unwin, 1995, Unwin, 1992, Dickinson *et al*., 2003, Department for Transport, 2007, Troped *et al*., 2001). A larger percentage of relatively higher earners (academic staff) were regularly cycling to work in comparison to lower earners (support staff) who were more likely to have not contemplated cycling to work. In accordance with the results, De Geus *et al*. (2008) found higher education to be associated with more cycling to work. Parkin *et al*. (2008) similarly found that a lower income indicates a lower proportion of cycle commuting. However, these results differed from Moudon *et al*. (2005) who found no significant relationship between household income and likelihood of cycling. Tin Tin *et al*. (2006) also found that the prevalence of cycling to work did not vary significantly by personal income. In the present study, proportionally, more women worked as support staff and more men as academic staff so it is possible that gender could also play an influencing role within the effect found here.

The differences in perceptions found between the stages of change lend support to the transtheoretical model (Prochaska and DiClemente, 1982). The model posits that as an individual progresses through the stages of change, their views towards the barriers associated with an activity decrease. Bull (2001) states that in the early stages of behaviour change individuals cannot see past the difficult aspects. It is therefore important to examine which are true barriers and which are 'excuses' or 'misperceptions' and what possible solutions can be found.

The precontemplator group held the highest perceptions of barriers to cycling. Whilst some of these may be realistic (e.g. amongst those who live a greater distance from work), other perceived barriers may be exaggerated, due to lack of experience, and amenable to change. For example, exhaust fumes, weather and danger on roads were perceived as stronger barriers among precontemplators than by individuals in all the other stages. As these factors are in reality likely to apply fairly equally to most people cycling to the university, this suggests a subjective, psychological, component to perceptions of barriers that could be the target of intervention work. The precontemplators comprised the largest single group (51% of sample), reflecting the current large numbers of non cyclists. Even if interventions only encouraged a small proportion of this group to engage in cycling, this could significantly increase overall cycling numbers.

Contemplators voiced a number of concerns but not as many or as strongly as precontemplators. As contemplators have the intention to start cycle commuting, it may be more cost effective to focus on moving these individuals closer to action. According to Marcus and Forsyth (2003), this can be done by carrying out an individual barriers assessment, and providing suggestions and action plans for overcoming barriers. Taster sessions are also recommended (Biddle and Mutrie, 2001). Rose and Manrfurt (2006) assessed the impact of a 'Ride to Work Day' and found that 27% of first time riders participating in the event were still cycling five months after the event. Such events may help to overcome misperceptions relating to issues such as time taken to cycle, nature of terrain on route and the physical effort involved, each of which was identified in the current study as being a significantly greater perceived barrier amongst those in the contemplation stage than in the maintenance stage. Cycle skills training may also be

appropriate at this stage to help cue action. Tefler *et al*. (2006) found cycle training to be effective in increasing people's cycle behaviour by providing, knowledge, skills and increasing self-confidence.

Preparers held less significant negative perceptions than contemplators. As preparers are already infrequently cycle commuting, it is likely that there will be very specific barriers holding them back from regularly cycling to work. In the Health Action Process Approach model (Schwarzer, 1992), the pre-action volitional stage, equivalent to the preparation stage of TTM, includes the mediators of action planning and coping planning. These types of planning aim to overcome the gap between intention and action (Schwarzer, 2008). In the current study, the significant differences between those in the preparation stage and those in the maintenance stage related to perceptions of barriers due to bad weather, darkness and carrying belongings. Potentially, receiving advice and strategies from experienced cyclists about how to overcome such barriers may help those in the preparation stage to progress into regular cycle commuters. Informal social support networks may facilitate such links and have been recommended for preparers (Marcus and Forsyth, 2003). Workplaces could set up bicycle user groups to create supportive social networks for the cycling community.

The results for actors and maintainers reveal that although both of these groups are regularly cycling to work, actors are more deterred by some perceived barriers than maintainers. These two groups differed significantly in their perceptions towards bad weather and carrying belongings. It is possible that those in the maintenance stage have developed strategies to overcome such barriers. It is therefore important that individuals who have recently started cycle commuting receive support to help them maintain their

behaviour. Social support from the workplace and encouragement to join networks and events is recommended (Marcus and Forsyth, 2003).

