



Department
for Transport

Moments of Change

How to enhance the effectiveness of
behavioural interventions in travel

March 2025

Department for Transport
Great Minster House
33 Horseferry Road
London
SW1P 4DR



© Crown copyright 2025

This publication is licensed under the terms of the Open Government Licence v3.0 except where otherwise stated. To view this licence, visit www.nationalarchives.gov.uk/doc/opengovernment-licence/version/3/ or contact, The National Archives at www.nationalarchives.gov.uk/contact-us.

Where we have identified any third party copyright information you will need to obtain permission from the copyright holders concerned.

This publication is also available on our website at www.gov.uk/government/organisations/department-for-transport

Any enquiries regarding this publication should be sent to us at www.gov.uk/government/organisations/department-for-transport

Contents

Contents	3
Glossary	5
Executive summary	6
Background and research objectives	6
Characteristics of moments of change that influence the planning, resourcing and design of interventions	7
Why behaviour is more easily influenced at moments of change	7
Conclusions	8
Introduction	9
Background & research objectives	9
Methods	9
Limitations	11
Understanding moments of change	12
A short definition of moments of change	12
Examples of moments of change	13
How moments of change facilitate changes in travel behaviour	13
An expanded definition of moments of change	18
Characteristics of moments of change that most influence the planning, resourcing and design of behaviour change interventions	24
Case study 1: Starting a degree course – a moment of change concentrated in time and place	26
Case study 2: Job relocation - an example of an involuntary moment of change	27
Case study 3: Moving home – a moment of change that can be predicted by practitioners	28
Case study 4: Learning to drive – an extended moment of change	29
Case study 5: Transport disruption - an example of when changes in Opportunities or Capabilities are transient	30
Conclusion	31

References	34
Appendix A: Literature review method	40
Appendix B: qualitative research method	41
Sampling and recruitment	41
Data collection	42

Glossary

Capability: an individual's psychological and physical capacity to engage in the behaviour in question, which includes having the necessary knowledge and skills. To distinguish this definition from the way 'capability' is used colloquially, we capitalise it in this report – Capability.

COM-B: a behavioural model that points to Capability, Opportunity and Motivation as key determinants of behaviour

Opportunity: the contextual factors that lie outside an individual's direct locus of control that make the behaviour possible or prompt it, such as the physical and social environment. To distinguish this definition from the way 'opportunity' is used colloquially, we capitalise it in this report – i.e. 'Opportunity'.

Moment of change: an event that, by affecting capability, opportunity and motivation (in any combination) makes it more likely people will change their behaviour.

Motivation: the brain processes that energise and direct behaviour, including goals and conscious decision-making but also non-conscious factors such as cognitive biases, emotions and habit. To distinguish this definition from the way 'motivation' is used colloquially, we capitalise it in this report – i.e. 'Motivation'.

Period of flux: the period in which a moment of change is most likely to prompt changes to behaviour.

Executive summary

Background and research objectives

This report draws together existing theory on how behaviour is affected by moments of change in people's lives. It provides a framework for practitioners who are designing and implementing interventions intended to promote sustainable travel behaviours. The report was commissioned under the previous, Conservative, government.

Moments of change are periods of flux when people are more likely than at other times to change their behaviours. In the context of travel, such moments include when people move home or when they become aware of the opening of a new travel facility. At such times, people are more likely to change the frequency with which they travel, how they travel, when they travel and to where they travel.

Understanding the opportunities presented by moments of change can give the transport sector opportunities to enhance the effectiveness of interventions that are designed to improve transport for the user and reduce environmental impact. For example, by aligning these interventions with moments of change can sometimes increase their effectiveness at promoting sustainable travel and active forms of travel.

In August 2023, DfT commissioned the Behavioural Insights Team (BIT) and TRL (formerly the Transport Research Laboratory) to improve its understanding of moments of change and examine implications for practitioners who develop transport policies, interventions and projects.

The research comprised a review of the literature on moments of change and research with practitioners. The literature review covered a variety of sectors, including transport, sustainable consumption, energy, food and health. The research with practitioners comprised group discussions and interviews with 43 participants from 22 organisations – including local authorities, transport operators and DfT.

