A CONCEPTUAL MODEL TO EXPLAIN TURNING POINTS IN TRAVEL BEHAVIOUR: APPLICATION TO BICYCLE USE

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ABSTRACT

Existing knowledge on cycling behaviour, as with travel behaviour in general, is mainly based on cross-sectional studies. It is questionable how much can be learnt about the reasons for behavioural change from such studies. A major investment programme to promote cycling in 12 English cities and towns between 2008 and 2011 provided the opportunity to study the bicycle use of residents and how it was affected by the investment. Face-to-face interviews collected biographical information on travel behaviour and life-change events during the investment period for 144 research participants and probed the reasons for changes in bicycle use. Theory (from the life course perspective) and preliminary analysis of the interview data were used to develop a conceptual model which hypothesises that turning points in travel behaviour are triggered by contextual change (a life-change event or change in external environment), and mediated by intrinsic motivations, facilitating conditions and personal history. The model provided an effective means of explaining turning points in bicycle use. The analysis of the interview data showed how the nature of behavioural influences (in particular life-change events and intrinsic motivations) varies over the life course. The research highlights the advantages of viewing travel behaviour change in the context of people's evolving lives and how this can assist in developing transport policies and practices.

1. INTRODUCTION

There is increasing recognition of the value of longitudinal studies in understanding how travel behaviour changes both in the context of interventions in the transport system (*1*) and stable transport environments (*2*). Handy et al. (*3*) note that most cycling behaviour studies have used cross-sectional designs. Cross-sectional studies relate cycling behaviour to prevailing characteristics and have found associations between high levels of cycling and provision of bicycle infrastructure (*3*). However, this does not necessarily demonstrate a causal relationship, as bicycle infrastructure may be provided reactively where there are more cyclists. Cross-sectional studies also fail to recognise that current behaviour may have been influenced by past experiences and events (for example, adult cycling may have been influenced by childhood cycling).

This paper presents the conceptual approach and findings from research investigating the impacts on cycling behaviour of targeted cycling investment in England. The research involved face-to-face interviews collecting biographical information on travel behaviour and life-change events during the investment period for 144 research participants and probed the reasons for changes in bicycle use.

Between October 2008 and March 2011, the UK Department for Transport (DfT) and Department of Health (DoH) invested over £43m (plus local match funding) to create the Cycling City and Towns (CCTs). The Cycling City was Greater Bristol and the 11 Cycling Towns were Blackpool, Cambridge, Chester, Colchester, Leighton-Linslade, Shrewsbury, Stoke, Southend, Southport, Woking and York. The CCT programme involved funding a mixture of initiatives such as improvements to cycle routes, training for children in schools and marketing and promotion work. The aim of the programme was to explore whether and how increased investment in cycling could lead to a significant and sustained increase in the number of cyclists and frequency of cycling.

An independent evaluation was commissioned by DfT and DoH to assess the benefits of the investment. A baseline survey was conducted in 2009 and involved a random sample of 16,343 households across the 12 CCTs (*4*). It identified that under a third of adult respondents aged 16 and over across the CCTs (28%) had cycled in the previous twelve months. Men, younger adults, adults in employment, adults from higher socioeconomic groups and adults with children were more likely to have cycled in the previous 12 months.

A repeat household survey is proposed for 2012, one year after the CCT programme funding period ends. This is expected to include a longitudinal panel, comprising baseline respondents who indicated that they were willing to be re-contacted, and a refreshment sample, comprising a new random sample of CCT residents. The longitudinal panel will enable changes in behaviour at the individual and household level to be analysed. For example, it will allow investigation of how many residents started cycling, how many increased their cycling levels and how many decreased and stopped cycling. However, there are limitations in the insights on behavioural change that can be gained from the panel. The panel will only obtain measurements at two time points and there may be relevant changes (in behaviour and other characteristics) that are undetected between these time points. Furthermore, the panel like any quantitative survey is restricted in the information that it can collect and will not obtain detailed information to explain why behavioural change has occurred.

Given these limitations qualitative research was undertaken with residents of the CCTs to explore their cycling behaviour and how and why this changed during the investment period. Section 2 of this paper explains the methodology used in the qualitative research. Section 3 explains how the life course perspective and preliminary analysis of data informed the design of a conceptual model. In section 4, findings are presented which illustrate how the

conceptual model provided an effective means of explaining turning points in bicycle use. The paper concludes by reflecting on the value of the methodology and conceptual model developed in the research.

2. RESEARCH METHOD

A main aim of the qualitative research was to understand why changes in cycling behaviour had taken place (or not taken place) and explore the role of the CCT programme in behavioural change. A research report contains full details of the research method and results (*5*). Twelve face-to-face interviews were conducted in each CCT, 144 in total, so that insights could be gained for the different CCT contexts. In each CCT the target was to recruit two new regular cyclists, three continuing regular cyclists (with one or two increasing their cycling), five occasional cyclists (with two or three increasing their cycling) and two non-cyclists. The sample source for the research was adult respondents (aged 16 and over) from the CCT baseline survey who said they would be willing to take part in further research. Recruitment telephone calls were made to selected survey respondents (selected based on answers to questions in the baseline survey asking about their frequency and duration of cycling). The recruitment call included a series of questions to establish whether or not people had changed their behaviours during the investment period. The responses to these questions enabled the final selection of 12 participants in each CCT.

