

CONTENTS

1. ABSTRACT.....	p.2
2. LITERATURE REVIEW.....	p.3-26
2.1 The case for changing people's travel mode choices.....	p.3
2.2 The appeal of personal vehicles and resistance to cycling.....	p.5
2.3 Challenges facing sustainability through cycling.....	p.16
2.4 The transactional model of behavioural change applied to cycling.....	p.19
2.5 The role of feedback upon pro-environmental behaviours.....	p.22
2.6 Conclusion.....	p.26
3. RESEARCH QUESTIONS.....	p.27
4. EXPOSITION.....	p.28-32
4.1 How the research will be undertaken.....	p.28
4.2 Anticipated problems.....	p.30
4.3 Completing or alternative explanations of findings.....	p.32
5. REFERENCES.....	p.33

PROMOTING CYCLING : COMPARATIVE AND NON-COMPARATIVE
FEEDBACK AND THE STAGES OF BEHAVIOURAL CHANGE.

ABSTRACT

Prior research has indicated why cyclists say they cycle and why non cyclists say they don't. However the distinction between these two groups is not subtle enough. Some people may have never considered cycling, whilst others might like to but certain factors act as deterrents. Gatersleben and Appleton (2007) showed that Prochaska and DiClemente's (1984) transactional model of behavioural change was useful for distinguishing between these distinct groups of cyclists. The model proposes behavioural change as a process rather than an event, characterised by a sequence of stages: precontemplation, contemplation, preparation, action and maintenance. Individuals have been shown to and digress through these stages, with advancement from contemplation through action providing the biggest challenge (Diclemente, Schlundt and Gemmell, 2004). This study aims to explore why people are reluctant to cycle, and encourage action amongst individuals in the contemplation and preparation stages. Motivating people to progress into the action stage is beneficial, since this has been shown to aid the development of more positive cycling attitudes, and a reduction in perceived personal and external barriers contributing to inaction (Gatersleben and Appleton, 2007). Throughout the action stage, cycling habits should be formed. This is important since research by Quelling and Wood (1998) indicated that for a behaviour to be maintained, a habit needs to be formed first. The effects of feedback would also be investigated, by recruiting participants into one of three groups: a control group, a comparative feedback group, or a non-comparative feedback group. The non-comparative feedback group will be informed of personal performance over the intervention period, whilst the comparative feedback group will be able to see their own performance relative to others within their group. This would establish which style of feedback is most effective in encouraging cycling

behaviours. Furthermore, participants attitudes, intentions, and behavioural changes will be monitored throughout.

2. LITERATURE REVIEW

2.1 The case for changing peoples travel mode choices

The majority of UK households possess at least one vehicle, with 10% having in excess of three (Department of Environment, Transport and the Regions, 1998a). In addition to increased car ownership, the numbers of journeys made are also rising, with a quarter being less than 2 miles distance (DETR, 1998b), suggesting many could easily be undertaken by foot or bicycle (Goodwin, 1995).

The apparent exponential growth of motor vehicle use is a global concern, due to the resultant air pollution, solid waste, the destruction of habitats and noise disturbances. Air pollution due to car use will be focused upon as it affects the greatest number of people, and has various concerning knock-on effects to the global atmosphere. Carbon dioxide is the result of petroleum combustion, along with carbon monoxide, volatile organic compounds, oxides of nitrogen and fine particles. In Europe, 47% of nitrogen oxides, 39% of volatile compounds and 66% of CO₂ emissions are produced by motor vehicles (Walsh, 1993). The corresponding figures for the US are higher.

Carbon dioxide contributes to greenhouse gases which have been building up since the beginning of the industrial revolution. The Intergovernmental Panel on Climate Change

(1995) estimates that CO₂ levels have risen by 30% since 1750 as a consequence of large scale fossil fuel use. Furthermore, they argue that this human influence has had a discernable effect on climate change.

Transport entails the consumption of two exhaustible resources, both land and oil. At the present rate of world oil use (25 billion barrels a year) the current proven resources would be exhausted within 40 years (Masters et al, 1994). However, forecasted oil discoveries are plentiful, therefore the immediate threat to sustainability shifts from hydrocarbon resource quantity, to the environmental and social impacts of their use.

Congestion within the UK has become increasingly chronic due to the greater number of cars on the road. The unpleasant experience of driving in rush hour has become familiar to many, with some journey times forecasted to lengthen by as much as 70% over the next 15 years in action is not taken (DETR, 1998c). The DETR reports commuter journeys as the main contributor to rising road use, accounting for over 1,300 miles per year for each individual (DETR, 1998a). This reflects a significant increase in car use, and a significant decrease in walking and cycling, in contrast to a decade earlier.

Kingham, Dickenson and Copsey (2001) examined employee's modal choice for their journey to work. In one company 88% of its 831 employees traveled to work by car, and in a second company this raised to 97.5% of 131 employees, despite two thirds of employees owning a bicycle. This difference reflected the alternative transport policies, illustrating that car use can be deterred.

2.2 The appeal of personal vehicles and resistance to cycling

Changing the travel habits of people faces two distinct challenges, the reluctance of people to give up their cars, and barriers which must be overcome to adopt alternative means. For those regularly using private motor vehicles in the presence of more sustainable alternatives, a number of factors are preventing behavioural shifts. Aarts, Verplanken and Knippperberg (1997) explored the roles of habit and information in travel mode choices. They argue that routine decisions such as transport modes lose deliberate decisional processing; rather the behaviour becomes automatic, triggered by the appropriate situational cues. Aarts (1996) argues that by the same token, habituation of travel choice is projected onto all contexts in which travel is the goal. The elaborateness of information processing regarding judgments of travel mode use for short journeys was investigated, with reference to preexisting habits. Subjects were asked to report their favorability of using a bicycle in a variety of travel situations using a ten point likert scale. In line with predictions strong habit participants used fewer circumstantial attributes to guide their decisions.