A separate report by DfT gives an overview of research into the benefits of timing travel behaviour change interventions to coincide with moments of change.

Characteristics of moments of change that influence the planning, resourcing and design of interventions

Based on papers identified in the literature (Thompson et al 2011; Nash et al 2020) and subsequent discussions between the researchers and the DfT Behavioural Science team, five characteristics of a moment of change are taken as particularly relevant to transport practitioners:

1. the geographical concentration of the people experiencing the changes
2. the longevity of the changes
3. whether people voluntarily submit themselves to the changes
4. the predictability of the moment of change
5. how rapidly the changes evolve

Each of these characteristics falls on a spectrum, and each moment of change sits somewhere on each of these spectrums. For example, the extent to which workplace relocation is voluntary will depend on the degree to which it is the result of personal choice to move jobs or a decision by an employer to relocate a post. The position of a moment of change on these spectrums can be important for decisions on the design and implementation of interventions.

Why behaviour is easier to change at moments of change

The most important reason why behaviour is easier to change during moments of change than at other times is because of temporary changes in motivation. When people become aware of changes to their capability or opportunity that occur during a moment of change, this can, for a while, affect their motivation to change the behaviours these apply to. (See West & Michie, 2020; Michie et al., 2011.) Moments of change can also impact on motivation directly.

Capability includes knowledge, skills and abilities. Some moments of change affect people's knowledge of the consequences of different travel behaviours. For instance, a major flooding event and associated news coverage might educate people about climate change and the importance of making sustainable choices. Moments of change can also influence people's physical ability to travel by a particular mode – for example, becoming injured or the development of infirmity can reduce the ability to drive.

Opportunity refers to the external environment that shapes choices. Examples of moments of change that affect Opportunity include the opening of new travel facilities. They also include changes to the social environment: for example, when the COVID-19 pandemic prompted changes in the social acceptability of working at home.

Motivation concerns conscious goal setting and decision-making, emotions and habits. The sense of flux induced by changes to goals and emotions produces higher than usual motivation to change behaviour. For example, when people become parents for the first

time, their values can sometimes align more closely with environmental sustainability, and they might set themselves the goal of travelling more actively. Although these values and goals might last for years, it is in the period of their initial emergence that they have the greatest influence on behavioural motivation. Similarly, habits that become unsustainable during moments of change present an opportunity for the development of new habitual behaviours.

Conclusions

Whether a moment of change in the travel environment has a short- or long-term impact on people's Capability, Opportunity or Motivation to travel differently, the period of flux is an opportune time for behaviour change because it is often associated by increased Motivation to change behaviour. Hence, those seeking to encourage certain behaviours of the travelling public may sometimes benefit from focussing interventions on these periods and aligning the design of these interventions with the characteristics of the relevant moment of change.

This report can inform the practice of those wishing to increase the effectiveness of travel interventions by, when appropriate, aligning them with periods of flux in people's lives. To do so, it draws together existing theory, and synthesises insights gathered in research with transport practitioners. It provides a framework for practitioners to use when considering the design and implementation of interventions intended to promote sustainable travel behaviours.

The report concludes that, in some circumstances, the effectiveness of travel interventions can be enhanced by timing them to coincide with the periods of flux generated when moments of change affect people's travel Opportunity, Capability or Motivation.

Whether it is practicable to ensure that interventions coincide with this period of flux will depend on practitioners' ability to prepare and deliver interventions in a timely and targeted fashion; this, in turn, will be influenced by the geographical concentration of the people experiencing the moment of change and also its predictability and how rapidly it evolves. How beneficial it is to time interventions in this way will depend on the duration of the changes in Opportunity and Capability, and on whether the degree of voluntarism in the change renders people receptive to external intervention.

Introduction

Background & research objectives

The Behavioural Insights Team (BIT) and TRL were commissioned by the Department for Transport (DfT) to improve their understanding of moments of change and examine the implications for practitioners who develop transport policies, interventions and projects.

Some literature suggests that the period of flux instigated by a moment of change (e.g. moving home or the opening of new travel facilities) can prompt people to change their behaviour – including how, when and where they travel (e.g. Kirkman, 2019; Ralph & Brown, 2019; Schäfer et al., 2012 on moving home). The alignment of interventions with moments of change can sometimes increase their effectiveness at enabling people to travel more sustainably and adopt other positive travel behaviours, such as driving more safely.

