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## Examining the relationship between life transitions and travel behaviour change: New insights from the UK Household Longitudinal Study

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### Abstract

Recent research has indicated that changes in travel behaviour are more likely at the time of major life events. However, there remains much to learn about the extent to which different life events trigger behavioural change and the conditions under which life events are more likely to trigger change. The UK Household Longitudinal Study (UKHLS) offers a previously unavailable opportunity to investigate this for a large, representative sample of the UK population. We have also linked UKHLS data to local spatial data, drawn from the census and other sources, to elucidate the effect of the spatial context on changes to travel behaviour in association with life events. Findings from an exploratory analysis of UKHLS waves 1 and 2 data are presented first. Transition tables demonstrate a strong association between changes in car ownership and commute mode and the following life events: employment changes, residential relocations, retirement, child birth and changes in household structure. Results are then shown of logit models which relate the probability of an increase and decrease in the number of cars owned to the occurrence of life events, controlling for individual and household characteristics and spatial context. These show, for example, that urbanizing and ruralizing moves have contrasting effects on travel behaviour.

### 1. INTRODUCTION

Worldwide, there is interest in reducing the negative impact of motorised personal transport. The UK Department for Transport's (DfT) business plan incorporates priorities to "encourage sustainable local travel" and to "tackle carbon and congestion on our roads" (DfT 2011a). Making public transport, walking and cycling more attractive is seen as instrumental in achieving these priorities. DfT's behavioural insights toolkit argues that "people and organisations are likely to be most open to changing habitual behaviours at key 'transition points' or 'moments of change' (DfT 2011b). We refer to these as life transitions and use the definition of these as 'major or minor life events that may cause changes in one's life and relationships' (Connidis 2010).

Longitudinal data provides observational information regarding the process of behavioural change and thus provides a stronger evidence base for identifying the antecedents of behavioural change than cross-sectional data (Davies and Dale 1994). Longitudinal research has shown that the formation of habits acts to maintain stable travel behaviours but life events can prompt a reconsideration of routine behaviours, breaking habits and prompting travel behaviour change (Bamberg et al 2003). This body of evidence has nevertheless tended to rely on relatively small scale retrospective surveys. It has also not been examined how spatial context affects how people respond to life events or how the role of life events varies at different life stages. The aim of this paper is to explain how a longitudinal data set, based on a sample representative of the English population, has been generated to investigate the inter-relationship between life transitions and travel behaviour. The paper

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also contributes new evidence on the effect of life transitions on car ownership and commuting behaviour.

In the next section, a review is provided of current knowledge on the relationship between life transitions and travel behaviour after which a research framework is established for further study of this subject. The generation of a data set suitable for the research is described before results are presented on the prevalence of life events and their association with changes in travel behaviour. Multivariate analysis of car ownership change is then used to illustrate what can be learnt about the role of life events while controlling for other factors.

## **2. EXISTING KNOWLEDGE ON LIFE TRANSITIONS AND TRAVEL BEHAVIOUR**

### *Theoretical and conceptual development*

Jones et al (1983) emphasised the importance of family life-cycle stages (defined based on age of youngest child) in determining travel behaviour, particularly noting the importance of constraints that exist at each stage. The implication is that changes in life stage are likely to lead to change in travel behaviour. Cohort studies compare different age cohorts and how their travel behaviour differs over the life span. As well as differences between life stage groups, cohort studies enable the effect of different historical experiences to be identified. Dargay and Vythoulkas (1999) used pseudo-panel data to show that car ownership increases as head of household reaches the age of 50 and thereafter declines, but also that successive generations have higher car ownership than earlier ones, indicating the importance of the historic time in which the cohort lived. It can be argued, however, that life stage is a restrictive concept as it implies the existence of a common developmental pattern over the life span when there may be significant individual variation in developmental patterns within the same age cohort.

A more general proposition was made by Fried et al (1977) who proposed a synthesized theory of travel behaviour. Behaviour is considered to be continually in a process of adaptation to changes in personal needs and environmental structures. Life events can be viewed in this context as internal forces that lead to changes in circumstance. Salomon and Ben-Akiva (1983) introduced the concept of a decision hierarchy with three inter-dependent levels. Lifestyle choice is at the top level of the hierarchy and represents the longest term decisions (e.g. family formation) below which is mobility choices (e.g. car ownership) with activity and travel choices at the lowest level. After a 20 year gap, Lanzendorf (2003) returned to the ideas of Salomon and Ben-Akiva (1983) and introduced the concept of mobility biographies, explicitly recognising the importance of the time dimension in people's lives. He proposed three biographical domains (lifestyle, accessibility and mobility domains) which are interlinked with events in one domain affecting the others. He noted that habitual behaviour forms in stable circumstances and can be interrupted by the occurrence of life events.