However, in the presence of the additional variable of decisional accountability, both weak and strong habit individuals demonstrated more complex and effortful processing. Such a finding is consistent with research demonstrating that people do expend more cognitive effort on decisions and judgments for which they are personally accountable (Weldon and Gargano, 1998). This psychological reactance to personal accountability

should be utilised in behavioural interventions due to the increased likelihood of active cognitive involvement. Though whether this effect would translate to actual behavioural choices, rather than the related judgments remains to be seen, since some psychologists argue the psychological processes underlying judgment and choice are both separate and distinct (Billings and Scherer, 1988).

Tertoolen, Kreveld and Verstraten (1998) investigated psychological resistance to reducing private car use prompted by failure of Dutch governmental campaigns. Van Vugt et al (1985) proposed that psychological resistance was a product of the private vehicle having attained status as a symbol of personal independence. Social dilemma theory (Dawes, 1980) was also thought to contribute to peoples unwillingness to change. Social dilemmas can be summarised as situations in which private interests are at odds with the collective interest. Automobile use is such a case where the personally attractive and convenient behaviour is to use your own car, however, when all succumb to this desire, it is detrimental to everyone sharing the environment, as this increases traffic pollution and congestion. Predominately social dilemma theory is confined to laboratory settings (Samuelson, 1990), but Van Vugt, Van Lange and Meertens (1998) brought social dilemma theory out into the field, studying car commuters in Deventer, a city located in central Netherlands. They were also concerned with how individuals social value orientations affect the assessment of social dilemmas.

The traditional perspective on social dilemma's, such as game theory, is that individuals consistently wish to maximise expected subjective utility (Olson, 1965). In terms of

travel mode, utility is increased by shorter travel times and small variability in travel times. Van Vugt et al (1996) extended this classical approach, hypothesising that social value orientations would also influence decision making. Prosocials were deemed more likely to consider the long term collective consequences of their actions in the commuting situation. It is thought this effect is due to the prosocials predisposition for increased sensitivity to information regarding the link between personal transport and negative environmental effects. The research concluded that there was a main effect of time, variability of time and social value orientation upon transport choice. If public transport demonstrates quicker and less time variable transit people are more willing to become users, especially those with a pro-environmental orientation. These findings extend the original claims underlying rational choice theory (Olson, 1965) by indicating that individuals assign meaning not only to the outcomes per se, but also to the variability, both of which are impacted on by social orientation.

However, the research is not devoid of criticism, since predominately people with a pro social orientation are those that self select themselves for study participation. In this instance 80% of the participants exhibited a pro-social orientation. Previous research has also indicated that pro-self individuals are less likely to participate in research studies in comparison to pro-social individuals (McClintock and Allison, 1989). The presence of socially desirable responses may also have accounted for the study findings, meaning that participants self reported choices in differing scenarios, may not actually match the exhibited behaviours were these scenarios to actually arise.

Personal vehicles are also thought to be related to the owners attitudes and lifestyles, and as such are intrinsically bound up with self identity resulting in the reluctance of minimising use in favor of other transport means. Choo and Mokhtarian (2004) investigated these relationships on the basis that increased clarity would be useful for decision makers and transport planners when developing transportation policy measures. Nine vehicle type categories were identified: small, compact, mid-sized, large, luxury, sports, van, pick-up and SUV (sports utility vehicle). The 32 attitude variables were distilled through factor analysis obtaining 6 underlying dimensions: travel dislike, pro-environmental solutions, commute benefit, travel freedom, travel stress, and pro-high density. The personality measure was composed of 17 attributes related to 4 personality factors: adventure seeker, organiser, loner, and the calm personality.

Small car users tended to have more intense pro-environmental morals, whereas luxury car drivers were identified as status seekers. Sports car drivers were presented as adventurous, and less likely to be calm, whilst SUV drivers exhibit strong travel freedom attitudes. Such conclusions add support to the contention that personal attitudes and personality constricts influence vehicle choice, suggesting vehicles have an important role to play in social and self identity.

However, the study has a number of weaknesses. The authors failed to take into account vehicles other than that driven most often. Similarly, acquisition history was not accounted for resulting in the possible failure to identify cases in which car type is more a consequence of circumstance, rather than choice. It is also acknowledged that the

unavailability of vehicle characteristics data (e.g. capacity, price, horse power) means it is possible that the novel variables which were included could simply be capturing the effects of excluded variables. It is suggested that similar future research should include these absent variables in order to formally assess any separate and interactive contributions they may have.

Kingham, Dickinson and Copsey (2001) indicated that within companies where the majority of employees drive to their place of work, a willingness to use alternative modal forms is evident, however this is mediated by the perception that these alternatives are not viable. The article tends to make assumptions from their findings which are unfounded, stating that 'on the face of it, people do not seem particularly interested in cycling as a form of commuter travel', despite previously stating high rates of bicycle ownership and respondents perceived barriers to use. One of the aims of the research was to investigate whether people can be moved out of their cars to other more sustainable forms of transport, however only a questionnaire is employed which fails to provide ecological validity, since it has been shown that what people say they would do often fail to match what people actually do (Armitage and Conner, 2001). This highlights the need for studies into sustainable transport behaviours to move into the field and investigate behaviours as they occur with a focus upon why they occur.

In contrast to the personal attraction of car use, there is a milieu of factors influencing the propensity to cycle. Wardman, Tight and Page (2007) formulated a predictive model of cycling behaviours on the basis of revealed preferences (RP) and stated preferences (SP).

The undertaking of research was thorough, dismissing pre-existing data bases such as the National Travel Survey due to the absence of cost and service quality data of travel modes which individuals did not select. Instead, Wardman et al (2007) opted for primary data collection in order to address these weaknesses, conducting surveys in Leicester, Norwich, Hull and York.