By timing a behaviour change intervention to coincide with a moment of change, you can increase its effectiveness.

Currently, the literature on moments of change is underdeveloped, both in the transport sector and more widely. Studies that look at how moments of change affect behaviour tend to focus on a limited range of moments of change. For example, previous research commissioned by DfT on this topic focused on a single moment of change: the end of the COVID-19 lockdown.¹

Methods

This research comprised three stages. These are described below and in Appendices A and B.

Stage 1: review of the literature on moments of change

¹ <https://www.gov.uk/government/publications/increasing-uptake-of-cycling-following-covid-19-travel-disruption>

A narrative literature review² sought to answer the following questions:

- what is a moment of change?
- how can practitioners distinguish between types of moments of change in a way that helps them ascertain the design of effective behavioural interventions?
- why is it more likely that people will change their behaviours during a moment of change than at other times? What behavioural mechanisms make it more likely?

These questions were addressed with reference to the literature on moments of change in general. The review was conducted in August 2023.

Stage 2: group discussions and interviews, primarily with stakeholders involved in developing transport policies and communications

These online discussions and interviews took place between September and November 2023, with group discussions lasting approximately 90 minutes each and interviews 30 to 60 minutes. The purpose of this stage was to learn which findings from the literature review would be most useful to transport practitioners and how best to communicate these findings.

TRL recruited participants from central government and arm's length bodies, sub-national transport bodies, transport authorities, local councils, transport operators and academia. In total, 43 individuals from 22 organisations participated in this research.

During four group discussions, TRL facilitators presented participants with a series of discussion prompts and activities to stimulate conversation on the following topics: familiarity with the concept of moments of change, the relevance of the concept to their work, examples of interventions implemented at moments of change, and potential barriers to supporting people at moments of change.

A fifth discussion took place with two academics with expertise on moments of change. During this discussion, the academic experts offered their insights on the emerging findings of the project.

In addition, TRL conducted four interviews to gather in-depth insights from those who could either not attend the group discussions or who TRL identified would be useful to have a more detailed conversation with based on their contributions in the group discussions. These interviews used a similar topic guide to the group discussions but allowed for more detailed discussion.

A detailed description of the methods for the qualitative research is in Appendix B.

Stage 3: synthesis and reporting

² A narrative review seeks to identify studies on the topic of interest but is not systematic and does not follow a specific protocol.

Insights from the literature review, group discussions and interviews were analysed using framework analysis and thematic analysis.

Limitations

This research synthesised existing literature and the views of transport practitioners. The literature uses multiple terms to describe what this report calls a 'moment of change', so it was difficult to identify relevant research. In addition, there was no existing synthesis of the impacts of moments of change on the effectiveness of behavioural travel interventions. To address these limitations, in 2024 DfT conducted a Rapid Evidence Assessment (REA) of English language published academic evaluations of behavioural travel interventions that had been implemented at moments of change.

Participation in the online interviews and discussions was voluntary. It is therefore likely that participants had a greater pre-existing interest in, or understanding of, the topic than the average stakeholder. Furthermore, invitations were sent to a list of people nominated by TRL and DfT, and not to all members of the population of interest. The research reflects the opinions of individuals and not of their organisations. No primary research was conducted to explore experiences of moments of change among members of the public.

Understanding moments of change

This section comprises:

- a short definition of ‘moments of change’
- examples of moments of change
- an explanation of how moments of change facilitate travel behaviour change
- an expanded definition of ‘moments of change’
- the characteristics of moments of change that are most important for the planning, resourcing and design of behaviour change interventions

