A framework of routine transitions in daily travel
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ABSTRACT
The occurrence of life events increases the likelihood of changes in travel behaviour and these are often discussed as windows of opportunity for interventions aimed at improving sustainable travel. Hence, theoretical knowledge of the process of change due to life events is important for enabling the development of interventions suited to these naturally-occurring situations. In this paper, the Framework of RoUtIne Transitions in daily travel (FRUIT) is presented, depicting the internal processes involved when one chapter of life, characterized by stability in daily travel, gives way to another. Building on theory relating to habit disruption and formation, and designed for the inclusion of existing models and concepts relating to deliberate decision-making, the framework points to two critical phases as focus areas. Using an empirical case, the applicability of FRUIT is illustrated, with the implications of the framework for future research and policy being outlined and discussed.

1. Introduction

‘Mobility biography’ is a field of research that addresses the dynamic relationship between how people live their lives and how their mobility is formed (Lanzendorf, 2003; Müggenburg et al., 2015). With its incorporated life course perspective, a large amount of research has focused on factors associated with both the stability of and changes in people’s travel behaviour, or their access to different travel modes (see, for instance, Beige & Axhausen, 2012; Prillwitz et al., 2007; Scheiner & Holz-Rau, 2013b). In its theoretical narrative, the mobility biography approach designates habits as the mechanism in the individual that explains travel pattern stability over longer periods of time (Lanzendorf, 2003; Rau & Scheiner, 2020). In simple terms, when their everyday setting is relatively stable, people tend to travel “as they usually do”, without giving other alternatives much thought. Elsewhere, researchers have argued that a behavioural change that replaces a harmful behaviour with a more preferable one will have a greater effect if the new behaviour becomes a habit and is thus more likely to persist (Verplanken & Whitmarsh, 2021; Whitmarsh et al., 2021). Hence, when searching for ways of encouraging sustainable travel alternatives, the mobility biography approach may offer some useful insights, with its expanded time perspective on everyday travel.

Using the mobility biography approach, major life events (e.g., changing jobs, having children or moving) are seen as times in a person’s life when everyday activities need to be reorganised, possibly entailing consequences for the individual’s mobility in general, and everyday travel in particular. When life events occur, current habits can be taken out of the equation and the individual may need to make new decisions about how daily travel should occur. These situations have been pointed out by many scholars (e.g., Bamberg.

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2006; Larouche et al., 2020; Whitmarsh et al., 2021) as particularly favourable when it comes to increasing the effectiveness of interventions aimed at guiding the individual towards more sustainable transport alternatives. Several previous studies have found that life events are associated with the increased likelihood of changes to mode choice and travel frequency (see for instance De Haas et al., 2018; Scheiner et al., 2016; Whittle et al., 2022):

However, to benefit from life events as regards increasing sustainable travel, an improved understanding of the change process is needed (Semenescu et al., 2020).

Since habit formation starts with a deliberate decision to carry out a certain behaviour, one which is later repeated and becomes habitual, deliberate decision-making is implicitly included in the mobility biography approach. The opportunity to use existing psychological theories and models of deliberate decision-making (e.g., the Theory of Planned Behaviour (Ajzen, 1991) or the Transtheoretical Model of Change (Prochaska and DiClemente, 1983)) in research using the mobility biography approach has been discussed by other researchers (McCarthy, Delbos, Currie, et al., 2021; Scheiner, 2018): However, no attempts have been made to explicitly integrate such models into the mobility biography approach. In this paper, we aim to develop a framework that facilitates the integration of existing concepts and models of deliberate decision-making into the theory underpinning the mobility biography approach. We do so by examining previous research and discussing the theoretical notions of the mobility biography approach upon which the framework is based. We also elaborate on the well-known psychological mechanisms that trigger change as additional elements of importance to the framework. Our work thus contributes towards the theoretical development of the mobility biography approach that has been called for (Chatterjee & Scheiner, 2015; Kroesen, 2020; Scheiner, 2018). In the long run, we envision our framework as a useful tool when the outcome of people’s transformed travel routines, in response to life events, is to be explained and studied in detail.

The mobility biography approach has struggled with a lack of stringency as regards how to define and operationalize some commonly-used terms within that field. In particular, this seems to be the case with the terms ‘life event’ and ‘key event’. For the purposes of theoretical development, we aim both to clarify here the distinction between events primarily belonging to the individual’s life course, known as ‘life events’, and events related to travel, known as ‘key events’, and to subsequently operationalize the terms in a distinct and meaningful way. In line with Müggenburg et al. (2015), we argue that the terms ‘life event’ and ‘key event’ can in some cases be used for the same specific event, albeit with this labelling indicating a difference in meaning. A ‘life event’ is an event which, from the individual’s perspective, is significant and unusual, taking place in that person’s private life or professional career but lacking a direct connection with travel. The term ‘key event’ is used for triggers of change in travel behaviour and shows that this event has affected, or caused a change in, the individual’s mobility. The term key event can also be applied to “external” events (e.g., interventions), or to events directly related to travel (e.g., the acquisition of a car) (Müggenburg et al., 2015). Accordingly, a ‘life event’ does not necessarily involve an impact on the individual’s mobility, or travel behaviour: However, when one and the same event is labelled both as a life event and a key event, the individual’s life course “comes together”, with the consequences of this for that person’s travel behaviour.