Prior studies (Cervero and Duncan, 2003) have revealed a significant effect of topography on cycling adoption, however this study failed to discern an effect of this well established behavioural determinant. It is though the absence of an identifiable effect was due to each sample location being relatively flat. Whilst they found that socio-economic variables had a statistically significant influence of mode choice, age and income level did not seem to have an impact, suggesting that cycling as a mode of transport is suitable for a diverse population.

Another issue which needs to be tackled in addressing the lack of bicycle use is the perceived social status of cyclists themselves. A number of studies report general public respect towards cyclists as low, exemplified by Ortuzar et al (2000) study exploring the public televised ridicule of cyclists in Chile. It has been shown that if one's perception of a certain 'type' of person, for example a cyclist, is negative the behaviours conducted by that 'type' of person, such as cycling, are unlikely to be carried out by those holding negative beliefs. This effect was concisely illustrated in a study by (Heddad, 2005) regarding people's perceptions of a recycler.

Personal vehicles are more often than not intrinsically linked with feelings of convenience and independence, resulting in psychological resistance to the adoption of alternative transport methods. Drivers hold several positive attitudes regarding the individual advantages of car use, whereas they possess relatively little negative attitudes linked to the collective use of cars resulting in congestion and pollution. Therefore in order to effectively change behaviour, focus must be placed upon changing attitudes and perceptions gradually, whilst introducing and encouraging the alternative behaviours.

Urban motorways have accelerated the trend of movement of people from the cities to the suburbs, resulting in a dramatic jump in commuting distances, which unfortunately renders many unable to use transportation alternatives to the private car. The relationship between spatial layout and people's travel behaviours has come to the fore over recent years (Ewing and Cervero, 2001). Research has indicated that spatial configurations and characteristics of the proximate area can facilitate or hinder pro environmental transport behaviours. Planners are beginning to take this influence on board, with an increasing number incorporating the promotion of sustainable travel in their designs. This involves a number of considerations including accessibility, action-space models, and integration with daily lives. However, Dijst, de Jong and Van Eck (2002) report that 47% of people still use their cars despite being in a position to substitute more environmentally friendly alternatives.

Neighborhood physical structure has also been implemented in peoples decisions whether to cycle. This is distinctly related to the modern phenomenon of New Urbanism and

Compact Cities in the US and Europe respectively. It had been shown that living in higher density, mixed use neighborhoods is associated with reduced car use, in contrast to low density, suburban settings (Cervero, 2002). However, Van Wee et al (2003) argues that this effect is confounded by the fact that people with a predisposition towards a certain type of travel "self-select" residential locations which are likely to support pursuit of their preferred mode. Thus, correlations between locality and travel behaviour do not reflect direct causality but a complex interplay of several factors. Boarnet and Crane (2001) refer to this phenomenon of matching travel behaviour and urban form as *residential self-selection*. Schwanen and Mokhtarian (2005) investigated this argument by assessing whether locality mismatched individuals travel more like those in the neighborhood they have ended up habitating, or like residents in the kind of neighborhood they would have liked to have lived in. The former outcome would suggest that the effects of the built environment can overcast personal predispositions, with the latter outcome suggesting the converse.

The analysis confirmed their expected outcome that cited individual preferences tend to overshadow the potential conditioning effects of the spatial environment in shaping their travel behaviours. However, this trend appears to reverse for mismatched suburbanites whereby the environmental conditioning influences prevail.

The study sample was extensive covering 8000 randomly selected households across three neighborhoods in the San Francisco Bay Area. A 25% response rate was yielded, resulting in the analysis of 2000 surveys. Factor analysis was utilised in order to identify

six dimensions based upon attitudinal statements related to travel. Only the pro-high density dimension is discussed in detail with the structural coefficients provided, of which one item has a value of $-.323$ which is below the recommended $.4$ cut off point, calling into questions the validity of the other identified constructs.

Within the same avenue of research Rodriguez and Joo (2004) explored the relationship between non-motorised mode choice and the local physical environment. Attributes such as topography, residential density and the availability of cycle/walking paths were taken into account, concluding that each had a marginal influence upon travel mode choice. This extends the findings of Ewing and Cervero's (2001) research concluding that attractiveness of non-motorised choices was a function of travel cost and time alone. Rodriguez and Joo's inquiry (2004) suggests that the integration of natural and built environment data aids the predictive power.

In a similar study Greenwald and Boarnet (2000) reported increased bicycle use in the presence of mixed land use, and high population density at both the departure and arrival points. In contrast regression equations attempting to predict travel behaviour from direct measures of street network attributes, have predominantly failed (Crane and Crepeau, 1998). As with a great deal of academic literature, Rodriguez and Joo's sample group was drawn from the university population, and hence generalisability of the results are somewhat restricted. Additional limitations include the classification of students as a 'commuter' population (many student have only 2/3 days on campus each week), and the failure to collect data concerning parking permit ownership within the sample. Further

research into the role of the physical environment upon sustainable travel behaviour will help constitute the empirical and theoretical foundations upon which town planners can anticipate the effectiveness of their interventions.

The effects of weather and climate have also been investigated, alongside the assumption that unpleasant weather deters cycling. Weather conditions such as rain, wind, and 'extreme' temperatures are thought to add a negative element to both walking and cycling. A diary study conducted by Hansen (1975) compared recorded weather conditions with the occurrence of discretionary and commuter cycle trips, concluding that discretionary trips are more affected by weather conditions. Seasonal climate affects have also been identified with a typical trend for the number of trips taken by bicycle to decline over winter, with a resurgence in spring. Nankervis (1999) investigated cycling habits throughout the year on university students studying at Melbourne University in Australia.

Day to day weather variations caused little variability, except in exceptional circumstances. However, when combining the three elements of weather into a single variable, a significant relationship arises (Pearson's $R = -0.348$). It is however evident that other significant variables of weather have been overlooked, for example humidity levels.