A short definition of moments of change

The evidence reviews and qualitative research revealed that no standard definition or terminology is used to describe moments of change. In the literature, similar concepts to moments of change are referred to using a range of terms – i.e. ‘life events’ (Ben Clark et al., 2014; Chatterjee et al., 2013; Klein & Smart, 2019; Olde Kalter et al., 2021; O’Loughlin et al., 2020; Whittle et al., 2022), ‘key events’, ‘habit discontinuities’, ‘transformative moments’, ‘teachable moments’, ‘turning points’, ‘context change’, and ‘disruptions’ (Beige & Axhausen, 2012; Hards, 2012; Kent et al., 2017; Lanzendorf, 2010; Marsden & Docherty, 2013; Scheiner, 2014; Verplanken et al., 2008; Verplanken & Wood, 2006). In the transport-related literature, terms such as ‘mobility trajectories’ and ‘mobility milestones’ are used (Laura McCarthy et al., 2019; Rau & Manton, 2016). In the group discussions and interviews, some participants were familiar with the concept of moments of change but, like in the literature, also used various other terms. Participants said that, to ensure that it is accessible and relatable to all, the term used should not be too technical or formal. Our decision to use the term ‘moments of change’ was influenced by the fact that participants agreed that this term met these criteria.

The term ‘moment of change’ refers to the period in which there is flux in the Opportunities, Capabilities and/or Motivations pertaining to a particular behaviour. This period covers the time during which a change is anticipated (when relevant); the time when the change is experienced, and the time during which the change is assimilated into

longer-term perceptions and practices (see Figure 1). In the case of a home move, for example, these three stages could be: a decision-making and planning stage; the move itself, and the settling-in stage (see Figure 2). In the case of extreme weather, these stages would be characterised differently – for example: the period in which someone is expecting severe weather; the weather event itself, and the period after the weather event when memories of it are still vivid.

‘Moment of change’: period in which events in society or a person’s life create a period flux in their ability to change their behaviour; the opportunity for them to change their behaviour, or their motivation to change their behaviour.

Examples of moments of change

This research identified the following moments of change as potentially increasing the propensity to change travel behaviours: residential relocation; workplace relocation; starting a new job; starting at a new educational institution; becoming a parent; personal injury, illness or loss of mobility; change in eligibility for a vehicle licence or concessionary travel pass; retiring; retiring from driving (e.g. for health reasons); road closures; transport strikes; extreme weather events; fuel shortages; supply chain issues (e.g. lithium batteries); pandemics; vehicle damage or breakdown; cost of living crises; new work location policy; seasonal changes; gaining a provisional driving license; purchasing a vehicle; introduction of new transport policies (e.g., low emission zones); significant calendar events (e.g. the new year); and major travel events (e.g. festivals, sporting events).

This is not an exhaustive list. Nor does it constitute evidence as to how and to what extent travel behaviours might change. However, it serves to demonstrate the diversity of different moments of change.

Examples of moments of change

- Moving home
- Sustaining an injury
- Experiencing an extreme weather event

How moments of change facilitate changes in travel behaviour

The ways in which moment of changes facilitate behaviour change are known as ‘mechanisms of action’. Much of the existing work on moments of change focuses on just

one such mechanism: habit disruption³. In this section we also describe other mechanisms.

During a moment of change, transformations in people's travel abilities and opportunities temporarily motivate them to make long-term changes to how they travel. This is true of passing transformations (e.g. weather events) and more enduring transformations (e.g. retirement).

This report uses the components of the COM-B model to structure its description of the range of mechanisms of action. The COM-B model points to Capability, Opportunity and Motivation⁴ as key determinants of behaviour (Michie et al., 2011). We use this typology of factors to explain why moments of change offer a better chance of success for travel interventions than moments when people's travel Opportunities and Capabilities are more stable. As we argue above, changes in Capability or Opportunity not only impact on whether someone can change their behaviour; they also impact whether people want to change their behaviour. This is because Motivation is affected by awareness of changes in Opportunity or Capability – e.g. an awareness the newness of a recently-opened train station; a sense of needing to adapt to a newly-sustained injury; the enhanced awareness of local transport options before and after residential relocation, or the loss of an ability to rely on habitual behaviours after residential relocation. The uniqueness of a moment of change lies in the impacts these changes can have on people's Motivations.

- **Capability** refers to the psychological and physical capacity to engage in the behaviour in question – including the necessary knowledge and skills. Changes in these impact on Motivation. In this report, we propose that these impacts are short-lived and that these short-lived changes in Motivation make the moment of change – the period of flux – a time at which behaviour change is particularly likely.
- **Opportunity** refers to the contextual factors that lie outside the locus of control of the relevant individual or group and that are essential behavioural enablers or prompts. These contextual factors include features of the physical and social environment. As with changes in Capability, the period of flux around a change in Opportunity is a time at which behaviour change is particularly likely.
- **Motivation** refers to the brain processes that energise and direct behaviour, including goals, conscious decision-making, emotions and non-conscious factors such as cognitive biases and habit.