The sample was evenly mixed in terms of gender (74 male and 70 female) with participants ranging in age from 16 to 85. For analysis purposes the interview sample was categorised into three types of cyclists as follows with the numbers of each given in brackets ('cycling regularly' is defined as cycling at least once a week):

- Continuing Regular Cyclists (cycling regularly since the start of the investment programme, i.e. cycling since at least October 2008) (55);
- New Regular Cyclists (started cycling regularly since the start of the investment programme, i.e. started cycling since October 2008) (31); and
- Non-Regular Cyclists (cycling occasionally or not at all) (58).

The interviews were conducted between October 2010 and February 2011 and mainly took place in the homes of participants. A topic guide was used for the interviews which covered a number of areas of interest to the project. Biographical methods were used in the interviews to identify changes in travel behaviour during the CCT investment period and to probe influencing factors. Biographical methods are increasingly being used in travel behaviour studies. Recall of major life-change events and key attributes of the events was shown to be satisfactory in an Internet-based survey (*6*), and should be enhanced in this research by the presence of the interviewer to assist with recollection and the period of interest being three years, whereas it was the lifetime in the Internet-based survey.

A Travel Behaviour Timeline was used at the start of the interview to identify how travel behaviour had changed over the last three years. The Travel Behaviour Timeline recorded changes to key aspects of the participant's life such as household composition and employment, as well as travel behaviour. An example of a completed timeline is shown in FIGURE 1. The Travel Behaviour Timeline formed the basis for the interviewer to seek explanation of changes in cycling behaviour. The interviewer asked participants to explain changes in their own words and then probed the reasons for changes, asking if anything else happened at the same time, if there were particular motivations or deterrents and if the environment around them had any influence.

It is emphasised that the research was qualitative and sought to obtain explanations for changes in cycling behaviour. It did not aim to quantify behaviour or to make statistically significant generalisations from the interview sample to the study population (the residents of CCTs). However, the qualitative approach does assume that, where mechanisms and explanations for behaviour are identified amongst particular samples, unless there are specific individual or local factors which affect those findings, they are likely to be relevant concepts for understanding behaviour more generally.

3. CONCEPTUAL APPROACH

3.1 Life course perspective

The life course perspective has informed the analysis of the biographical information. Giele and Elder (*7*) define the life course as "a sequence of socially defined events and roles that the individual enacts over time" and state that in the life course perspective it is assumed that "any point in the life span must be viewed dynamically as the consequence of past experience and future expectation as well as the integration of individual motive with external constraint". The application of the life course perspective to cycling behaviour is conceptualised by the cycling trajectory in FIGURE 2.

The cycling trajectory represents a person's thoughts, feelings, capabilities and actions related to cycling. Its dynamic evolution occurs in a sequence of linked states that occur throughout the person's life from past to present and into the future. People arrive at their current cycling behaviour within trajectories that are developed over the course of their lives and shaped by transitions (or life-change events) that they have made and the contexts that they encounter.

The contexts encountered during the life course are represented in FIGURE 2 using a multi-layered structure in the form of concentric circles. This is consistent with recent cycling studies (*3*) that have used the ecological model as a holistic conceptual framework for research seeking to explain variation in cycling behaviour between individuals. When the ecological model has been applied to physical activity research it typically includes variables at the level of individual (or intra-personal), social/cultural (inter-personal), organisational, physical environment (built and natural) and economic/policy (*8*).

Individual lives as a whole can be conceived as a set of interwoven trajectories that together tell a life story. Trajectories can be defined in terms of different domains (such as employment, family, health, mobility) and sub-domains (cycling being a sub-domain of mobility). These trajectories are inter-connected and have reciprocal effects on each other. Life-change events from one state to another in one domain such as a change in employment can lead to changes in the trajectories in other domains. Life-change events affect roles, resources, health and context (*9*). Turning points occur when there are major changes to a trajectory.

3.2 Life events and travel behaviour studies

Application of the full principles of the life course perspective to travel behaviour would require consideration of the entire chain of events that take place in people's lives and the contexts they experience. This has not been pursued in travel behaviour studies, but exploratory studies have investigated which life-change events are most relevant to travel behaviour (*10, 11*). Some studies have focused on particular types of life-change event and examined their effect on travel behaviour (residential moves (*12*), childbirth (*13*), presence of children (*14*)), while other studies have focused on particular types of travel behaviour and

the influences of life-change events on them (car ownership (*15, 16, 17*), commuting distance (*17, 18*)).

Some studies have used panel data sets (*14, 16, 17, 18*), while others have designed questionnaires to collect retrospective biographical data (*12, 15*). One study (*13*) interviewed participants to gain an in-depth understanding of how a life-change event (childbirth) affected travel behaviour. It is not known of any study that has explored the interactions of life-change events with an external transport intervention and how these jointly affect travel behaviour. This is attempted in the present study which also seeks to reflect the principles of the life course perspective more fully than previous travel behaviour studies by investigating how both past history and life-change events influence cycling behaviour.

3.3 Conceptual model used for analysis of the biographical data

The interviews obtained biographical information going back from the time of the interviews to the start of 2008 and provided the opportunity to investigate how cycling trajectories were affected by both changes to external environments encountered (including cycling environment) and life-change events. For each participant it was assessed whether they had experienced a turning point (significant change in their cycling trajectories) during the investment period. Seasonal changes in cycling were not considered in the analysis, as it was common for participants to indicate that they cycled more in the summer than winter.

A case summary was prepared for all occurrences of a turning point in cycling trajectory, setting out what was elicited from the interviews on relevant factors which played a role in the turning point. These case summaries formed the main basis for the analysis. Theory (from the life course perspective) and preliminary analysis of the case summaries were used to develop a conceptual model for full analysis of the data. FIGURE 3 presents the conceptual model which is further explained in the rest of this section.