There are clear differences in perceptions of barriers between men and women. Females perceived 13 out of the 18 barriers to be significantly more discouraging than males. This is an important finding as few studies have explored women's perceptions of barriers to cycling in detail (Garrard *et al*., 2006). In the current study, women did not just hold heightened perceptions towards risk orientated barriers, but also towards more general barriers such as: natural terrain, distance to work, carrying belongings, storage at home, the school run, physical effort involved, the expense of buying a bike and wearing casual clothing. Previous studies indicate that complex trip characteristics (such as shopping and child responsibilities) may partially explain why fewer females cycle commute (Pooley, 2000; Dickinson, 2003). Garrard *et al*. (2006) proposed that social and environmental factors underpin women's uptake of cycling stating "female participation in cycling appears to be an indicator of a cycling friendly culture and environment with each contributing to the other interactively" (p.6, Garrard *et al*., 2006). However, the current study found that all of the 18 perceived barriers, gender and stages of change act independently of each other. This finding suggests that although women might hold relatively heightened perceptions of barriers than men, as they progress through the stages of change their perceptions towards barriers decrease. This indicates that individual (psychological) support also has an instrumental role to play in encouraging women to cycle. Daley, Rissel & Lloyd (2007) found that females were attracted to cycling as it's a low impact form of exercise; therefore, if the necessary support is in place, cycle commuting would be appealing to women.

Overall, across the stages of change and gender, danger on the roads posed the biggest barrier to cycle commuting. Precontemplators viewed danger on the roads as very discouraging in comparison to maintainers who were only slightly/moderately discouraged. Stinson & Bhat (2004) suggested that non-cyclists may hold misconceptions regarding the dangers of cycling. This is a plausible explanation but such statements should be made with caution. Daley *et al*. (2007) also found that danger was a significant barrier for occasional and non-cyclists who had lower levels of skills than regular riders. It is possible that inexperienced cyclists may be at higher risks on the roads in comparison to experienced cyclists, who are likely to have developed skills and confidence with exposure to cycling in traffic. There is also evidence to the contrary, finding no significant differences in perceptions of danger between cyclists and non-cyclists (de Geus, *et al*., 2008). This contradiction in findings may relate to the environmental context of the research as de Geus *et al*. (2008) carried their research out in Belgian town with basic cycle infrastructure available in most places. Women perceived danger on the roads to be a great barrier than men in the present study, as has been found previously (Krizek *et al*., 2005, Transport, 2007, Davies *et al*., 1997, Tilahun *et al*., 2007). This is likely to stem from established gender differences in risk taking (Byrnes, Miller & Williams, 1999).

The weather posed the second biggest challenge across stages of change and gender. Mayes *et al*., (1996) found bad weather to be a common barrier for people who don't cycle and suggested this is an excuse that non-cyclists hide behind. The present results showed that not only non-cyclists but infrequent and new cyclists also perceive the weather to be a significantly bigger challenge than experienced cyclists. A possible

explanation is that cyclists develop strategies to cope with weather conditions over time. Women also perceived weather to be more of a challenge than men. This may also stem from women's aversion to risk taking (Byrnes *et al*., 1999) as inclement weather can increase danger on the roads from poor visibility and wet surfaces. Another possible reason is that women often have more complex needs, in relation to their physical appearance (hair and make up) than men and poor weather conditions can adversely affect appearance.

Workplace cycle facilities were generally not considered to be a substantial barrier to cycle commuting. It is likely that this result was due to the cycle-friendly facilities available to all participants. However, precontemplators were significantly more discouraged than maintainers by their perceptions of the showers and changing facilities available. This may simply reflect lack of awareness towards some of the available cycle facilities and highlights the importance of ensuring that cycle facilities are widely communicated to maximise their use and to dispel inaccurate perceptions.

Whilst the most important barriers reported in this study relate to aspects of the physical environment that are not within the control of an individual, the significant perceptual differences between individuals at differing stages of change indicate that views regarding these environmental barriers may be amenable to change. This supports the findings of a recent qualitative study carried out in a different workplace setting (van Bekkum *et al.*, (under review). However, environmental barriers such as danger on the roads and manmade terrain remain strong deterrents to cycling. It is therefore crucial to provide better environmental support for cyclists in terms of infrastructure and provision.