Figure 1 shows that changes in Capability, Opportunity or Motivation can each have direct impacts on behaviour. Figure 2 shows that Capability and Opportunity also have direct impacts on behaviour through the influence they have on Motivation.

A change in Capability or Opportunity therefore has both direct and indirect impacts on behaviour. Direct impacts often last beyond the duration of the moment of change. Indirect impacts last for only a short period of time – the moment of change itself. This report

³ Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. *Journal of Environmental Psychology*, 28(2), 121–127. <https://doi.org/10.1016/j.jenvp.2007.10.005>

⁴ In this report, we use capital letters when we use these terms to refer to the concepts described in the COM-B model: i.e. Capability, Opportunity and Motivation.

focusses on these indirect impacts: the fleeting increases in motivation that last only as long as the moment of change itself.

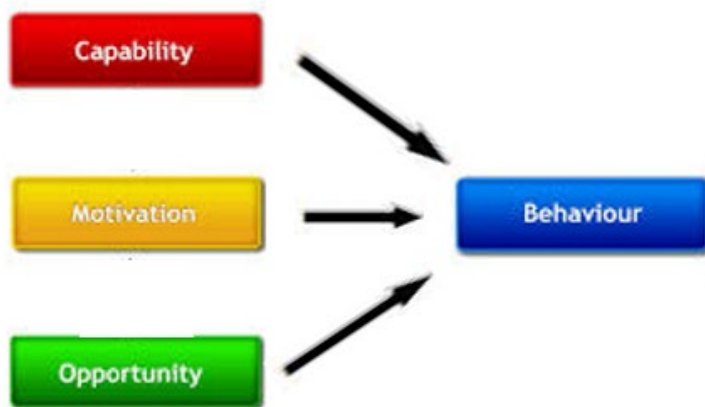


Figure 1 Direct impacts of changes in Capability or Opportunity or Motivation

Examples of direct impacts: sustaining a leg injury makes it impossible for someone to drive a car; a change in timetabling hampers someone's ability to commute at suitable times.



Figure 2 Indirect impacts of changes in Capability and Opportunity

Examples of indirect impacts: sustaining a leg injury motivates someone to look for alternatives to car use; a change in rail timetabling motivates someone to consider multi-model travel by bus and on foot.

This research drew on literature on moments of change from a variety of sectors including transport, consumer purchasing, energy use, diet change and health to describe mechanisms of action in each COM-B category. In each moment of change, a variety of mechanisms of action will be at play.

Changes in capability

Changes in attention and focus impact on people's **Capability** to adopt or maintain certain travel behaviours.

People pay more attention to something that has recently changed than they do to things that remain the same. This shift in focus can make it more likely that people will engage with travel behaviour interventions.

Attention and focus influence the behavioural choices people make (Hansen & Jespersen, 2013; Herath, 2010). Moments of change can temporarily redirect attention and focus by changing the salience of familiar aspects of the environment or adding new features. For example, the building and opening of a new sporting facility creates salience by causing a period of flux in the physical and cultural environment. (This helps explain why average attendance at sporting events sometimes increases immediately after the opening of new sports stadia – Coates & Humphreys, 2005; Soebbing et al., 2016).

On the other hand, if a moment of change occupies so much emotional or cognitive attention that it overwhelms the subject, this can reduce people's capacity to engage with the idea of changing their travel behaviour (Thronicker & Klinger, 2019).