The hypothesis made in line with the life course perspective is that turning points in travel behaviour are triggered by a contextual change which can be either a life-change event (referred to in life course terminology as a transition), or a change in external environments encountered (relating to social/cultural, organisational, physical or economic/policy environments in accordance with the ecological model). It was found that a contextual change of one kind or another played a role in triggering behavioural change in nearly all cases.

The literature suggests contextual change leads to conscious deliberation over behaviour, whereas habitual behaviour is likely to be prevalent otherwise (*10)*. Life-change events can alter the roles that people perform within their family and social networks, alter the values people hold, alter the resources available for travel and physical exercise and alter the context for travel and physical exercise. This can change the characteristics of travel that are considered salient and hence attitudes towards travel modes. Changes to external environments can alter beliefs and attitudes towards travel modes, or even the possibility of using particular modes of transport.

It was found in preliminary analysis of the interviews that three types of mediating factor (see FIGURE 3) played a role in the outcome on cycling behaviour of contextual change. These were intrinsic motivations (for example, increasing physical fitness), facilitating conditions (for example, facilities to store a bicycle at the destination) and personal history (for example, past experience of cycling).

4. ANALYSIS OF TURNING POINTS IN BICYCLE USE

4.1 Descriptive summary of turning points

TABLE 1 summarises for the interview sample the types of turning points found to occur and the contextual changes that were identified to trigger them. Turning points in cycling trajectories were found to occur for 95 of the 144 participants. (The purposive sampling used to recruit the interview sample intentionally sought participants who had changed cycling behaviour, so this level of behavioural change would not be expected in the wider CCT population.)

There were 31 cases where interviewees became New Regular Cyclists (cycling at least once a week where they had previously cycled less frequently than this or not at all). There were 23 cases where Continuing Regular Cyclists increased cycling and 16 cases where Continuing Regular Cyclists decreased cycling. There were 11 cases where Non-Regular Bicyclists increased cycling (but not sufficiently to be considered New Regular Cyclists) and 14 cases where Non-Regular Cyclists decreased cycling.

The classification of turning point cases by type of contextual change was not intended to identify a definitive trigger for every case, but to be an organizing basis for presenting the interacting influences. In some cases it was apparent that a combination of contextual changes (simultaneous or separated over time) led to a turning point and in other cases it was possible that a relevant contextual change was not elicited from the interviews. There were often found to be delayed behavioural responses to contextual changes which can be attributed to habitual behaviour and time required to plan changes to behaviour.

It can be seen from TABLE 1 that a life-change event (outside transport domain) was identified as triggering a turning point in bicycle use in 69 of the 95 cases. Transport-related events were found to trigger a turning point in 18 cases. These events related to the availability of a form of transport or the skills to use a form of transport. External changes to the cycling environment were found to be the trigger for a turning point in bicycle use in 8 cases. Other types of change to the external environment (social, cultural, organisational and policy/economic) were not found to trigger turning points, although the external environment (bicycle or non-bicycle) was found to play a role in facilitating change in many cases.

4.2 Example cases of turning points

A full thematic analysis of the turning points in bicycle use is included in full in a research report (*5)*. A small number of example cases of turning points are presented now to illustrate how the conceptual model is a helpful basis for explaining behavioural change. Pathway diagrams are used to present visually the role of contextual change and mediating factors in turning points taking place.

The first example is a turning point in bicycle use associated with a change in employment location. A 25-44 year-old male in Southend (Continuing Regular Cyclist, Cycling More), who described himself as a lifelong cyclist, started cycling to work on taking up a new, local job in May 2010 (see FIGURE 4). The previous job was ten miles away but the new job was two to three miles away.

"Probably within the last two years my usage of the car has dropped, mainly because of my new job, 'cos that's made it easier to get to work, whereas before, when I was travelling into my other job I just had to use the car everyday because of the distance, it was about 10 miles away to get to." Male, 25-44, Continuing Regular Cyclist, Cycling More, Southend

He noted that there was limited parking where he works which encouraged him to cycle but he was also motivated to cycle by the exercise obtained, saving money on fuel and the environmental benefits of cycling. He saw cycling as a long-term commuting option as parking for employees was to be further restricted at his workplace in the future.

Children provided an impetus for parents to start cycling or cycle more often. This applied more to women in the interview sample than men. Many of the participants who cycled due to their children had not been cycling previously. Cycling was seen as a healthy activity for parents themselves and for their children.

For a 45-64 year old female in Woking (New Regular Cyclist) with three children, her youngest five year old child starting school had led to greater opportunity to cycle during the school day (see FIGURE 5). She had tried cycling with a child seat with them previously but had not felt confident and usually walked with them. She was now cycling into the town centre on her own whilst the children were at school. She had access to a car but enjoyed cycling and wanted to avoid parking costs.

"The main reason is the children being at school, that I don't have a buggy to push anymore, so that's just freed up my time and not having a small child in tow." Female, 45-64, New Regular Cyclist, Woking

She also noted that she had started cycling with the rest of the family (husband and children) at the weekend. The youngest child was now old enough to use his own bicycle. Her husband was a keen cyclist and tended to instigate the cycle rides. Improvements made to the surface of the canal cycle path in Woking (which is no longer muddy) had encouraged this.