Miller (2005) took a similar conceptual approach to Salomon and Ben-Akiva but with two levels of decision making with long run decisions determining spatial context and transport resources and short run decisions determining day to day travel choices. Short run decisions are governed by the resources and constraints set by long run decisions. He used the concept of household 'stress' which can occur where there is excessive constraint from the spatial and mobility context and can lead to an incentive to make changes of different kinds (for example, change of mode or purchase of car). Clark (2012) puts forward a process model for car ownership change which draws on the concept of stress. This model hypothesises that life events are often the initial stimulus for car ownership change. Life events may produce an imbalance between the current car ownership needs and desires and the actual car ownership position which may no longer be suitable, having been established to meet the needs of a past circumstance. In section 3 we introduce a new conceptual framework for the inter-relationship between life events and travel behaviour but we now review empirical evidence on the role of life events in travel behaviour change.

### *Exploratory studies on role of life events*

Initial studies of the impact of life events sought to identify the most influential life events for travel behaviour. Van der Waerden et al (2003) identified 90 key events and critical incidents with potential to influence travel behaviour and then conducted a detailed survey involving 173 respondents on the effects of a short-listed set of 17 of the events. The events which had most impact were reported to be a residential move, starting first job, change of work situation, getting a driving licence and getting a new car.

Similarly, Klöckner (2004) carried out an online survey of 91 participants in Germany and asked them to identify up to 10 life events over their lifetimes that influenced a change in travel mode. The most commonly identified events were moving to a new town (mentioned by 61%), starting studies/apprenticeship (55%) and acquiring driving licence (54%). Looking at retrospectively recorded mode usage over the life course and the occurrence of life events, Klöckner showed three different developmental patterns and concluded that life events experienced varied across the sample and their significance for mode use also varied.

#### *Studies of specific life events*

A growing number of studies have focused on specific life events. Residential relocation and job changes have received the greatest attention. Stanbridge and Lyons (2006) found that 27% of respondents to a survey of home movers in Bristol (England) reported changing commuting mode after moving. They found that respondents differed not only in the degree of consideration of transport in the moving decision but also in the stage in the move process where they considered transport.

Verplanken et al (2008) studied university employees who had recently moved and found that those with environmental concern were more likely to have reduced car use after moving. Scheiner and Holz-Rau (2013a) used retrospective data collected in Cologne to analyse using structural equation modelling how residential relocations affect change in use of car, public transport, walking and cycling. They found an effect from the change in built environment characteristics (whether measured objectively or subjectively). Changes in household structure occurring simultaneously to the move also were found to play a role, demonstrating the importance of recognising interactions between different life events.

Lanzendorf (2006) conducted retrospective interviews of 20 parents in Leipzig, Germany. It was found that child birth events tended to increase levels of car use, but conversely there was another group of mothers that reduced car use. Harms and Lanzendorf (2007) conducted a survey on the travel behaviour change of 1800 students who had graduated from university in Leipzig and started employment. The survey revealed that the most decisive changes in mobility behaviour generally occur when the first well-paid full-time job is started; before occurrence of this event, individual needs, opportunities and abilities may change in short intervals. Thus, 'leaving university and starting a job' cannot be considered as a single life event.

Involvement in transport incidents might also influence travel behaviour. Lee et al. (2012) obtained cycling histories of 54 residents of Davis (California) and used these to examine the influence of cycling 'incidents' (accidents involving and not involving other vehicles) on cycling attitudes, comfort and preferences. They found incidents in childhood had less serious impact than those in adulthood.

One study has tested whether an intervention at the time of a life event influences travel behaviour after the event. Bamberg et al. (2003) investigated changes in car use of people moving home to Stuttgart, Germany, with half of the participants studied being given a public transport information pack. They found that the move caused the participants to re-evaluate their behaviour and that the group receiving the pack changed more to public transport use after the move. This indicates that an intervention timed to coincide with a major life event can achieve a desired shift in travel behaviour.

#### *Travel behaviour change and the role of life events*

Other studies have taken the opposite stance and focused on travel behaviour change and investigated the role of life events. Dargay and Hanly (2007) found using British Household Panel Survey data that a high proportion of household car ownership changes are associated with life events. Higher rates of car ownership change were noted for households who moved home (27.2%), or where an individual changed employer (25.9%), than those where neither of these events took place (13.8%).

Beige and Axhausen (2012) carried out a 20 year retrospective biographical survey of residents in the Zurich region of Switzerland. They observed that the lives of young adults are subject to greater frequency of life events. They examined the relationship between changes in car ownership and public transport season ticket holding and life events and other contextual factors using binary logit models but did not distinguish between positive or negative changes in the behaviour and hence the findings are ambiguous about direction of effect.