Nankervis (1999) identifies a number of confounding variables in relation to his sample group suggesting that social factors such as maturation into vehicle licensing age amongst first year students may have elicited a reduction in cyclist numbers independent of

climate factors. The researcher also makes assumptions regarding the favorability of weather conditions for cycling, based upon personal opinion which may not hold true for the general target population. The methodology by which the weather scores regarding wind, rain, and temperature were constructed is dubious, assuming that the power of each element and classification groups is equal.

Financial incentives are prominent as a reliable strategy to increase the number of employees adopting more sustainable transport behaviours. Kingham et al's (2001) research found financial rewards would encourage one quarter of car commuting respondents to cycle instead of drive. Wardman et al (2007) found that simply offering a £2 daily incentive would increase the proportion of employees willing to cycle three fold, decreasing car commuting trip by 13%. Unfortunately the provision of frequent monetary rewards is beyond the realm of this study, mostly due to temporal constraints.

2.3 Challenges facing sustainability through cycling

Whilst some argue sustainability is related solely to the economy (Pearce and Warford, 1993), others place greater weight upon environmental factors (Daly, 1991). According to the World Commission on Environment and Development (1987), sustainability is described as developments that meet the needs of the present without compromising future generations' abilities to meet their own needs. Within Europe, the Charter of European Cities and Towns Towards Sustainability (1994, cited in Greene and Wegener, 1997) clarified the objective as the achievement of social justice, sustainable economies, and environmental stability.

Within the UK, cycle traffic has dramatically declined over the last fifty years from 23 to 4.5 billion passenger kilometers. Similarly, there has been a decline in the proportion of people commuting to work by bicycle dropping from 3.8% to 2.9% between 1981 and 2001 (Parkin, 2003). Internationally, in other developed countries, this percentage is even lower, with the US and Canada reporting between only 1% and 2% of urban trips being made by bicycle. In contrast, much higher levels are reported in some regions of Northern Europe, with 28% of urban trips in the Netherlands being made by bicycle (Pucher and Dijkstra, 2003). Due to this discrepancy, and the ever increasing emphasis upon the environmental impacts of private car use, many local authorities within the UK (46%) now have a cycling strategy in place, often in addition with a Cycling Officer post dedicated to promoting cycling development. Surrey County Council (2003) currently

has plans to assist the promotion of cycling through the expansion of cycle networks from 470km in 2001 to 4,000km by 2016.

Evidently this is not enough, reflecting by the failing of government initiative National Cycle Strategy which intended to double the number of trips cycled between 1996 and 2002, and double this again by 2012. Failure to meet the projected goals has resulted in softening of targets (Transport 2000). Some attribute the sluggish adoption of cycling to local authorities inability to provide the necessary support due to lack of funds, and/or knowledge about effective interventions.

This drive to boost the adoption of cycling behaviours perpetually faces a struggle due to a dearth in research dedicated to understanding the discrepancies in desirability of cycling compared to motorised transport. Yet there is an increasing demand for the evaluation of intervention measures and related schemes, in terms of their potential to motivate cycling behaviours.

However, over the past thirty years bike sales have increased resulting in 32% of people owning a bike in 1995, in contrast to 14% in 1975 (Lawler, Ness, Cope, Davis, Insall and Riddoch, 2003). Yet it is evident that over the same period the number of journeys cycled has declined. Evidently many people are in possession of bicycle, yet do not utilise it, suggesting many people wish to cycle but something, or a combination of factors prevents the transition from intention to actual participation. This is reflected in Kingham et al's (2001) survey based study which reported two-thirds of respondents owning

bicycles, and living within reasonable proximity to work, yet 97% of respondents conducted the daily commute by car. This did however reduce to 88% for a comparable company which did not provide company cars. Both instances offer support for the argument that individuals simply use private vehicle travel through default and this effect is further amplified in the provision of company cars.

2.4 The transactional model of behavioural change applied to cycling

Gatersleben and Appleton (2007) recognised that individuals willing to contemplate cycling are not one homogenous group, but rather are distinguishable using Prochaska and DiClemente's (1984) model of behavioural change. Studies exploring cycling attitudes have predominantly distinguished between cyclists and non-cyclists, though Bergstrom and Magnussen (2003) indicated that a more subtle classification system may reap more reliable results. They proposed the existence of four distinct groups: year round cyclists, summer only cyclists, infrequent cyclists, and never-cyclists, each of which was discriminable by their attitudes and perceptions of cycling. This effect may be comparable to individuals personal progress (or stability) within behavioural change.

Prochaska and DiClemente's (1984) behavioural change model breaks down change into a series of progressive stages, rather than viewing behavioural transitions as a single event. Five stages were proposed over which individuals both progress and transgress: precontemplation, contemplation, preparation, action and maintenance. Typically the model has been applied to the termination of undesirable behaviours such as smoking and condom use within the realm of health psychology. Similarly, it may be applicable to aiding the understanding of travel behaviours in order to inform policy makers of more effective interventions.

Gatersleben and Appleton's (2007) study incorporated both a survey of commuter transport choices, and a two-week period in which participants cycled to the University of

Surrey (where they were either staff or students) and their experiences recorded. The survey identified people within each stage of the behavioural change model, with those in the precontemplation stage citing personal barriers, and those in the contemplation stage, structural barriers to cycling. Content analysis was used to explore the perceived personal and structural barriers which concluded five categories by which respondents may progress closer to the action stage of behavioural change. Unfortunately one of these categories was 'under no circumstances', however the others were 'better weather and terrain', 'better and safer facilities', 'lived closer' and 'fewer work/family commitments'.

Prochaska and DiClemente (1984) suggest that individuals can be encouraged to progress from contemplation into action via the development of specific action plans. Gatersleben and Appleton (2007) put this theory into practice through participant pledges to cycle into university for a two-week period. None of the 22 participants had previously cycled to the university in an attempt to ensure that each were in the contemplation stage. Whether recreational, or other commuter cycle use (i.e. part time jobs) occurred is not discussed.