For older adults (especially men aged 40 and over) health concerns prompted increased cycling. A 45-64 year old male in Southend (New Regular Cyclist) said that witnessing the health problems of other people prompted him to start cycling to lose weight, get fit and improve his health (see FIGURE 6). His wife was a keen cyclist already and he was able to join her on cycle rides. He was doing a weekly circular ride with his wife and they took advantage of the improved off-road cycle route network in Southend.

"I think we're both in a position where we both need to lose a bit of weight, I'm 56 now and I'm sort of conscious of that, I've got a lot of people round me at the moment having various operations and heart operations, and it tends to waken you up." Male, 45-64, New Regular Cyclist, Southend

4.3 Turning points leading to a sustained change in behaviour or not

The analysis of the interview data also considered whether a change in behaviour is sustained and it was found that this depended on the balance between positive and negative outcomes (both of which are based on experience with the performed behaviour). If negative outcomes are dominant then behaviour will be reconsidered. The conceptual model introduced in FIGURE 3 was extended to consider behaviour subsequent to the turning point (see FIGURE 7).

An example is shown in FIGURE 8 of a participant who started cycling regularly to work but did not sustain this. The 25-44 year old female (New Regular Cyclist), who did not drive, moved to Shrewsbury in 2007. She perceived Shrewsbury to be supportive of cycling as she saw people of all ages cycling and a visible network of off-road cycle paths. However, she was not confident to cycle to work on roads with traffic. She found that adult cycle training was available, purchased a new bike and undertook the training. This included training particularly aimed at helping her cycle to work (accompanied journey with the trainer on the route to work) and she had subsequently started cycling regularly to work. She did not sustain cycling to work, however, due to concerns about traffic safety, the attitudes of colleagues towards her cycling and lack of shower facilities.

5. CONCLUSIONS

The conceptual model developed in this research hypothesises that turning points in travel behaviour are triggered by contextual change (a life-change event or change in external environment), and mediated by intrinsic motivations, facilitating conditions and personal history. Whether the change in behaviour is sustained depends on the balance between positive and negative outcomes (both of which are based on experience with the performed behaviour).

Contextual change may or may not lead to a turning point (significant and non-temporary change in behaviour) in behaviour. Existing behaviour may continue. This research focused on people that had changed cycling behaviour and it would be valuable to also carry out research focusing on people experiencing life-change events (such as changes in employment status or location) and to seek to understand under what circumstances these lead to behavioural change. With the proposed panel data it will be possible in this research project to quantify the prevalence of changes to cycling behaviour associated with some life-change events (those that can be identified as occurring from the survey).

The conceptual model has been used to explain turning points in bicycle use of residents living in towns and cities subject to major bicycle investment. It was rarely found in the interview sample that increased cycling was triggered by awareness of a change in the cycling environment. More commonly it was found that a life-change event triggered a turning point in cycling. This is not to say that the CCT investment programme had little impact. Where life-change events initiated deliberation over travel behaviour, a supportive environment for cycling was found to encourage increased bicycle use. Motivations to increase fitness and save time and money also encouraged increased bicycle use, as did past experience of being a cyclist.

This paper has shown how viewing travel behaviour dynamically in the context of people's evolving lives assists in understanding behavioural change. It has demonstrated that life-change events lead to reconsideration of travel and turning points in travel behaviour. Transport policy makers and practitioners could take advantage of life-change events as opportunities to market travel alternatives, but they need to be able to access groups/individuals at these points. This requires collaborating with professionals from other sectors (e.g. education providers, employers). The paper has also shown how past experience of cycling played an important role in taking up cycling again. This suggests that marketing needs to be differentiated according to groups with different experience levels of the behaviour being promoted.

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TABLE 1 Contextual Changes Associated with Turning Points

	Turning Points					
Key Trigger	New Regular Cyclist	Experienced Regular Cyclist		Non-Regular Cyclist		Total
	Cycling More	Cycling Less	Cycling More	Cycling Less	Cycling More	-
Life-change events						
Education	1	0	0	0	0	**1**
Employment	7	1	6	0	0	**14**
Relationships and residential location	2	1	3	1	0	**7**
Children's development	6	6	4	2	3	**21**
Physical health	3	5	2	5	0	**15**
Leisure interests	3	0	2	3	3	**11**
Transport-related events						
Car availability	0	1	1	0	0	**2**
Bicycle availability	6	2	2	3	1	**14**
Bicycle riding skills	2	0	0	0	0	**2**
Changes to external environment						
Cycling environment	1	0	3	0	4	**8**
Total	**31**	**16**	**23**	**14**	**11**	**95**

3)