Wardman *et al.* (2007) suggests that in order for large numbers of people to start cycle commuting in the UK, adequate infrastructure needs to be in place.

There were a number of limitations within this study. Firstly, data was collected via a self-report, with no objective measures in place. The response rate (42%) was good for a survey of this nature. However, this study was carried out in a workplace providing adequate cycle facilities; therefore some findings would not apply to workplaces that do not provide suitable cycle provision for employees. It is also acknowledged that cycle environments vary between places and cultures so findings from this study, regarding environmental barriers, which confirm other research evidence (Unwin, 1995; Crawford *et al*., 2001; Daley *et al*, 2007), should be interpreted in context.

Conclusion

This study has revealed significant differences in perceptions of barriers to cycle commuting as a function of both stage of change and gender. Individuals at earlier stages of change perceive stronger barriers to cycle commuting than those individuals who engage in the behaviour. Furthermore, women perceive relatively higher barriers than men. However, there is general agreement across groups that danger on the roads and bad weather are the two main barriers to cycling to work. Individual-level interventions to promote cycle commuting that focus on barrier reduction could be tailored to the stage of change and gender of participants in order to enhance effectiveness and facilitate behaviour change.

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Table 1: Descriptions of 'stage of change' categories in relation to cycle commuting, taken from the transtheoretical model of behaviour change (Prochaska and DiClemente, 1982)

Stage	Description
Precontemplator	No intention to start cycle commuting in the next six months
Contemplator	Thinking about starting to cycle commute in the next six months
Preparer	Infrequently cycle commuting (no more than once a week)
Actor	Started regularly cycle commuting in the last six months
Maintainer	Has been regularly cycle commuting for at least six months

Table 2: Demographic variables displayed by stage of cycle commuting behaviour

Demographic Variables	PC	C	P	A	M	S	Total
Behaviour	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)	% (n)
Stage	51.1% (433)	9.1% (76)	3.7% (31)	2.5% (21)	26.5% (220)	6.0% (50)	100% (831)
Gender							
Male	25%(208)	4.2% (35)	1.9% (16)	1.3% (11)	17.9% (149)	3.5% (29)	53.9% (448)
Female	27.1% (225)	4.9% (41)	1.8% (15)	1.2% (10)	8.5% (71)	2.5% (21)	46.1% (383)
Age							
18-30 years	16.5% (137)	2.9% (24)	1.4% (12)	1.7% (14)	9.6% (80)	1.6% (13)	33.7% (280)
31-40 years	17.2% (143)	3.2% (27)	1.0% (8)	0.7% (6)	7.1% (59)	2.5% (21)	31.8% (264)
41-50 years	9.1% (76)	1.4% (12)	1.3% (11)	0.1% (1)	5.8% (48)	0.8% (7)	18.7% (155)
51-60 years	7.2% (60)	1.4% (12)	0.0% (0)	0.0% (0)	3.4% (28)	0.7% (6)	12.8% (106)
61-70 years	2.0% (17)	0.1% (1)	0.0% (0)	0.0% (0)	0.6% (5)	0.4% (3)	3.1% (26)
Job role							
Academic	13.2% (110)	2.4% (20)	1.3% (11)	0.0% (0)	9.9% (82)	2.5% (21)	29.4% (244)
Research staff	11.4% (95)	2.8% (23)	0.6% (5)	1.2% (10)	6.3% (52)	1.4% (12)	23.7% (197)
PhD students	11.9% (99)	1..7% (14)	1.2% (10)	1.0% (8)	6.7% (56)	1.2% (10)	23.7% (197)
Support staff	14.7% (122)	2.2% (18)	0.5% (4)	0.2% (2)	3.1% (26)	0.8% (7)	21.5% (179)
Other	0.8% (7)	0.1% (1)	0.1% (1)	0.1% (1)	0.5% (4)	0.0% (0)	1.7% (14)
Distance (one way)							
0-1 mile	9.9% (82)	1.3% (11)	1.1% (9)	0.4% (3)	3.2% (27)	0.7% (6)	16.6% (138)
1-2 miles	14% (116)	2.9% (24)	0.7% (6)	1.1% (9)	10.3% (86)	2.3% (19)	31.3% (260)
2-5 miles	12.5% (104)	4.0% (33)	1.4% (12)	1.0% (8)	9.0% (75)	2.2% (18)	30.1% (250)
5-10 miles	5.8% (48)	0.6% (5)	0.4% (3)	0.0% (0)	1.7% (14)	0.2% (2)	8.7% (72)
10miles +	10.0% (83)	0.4% (3)	0.1% (1)	0.1% (1)	2.2% (18)	0.6% (5)	13.4% (111)