By predominantly focusing on the role of mechanisms internal to the individual, this paper raises a set of research questions with the aim of advancing knowledge of travel routine transitions. Specifically, we highlight three key domains in our proposed framework:

1. The determinants behind life events turning into key events.
2. Acknowledging the relationship between life events and concepts of deliberate decision-making.
3. The importance of habit formation during daily travel routine transitions.

The remainder of the paper is arranged as follows: In the next section, we review the literature regarding the association between life events and changes in daily travel behaviour, including conceptual models and previous theoretical work on the behavioural change process potentially ensuing from life events. In this vein, we continue with a theoretical discussion, presenting our proposed framework in Section 3. The method and results concerning an empirical case illustrating how the framework can be used, and the validity of its basic structure, are presented in Sections 4 and 5. In our concluding discussion, Section 6, we identify some future areas of research relating to the framework, we discuss relevance to policy and practice, and we end with general conclusions.

2. The association between life events and changes in daily travel

In the mobility biography approach, it is emphasized that a change taking place in one life-domain can also affect other life-domains (Lanzendorf, 2003). Research on different contextual changes in everyday life that are associated with specific life events, and their consequences for daily travel, has been the focus of several studies. One association was found between life events characterized by changes in personal finances and travel. Personal finances can be affected when people, for example, change job, change their employment status, take sick leave, or enter the labour market. An increase in income was generally associated with the increased likelyhood of purchasing a car (Dargay & Hanly, 2007; Prillwitz et al., 2006), in turn strongly being associated with increased car use (Simma & Axhausen, 2003). The reverse association was also observed, whereby a decrease in income brought the increased likelihood of car relinquishment, and thus a decrease in car use (Clark et al., 2015; Dargay, 2001).

Another association was found between life events characterized by changes in distances to important locations (e.g., workplaces, schools, shopping districts) and travel. Longer distances to work increased the likelihood of car use, while shorter distances increased the use of other travel modes (Clark et al., 2016). Furthermore, changed distances also affected people’s access to important places (Larouche et al., 2020). Similar results were also observed when home and workplace relocations were investigated in relation to moving away from, or into, more highly densely populated areas (Scheiner & Holz-Rau, 2013a; Zarabi & Lord, 2018). However,
researchers (Handy et al., 2005) have noted that the association between relocation and mode use is complex and difficult to investigate mainly due to self-selection inasmuch as individuals choose where to live and work. Also, the impact of the built environment on a new contextual situation, as well as psychological mechanisms (e.g., attitudes and environmental concerns), complicate the picture (Ramezani et al., 2021; Walker et al., 2014; Whittle et al., 2022).

A third association was found between life events characterized by changes in household composition and travel. Increasing the number of adults in the household (e.g., cohabitation or when children grow into adults) was shown to increase car use since more adults meant more car access (Clark et al., 2015; Dargay & Hanly, 2007). Life events such as having a child, however, have shown mixed results. When the household had a greater number of young children, car dependency tended to increase, while car use tended to decrease as children grew older and became more independent (Dargay & Hanly, 2007; Lanzendorf, 2010; McCarthy et al., 2017; McCarthy, Delbosc, Currie, et al., 2021).

From a theoretical point of view, the mobility biography approach emphasizes that experiencing life events can initiate a transition from one life stage to another (Janke et al., 2021). However, defining a life stage is somewhat difficult (Plyushteva & Schwanen, 2018; Zimmerman, 1982). From a life course perspective, life stages often span specific periods in life such as when children enter their teenage years or become young adults, when people enter the labour market or become parents, or when people retire (Clark et al., 2015; Scheiner & Rau, 2020). Although difficult to define, different life stages entail changes in social roles, in turn suggested as potentially changing the psychological needs of the individual (e.g., expectations and values) (Clark et al., 2015; Scheiner, 2018).

Previous models, with the aim of illustrating how life events trigger travel behaviour, have recognised deliberation rather than current travel behaviour as the central component of change (Chatterjee et al., 2013). This is in line with Verplanken et al. (2008) who argue that increased awareness of current travel decisions will occur when habitual behaviour is interrupted. Furthermore, Chatterjee et al. (2013) present two triggers activating the deliberative process, which can either act alone or be intertwined. One trigger is the life event itself and another is case-specific constraints and opportunities.