DEPTH INTERVIEW REFERENCE NUMBER
(TO BE LINKED TO TRANSCRIPT & OBSERVATION PROFORMA) 2_2287_3344

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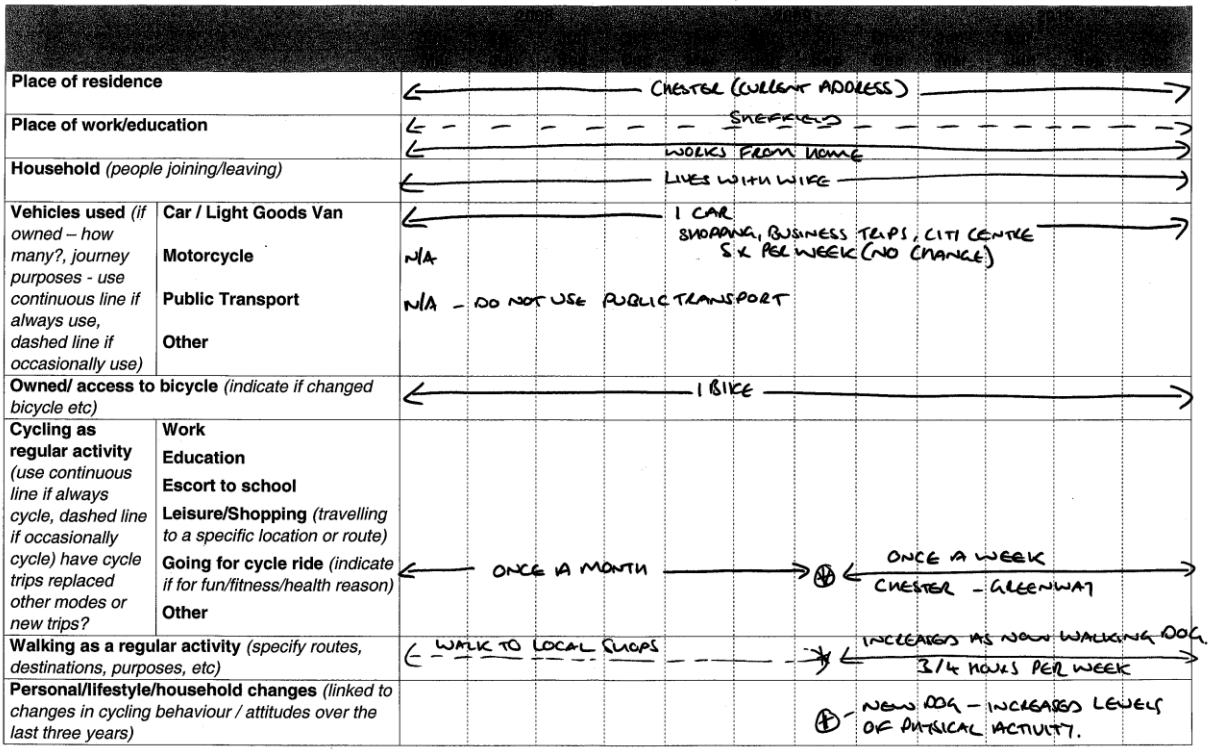

FIGURE 1 Example of completed Travel Behaviour Timeline.

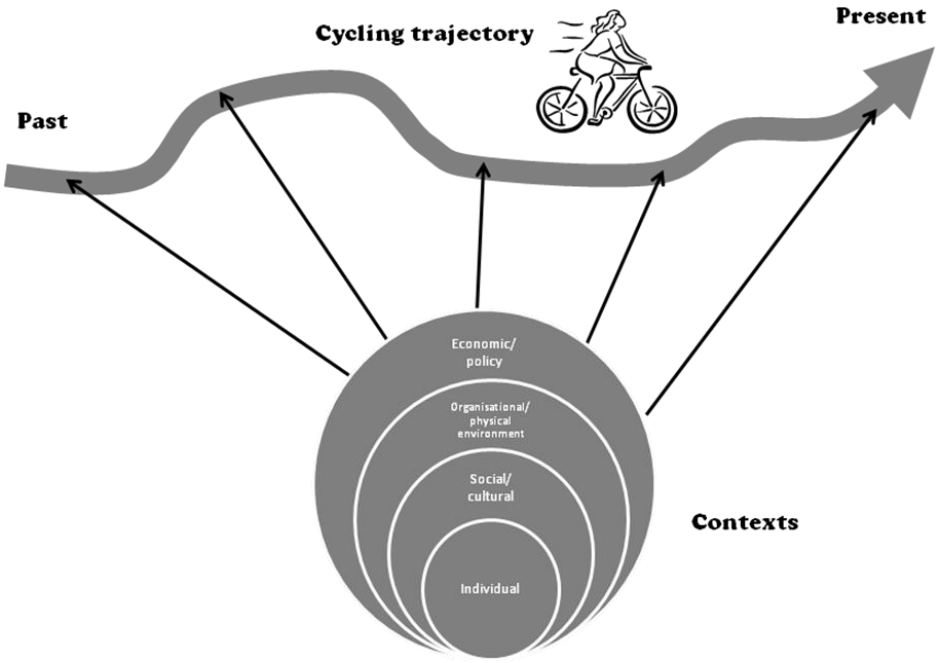

FIGURE 2 Cycling trajectory.