At the end of the trial 95% of the sample reported enjoying the experience emphasising the sense of achievement and being independent from the troubles of motor vehicle traffic. Ambient factors including bad weather and darkness were mentioned as negative aspects.

The researchers acknowledge limitations of their sample group having been drawn from an academic population, and the universities green travel plans may have made

participant behaviour less comparable to other organisations. Nonetheless, the successful identification of numerous distinct groups based upon the stages of behavioural change have important implications for targeting cycling policies. An overt commitment helps people progress into action which offers the potential for habit formation. Of the 22 participants in the active component of Gatersleben and Appleton's (2007) study 18 intended to continue cycling regularly. Prochanska et al (1994) suggests this effect can be further endorsed through the use of feedback and social support.

2.5 The role of feedback upon pro-environmental behaviours

Feedback has shown to be more effective than mass media campaigns. Staats, Wit and Midden (1996) evaluated the effects of such a campaign related to global warming, and found that although it raised general awareness, behavioural changes were not evident. Overall, the provision of educational campaigns succeeds in the provision of knowledge about the concerning issue, but does not necessarily create the desired behavioural changes. It is due to this issue we turn to the comparatively more reliable effects of feedback.

There is a dearth of studies investigating the effects of feedback upon pro-environmental behaviours, however, a simple experiment determined feedback effects on improving solid waste reduction and recycling performance on a stadium construction site in Australia (Lingard, Gilbert and Graham, 2001). Feedback was provided using display posters. The already high resource use efficiency improved from 97.6% to 99.3%, however this was not sustained over time. Typically, construction work rewards fast workers with payment often being given on a piece rate basis, or bonuses offered for early completion. Consequently the practical logistics and personal inconveniences of pro environmental behaviours are likely to be deterrent enough to disengage (Vining et al, 1992). Evidently there is a fundamental theoretical problem with the application of environmental waste management on construction sites which do not encourage or endorse the required behaviours.

Abrahamse et al (2007) provide a thorough account of feedback effects upon household energy related behaviours. Since households within the UK account for 15% of total greenhouse gas emissions they are key target for energy conservation.

An impressive sample of 189 households were used in the city of Groningen in the northern part of the Netherlands. Online questionnaires were completed by both the control and experimental groups. Through the use of a resource such as the internet, feedback of household performance can be provided both conveniently and instantaneously. A repeated measures analysis of variance was conducted on the energy use changes throughout the study for each group revealing a marginally significant main effect across the 5 month period for all groups ($p = .08$). The interaction effect of group was not significant when accounting for all energy use measures. However, for direct energy use (gas, electricity and fuel) the intervention groups saved significantly more, but unfortunately a significant difference was absent between the two experimental conditions: non-comparative feedback and comparative feedback.

Other studies contest that there is an effect of feedback (Siero, Bakker, Dekker and Van den Burg, 1996; Staats et al, 2004) which the present study may have failed to elicit due to the absence of communications between the groups. However, if studies investigating the differing effects of non comparative and comparative feedback allow communication in the comparative condition it becomes impossible to attribute any effects to the comparative feedback alone. This is because essentially a new variable of social

communication has been added which may indeed be the cause of the effect. Such subtleties in experimental design must be well considered and justified.

Not uncommon for longitudinal studies, there was a substantial attrition rate.

Additionally, it was found that due to technical difficulties several households had received incorrect feedback which may have caused participant dissatisfaction and consequently drop-out. A large within groups variance was also reported, and as such a larger sample size would increase the statistical power of the analysis. Brandon and Lewis (1999) point out that this issue is not uncommon, and is largely unavoidable in energy conservation research.

Siero et al's (1996) study was also conducted in the Netherlands within two units of a metallurgical company. Energy consumption feedback was provided to each unit, one unit receiving non-comparative, and the other comparative. The results clearly showed that those in the comparative feedback condition saved significantly more energy than those who only received information about their own performance. The absence of a control group prevents baseline level comparisons. Notwithstanding, behavioural change took place despite attitudinal changes contradicting the traditional 'attitude-to-behaviour' perspective that changes in attitudes and intentions is an essential prerequisite for behavioural change (Ajzen, 1991). Comparative feedback alone presents a powerful strategy for changing the behaviour of employees within an organisation.

Though the two units were similar in function and employee demographics, there was a substantial difference in size between the basic feedback unit ($n = 135$) and the comparative program unit ($n = 50$) which could have potentially had a confounding effect upon the study outcomes. For instance, it is possible that the lesser populated of the two units experienced greater group cohesion, and enabled more effective supervision of energy related behaviours. Despite this, the research was conducted diligently, reporting Cronbach's alpha reliability measures for each construct applied.

The effectiveness of group feedback could be caused by two distinct mechanisms. Individuals with a competitive predisposition might view the relative performance of self to others as an opportunity to compete and outperform the rest of the group. Alternatively, the apparent activity of the rest of the group may create a salient social norm in favor of the given behaviour, resulting in self involvement in accordance with social identity theory (Tajfel, 1978).

2.6 CONCLUSION

It is evident that our current behavioural choices, such as the ways we choose to travel, are having a negative impact upon our environment. It is also clear that despite this knowledge, personal vehicle use is still increasing, primarily due to the conveniences which they provide. People are also resistant to alternative modes due to perceived personal and operational barriers.

However, it is vital that research continues into the promotion of alternative travel means in order to promote sustainability. Research must be undertaken into effective interventions aiming at reversing the trend of decreased cycling. Such research can inform government policy and assist National Cycle Strategy targets.

It has been shown that both specific action plans, and feedback increase the adoption of proenvironmental behaviours, though these have never been explored in parallel.