In their conceptual model, they also include three categories that mediate the outcome of the deliberation process. One such mediator is personal history, relating to previous experiences of the travel mode under consideration. Another mediator is intrinsic motivation, relating to personal motives such as exercise or convenience. The third mediator is existent facilitating conditions, e.g. the level of service or the provision of infrastructure.

Clark et al. (2016) added transportation stressors as an antecedent of the deliberation process. Transportation stressors are perceived aversive feelings towards the available travel alternatives. Such feelings can be evoked by contextual changes associated with specific life events causing a mismatch between mobility needs and current mobility solutions. Scheiner (2018) suggests that transportation stressors could also be decisive components of potential changes in travel behaviour, reasoning that a motivation to change can be insufficient if a prevailing behaviour does not cause aversive feelings.

Experiences of changing behaviour, both in terms of a direct experience but also as a solution to present needs and demands, may also be a mediating factor in similar deliberative processes occurring after the behaviour (Chatterjee et al., 2012). The outcome of this process can either result in a real “turning point”, meaning that the behavioural change endures, or it can result in a decrease in or the end of the new behaviour.

3. Theoretical development

3.1. From a life event to a new travel routine

We extend previous theoretical work with a further focus on internal psychological processes. The work that has been done so far on previous experiences, motives, and transportation stressors could be complemented with further knowledge of psychological mechanisms known to be important for travel habits and mode choice. Our unilateral focus should not, however, be interpreted as ignoring the importance of external factors (e.g. the existent facilitating conditions or the role of the built environment). Rather, it is an attempt to complement the large body of research predominantly focusing on external circumstances, and to facilitate the inclusion of internal factors in future research.

The mobility biography approach is based on the assumption that daily travel is habit-driven (Lanzendorf, 2003). The breaking of habits is thus an important part of the explanation as to why the likelihood of changed travel behaviour increases when life events occur (Müggenburg et al., 2015). Hence, we posit that the theory underpinning the mobility biography approach is strengthened when habit disruption and formation is applied in order to explain transitions between two periods of travel stability.

In relation to previous discussions about life events creating a “window of opportunity” (see for instance Janke & Handy, 2019; Larouche et al., 2020; Thronicker & Klinger, 2019), we emphasize that behavioural change need not to be the equivalent of a new daily travel routine. Instead, openness to change, and the act of changing behaviour, can be viewed as important stages along the route towards a daily travel routine transition.

In the mobility biography approach, the concept of the habit is used with an emphasis on its dimension of automatic and unconsidered decision-making in the context of everyday life. One definition describes habits as “…learned sequences of acts that have become automatic responses to specific cues, and are functional in achieving certain goals or end states” (Verplanken & Aarts, 1999, p. 104). To clarify, the element of goal-directedness with regard to habits is deliberate for the individual (what to do), while the sequence of acts for reaching this goal (how to do it) is an automatic response (Verplanken & Aarts, 1999).

‘Habit discontinuity’ is a term used to illustrate when the cues triggering an automatic decision are removed due to changes occurring under otherwise stable circumstances, changes which may be the result of a life event. In these situations, the decision is more likely to be determined by a deliberate process (Verplanken et al., 2008). In other words, the factors associated with deliberate
decision-making on the part of the individual can be decisive as regards whether or not a life event will turn into a key event (i.e., leading to behavioural change). Thus, factors relating to deliberate decision-making are crucial in the context of daily travel routine transitions. The association between life events and habit discontinuity has received some attention in research (see e.g., Klöckner, 2004; Walker et al., 2014), but research on the association between life events and deliberate decision-making is scarce (see Janke & Handy, 2019; McCarthy, Delbosc, Currie, et al., 2021 for two exceptions from qualitative research).

The formation of habits is a gradual process when the behaviour is repeated in a relatively stable context. As the strength of the habits increases, so too does the level of automaticity of the decision-making, and hence the level of deliberation declines (Verplanken et al., 1997). Thus, the important factors associated with deliberate decision-making is also present during this stage of a travel routine transition, particularly at the beginning of habit formation.

In summary, the life course in-between two different eras of daily travel pattern stability is characterized by the process of a daily travel routine transition. Since eras of stability are explained by habits, daily travel routine transitions will naturally be based on the implications of habits as well. In many cases, the starting point of such a period is the occurrence, or predicted occurrence, of a life event that might possibly turn into a key event. The endpoint of the period is when the strength of habit of the travel behaviours concerned has reached its maximum potential, and hence a new daily travel routine is established. This definition of a transformed daily travel routine is thus similar but not the same as a turning point, as it always refers to a maintained behavioural change (Chatterjee et al., 2012).