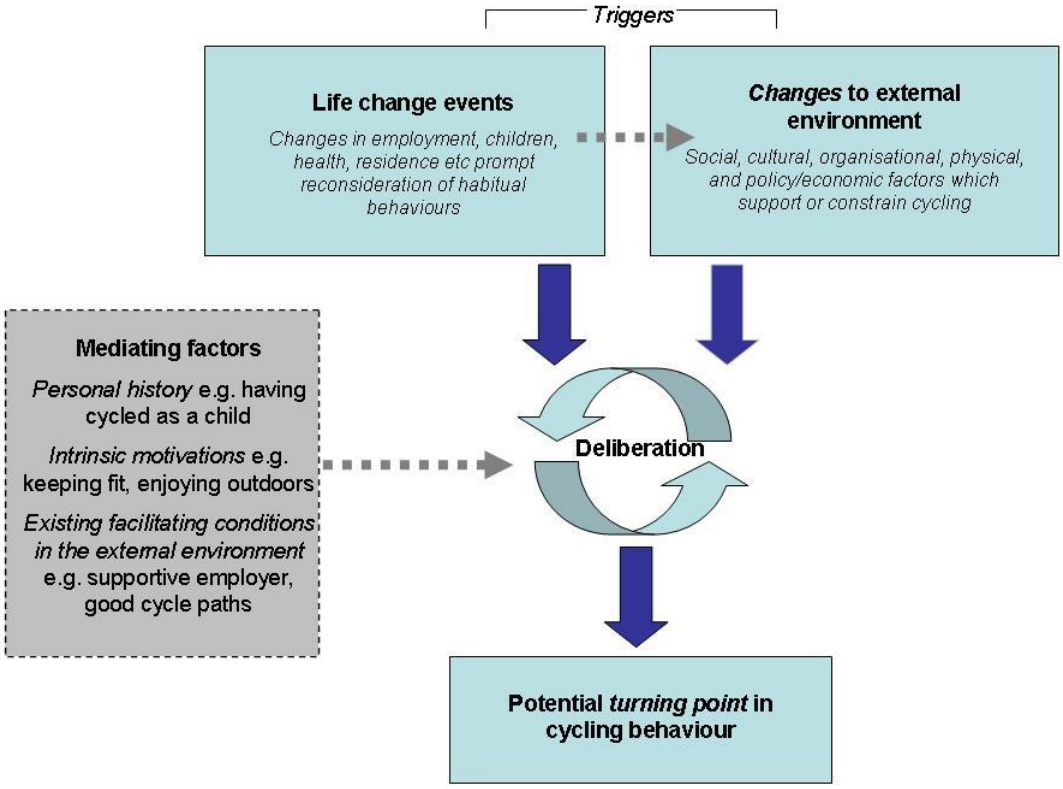

FIGURE 3 Conceptual model for explaining turning points in travel behaviour.

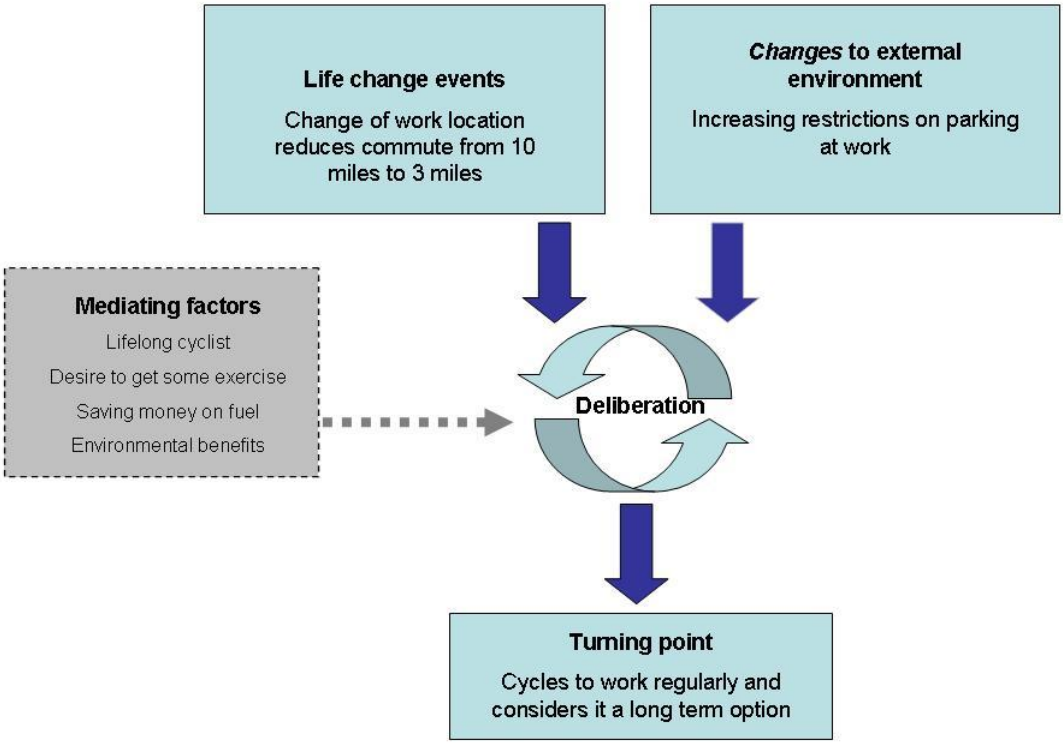

FIGURE 4 Pathway diagram – change in employment location.