Oakil et al (2011) used a 20 year retrospective life calendar grid to collect data from residents of Utrecht region in the Netherlands on life events and change in car ownership. Cross tabulations showed prevalence of car ownership changes in the same year as life events or one year earlier or after. Childbirth and residential relocation were found to be associated with a change in car ownership in advance of the event while job changes were associated with a change in car ownership after the event. This is supported by Clark's (2012) neighbourhood survey which generated 184 qualitative household car ownership histories. Two thirds of car ownership level changes recorded were found to be associated with life events (encompassing employment changes, cohabitation, an adult joining or leaving the household, residential relocation, child birth, offspring reaching driving age and retirement).

Commuting behaviour has also been a focus of interest. Dargay and Hanly (2007) found that whilst 14.0% of those who do not move home and do not change employer change commute mode, this increases to 28.1% for those who move home, 32.7% for those that change employer and 44.6% for those that change both home and employer. Prillwitz et al (2007) used 1998-2003 German Socio-Economic Panel data to explore the factors associated with a change in commute distance over the five year period. They found that an increase in commuting distance was associated with a job change, increase in car availability, move from an urbanised centre to peripheral area and move to single family-house.

Goodwin (1993) examined the role of life events (relating to life stage, employment status, income and car ownership) for public transport use and found that those with life events occurring are more likely to change public transport use. Chatterjee et al (2013) investigated turning points in cycling behaviour through in-depth interviews and found that turning points were usually triggered by life events. Cases where participants started to cycle to work were triggered by starting a new job, a change of workplace or an event provoking concern about health.

A recent study by Scheiner and Holz-Rau (2013b) has used data from the German Mobility Panel for an analysis of year-to-year changes in general use of travel modes and their relationship to life events, while controlling for socio-demographics, spatial attributes and period effects. In general, the results suggest a modest effect of life events on travel mode use with behaviour appearing stable in the short term after life events occur. This contradicts the other studies reported in this review and highlights the need for further investigation examining more specific travel behaviour indicators (such as car ownership and commuting mode).

#### *Inter-dependencies between life events and travel behaviour*

Some studies have explicitly examined inter-dependence between life events and travel behaviour in both directions. They have highlighted that life events are not necessarily exogenous from travel behaviour and can be partly stimulated by travel circumstances. Van Ommeren (1997) found from an empirical analysis of Dutch panel data that every additional 10 kms of commuting distance decreased the expected duration of the current job and current residence by more than two years. Rashidi et al (2011) modelled the inter-dependencies between vehicle transactions, residential relocation and job change with long travel times being tested and shown to be one factor explaining the probability of changing job and residence.

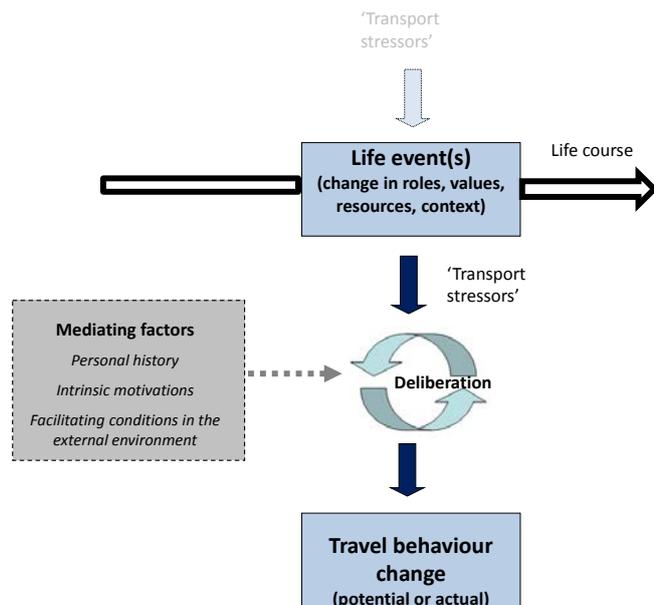
#### *Summary of knowledge*

The review has shown that significant changes in travel behaviour are likely at the time of major life events, especially those involving a change in household composition, employment status or residential or job location. However, the extent to which life events are triggers for travel behaviour change has not been evidenced for large scale samples representative of the general population. It has been shown that some life events can be stimulated by an unsatisfactory travel situation (in particular home and job changes in response to long commutes) which suggests it is important to consider the travel behaviour context alongside life events. It has not been examined in much depth how spatial context and attitudes affect how people respond to life events, or how the role of life events varies at different life stages. There is some indication that certain life events cluster together (particularly in early adulthood) and that there is greater impact on travel behaviour when this is the case.

### 3. RESEARCH FRAMEWORK AND QUESTIONS

The life course perspective provides a helpful framework for studying the inter-relationships between life events and travel behaviour. Giele and Elder (1998) 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”.