In the next section, as visualized in Fig. 1, we present our proposed Framework of RoUtIne Transitions in daily travel (FRUIT), which includes habits, psychological factors, behavioural changes, and their relationships. In this framework, we have included, for illustrative purposes, the concepts of attitude, subjective norm, perceived behavioural control (PBC) and intention, from the theory of planned behaviour (Ajzen, 1991). This exemplifies how a well-established psychological theory can be included in the framework. The point is, thus, that different concepts, or even entire psychological models, can be integrated into the framework depending on the purpose. In the remainder of this paper, we use the term ‘psychological factors’ as an overarching term for any psychological model or concept that is associated with deliberate decision-making.

3.2. The framework of RoUtIne transitions in daily travel (FRUIT)

As illustrated in Fig. 1, the model starts at left with the “life event (cluster)”. This label indicates that, within the model, the importance of life events is not primarily to do with type, sequences of several life events, or whether the process of change is triggered prior to or after the actual event has occurred. Instead, the perspective on life events is the function as a potential trigger, without any further specification. Hypothetically, a travel routine can change even though habits or psychological factors are not involved, as illustrated by the horizontal arrows at the top of the model. This is the case when an individual is forced to make a change due to, for instance, restrictions in the spatial context or due to health reasons that limit the number of travel alternatives. Involuntary changes are an underexplored area and not currently being prioritized in mobility biography research (Rau & Scheiner, 2020).

The first critical step towards a daily travel routine transition, as illustrated in Fig. 1, is whether the sum of the influence on habits and psychological factors induced by the life event will result in a decision to initiate and try out a different travel behaviour, thus turning the life event into a key event. This is referred to in Fig. 1 as the life event phase. The arrow between “Life event (cluster)” and the box labelled “habit” concerns the association of life-event-disrupting habits, that can reasonably be the effect of two conditions,
either through external and/or internal change, which is large enough to rule out the cues triggering the current habit (habit discontinuity), or through a non-preferable experience of the outcome of the prevailing habit, making the habitual behaviour unsuccessful within the changed context. Either way, this forces the individual to make a more deliberate decision. However, this is not enough for behavioural change to occur since the individual also needs to consider the potential and attractiveness of an alternative behaviour. The potential and attractiveness of the life-event-affecting factors of deliberate decision-making are expressed using the arrow between “Life event (cluster)” and “Psychological factors” (exemplified in FRUIT using the factors of the theory of planned behaviour). As mentioned in Section 1, there is an association between life events and the purchase/relinquishment of travel modes. In the mobility biography literature, this is viewed as a long-term decision, symbolized using the arrow between “psychological factors” and “mode access” (encircled). Most likely, such a decision would imply that the individual either starts or stops using the specific mode of transport, with the purchase/relinquishment of modes having been used, in research, as a proxy for behavioural change (Beige & Axhausen, 2012).

When a life event turns into a key event (behavioural change), the second critical step of the key event phase begins. The creation of a new daily travel routine is determined by whether or not the context and the changed behaviour persist long enough to form a viable habit. The arrow between “behavioural change” and “habit” indicates that the process of habit formation potentially starts as soon as the changed behaviour occurs. The arrow between “behavioural change” and “psychological factors” concerns the potential effect of the experience of performing the behaviour on the psychological factors (see e.g., De Vos & Singleton, 2020; McCarthy, Delbosc, Kroesen, et al., 2021 for the link between behaviour and attitude). Research by Walker et al. (2014) shows that a new travel behaviour can occur while an old habit still persists on a latent level, albeit at decreased strength. This is in line with other research showing that a newly-established behaviour is not the end of an individual’s vulnerability to influences, nor to the risk of reverting to old travel behaviour (Olsson et al., 2018). Accordingly, the boxes labelled “habit” in the model can include one or more habits, as well as their strength and/or goal orientation (e.g., habits for leisure travel versus commuting). The duration of a key event phase, on being transferred to a new travel routine, needs to be studied: However, since the outcome is habit formation, the phase will most likely fade away simultaneously with a decrease in the level of receptiveness to external influences. Previous research indicates that the time needed for a habit to reach maximum strength can vary substantially between individuals (Lally et al., 2010). Hence, during the formation of a new habit, behaviour is decreasingly under the control of psychological factors. This is why the model has arrows between both “habit” and “psychological factors” and “transformed daily travel routine”.

3.3. FRUIT applied to an empirical case for illustrative purposes

FRUIT can be used to analyze travel decisions during the life course and it proposes two different, but related, processes. The life event phase is separated from the key event phase by a behavioral change. An empirical case is used to illustrate the differences between people during different phases.