Changes in attention and focus also mediate the impacts on behaviour of a series of other mechanisms of action:

- **Changes in knowledge and understanding** affect the Capability to adopt or maintain travel behaviours.
There is clear evidence to show that shifts in knowledge can impact on travel behaviour (Denzin, 1989; Lawson & Flocke, 2009; McDonald, 2008; Puleo et al., 2022). For example, a news broadcast about an extreme weather event (e.g. a heatwave or flood) can increase knowledge and understanding of the effects of climate change and subsequently affect the uptake of pro-environmental behaviours (Lohmann & Kontoleon, 2023). Although such changes have enduring impacts on decisions, their influence is greatest when the changes are new and attract more attention and focus.
- **Physiological changes** affect the Capability to adopt or maintain travel behaviours. Some moments of change alter physical capabilities in a manner that affects how people interact with available transport infrastructure. For example, a physical injury can prevent an individual from continuing to cycle and necessitate choosing a new way to travel (Musselwhite et al., 2016). Similarly, the development of age-related changes in physical and mental capacity – a moment of change that can last for many years – sometimes leads to reductions in active travel (Jamal & Newbold, 2020; Moniruzzaman et al., 2013). Even when impacts on travel Capabilities are enduring (e.g. if an injury results in amputation) the effects of such changes on behavioural motivation diminish when emotional adaptation brings a reduction in attention and focus.
- **Changes in hassle and friction** affect the Opportunity to adopt or maintain travel behaviours.
Behaviours often follow the path of least resistance (Park et al., 2023; Service et al.,

2014) so moments of change that affect convenience or accessibility can influence the adoption of a behaviour (Verplanken et al., 2018). For example, studies of involuntary workplace relocation show that changes to access to facilities or infrastructure can prompt employees to change their commuting practices (Zarabi & Lord, 2019). For example, reduced access to free car parking and increased availability of public transport can lead to less commuting by car and more by public transport (Aguilera et al., 2009; Walker et al., 2015; Wee & Hoorn, 2002). This influence greatest when the changes first become apparent and therefore command most attention.

- **Changes in financial resources** affect the Opportunity to adopt or maintain travel behaviours.
Financial shocks and windfalls change the perceived affordability of some behaviours. For example, urban residents change their transport behaviour during times of economic hardship by reducing trip frequency and private car use (Papagiannakis et al., 2018). Similar effects are also observed when oil price shocks affect petrol prices (Solaymani et al., 2015). Like so many of the mechanisms of action, these impacts are mediated by attention and focus, and these often reduce when the moment of change is over.

Disruption to habits

Disruption to habits (including by changes in contextual cues) impact on people's Motivation to adopt or maintain travel behaviours. The habit discontinuity hypothesis suggests that changes to external environmental cues can disrupt behaviours that have become habituated, forcing a moment of more reflective decision-making. Studies have documented how disrupting contextual cues can shape people's choices (Wood et al., 2005). For example, researchers found that travel choices became less automatic after university students relocated home between academic years (Haggar et al., 2019). Another study found that transport strikes can disrupt travel habits and require people to actively re-plan routes and journeys (Job van Exel et al., 2001).

It is usually easier to follow patterns of travel behaviour that are based on habits. When a life event or societal event makes this impossible, we become more open to making long-term changes to our travel behaviours.

Changes in social norms

Social norms are perceptions of what other people do and of what other people think one should do (Chung & Rimal, 2016; Service et al., 2014). They affect people's Capability to adopt or maintain behaviours. Some moments of change result in temporary changes in social norms. In a study conducted during the COVID-19 pandemic (Larsen, 2021) 26% of respondents said they would reduce their air travel. The author argued that this was, in part, because of participants' perceptions that other people believed that they should reduce their flying because of climate change.

All other things being equal, people are inclined to copy the behaviours of those they consider to be 'like them', and to adhere to what they imagine these people think they

should do. When these norms change, people are more open to adopting new travel behaviours.

Changes in values and beliefs

Moments of change can affect preferences, priorities, values, and beliefs. While these are in flux, people are more Motivated to change their travel behaviours; this has been shown to lead to behaviour change (Verplanken et al., 2018).