A generalised conceptual model, which draws on the life course perspective, is shown in Figure 1. This frames the empirical research presented subsequently. The hypothesis made is that turning points in travel behaviour are triggered by a contextual change (a life event for the purposes of our research but this could also be a change to the transport system). Life 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 alter the context for travel. These can create ‘transport stressors’, which entail discrepancies between the current transport circumstances and a desirable alternative (Miller 2005) and can change the travel mode alternatives that are available, the characteristics of travel that are considered salient and hence attitudes towards travel modes (Van der Waerden et al 2003). Three types of mediating factor are assumed to play a role in the outcome on travel behaviour of contextual change. These are personal history (for example, experience in using travel modes), intrinsic motivations (for example, saving money or improving health) and facilitating conditions (for example, public transport availability).



**FIGURE 1 Conceptual model for explaining turning points in travel behaviour.**

The paper now presents an empirical analysis that used UK Household Longitudinal Study (UKHLS) data to examine specific aspects of the framework. The analysis addressed the following research questions: To what extent are different life events associated with changes in travel behaviour (car ownership level and commute mode)? And under what conditions are life events most likely to result in changes in travel behaviour and why?

### 4. DATA SET GENERATION

The data set prepared was derived from the *first two waves* of the UKHLS. The UKHLS started in 2009 and follows the lives of approximately 40,000 households living in the UK. Given restrictions in the availability of local context variables for all regions of the UK, the sample analysed incorporated individual adults that were successfully interviewed and who lived in England at both waves. This constituted 32,151 individuals living in 19,615 household units.

The dependent variables of interest were increases and decreases in the number of household cars or vans between wave 1 and wave 2 and changes in the commuting mode used between wave 1 and wave 2. Specifically this paper focuses on switches to and from commuting by car (which includes ridesharing). Analyses relating to car ownership were necessarily conducted at the level of the *household*, while analyses concerning commute mode were conducted at the level of the *individual* respondent.

The life transitions examined are listed in Table 1. These were represented in the analysis by binary variables indicating whether the life event had been experienced between wave 1 and wave 2 or not. A number of spatial context variables were also prepared to enable an examination of the effect of the local built and social environments on behaviour change.

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This was achieved by linking UKHLS data to other sources including the UK Census, the DfT's accessibility indicators and Indices of Multiple Deprivation.

## 5. DESCRIPTIVE ANALYSIS

The overall prevalence of travel behaviour changes and life transitions across the sample is summarised in Table 1 with population weighted values (for England) also identified (weighting is not applied to subsequent results tables as they refer to relationships rather than prevalence). Around nine per cent of households in the sample changed car ownership level (in either direction) while five to six per cent of employed individuals switched commute mode from and to car (respectively) between waves 1 and 2. The most commonly experienced life transitions relate to employment and residential location. Plotting the percentage of individuals experiencing each life transition against age confirmed expected age profiles (for example, child birth generally occurs for individuals aged less than 40). It is also notable that employment changes and residential relocations are more prevalent amongst younger adults.

Cross tabulations of households gaining or losing a car with at least one household member experiencing each life transition are presented in Table 2. For each of the life transitions examined, the proportion of households experiencing a change in car ownership level is higher (in one or both directions) when the life transition has also been experienced. Chi-square tests confirm that these differences are all statistically significant.

The direction of car ownership level changes associated with life transitions is in line with expectations. Gaining employment is associated with vehicle acquisitions, while losing employment (including retirement) is associated with vehicle relinquishments. Gaining a driving licence is very strongly associated with acquiring a vehicle. Partnership formation and dissolution strongly reflect changes in the number of adults in the household in being associated with increases and decreases in the number of household cars respectively. Having children and residential relocations appear to be associated with both increases and reductions in the number of household cars.

The observation that a greater proportion of households reduced car ownership in conjunction with a residential relocation relates to an inevitable feature of the panel sample rather than to a characteristic of the population at large. The panel survey tracks individuals leaving wave 1 households (which involves both a residential relocation and a change in household structure). Closer inspection reveals that these newly formed households in the panel are smaller in size, explaining in part the reason why a higher proportion of residential relocations recorded in the survey are associated with reductions in car ownership.

Commute mode switches are found to be more prevalent in conjunction with life transitions (compared to a stable situation), except for child birth. However, this result is likely to relate to the two-wave nature of the commute mode sample which excludes parents that are yet to return to the workforce following child birth. Employment changes, residential relocations and gaining a partner are equally associated with both switches to and from car commuting. It is notable that stopping cohabitation is associated with switches from car commuting. This suggests a tendency towards a reduction in access to household cars following the loss of a partner.

## 6. MULTIVARIATE ANALYSIS

The paper now presents the results of multivariate analysis which elucidate the effect of life transitions, whilst controlling for other factors (including socio-demographic and spatial characteristics). Two multiple regression models of car ownership level change are estimated on household level data. The dependent variable for Model 1 is a binary variable reflecting whether the household gained one or more cars between wave 1 and wave 2. Conversely, the dependent variable for Model 2 is a binary variable reflecting whether the household lost one or more cars between wave 1 and wave 2. Binary logistic regression models have been employed and independent variables have been selected from the following variable groupings: The life transitions experienced by one or more household member between wave 1 and 2; The structure and life stage of the household in wave 1 (baseline); The socio-demographic characteristics of the household in wave 1 (baseline); and the characteristics of the built and social environment in wave 1 (baseline).