As our initial purpose, we investigate the applicability of FRUIT’s basic structure by means of making group comparisons between participants undergoing a stable life period (i.e., who have not recently experienced any life events) and participants undergoing the life event phase and the key event phase, respectively. Since the experience of behavioral change has a key role in the framework, we hypothesize that the degree of change in travel routines is important, and thus the participants during the key event phase were divided up into two groups: (1) those who made minor changes and (2) those who made major ones to their travel routines. Hence, the reported life events that turned into key events (i.e., found to be associated with behavioral change) are presented in further detail.

As our second purpose, we illustrate how FRUIT can be used as a tool for guiding how to operationalize research questions involving psychological factors in routine transitions. We do this by analyzing a number of different psychological factors associated with deliberate decision-making (in FRUIT, referred to as psychological factors), all related to car-use reduction.

Although not to be considered as the main purpose, and with limitations as regards drawing causal conclusions using a cross-sectional design, the case gives an indication of how life events relate to the psychological factors associated with sustainable travel.

4. Method

4.1. Sample and procedure

A web-based survey was conducted in October 2021, administered by a survey institute. A total of 1,041 participants completed the questionnaire (the brief of this institute was to provide a minimum of 1,000 completed surveys). Sampling followed a standard procedure used by the institute whereby panellists were randomly selected, but with the restriction of providing a representative sample as regards age (above 18 years), gender, and residence (Stockholm and Karlstad). As panellists, they received points for their participation in the surveys, points that they could exchange for gifts. In the present study, the participants’ ages ranged from 18 to 88 (M = 48.2 SD 18.3), with 51% being women and all being residents of the Swedish cities of Stockholm (n = 537) and Karlstad (n = 504), cities with populations of 2 million and 100,000 respectively. The questionnaire took approximately 15 min to complete. For the overall aim of this study, we analyzed questions related to sociodemographic information, life events, changes in daily travel routines, motivation, attitudes, norms, and perceived behavioural control (PBC).
4.2. Measurements

4.2.1. Life events and changes in daily travel routines

To gather information about life events, the respondents were asked to state “yes” or “no” with regard to experiencing any of the 11 listed life events (considered generally important, see e.g., Klöckner, 2004; van der Waerden et al., 2003) over the past year: i.e. moving home, changing jobs, being on sick leave, having a child, starting university studies, moving in with a partner, separating, children moving away from home, changes in financial resources, the death of a partner, or some other life event. The last alternative was an open-ended question where the participant was able to add a life event not included in the list. For each life event the participant had experienced over the past year, a follow-up question on how that specific life event had affected travel routines was to be answered. Changes in travel routines were rated on a seven-point Likert scale, ranging from “not at all” to “a lot”.

4.2.2. Attitudes

Two items were used to measure attitudes. One of these addressed the cognitive/instrumental dimension of attitudes while the other addressed the affective dimension (Ajzen, 2001). Each item was formulated as a statement: “Choosing another mode than by car would work…” (instrumental) and “Choosing another mode than by car would feel…” (affective). The participants were asked to indicate the extent to which they agreed with each statement on a seven-point scale, ranging from (1) “Very bad” to (7) “Very good”.

4.2.3. Norms

Three items measured norms; i.e. two items addressed social norms and one item moral norms. The social norms captured injunctive and descriptive norms, whereby the former can be described as the perceived support given by significant others as regards target behaviours, while the latter is the perception of how significant others act themselves (Smith et al., 2012). The following statements were used: “Most of the people important to me think it’s good that I choose other modes than by car…” (injunctive) and “Most of the people important to me themselves choose other modes than by car…” (descriptive). Moral norms, which has been shown to be associated with social norms and behavioural intentions (Abrahamse et al., 2009; Olsson et al., 2018), was captured using the statement: “I often feel an obligation to use the car to the least extent possible...”. All the items were measured on a seven-point scale, ranging from (1) “Do not agree at all” to (7) “Fully agree”.

4.2.4. Perceived behavioural control (PBC)

Perceived behavioural control is considered important when it comes to explaining intentions regarding a behaviour, as well as the behaviour itself. It can work as a proxy for the actual control of the behaviour, but it can also mirror perceived constraints in the individual (Ajzen, 1991). One statement was used to capture PBC, i.e. “For me, it would be easy to choose something other than by car…”, and measured on a scale ranging between (1) “Do not agree at all” and (7) “Fully agree”.