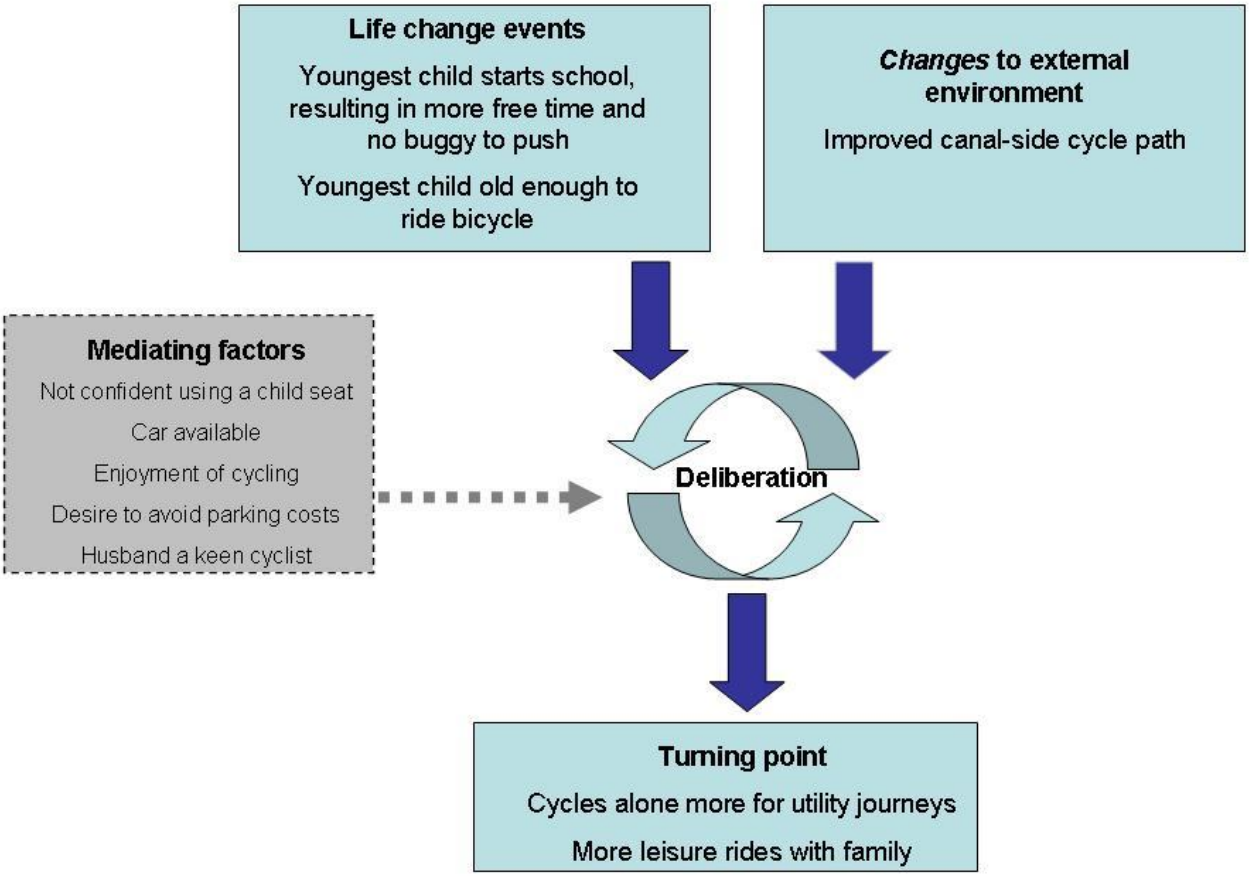

FIGURE 5 Pathway diagram – children starting school.

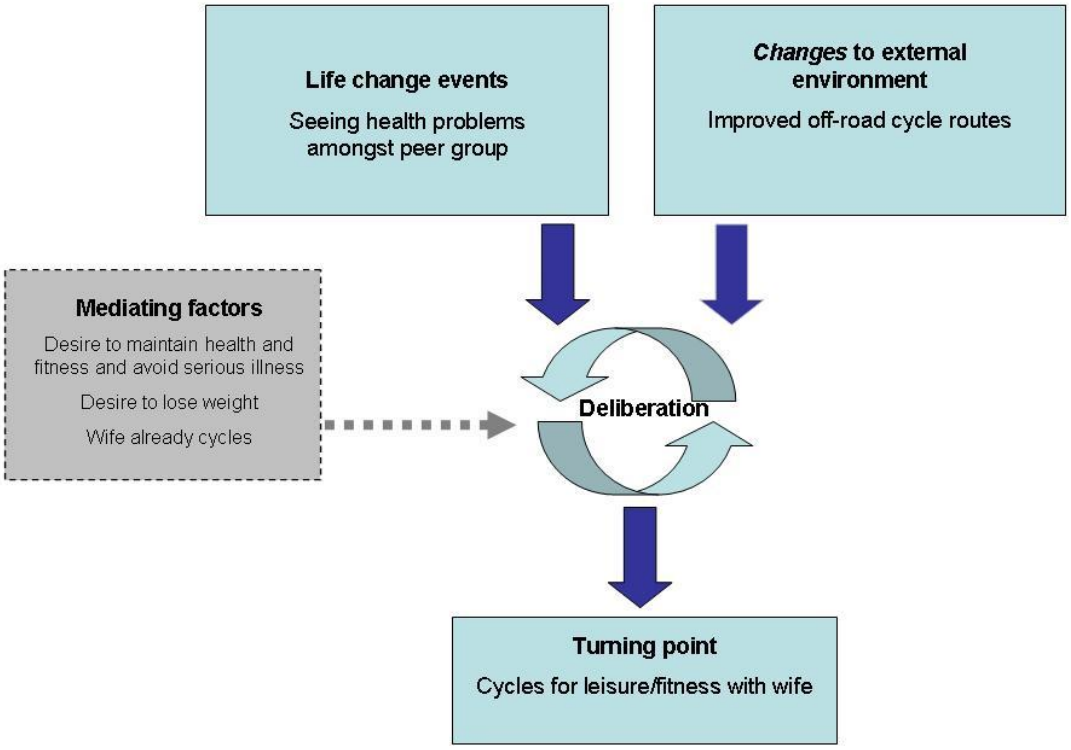

FIGURE 6 Pathway diagram – health problems amongst peer group.