**TABLE 1 Prevalence of travel behaviour changes and life transitions.**

<b>Travel behaviour change</b>					
<b>Event</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	<b>Percentage</b>	<b>Weighted Percentage</b>
No. of households gaining a car	1752	17793	19545	8.96%	N/A
No. of households losing a car	1769	17776	19545	9.05%	N/A
No. of employed individuals that switched from car commuting	818	14382	15200	5.38%	5.42%
No. of employed individuals that switched to car commuting	931	14269	15200	6.13%	6.17%
<b>Life transitions (no. of individuals experiencing the transition)</b>					
<b>Event</b>	<b>Yes</b>	<b>No</b>	<b>Total</b>	<b>Percentage</b>	<b>Weighted Percentage</b>
Residential relocation	2032	30097	32129	6.32%	6.85%
Had child	939	28655	29594	3.17%	3.13%
Gained a partner	473	31678	32151	1.47%	1.61%
Lost a partner	395	31756	32151	1.23%	1.33%
Entered employment from non-employment	1621	30522	32143	5.04%	5.09%
Lost employment (excl retirement)	1065	31078	32143	3.31%	3.27%
Switched employer	1770	28388	30158	5.87%	6.23%
Retired	380	31763	32143	1.18%	1.18%
Gained a driving license	836	31191	32027	2.61%	2.46%

Notes: Longitudinal weights are not available at the household level

Source: Understanding Society, Waves 1 and 2, 2012, linked with neighbourhood indicators at LSOA level.

**TABLE 2 Association of behaviour changes with life transitions.**

<b>Households experiencing a car ownership level change</b>				
<b>Life transition</b>	<b>Cars up with transition (%)</b>	<b>Cars up with no transition (%)</b>	<b>Cars down with transition (%)</b>	<b>Cars down with no transition (%)</b>
Residential relocation	14.26	8.54	23.32	7.92
Had child	11.34	8.54	11.82	8.72
Gained a partner	38.63	8.26	14.57	8.92
Lost a partner	6.95	9.00	42.78	8.39
Entered employment from non-employment	15.02	8.44	9.84	8.98
Lost employment (excl retirement)	9.44	8.94	14.55	8.74
Retired	6.65	9.01	12.74	8.98
Gained a driving license	34.13	7.88	5.65	9.18
<b>Employed individuals experiencing a commute mode change</b>				
<b>Life transition</b>	<b>From car with transition (%)</b>	<b>From car with no transition (%)</b>	<b>To car with transition (%)</b>	<b>To car with no transition (%)</b>
Residential relocation	8.87	5.12	9.65	5.87
Had child	5.81	5.37	7.35	6.08
Gained a partner	8.96	5.31	8.24	6.09
Lost a partner	10.27	5.32	5.41	6.13
Switched employer	11.07	4.61	11.50	5.26
Gained a driving license	4.18	5.41	25.78	5.74

Source: Understanding Society, Waves 1 and 2, 2012, linked with neighbourhood indicators at LSOA level. Weighting not applied.

The results for Model 1 and Model 2 are presented in Table 3 and Table 4 respectively. Firstly, the models indicate that a range of baseline conditions have a significant effect on changes in car ownership. Having fewer cars in the household (in wave 1) and being a larger

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household increases the odds of a household increasing the number of cars owned by wave two. The converse is true for reductions in car ownership. Together these factors show that households with more household members per car (a measure of pressure on the household vehicle fleet) are more likely to gain cars and less likely to lose cars over time.

The models also reveal some evidence of expected life stage effects suggested by Dargay and Vythoukas (1999). Households with oldest members aged over 60 are less likely to acquire additional cars compared to households with oldest members aged between 45 and 59. Very young households (with oldest members aged between 16 and 24) are the most likely to have reduced their household car ownership level. This suggests that young adults leave the parental home and start independent adult life in lower car owning household units. Having children present in the household in wave 1 appears to reduce the odds of a household gaining a car, while having very young children in the household (aged 0-2) appears to increase the odds of a household losing a car. This may relate to a lagged effect of temporarily exiting the labour market following the birth of the child.

Being in a 'small employers & own account' occupation increases the odds of a household increasing the number of cars owned compared to not being employed (over and above other occupations, including 'management and professional'). Again, the converse is true for reductions in car ownership. This suggests that these occupation types involve a higher degree of need for automobility compared to other occupations. Similarly, higher qualifications, which may indicate upwardly mobile lifestyles, tend to be associated with increased odds of gaining cars and reduced odds of losing cars.