Additionally, it is hypothesized that both will aid the progression of individuals through the stages of behavioural change. Cycling experience also predicts changes in cycling and cyclist attitudes and perceptions. This study aims to investigate these roles within a more population representative sample.

3. RESEARCH QUESTIONS

- Does cycling experience change individuals attitudes and perceptions towards cycling and cyclists?
- Is feedback effective in promoting cycling behaviours, over and above overt short-term commitment?
- Is comparative feedback more effective at promoting cycling behaviours than non-comparative feedback and no feedback?
- Does the frequency with which feedback is provided correlate with the extent to which cycling behaviours are adopted?
- Following the intervention had people progressed to the action, or maintenance stage (follow up questionnaire)?

Subsidiary points:

- As previous research suggests, are males more likely than females to cycle?
- Does the provision of a company car affect the likely hood to cycle?
- Does the individuals perceived difficulty of likely cycling terrain affect cycling adoption?
- Are those exhibiting strong car attachment less likely to cycle?
- Are mismatched urbanites less likely to cycle?

4. EXPOSITION

4.1 How the research will be undertaken

The study is similar to Gatersleben and Appleton's (2007) in that it encourages progression from the contemplation stage of behavioural change into action (Prochaska and DiClemente, 1984). However, it shall be less intensive in order to assist recruitment and retention rates, and offer a more easily applicable solution to changing transport habits within organisations

The commute to work is often the focus of many transport studies since it is the most significant contributor to rise in road use. The DETR (1998) also report that commuter journeys account for over 1,300 miles per year per individual. Consequently, the commuting market will be targeted in this study due to its representation as the main proportion of trips, often at times when congestion is worst.

Ideally, within the study all participants would have equal opportunities to cycle. It would therefore be helpful if each individual lived within a cycleable distance from their place of employment. Previous studies have also used this as a basis for recruitment, though vary of their distance criteria as 'cycleable'. Wardmen, Tight and Page (2007) suggested a maximum of 7.5 miles (12km), whereas Gatersleben and Appleton (2007) settled on 5 miles (8.05km). Unfortunately, difficulties of participant recruitment are likely to prevent much selectivity over this variable.

Local businesses' and organizations are approached in order to recruit participants. This will mostly be through office emails and bulletin boards. The study targets individuals who own a bicycle, but do not use it as much as they would hope. They are then asked to sign a pledge to cycle as much as they can over a three week period. Each participant is provided with a cyclometer in order to monitor their progress.

There are three experimental conditions. The control condition simply is the pledge alone, and experimental questionnaires. The feedback conditions are split into two, non-comparative feedback and comparative feedback. Questionnaires and feedback shall be provided using a website which participants log on to. The non-comparative feedback participants, in addition to the periodic questionnaires, will be presented with personal feedback on their own performance. In contrast, in addition to the questionnaires, the comparative feedback participants will be able to track their own performance in relation to others within their group.

The cycling period is projected to be three weeks long, with a questionnaire about their cycling related attitudes and beliefs each week, totaling four questionnaires. The extent to which people cycled, and their related attitudinal and perceptual changes will be explored in relation to which group they were placed.

Van Houwelingen and Van Raaij (1989) found that in addition to feedback being effective in encouraging energy conservation, the more frequently the feedback was provided, the greater the effect. Therefore this study shall also investigate whether there

is a relationship between participant performance and the frequency with which they logged on to view the online feedback.

Whether participants have progressed into the maintenance stage shall be explored using a follow-up questionnaire of their current cycling habits.

4.2 Anticipated problems

As touched upon earlier, the predominantly student samples in transport research, gained through opportunity sampling, can be problematic in terms of the ecological validity of findings. Often, being a student means a willingness to walk a bicycle through default due to lack of funds to own and maintain a motor vehicle. Many studies, including Rodriguez and Joo's (2004) research, assume all alternative transport modes as being available. Clearly this is unlikely to be the case within student samples.

This study therefore aims to recruit participants who are not students. Although this is beneficial for the research outcomes, implications and applications, it is however problematic in terms of obtaining numbers easily. If it proved too problematic to recruit all participants externally, university staff and students may be approached.

Gender is often cited as an influential factor in the propensity to adopt more sustainable transport means, with females typically cycling less (US Federal Highway

Administration, 1994). This has been attributed to family and life cycle responsibility. Likewise, age has been shown to deter bicycle use, especially within older generations for transport modes requiring a certain level of agility and physical fitness. Due to this effect being most prominent in individuals entering the late stages of life, this studies commuting sample are all under retirement age, and thus age should not be a concerning factor.

Abrahamse et al's (2007) research into reducing household energy use found that behavioural changes were particularly marked for relatively low cost behaviours in terms of effort and time. They were unfortunately less likely to adopt behaviours associated with high effort and time costs, including the reduction of motor vehicle journeys. This effect might arise once again exhibited by a general reluctance of participants in the study to cycle. What's more the study is being conducted in the UK characterised by a more challenging terrain than the relatively flat contours of the Netherlands. However, such an effect would be largely unavoidable and would still provide useful information related to the difficulties of changing people's ingrained travel habits.

Personal goal setting has also been shown to increase performance (Siero and Van Oudenhoven, 1995). Although no direct goals are exercised in the study, participants may set their own. A post-hoc analysis upon the effect of self reported personal goal setting could be conducted in order to identify any significant effects.

4.3 Competing or alternative explanations of findings

In some instances comparative feedback has been found to be antagonistic to the encouragement of target behaviours. Dakin and Arrowood (1981) reported that in the case of continuing bad performance people tend to avoid comparison with people who are performing better. They become demoralised, unmotivated and exhibit cognitive dissonance between their original intentions and current behaviours. It is possible this may prevent significant differences emerging between the two feedback groups. There is little that can be done to prevent such an effect, however related participant feelings shall be explored in the comparative feedback group in order to identify any potential cases. However, this in itself is also problematic due to the social desirability effect people are likely to be unwilling to present themselves as 'spoilsports'.