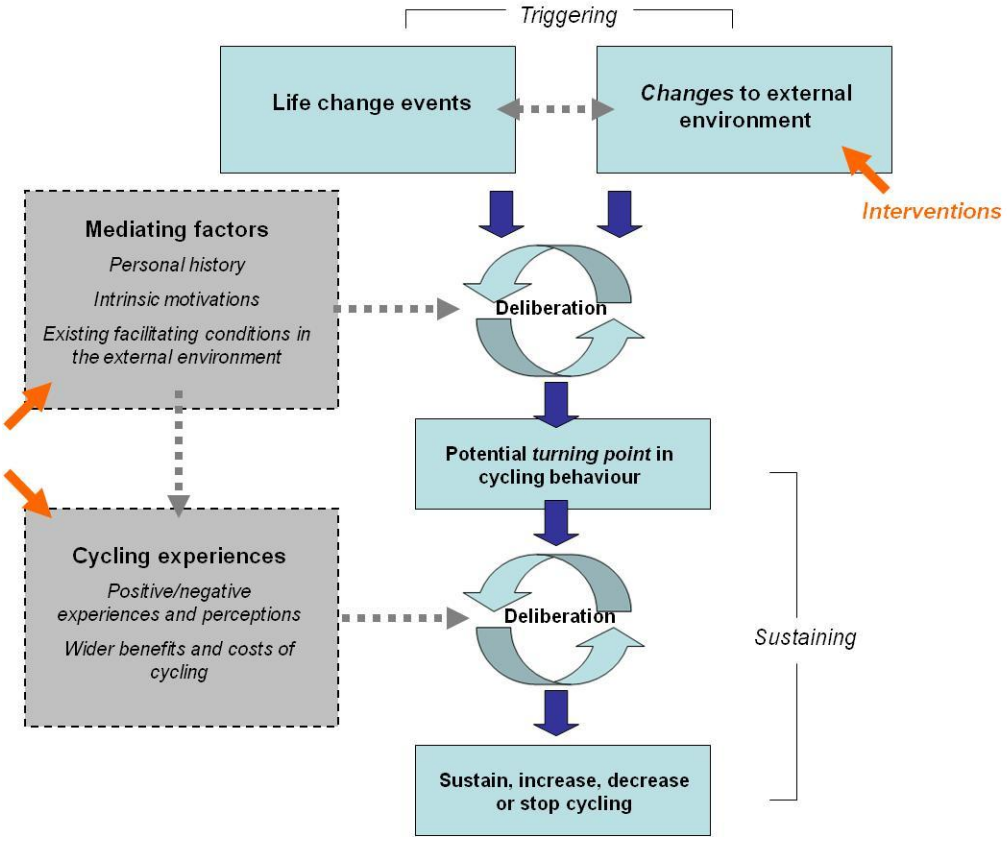

FIGURE 7 Conceptual model extended to consider whether behavioural change sustained.

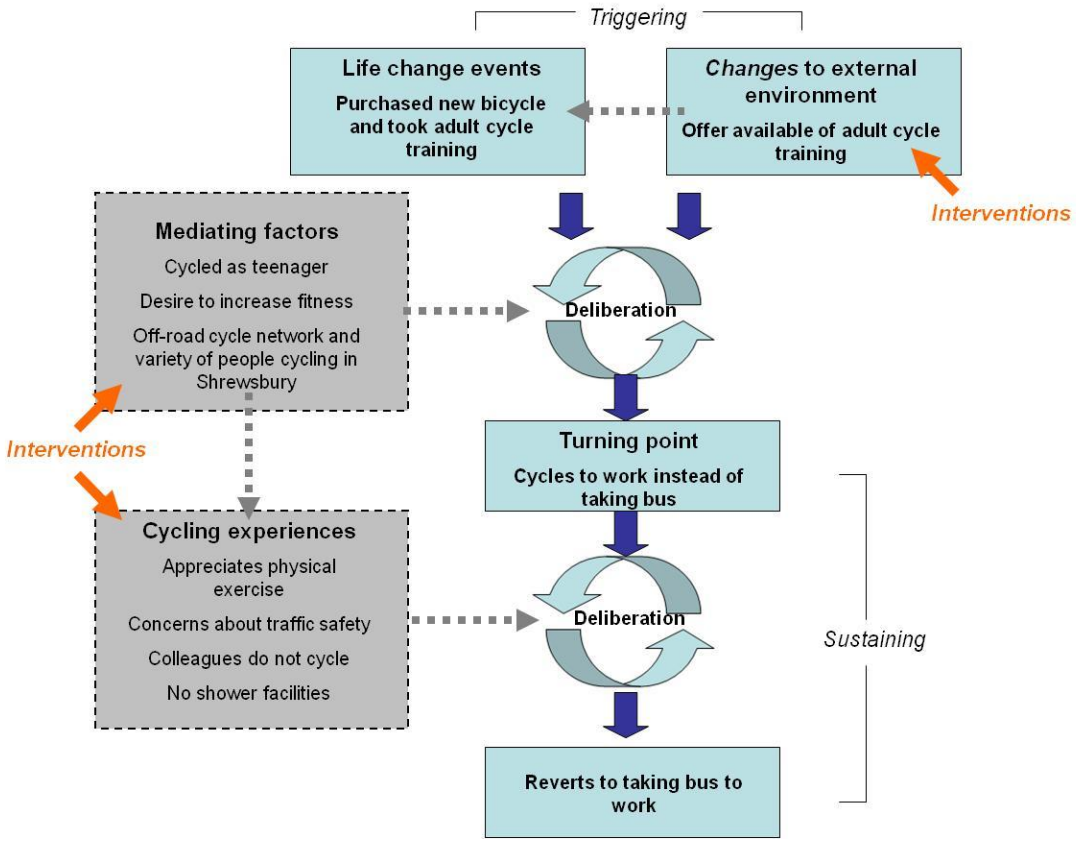

FIGURE 8 Turning point and subsequent cycling behaviour after adult cycle training.