With respect to the built environment, car ownership increases are more likely and decreases less likely in areas of higher population density. This confirms that proximity to activity centres suppresses the need to acquire cars. Furthermore, higher journey times to employment centres by public transport are shown to increase the odds of a household increasing the number of cars owned, but does not change the odds of a household decreasing number of cars. This suggests that high quality public transport connections to employment centres could suppress the rate at which car ownership grows in a local area.

Finally, it is notable that living in a more deprived area (after controlling for income, education occupation and built environment) increases the odds of a household reducing the number of cars owned. This suggests that there may be physical, lifestyle or attitudinal characteristics of living in such neighbourhoods that reduce reliance on or opportunity for car oriented mobility.

#### *Life transitions*

In line with expectations, life transitions that change the composition of the household are the strongest predictors of changes in car ownership level. Households that gain (lose) an adult and/or a new cohabiting relationship are more likely to also gain (lose) cars. The acquisition of a driving licence by a household member is also a very strong predictor of households gaining cars, confirming that driving licence acquisition demonstrates a strong commitment to independent car ownership. Having children notably is not found to increase the odds of gaining cars, but is found to increase the odds of decreasing cars. This is perhaps counter to expectations and might relate to households having adults that leave the employment market.

With respect to residential relocations, urbanising moves are confirmed to be associated with households decreasing cars, while ruralising moves are confirmed to be associated with households increasing cars. Moves within London/metropolitan and urban areas are also associated with decreasing cars. One hypothesis is that this relates to households intentionally seeking less car dependent lifestyles at the time of the move, and is a finding that is worthy of further examination. Overall, the model offers evidence of the behavioural process through which the cross-sectional relationship between built environment and car ownership arises, i.e. households are shown to adjust to the new built environment circumstance in association with the move, rather than moving to the new environment with the prevailing behaviour already established. Finally, moves into and out of employment (including retirement) are associated with car increases and decreases respectively. Switching employer increases the odds of increasing cars, but is not a significant predictor of decreasing cars.

**TABLE 3 Model 1 – Increase in household car ownership level (yes or no).**

	Coef	Std. Err.	z	Odds Ratio
Residential relocation: London/met to urban	1.41	0.38	3.69	4.10
Residential relocation: London/met to rural	1.35	0.53	2.53	3.86
Residential relocation: Urban to London/met	0.20	0.52	0.38	1.22
Residential relocation: Urban to rural	0.62	0.32	1.94	1.86
Residential relocation: Rural to London/met	-0.09	0.84	-0.11	0.91
Residential relocation: Rural to urban	0.22	0.35	0.64	1.25
Residential relocation: London/met to London/met	-0.27	0.21	-1.31	0.76
Residential relocation: Urban to urban	0.05	0.17	0.29	1.05
Residential relocation: Rural to rural	0.13	0.35	0.37	1.14
Remained within London/met	-0.15	0.11	-1.31	0.86
Remained within urban [Ref: remained within rural]	-0.06	0.09	-0.60	0.95
Householder gained partner	1.08	0.24	4.51	2.95
Householder gained partner & household gained 1+ adult	-0.15	0.29	-0.50	0.86
Householder lost partner	0.90	0.35	2.60	2.47
Householder lost a partner & household lost 1+ adult	-1.32	0.49	-2.72	0.27
Householder entered employment from non-employment	0.32	0.09	3.73	1.38
Householder lost employment (excl retirement)	-0.18	0.13	-1.38	0.83
Householder retired	-0.01	0.23	-0.04	0.99
Householder switched employer	0.36	0.08	4.35	1.43
Householder had child	0.15	0.16	0.94	1.16
Householder had child & householder lost employment	-0.46	0.36	-1.28	0.63
Householder acquired driving licence	1.55	0.09	17.27	4.70
Householder turned 17	-0.84	0.22	-3.76	0.43
No. of adults increased	1.75	0.12	15.08	5.77
No. of adults reduced	-0.47	0.15	-3.05	0.62
Wave 1 household has divided by wave 2	-0.32	0.19	-1.67	0.73
Wave 2 household income - Wave 1 household income	0.06	0.01	5.62	1.06
No. of household cars	-0.61	0.04	-14.02	0.54
Household size: 1 person	-0.67	0.11	-6.24	0.51
Household size: 3 people	0.60	0.09	6.43	1.81
Household size: 4+ people [Ref: Household size: 2 people]	1.09	0.11	10.23	2.98
Cohabiting relationship present in household	0.01	0.08	0.11	1.01
Child present in household	-0.44	0.11	-4.03	0.64
Eldest householder 16-24	-0.03	0.16	-0.21	0.97
Eldest householder 25-29	0.01	0.12	0.07	1.01
Eldest householder 30-44	-0.10	0.07	-1.40	0.90
Eldest householder 60-74	-0.34	0.09	-3.74	0.71
Eldest householder 75+ [Ref: Eldest householder 45-59]	-0.96	0.16	-6.09	0.38
Child 0-2 present	-0.23	0.11	-2.19	0.79
Child 3-4 present	-0.21	0.11	-1.89	0.81
Child 5-11 present	-0.34	0.09	-3.67	0.71
Child 12-15 present	-0.28	0.10	-2.80	0.76
Offspring aged 16 present	-0.81	0.21	-3.90	0.44
Monthly household income (£1000)	0.08	0.01	6.33	1.08
Highest household qual: degree	0.20	0.11	1.84	1.22
Highest household qual: other higher	0.32	0.11	2.79	1.37
Highest household qual: A level	0.31	0.10	2.99	1.37
Highest household qual: GCSE [Ref: Other or no qualification]	0.19	0.11	1.76	1.21
Highest SEC: Management & professional	0.30	0.10	3.09	1.35
Highest SEC: Intermediate	0.36	0.11	3.20	1.43
Highest SEC: Small employers & own account	0.71	0.12	5.79	2.04
Highest SEC: Lower supervisory & technical	0.62	0.14	4.55	1.85
Highest SEC: Semi routine, routine & unemployed [Ref: No employment status]	0.25	0.10	2.51	1.28
Travel time to nearest employment centre by PT/walk (mins)	0.01	0.01	2.51	1.01
No. of emp centres in LSOA with 100+ jobs by PT/walk	-0.01	0.05	-0.23	0.99
Travel time to nearest town centre by PT/walk (mins)	0.00	0.00	-0.24	1.00
No. of foodstores in LSOA accessible by PT/walk	0.06	0.05	1.27	1.06
Overall Index of Multiple Deprivation	-0.01	0.00	-1.94	0.99
Living environment Index of Multiple Deprivation score	0.00	0.00	-1.36	1.00
MSOA population density (persons/HA)	-0.01	0.00	-4.59	0.99
LSOA proportion economically active	0.27	0.43	0.63	1.31
Ethnic minority boost sample household	0.13	0.09	1.46	1.14
Intercept	-2.51	0.47	-5.32	0.08