- **Changes in personal values and priorities:** During transitions, people often change their outlook, attitudes and personal preferences. For example, people transitioning to parenthood sometimes value security and health more highly; relocating to a different culture brings shifts in priority and value, and experiencing the exogenous shock of extreme flooding or heatwaves shapes a variety of climate attitudes and opinions (Bardi et al., 2014; Diaz et al., 2011; Lohmann & Kontoleon, 2023; Margalit, 2019; Ramos et al., 2016; Tubadji & Nijkamp, 2019). A study across 12 towns and cities in the UK showed that parents are more likely to cycle when their children are of a certain age because they become more motivated by the health and enjoyment benefits cycling offers to their children and to the family as a whole (Chatterjee et al., 2013).
- **Awakening dormant preferences and values:** Changes to a person's context after a personal life transition or event might foster a behaviour that aligns with existing, but dormant, motivations and values. For example, after relocating for work, people with pre-existing pro-environmental attitudes are more likely than their colleagues to switch from car use to public transport or active travel (Clark et al., 2016). Similarly, price changes or the opening of new transport routes can awaken previously dormant preferences for affordability or convenience. This awakening of dormant preferences/values is a transient phenomenon – as the moment of change moves into the past, the effect diminishes (Thomas et al., 2016; Verplanken et al., 2008).
- **Discontinuity of beliefs and perceptions:** Moments of change can affect behaviour by changing people's beliefs and perceptions about the world. For example health shocks, scares and health-related diagnoses increase people's perceptions of risk (McBride et al., 2003) and their motivations to change risk behaviours (Puleo et al., 2022). Hence, the COVID-19 pandemic resulted in reductions in public transport use due to perceived risk of transmission (Gramsch et al., 2022; Tiikkaja & Viri, 2021).

Changes that trigger emotional responses

Moments of change can elicit emotional responses that affect attention and focus, and directly impact on Motivation. There is evidence that anxiety around COVID-19 transmission shaped public transport use following the pandemic (Dong et al., 2021).

An expanded definition of moments of change

The many types of moments of change all share one feature: the anticipation, experience and assimilation of some change in Opportunity, Capability or Motivation. Importantly,

moments of change are characterised by the process of such change, not by the outcomes of this process. They are the period of flux between one state and another – between initial and subsequent sets of Opportunities, Capabilities and Motivations.

These periods of flux are characterised by changes in people's Capability to consider behaviour change and their Opportunity to make these changes. They are also, critically, characterised by consequent impacts on people's Motivation to make these changes. For example (Figure 2) the anticipation of a home move can increase awareness of existing habits and prompt information searches, and being in a new area can eliminate the environmental cues that held old habits in place and sensitise people to environmental signals that indicate travel options in the new area (e.g. bus shelters, parking spaces or behaviours indicative of social norms). Similarly, awareness of an impending extreme weather event (Figure 3) might lead to a realisation that others are prone to work at home when there is travel disruption; staying at home during extreme weather might affect future motivation for home-working and, to justify this decision, an exaggerated estimation of the risk involved in travelling during inclement weather.

These changes affect travel Motivations. For example, awareness of the bus infrastructure around a new home location might motivate bus travel, or people might be deterred from using buses if they perceive that the social norm in the new area is to not use buses. Similarly, a perception that it is normal to work at home during extreme weather would motivate someone to do likewise during future travel disruption, and changes in the estimation of the riskiness of severe weather might have enduring impacts on someone's willingness to commute by car.

The duration and character of these stages will differ significantly according to the Characteristics of the moment of change (see next section). For example, for extreme and disruptive weather (Table 3) the second stage is usually shorter than for a house-move. In such events, changes in Opportunity and Capability will also usually be of short duration and their impacts on travel practices more susceptible to reversal ("driving in that weather wasn't really dangerous"; "it won't happen again"; "I can still rely on commuting by car").

The period of flux (stages 2-4, tables 1-3) ends when the impacts on Motivation taper off and a new steady state is reached in a person's motivation to change their travel behaviours (see stage 5) – that is, when old habits are reasserted or new travel practices become habitual and embedded in material arrangements (e.g. bus passes, wet weather clothes for walking), social expectations (e.g. a spouse's expectation that one will take the bus) and life arrangements (e.g. a family schedule that assumes a parent commutes by bus).