Prior research into sustainable behaviours (McKenzie-Mohr, 2000) have emphasised the need for tailored interventions targeting personal shortcomings or barriers to change. Unfortunately this is beyond the scope of the present study, however provides an interesting stimulus for future research since the internet is an ideal medium for tailored interventions since it offers the potential to reach large numbers of people, to readily provide custom made information and electronic feedback to users. In fact, such applications are already available to monitor household energy use, for example the electricity and gas company e.on's provision of energy efficiency reports for customers.

5. REFERENCES

- Aarts, H. Verplanken, B. and Van Knippenberg, A. (1997). Habit and information in travel mode choices. *Acta Psychologica*. 1-14
- Aarts, H. (1996). *Habit and decision making: The case of travel mode choice*. Unpublished Dissertation, University of Nijmegen.
- Abrahamse, W., Steg, L., Vlek, C., & Rothengatter, T. (2005). A review of intervention studies aimed at household energy conservation. *Journal of Environmental Psychology*. 25: 273-291
- Ajzen, I. (1991). The theory of planned behaviour. *Organisational Behaviour and Human Decision Processing*. 50: 179-211.
- Armitage, C. J. and Conner, M. (2001). Efficacy of the theory of planned behaviour: A meta-analytic review. *British Journal of Social Psychology*. 40: 4: 471-499.
- Bergstrom, A. and Magnusson, R. (2003). Potential of transferring car trips to bicycle during winter. *Transport Research Part A*. 37: 649-666
- Billings, R. S. and Scherer, L. L. (1998). The effects of response mode and importance on decision-making strategies. *Organisational Behaviour and Human Decision Making Processes*. 41: 1-19
- Brandon, G. & Lewis, A. (1999). Reducing household energy consumption: A qualitative and quantitative field study. *Journal of Environmental Psychology*. 19: 75-85
- Boarnet, M. G. and Crane, R. (2001). *Travel by design: The Influence of Urban Form on Travel*. Oxford University Press: New York.
- Cervero, R. and Duncan, M. (2002). Residential Self Selection and Rail Commuting: A nested logit analysis. *University of California Transportation Centre, Berkeley, CA*.
- Cervero, R. (2002). Built environments and mode choice: towards a normative framework. *Transportation Research Part D*. 7: 4: 265-284
- Choo, S. and Mokhtarian, P. L. (2004). What type of vehicle do people drive? The role of attitude and lifestyle in influencing vehicle type choice. *Transport Research Part A*. 38: 201-222

- Conner, M. Graham, S & Moore, B. (1999). Alcohol and intentions to use condoms: Applying the theory of planned behavior. *Psychology and Health*. 5: 795-812
- Crane, R. and Crepeau, R. (1998). Does neighborhood design influence travel?: A behavioural analysis of travel diaries and GIS data. *Transportation Research Part D*. 3: 4: 225-238.
- Dakin, S. and Arrowood, J. A. (1981). The social comparison of ability. *Human Relations*. 34: 89-109.
- Daly, H. E. (1991). *Steady State Economics*. Island Press, Washington, DC.
- Dawes, R. M. (1980). Social Dilemmas. *Annual Review of Psychology*. 31: 169-193.
- DiClemente, C. C. Schlundt, D & Gemmell, L. (2004). Readiness and stages of change in addiction treatment. *American Journal of Addiction*. 2: 103-119
- Dijst, M., Jong, T. and Van Eck, J. R. (2002). Opportunities for transport mode change: an exploration of a disaggregated approach. *Environment and Planning B*. 29: 3: 413-430.
- Department of the Environment, Transport and the Regions (DETR). (1998a). Transport Statistics Great Britain 1998. *The stationary Office*, London.
- Department of the Environment, Transport and the Regions (DETR). (1998b). A New Deal for Transport: Better for Everyone, the Governments White Paper on the Future of Transport. *The stationery Office*, London.
- Department of the Environment, Transport and the Regions (DETR). (1998c). Traffic speeds in Central and Outer London: 1996-1997. *Statistics Bulletin* (98) 17.
- Ewing, R. and Cervero, R. (2001). Travel and the built environment: A synthesis. *Transportation Research Record*. 17: 87-114
- Gatersleben, B & Appleton. K. M. (2007). Contemplating cycling to work: Attitudes and perceptions in different stages of change. *Transportation Research A* 41: 302-312
- Geller, E. S. (2002). The challenge of increasing proenvironmental behavior. In R. G. Betchel, & A. Churchman (Eds), *Handbook of Environmental Psychology*. 525-540. New York: Wiley.
- Goodwin, P. (Ed.). (1995). *Car dependence*. A report for the RAC Foundation for Motoring and the Environment by ESRC Transport Studies Unit. University of Oxford with RDC Inc. San Francisco.