Notes: Grey shading indicates statistical significance

Source: Understanding Society, Waves 1 and 2, 2012, linked with neighbourhood indicators at LSOA level. Weighting not applied.

n=19,344 pseudo R<sup>2</sup>=0.1532

**TABLE 4 Model 2 – Decrease in household car ownership level (yes or no).**

	Coef	Std. Err.	z	Odds Ratio
Residential relocation: London/met to urban	-0.15	0.61	-0.24	0.86
Residential relocation: London/met to rural	1.01	0.80	1.26	2.74
Residential relocation: Urban to London/met	1.17	0.55	2.13	3.22
Residential relocation: Urban to rural	0.11	0.39	0.28	1.12
Residential relocation: Rural to London/met	1.61	0.71	2.28	5.01
Residential relocation: Rural to urban	0.97	0.35	2.75	2.63
Residential relocation: London/met to London/met	0.72	0.23	3.08	2.06
Residential relocation: Urban to urban	0.89	0.17	5.15	2.44
Residential relocation: Rural to rural	0.59	0.35	1.72	1.81
Remained within London/met	0.22	0.12	1.75	1.24
Remained within urban [Ref: remained within rural]	0.00	0.10	0.00	1.00
Householder gained partner	-0.67	0.27	-2.47	0.51
Householder gained partner & household gained 1+ adult	0.15	0.50	0.31	1.17
Householder lost partner	1.79	0.39	4.55	5.98
Householder lost a partner & household lost 1+ adult	-0.75	0.43	-1.74	0.47
Householder entered employment from non-employment	-0.13	0.11	-1.18	0.87
Householder lost employment (excl retirement)	0.61	0.12	4.91	1.85
Householder retired	0.46	0.19	2.40	1.59
Householder switched employer	0.00	0.10	-0.02	1.00
Householder had child	0.43	0.19	2.19	1.53
Householder had child & householder lost employment	-0.73	0.34	-2.16	0.48
Householder acquired driving licence	-0.46	0.19	-2.36	0.63
Householder turned 17	0.64	0.32	1.99	1.90
No. of adults increased	-0.64	0.21	-3.11	0.53
No. of adults reduced	1.88	0.12	15.48	6.58
Wave 1 household has divided by wave 2	0.82	0.15	5.59	2.26
Wave 2 household income - Wave 1 household income	-0.11	0.02	-7.03	0.90
No. of household cars	1.90	0.06	32.72	6.70
Household size: 1 person	0.11	0.12	0.86	1.11
Household size: 3 people	-0.23	0.10	-2.22	0.80
Household size: 4+ people [Ref: Household size: 2 people]	-0.35	0.13	-2.77	0.70
Cohabiting relationship present in household	-0.73	0.09	-7.69	0.48
Child present in household	0.07	0.12	0.61	1.08
Eldest householder 16-24	0.77	0.21	3.71	2.16
Eldest householder 25-29	0.23	0.16	1.41	1.25
Eldest householder 30-44	0.12	0.09	1.38	1.13
Eldest householder 60-74	-0.17	0.09	-1.78	0.85
Eldest householder 75+ [Ref: Eldest householder 45-59]	0.15	0.14	1.11	1.16
Child 0-2 present	0.28	0.12	2.31	1.32
Child 3-4 present	0.14	0.13	1.06	1.15
Child 5-11 present	0.13	0.11	1.18	1.14
Child 12-15 present	-0.06	0.12	-0.50	0.94
Offspring aged 16 present	0.12	0.28	0.44	1.13
Monthly household income (£1000)	-0.13	0.02	-7.69	0.88
Highest household qual: degree	-0.44	0.11	-3.96	0.64
Highest household qual: other higher	-0.44	0.12	-3.71	0.65
Highest household qual: A level	-0.40	0.11	-3.64	0.67
Highest household qual: GCSE [Ref: Other or no qualification]	-0.30	0.11	-2.61	0.74
Highest SEC: Management & professional	-0.29	0.11	-2.74	0.75
Highest SEC: Intermediate	-0.29	0.13	-2.30	0.75
Highest SEC: Small employers & own account	-0.49	0.14	-3.59	0.61
Highest SEC: Lower supervisory & technical	0.07	0.15	0.46	1.07
Highest SEC: Semi routine, routine & unemployed [Ref: No employment status]	-0.07	0.11	-0.63	0.93
Travel time to nearest employment centre by PT/walk (mins)	0.00	0.01	-0.16	1.00
No. of emp centres in LSOA with 100+ jobs by PT/walk	0.02	0.05	0.40	1.02
Travel time to nearest town centre by PT/walk (mins)	0.00	0.00	0.09	1.00
No. of foodstores in LSOA accessible by PT/walk	0.02	0.05	0.45	1.02
Overall Index of Multiple Deprivation	0.02	0.00	4.77	1.02
Living environment Index of Multiple Deprivation score	0.00	0.00	0.34	1.00
MSOA population density (persons/HA)	0.00	0.00	3.16	1.00
LSOA proportion economically active	0.41	0.50	0.81	1.50
Ethnic minority boost sample household	0.29	0.11	2.71	1.34
Intercept	-5.33	0.54	-9.86	0.00