4.2.5. Motivation

In stage-based models, motivation towards behavioural change is viewed as hierarchically-ordered stages. Building upon work by Bamberg (2013) and Prochaska and DiClemente (1983), and previously used in Olsson et al. (2018), we measured motivation using one question consisting of six different statements, corresponding to varying degrees of motivation to change. The participants were asked to select the statement they felt best described their view on car use. From the lowest to the highest level of motivation, the six target behaviours, while the latter is the perception of how significant others act themselves (Smith et al., 2012). The following in junctive and descriptive norms, whereby the former can be described as the perceived support given by significant others as regards

5. Results

5.1. Data preparation

Following a review of the answers to the open-ended question (n = 40), no additional life events were added due to the high diversity of answers, making it inappropriate to create an additional life event category. One life event (changing financial resources) was removed from further analysis due to the vague description it had been given in the questionnaire. As the question did not indicate the magnitude of the change, the participants may also have included very minor changes, e.g. yearly salary increases, which we considered not to reach our definition of life events. Thus, the validity of this item was considered inadequate for further analysis. The life event “widowhood” was only confirmed by three participants. It was thus deemed insufficient for comparison with other life events, and was subsequently removed from further analysis.

In Section 4.2, the frequency of reported life events and the associated changes in travel routines are reported on the basis of the

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1 However, we acknowledge that, for some individuals, changes in their financial resources may be an important life event that leads to a key event.
entire sample. For further analysis including group comparisons, the participants who reported not using a car (Statement 6 of the stage-based model) were removed from further analysis due to the fact that they had not answered any questions measuring attitudes, norms and PBC. These questions presupposed a reduction in car use and were thus irrelevant to participants not using a car.

The remaining 785 participants were allocated to four groups based on their assumed position during the routine transition process. The first group included those who had not reported any life events. The participants in this group were considered to be in a stable life period, labelled “No life event group” (n = 401). The participants reporting one or several life events, but no change in travel routines, were considered to be in the life event phase labelled “Life event group” (n = 93). The participants who reported changes due to life events were considered to be in the key event phase. Since the magnitude of change was hypothesised as important, this group were split by the median on the basis of the highest reported change for any life event. Thus, the participants who reported 2–5 on the seven-point scale measuring the changes in travel routines associated with a life event were allocated to the “Minor key event group” (n = 142), while those who reported 6–7 were allocated to the “Major key event group” (n = 149).

5.2. Descriptive

The nine life events used in the analysis are illustrated in Fig. 2. As can be seen, getting a new job, moving away from home, and starting university studies are the three most common life events reported on in this study.

Of the total sample of 1,041 participants, 517 (49.7 %) reported experiencing one or more life events over the past year. In this group, 269 (52.0 %) reported experiencing one life event, while 149 (28.8 %) reported experiencing two life events and 99 (19.1 %) reported experiencing more than two life events. Thus, it is quite common to report experiences of one or more life events in tandem. It was more common for the younger participants (18–50) to report one or more life events, among both women (χ² = 184.7, df = 12, p < 0.001) and men (χ² = 161.1, df = 12, p < 0.001).

Fig. 3 illustrates how life events are associated with a great variety of changes in daily travel. The stacked bar charts show the degree to which a specific life event has affected the participants’ daily travel routines. The responses used a seven-point scale, ranging from (1) ‘Not at all’ to (7) ‘A lot’. Several participants reported (1) that they did not consider the life event to be associated with any changes in their daily travel routines. The life event associated with the highest proportion of participants reporting no change in their travel routines was when a child moved away from home (48 %). On the contrary, childbirth was the life event with the lowest proportion of participants reporting no change in their travel routines (18 %). An important observation here is that, although the majority report changes in their daily travel routines due to the life events they had experienced, there is still a considerable proportion reporting no changes across all the life events.

As some life events may come in tandem, the bar at the right end of Fig. 3 illustrates a general change in daily travel routine regardless of the number or type of life events reported. For each participant, the highest score (on the 1–7 scale) of changed travel routines, for any life event experienced, was used as the outcome variable. For some, the outcome was thus based on one life event, while for others, it may have been based on two or more life events. As can be seen, the same pattern is observed, with 24 % reporting no change in their daily travel routines. It is concluded that life events only turn into key events for some people, but not for all, and this holds true for any of the life events, or combinations thereof.

5.3. Analysis and group comparisons

The type of life event experienced is not a determinant of whether the participants are undergoing a life event phase or a key event.
This section focuses on how the basic structure of FRUIT can be applicable to the psychological factors associated with sustainable travel. It is an attempt to show the potential value of the framework by contrasting psychological states for people with behavioural change responses to life events. The different psychological factors to car use reduction are useful to know to understand and potentially influence routine transitions.