- Greene, D. L, and Wegner, M. (1997). Sustainable Transport. *Journal of Transport Geography*. Vol 8:5: 177-190
- Greenwald, M. J. and Boarnet, M. G. (2000). Land use, urban design, and nonwork travel: Reproducing other urban areas. *Transportation Research Record*. 22: 27-37.
- Haddad, H. (2005). *Cycling Stereotypes and Identity*. MSc Dissertation. University of Surrey, UK.
- Hansen, S. (1975). *Evaluating the impact of weather on bicycle use*. Committee on Bicycle and Bicycle Facilities, Washington.
- Kingham, S. Dickinson, J. and Copsey, S. (2001). Travelling to work: will people move out of their cars. *Transport Policy*. 8: 151-160
- Lawer, D. A., Ness, A. R., Cope, A. M., Davis, A., Insall, P. and Riddoch, C. (2003). The challenges of evaluating environmental interventions to increase population levels of physically activity: the case of the UK National Cycle Network. *Public Health Policy and Practice*. (Available at jech.bmj.com)
- Lex. (1999). *The 1999 Lex Report on Motoring*. Lex Service Plc. (Available at www.lex.xo.uk/Irom.html).
- Lingard, H., Gilbert, G. and Graham, P. (2001). Improving solid waste reduction and recycling performance using goal setting and feedback. *Construction Management and Economics*. 19: 809-817
- Masters, C. D., Attanasi, E. D. and Root, D. H. (1994). World petroleum assessment and analysis. *US Geological Survey*, National Centre. Reston: VA.
- McClelland, L. & Cook, S. W. (1979, 1980). Energy conservation effects of continuous in-home feedback in all electric homes. *Journal of Environmental Systems*. 9: 169-173
- McClintock, C. G. and Allison, S. T. (1989). Social value orientation and helping behaviour. *Journal of Applied Social Psychology*. 19: 4: 353-362.
- McKenzie-Mohr, D. (2000). Fostering sustainable behaviour through community based social marketing. *American Journal of Psychology*. 56: 458-459.
- Nankervis, M. (1999). The effects of weather and climate on bicycle commuting. *Transportation Research Part A*. 33: 417-431
- Noland, R. B. and Kunreuther, H. (1995). Short-run and long-run policies for increasing bicycle transportation for daily commuter trips. *Transport Policy*. 2: 67-79

- Olson, M. (1965). *The Logic of Collective Action*. Harvard University Press: Cambridge.
- Ortuzar, J. Iacobelli, A. and Valeze, C. (2000). Estimating demand for a cycle-network. *Transportation Research Part A*. 34: 353-373.
- Parkin, J. (2003). Comparisons of cycle use for the journey to work from the '81, '91 and 2001 censuses. *Traffic Engineering and Control*. 44: 8: 299-302.
- Pearce, D. W. and Warford, J. J. (1993). *World Without End: Economics, Environment and Sustainable Development*. The International Bank for Reconstruction and Development, Washington, DC.
- Prochaska, J. O & DiClemente, C. C. (1984). *The transtheoretical approach: Crossing traditional boundaries of change*. Dow Jones/Irwin, Homewood, IL
- Prochaska, J. O., Velicer, W. F., Rossi, J. S., Goldstein, M. G., Marcus, B. H., Rakowski, W., Fiore, C., Harlow, L. L., Redding, C. a., Rosenbloom, D. and Rossi, S. R. (2004). Stages of change and decisional balance for twelve problem behaviours. *Health Psychology*. 13: 34-46.
- Pucher, J. and Dijkstra, L. (2003). Promoting safe walking and cycling to improve public health: Lessons from the Netherlands and Germany. *American Journal of Public Health*. 93:9
- Quellette, J. A & Wood, W. (1998). Habit and intention in everyday life : The multiple processes by which past behavior predicts future behavior. *Psychological Bulletin*. 124: 1: 54-74
- Rodriguez, D. and Joo, J. (2004). The relationship between non-motorised mode choice and the local physical environment. *Transport Research Part D*. 9: 151-173
- Samuelson, C. D. (1990). Energy conservation: A social dilemma approach. *Social Behaviour*. 5: 207-230
- Schwanen, T. and Mokhtarian, P. L. (2005). What if you live in the wrong neighborhood? The impact of residential neighborhood type dissonance on distance travelled. *Transportation Research Part D*. 10: 2: 129-151.
- Siero, F. W., Bakker, A. B., Dekker, G. B. and Van den Burg, M. T. C. (1996). Changing organisational energy consumption behaviour through comparative feedback. *Journal of Environmental Psychology*. 16: 235-246.
- Siero, F. W. and Van Oudenhoven, J. P. (1995). The effects of contingent feedback on perceived control and performance. *European Journal of Psychology of Education*. 10: 13 -24.

- Staats, H. J., Wit, A. P. and Midden, C. Y. H. (1996). Communicating the greenhouse effect to the public: Evaluation of a mass media campaign from a social dilemma perspective. *Journal of Environmental Management*. 45: 189-203.
- Staats, H., Harland, P. and Wilke, H. A. M. (2004). Effecting durable change. A team approach to improve environmental behaviour in the household. *Environment and Behaviour*. 36: 341-367.
- Surrey County Council. (2003). *Transport and journey to work*. Surrey County Council, Kingston. (Available from www.surreycc.gov.uk)
- Tajfel, H. (1978). *Differentiation Between Social Groups: Studies in the Social Psychology of Intergroup Relations*. London: Academic Press.
- Tertoolen, G., Van Kreveld, D. and Verstraten, B. (1998). Psychological resistance against attempts to reduce private car use. *Transport Research Part A*. 32: 3: 171-181.
- Transport 2000. (2000). Is cycling really moving up a gear. *Transport Retort*. 23: 9-14.
- US Federal Highway Administration. (1994). *The National Bicycling and Walking Study: transportation choices for a changing America*. US Department of Transportation Washington, DC.
- Van Vugt, M. Meertens, R. M. and Van Lange, P. A. M. (1995). Car versus public transportation? The role of social value orientations in real life social dilemma. *Journal of Applied Social Psychology*. 25: 258-278.
- Vining, J., Linn, N. and Burdige, R. J. (1992). Why recycle? A comparison of recycling motivation in four communities. *Environmental Management*. 16: 785-797.
- Walsh, M. (1993). Motor vehicle trends and their implications for global warming. In *Transport Policy and Global Warming*, pp.69-93. European Conference of Ministers of Transport, Paris.
- Wardman, M., Tight, M. and Page, M. (2007). Factors influencing the propensity to cycle to work. *Transport Research Part A*. 41: 339-350
- Weldon, E. and Gargano, G. (1988). Cognitive loafing: The effects of accountability and shared responsibility on cognitive effort. *Personality and Social Psychology Bulletin*. 14: 159-171
- World Commission on Environment and Development. (1987). *Our Common Future, Brundtland Report*. Oxford University Press, Oxford.