PC = precontemplators, C = contemplators, P = preparers, A = actors, M = maintainers, S = seasonal

Table 3: One-way ANOVA results for perceptions of barriers between stages of change

Potential Barriers	PC Mean (SD)	C Mean(SD)	P Mean (SD)	A Mean (SD)	M Mean (SD)	Total Mean (SD)	df	F	*p*	Tukey
Danger on the roads	4.03 (1.21)	3.42 (1.28)	3.00 (1.36)	3.14 (1.01)	2.63 (1.18)	3.47 (1.35)	4, 731	48.658**	<0.001	PC & C PC & P PC & A PC & M C & M
Bad weather	3.21 (1.26)	3.12 (1.15)	3.68 (1.11)	3.38 (102)	2.33 (1.06)	2.98 (1.24)	4, 736	23.665**	<0.001	PC & M C & M P & M A & M
Darkness	2.95 (1.37)	2.54 (1.16)	2.90 (1.27)	2.19 (0.93)	1.71 (0.91)	2.54 (1.33)	4, 730	37.261**	<0.001	PC & A PC & M C & M P & M
Manmade terrain (poor road surfaces)	2.59 (1.40)	2.01 (1.09)	2.23 (1.31)	2.14 (1.15)	1.97 (1.03)	2.32 (1.28)	4, 720	9.837**	<0.001	PC & M PC & C
Natural terrain (hilliness)	2.80 (1.44)	2.42 (1.33)	1.94 (0.96)	2.29 (0.90)	1.54 (0.77)	2.31 (1.33)	4, 725	36.575**	<0.001	PC & P PC & M C & M
Exhaust fumes	2.71 (1.33)	2.08 (1.03)	1.83 (1.15)	1.76 (0.62)	1.78 (0.91)	2.31 (1.24)	4, 732	25.899**	<0.001	PC & C PC & P PC & A PC & M
Distance from work	2.67 (1.73)	1.63 (1.07)	1.76 (1.06)	1.86 (1.19)	1.66 (0.96)	2.18 (1.50)	4, 738	22.089**	<0.001	PC & C PC & P PC & M
Carrying belonging	2.34 (1.35)	1.90 (1.06)	2.33 (1.27)	2.55 (1.10)	1.60 (0.80)	2.08 (1.21)	4, 723	15.677**	<0.001	PC & C PC & M P & M A & M
Storage at home	2.36 (1.48)	2.35 (1.40)	1.61 (0.98)	1.89 (0.99)	1.47 (0.77)	2.05 (1.33)	4, 647	16.250**	<0.001	PC & M C & M
School/nursery run	2.28 (1.76)	1.85 (1.41)	2.47 (1.88)	1.60 (1.35)	1.36 (0.82)	2.01 (1.57)	4, 354	5.935**	<0.001	PC & M
Time taken to cycle	2.46 (1.62)	1.77 (1.18)	1.50 (0.86)	1.81 (1.03)	1.26 (0.68)	1.98 (1.41)	4, 725	30.192**	<0.001	PC & C PC & P PC & M C & M
Changing and showering facilities	1.91 (1.25)	1.89 (1.19)	1.81 (1.08)	1.68 (1.16)	1.46 (0.86)	1.78 (1.16)	4, 627	4.999*	0.001	PC & M
Physical effort involved	2.13 (1.30)	1.62 (0.97)	1.55 (0.85)	1.43 (0.68)	1.15 (0.39)	1.74 (1.11)	4, 732	31.954**	<0.001	PC & C PC & P PC & A PC & M C & M
Storage at work	1.75 (1.09)	1.75 (1.09)	1.71 (1.10)	1.94 (1.14)	1.50 (0.93)	1.72 (1.08)	4, 635	2.093	0.080	
Expense of buying a bike	1.97 (1.24)	2.20 (1.35)	1.00 (0.00)	1.60 (0.88)	1.23 (0.59)	1.71 (1.11)	4, 662	20.627**	<0.001	PC & P PC & M C & P