Table 1
Summary of results from the one-way ANOVAs.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Groups</th>
<th>Mean (SD)</th>
<th>$F$ (df)</th>
<th>Effect size ($\omega^2$)</th>
<th>p-value</th>
<th>Mean differences(^1) (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motivation</td>
<td>No life event group</td>
<td>3.29 (1.64)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>3.33 (1.68)</td>
<td>2.18</td>
<td>0.004</td>
<td>0.091</td>
<td>-0.350 (0.097)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>3.54 (1.51)</td>
<td>(3, 276)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major key event group</td>
<td>3.64 (1.55)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>No life event group</td>
<td>3.54 (1.89)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude - instrumental</td>
<td>No life event group</td>
<td>3.94 (1.96)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>3.72 (2.11)</td>
<td>5.50</td>
<td>0.016</td>
<td>0.001</td>
<td>-0.698 (&lt;0.001)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>4.24 (1.84)</td>
<td>(3, 270)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major key event group</td>
<td>3.97 (1.81)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude - affective</td>
<td>No life event group</td>
<td>4.15 (1.99)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>4.48 (1.99)</td>
<td>3.48</td>
<td>0.009</td>
<td>0.016</td>
<td>-0.536 (0.016)</td>
</tr>
<tr>
<td>Norm – personal</td>
<td>No life event group</td>
<td>3.54 (1.76)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>3.52 (2.27)</td>
<td>3.28</td>
<td>0.010</td>
<td>0.022</td>
<td>-0.630 (0.010)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>4.03 (2.15)</td>
<td>(3, 268)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norm – descriptive</td>
<td>No life event group</td>
<td>2.99 (1.70)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>2.29 (1.59)</td>
<td>4.30</td>
<td>0.015</td>
<td>0.006</td>
<td>-0.475 (0.015)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>2.66 (1.51)</td>
<td>(3, 267)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Norm – injunctive</td>
<td>No life event group</td>
<td>2.70 (1.66)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>2.76 (1.96)</td>
<td>4.50</td>
<td>0.014</td>
<td>0.004</td>
<td>-0.532 (0.017)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>3.17 (1.79)</td>
<td>(3, 264)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PBC</td>
<td>No life event group</td>
<td>3.03 (1.80)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Life event group</td>
<td>3.30 (2.18)</td>
<td>6.98</td>
<td>0.022</td>
<td>&lt;0.001</td>
<td>-0.755 (&lt;0.001)</td>
</tr>
<tr>
<td></td>
<td>Minor key event group</td>
<td>3.57 (1.97)</td>
<td>(3, 264)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Major key event group</td>
<td>3.79 (1.93)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

\(^1\) Games-Howell post-hoc test. Mean differences and p-values concern the comparison between the No life event and Major key event groups.
A series of one-way ANOVAs were conducted with the four groups (No life event, Life event, Minor key event, Major key event) as independent variables, and with motivation, attitudes, norms, and PBC as dependent variables. The results are reported in Table 1, alongside the means and standard deviations for each group. Due to unequal sample sizes across the groups, and because the assumption regarding the homogeneity of variance was not met for all the included variables, the robust Welch’s F (Tomarken & Serlin, 1986) is reported. For the same reason, the Games-Howell test was applied to post-hoc pairwise comparisons (Fields, 2020). Effect sizes are reported in omega-square ($\omega^2$) where 0.01, 0.06, and 0.14 are respectively considered small, medium, and large effect sizes (Kirk, 1996).

The ANOVAs showed significant results ($p < .05$) for all the outcome variables, except for motivation, which was observed as marginally significant ($p = .09$). Post-hoc tests showed that the significant difference was between the “No life event group” and the “Major key event group” (for mean difference and p-values, see Table 1). Additionally, significant differences were observed between the “Major key event group” and the “Life event group” in descriptive norms (mean difference = 0.703, $p = .007$), and between the “No life event group” and the “Minor key event group” in injunctive norms (mean difference = 0.466, $p = .035$) and PBC (mean difference = 0.540, $p = .023$). Although the effect sizes were small, it was observed that the participants who had recently made substantial changes in their travel routines, due to life events, had reported more positive attitudes, stronger norms, and higher levels of perceived behavioural control as regards car-use reduction compared to participants who had not reported any life events.

Stronger injunctive norms and higher levels of PBC were also observed among the participants who made small changes in their travel routines, due to life events, compared to those not recently experiencing a life event. One significant difference was observed between the participants undergoing the life event and key event phases, whereby the participants recently making major changes in their travel routines had reported stronger descriptive norms compared to the participants undergoing the life event phase.

### 6. Discussion

When life changes, our way of travelling may change with it. Framework of RoUtline Transitions in daily travel (FRUIT) brings to the mobility biography approach a theoretical understanding of the internal processes involved when one prolonged daily travel pattern gives way to another. The framework uses the terms ‘life event’, with the emphasis on the potential of this to trigger change, and ‘key event’ to show whether the life event has had an impact on travel behaviour or not. This operationalisation responds to calls for clarity in how the terms are used and defined in research (Müggenburg et al., 2015).