Notes: Grey shading indicates statistical significance

Source: Understanding Society, Waves 1 and 2, 2012, linked with neighbourhood indicators at LSOA level. Weighting not applied.

n=14,862 pseudo R<sup>2</sup>=0.2826

## 7. CONCLUSIONS

The analyses presented in the paper offer further evidence (from a nationally representative sample) that travel behaviour changes are more likely to occur around the time of a life transition than when circumstances are stable. In particular, residential relocations, employment changes and changes in household structure are found to be triggers for both car ownership level changes and commute mode switches. It was further observed that different life events are more likely to occur at different life stages. The regression models provide tentative evidence of the relationship between life stage and car ownership level change as observed by Dargay and Vythoulkas (1999). In this respect, we acknowledge that different car ownership transitions (0 to 1 car and 1 to 0 car, 1 to 2 cars and 2 to 1 cars and so on) are likely to involve quite different decision processes and may occur at different life stages. In further research we are investigating models of each of these car ownership transitions separately. Subsequent to car ownership modelling, we will develop models of commute mode switching in a similar way. In these we will seek to recognise inter-relationships between car ownership and commuting and also have the potential to examine the influence of attitudes (which cannot be easily aggregated to the household level).

The conceptual framework presented in Figure 1 recognises the complex two way relationships between life events and travel behaviour. With two wave data, we have examined one aspect of this in confirming a strong association between life events and coincident behavioural changes. As longer history data becomes available with more waves, we will examine whether responses to life events are observable after a greater length of time than the concurrent year. Using duration models we will examine the stability of travel behaviour and whether longer durations in a behavioural state affect the likelihood of changing behaviour in response to a life event. Longer history data will also open up the possibility to examine longer event histories to understand more about cause and effect, i.e. whether behavioural changes lead or follow certain life events. We acknowledge that it remains a challenge to operationalize the hypothesised longitudinal relationships in quantitative modelling frameworks. An approach advocated by Mohktarian and Cao (2008) is the application of structural equation models to panel data to examine two way relationships that act over time (as employed by Scheiner and Holz-Rau (2013a)). This appears to be a method that is worthy of further application in the longitudinal domain. We would further advocate the use of complementary longitudinal qualitative methods to provide deeper insights into the mechanisms through which travel behaviours evolve over the full life course, in association with life events. Finally, the findings reported in this paper demonstrate that the data generated from the first waves of the UKHLS has provided new opportunities to improve understanding of the role of life transitions as drivers of travel behaviour change.

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