										C & M
Casual clothing	1.77 (1.19)	1.57 (0.92)	1.75 (1.00)	1.70 (0.92)	1.27 (0.59)	1.60 (1.01)	4, 685	8.242**	<0.001	PC & M
Health problems	1.65 (1.26)	1.16 (0.71)	1.37 (1.01)	1.50 (0.94)	1.38 (0.89)	1.52 (1.11)	4, 509	2.986	0.019	PC & C
Lack of waterproof clothing	1.60 (1.00)	1.59 (0.98)	1.36 (0.91)	1.63 (0.83)	1.29 (0.63)	1.51 (0.91)	4, 631	3.766*	0.005	PC & M

PC = precontemplators, C = contemplators, P = preparers, A = actors, M = maintainers

df = degrees of freedom, F = ANOVA score, p = significance level, * ≤ 0.01, ** ≤ 0.001, Tukey = post hoc Tukey test group differences significant at $p \leq 0.05$.

Table 4: Differences in Perceived barriers between males and females

Potential Barriers	Female Mean Score (SD)	Male Mean Score (SD)	df	T	p
Danger on the roads	3.82 (1.23)	3.18 (1.38)	732	6.759**	<0.001
Bad weather	3.21 (1.21)	2.80 (1.24)	739	4.608**	<0.001
Darkness	2.90 (1.33)	2.24 (1.25)	733	7.299**	<0.001
Manmade terrain (poor road surfaces)	2.54 (1.29)	2.14 (1.24)	723	4.265**	<0.001
Natural terrain (hilliness)	2.69 (1.38)	2.00 (1.19)	661	7.224**	<0.001
Exhaust fumes	2.56 (1.29)	2.10 (1.16)	690	4.752**	<0.001
Distance from work	2.34 (1.58)	2.06 (1.42)	695	2.501**	<0.001
Carrying belongings	2.29 (1.26)	1.89 (1.13)	678	4.422**	<0.001
Storage at home	2.25 (1.47)	1.89 (1.18)	549	3.106*	0.002
School/nursery run	2.48 (1.80)	1.66 (1.29)	270	4.979**	<0.001
Time taken to cycle	2.08 (1.42)	1.90 (1.40)	728	1.723	0.085
Changing and showering facilities	1.81 (1.18)	1.77 (1.14)	630	0.640	0.522
Physical effort involved	1.96 (1.21)	1.55 (0.99)	654	5.263**	<0.001
Storage at work	1.72 (1.08)	1.71 (1.09)	638	0.070	0.944
Expense of buying a bike	1.85 (1.20)	1.61 (1.04)	581	2.621*	0.009
Casual clothing	1.84 (1.16)	1.41 (0.83)	543	5.431**	<0.001
Health problems	1.63 (1.23)	1.43 (1.00)	447	1.948	0.052
Lack of waterproof clothing	1.59 (1.02)	1.44 (0.81)	554	-1.903	0.058

df = degrees of freedom, T = t-test score, p = significance level, * ≤ 0.01, ** ≤ 0.001

Abstract

Purpose - This paper investigates 'stage of change' and gender differences in perceptions of barriers associated with cycle commuting.

Design/methodology/approach - A cross-sectional online survey was completed by a staff and PhD students (n=831) based in cycle-friendly buildings in a large international UK university. The survey included questions relating to demographics, stages of behaviour change and 18 potential barriers. Data was analysed using t-tests, one-way ANOVAs and two-way ANOVAs.

Findings - Although each 'stage of change', and gender held common perceptions about the biggest barriers associated with cycle commuting (danger on the roads and bad weather), there were significant differences regarding the strengths of these perceptions. Participants in the earlier stages of change held stronger perceptions for 16 out of 18 barriers than those in the latter stages. Similarly, females perceived 13 out of 18 barriers more strongly than males.

Practical implications - The results indicate that 'stage' tailored psychological interventions that focus on reducing barriers have a role to play in encouraging people to cycling to work. The results also suggest that women may require a higher-level support that males in order to effectively encourage then to cycle commute.

Originality/value – The study reveals that there is a strong psychological element involved in peoples' understanding of barriers associated with cycle commuting. Additionally, this study found that women not only hold stronger perceptions than males towards both risk orientated barriers and more general barriers associated with cycle commuting.