FRUIT offers a slightly new perspective, pointing out the fundamental components of interest, and how these relate on a general level during the two phases. Our illustrative case has investigated the basic structure of FRUIT, and the findings support its applicability. With outcome variables relating to car-use reduction, significant differences in attitudes, norms, and perceived behavioural control were found between those undergoing a stable life period and the participants reporting substantial changes in their travel routines due to life events. Additionally, significant differences in descriptive norms were also found between the participants undergoing the life event phase and those reporting substantial changes in their travel routines. Those reporting minor changes in their travel routines, due to life events, differed significantly from those undergoing a stable life period regarding injunctive norms and perceived behavioural control.

The development of FRUIT urges future research to further investigate the components and phases constituting the internal processes of daily travel routine transitions. We recommend that our proposed framework be used with a range of psychological models and concepts to explore how the different factors associated with deliberate decision-making function during these parts of the life course. Previous research on habits predicts a somewhat general principle regarding how habits are affected during the two phases of a travel routine transition. The increased likelihood of habits being weakened is expected during the life event phase, while a gradual strengthening of the habits of the changed behaviour is expected during the key event phase. However, the functioning of the psychological factors during the two phases is less clear. One question for future research would be whether or not the changeability of any psychological factors is affected, in any direction, during travel routine transitions. This issue is of relevance to study in relation to different life events and different external contexts.

As shown in our findings, a substantial proportion of the individuals experiencing life events do not change their travel behaviours. The issue of how the internal factors associated with individuals undergoing the life event phase differ from those undergoing the key event phase needs to be studied in further detail, and using other concepts than those reported on in the present study. In our empirical case, a difference between the participants during the two phases was only found for the descriptive norms. Future investigations will hopefully provide some insights into potential target groups for interventions and possible policy implications. As an example, we assume that individuals undergoing the life event phase have a significantly higher level of motivation to stay with their current mode of travel, compared to those undergoing the key event phase. This kind of result would indicate that it could be more effective for transportation agencies to target their offers at those who have recently started using public transport than at those who have recently relocated to a region.

It is important to note that, based on our findings, it is not possible to truly know how many people are still undergoing the key event phase or how many of those changing their behaviour have already established a new daily travel routine. Thus, it is highly relevant to investigate for how long a key event phase is ongoing, by means of measuring habit strength in relation to the time when the behavioural change occurred. Having some idea of the length of the key event phase is crucial when it comes to gaining any practical use from the knowledge relating to this phase during the process of travel routine transition.

Another concern relating to the key event phase is how common it is for individuals to change their travel behaviour while reverting, at some point, to old travel behaviour patterns. For policymakers, such knowledge could be useful when endeavouring to maintain sustainable travel and counteract habit formation with regard to car use. Likewise, it is also possible that purchasing a travel...
mode prior to travel behaviour change decreases the likelihood of reverting during the key event phase since a long-term mobility decision may indicate a high level of motivation to use that particular mode. This is also an issue for future research to explore.

Reflecting on the empirical data, the answers given by those reporting changes in their travel routines do not tell us what kind of changes were made. It could be hypothesized that those who made substantial changes in their travel routines are less likely to revert to previous travel behaviour than those reporting minor changes. If the size of the change reflects, to some degree, the frequency of use of a new travel mode, then the individuals making substantial changes in their travel routines should reach maximum habit strength faster than those making minor changes. Hence, they will undergo a shorter key event phase during which habit formation can be impeded. Additionally, it is also thinkable that the size of the behaviour change correlates with the extent to which the external circumstances have changed. If so, individuals making minor changes will be more likely to have the same external preconditions for travelling that they did before a specific life event occurred. We encourage future research to investigate the relevance of the size of change in travel behaviour, as well as the implications this might have for the transitioning of daily travel routines.

Finally, in our sample, younger respondents were overrepresented among those reporting having experienced one or more life events. This is in line with previous findings (Beige & Axhausen, 2012) and may indicate that life events generally occur at a higher frequency early on in life. However, it may also reflect the fact that the types of life events asked about in the survey more commonly occur in young individuals. The inclusion of other types of life events may have provided a different result.

7. Conclusions

This paper highlights the internal processes of daily travel routine transitions, contributing theoretical development to the mobility biography approach. Suggestions for future research are outlined in order to provide explanations as to how the outcomes of routine transitions are affected by the internal processes of individuals. Based on a new framework, FRUIT, the change process is divided up into two phases, i.e., the life event and key event phases, and these are pointed out as focus areas. An increased understanding of the significance of internal factors, and how these may be affected by life events, is considered important to the design of any future interventions and strategies aimed at improving sustainable travel.

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CRediT authorship contribution statement

Henrik Johannsson Rehn: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization. Lars E. Olsson: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition, Supervision. Margareta Friman: Conceptualization, Methodology, Formal analysis, Writing – original draft, Writing – review & editing, Visualization, Project administration, Funding acquisition, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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References