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
1. Pre-awareness	This is the steady state before the travelling individual becomes aware of the impending changes. Their travel involves familiar and established materials and behaviours. They are not aware of the social expectations that hold these in	N	N

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
	place. There is no expectation that they will change.		
2. Period of flux – becoming aware	An awareness that things are going to happen generates Motivation to change travel behaviour. The person gathers information about likely impacts on their Capabilities and Opportunities. The Motivation to change might lead to behaviour change.	N	Y
3. Period of flux: changes in Capability/ Opportunity	Awareness of changes in travel Opportunities and Capabilities prompts deliberation over how to respond to the changes. The Motivation to change behaviour is likely to be at its greatest; so also, therefore, is the likelihood of behaviour change.	Y	Y
4. Period of flux - assimilation	The new set of Opportunities and Capabilities begins to feel normal, as do any new travel behaviours. There is still a Motivation to change, but less than in the previous stage.	Y	Y
5. Back to normal/new normal	Any new behaviours, Capabilities or Opportunities have been assimilated into the person's life and have drifted out of awareness. There is no expectation that they will change and no Motivation to change travel behaviours.	Y	N

Table 1 Stages in a moment of change

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
1. Pre-awareness	The person's travel is characterised by familiar and established materials and behaviours. They are not aware of the social expectations that hold these in place. There is no expectation that they will change.	N	N
2. Period of flux – becoming aware	Awareness of an impending move Motivates them to reflect on future travel behaviours. They gather information about the likely impacts of the move on their travel Capabilities and Opportunities. The Motivation to change might lead them to make different decisions (e.g. about the location of the new home). It might also stimulate behaviour change – e.g. getting used to cycling in anticipation of future commuting patterns.	N	Y
	The person packs up their old home and moves to the new		

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
3. Period of flux: changes in Capability/ Opportunity	one. The novelty of the travel possibilities in the new area generates Motivation to change travel behaviour. This Motivation might lead to behaviour change. However, the other demands associated with moving limit the cognitive capacity they can give to this issue.	Y	Y
4. Period of flux - assimilation	Now that the move is over, a new travel routine takes shape. The person deliberates over how to get themselves and their family to work, school, shops and leisure. The Motivation to get all this worked out is great. The likelihood of behaviour change is also great but is countered by the urgent need to address all the other challenges associated with the move.	Y	Y
5. Back to normal/new normal	The Capabilities or Opportunities afforded by the new home and area have become familiar – and so too have the new behaviours. There is no expectation that they will change and no Motivation to change travel behaviours.	Y	N
Text	Text	Text	Text

Table 2 Stages of a moment of change – case study: moving home

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
1. Pre-awareness	The person's travel is characterised by familiar and established technologies and behaviours. They have no expectation that this will change.	N	N
2. Period of flux – becoming aware	Awareness of an impending weather event prompts a search for information about its impacts on their travel Capabilities and Opportunities. They are Motivated to adopt new travel options and investigate what these might be. Behaviour change might occur for journeys whose completion could be affected by the predicted event occur.	N	Y
3. Period of flux: changes in Capability/ Opportunity	The weather event materialises. Changes in Opportunity (e.g. closed roads) or Capabilities (e.g. unable to drive safely in a storm) can create strong Motivations to change behaviour. The person adapts their travel plans – e.g. by		

Stage	What happens during this stage	Changed Capabilities or Opportunities?	Motivation to change travel behaviour?
	staying put; driving more slowly; choosing a different mode or changing destination.	Y	Y
4. Period of flux - assimilation	The weather event has passed. The likelihood of ongoing behaviour change is small. However, the person's evaluation of the new behaviours (and their memory of the weather event itself) may Motivate them to sustain some of their adaptive behaviours – e.g. by working at home more often or taking the train more frequently.	Y	Y
5. Back to normal/new normal	There is no prospect of any severe weather in the near future and memories of the recent event have faded. There is no Motivation to change travel behaviours. New behaviours will only be sustained if they have become habituated.	Y	N

Table 3 Stages of a moment of change – case study: severe weather

Following the evidence reviews, qualitative research and internal discussion within the research team, the following extended definition of moments of change was developed:

Moments of change are events that prompt a period of flux in Motivation either directly or via changes in Capability or Opportunity, and that thereby temporarily affect the likelihood that people will change their behaviour. When an intervention is applied at a moment of change, it can enhance the ability of the intervention to change behaviour.

The key elements of this definition are:

- **Any number of events can create the period of flux that constitutes a moment of change** – for example, residential or workplace relocation, becoming a parent, retiring, an extreme weather event, fuel shortage, a sporting event or a pandemic.
- However permanent or transient the impacts on opportunities, capabilities or motivation, **a moment of change only lasts as long as the period of flux between one state and another** – e.g. the months or years it takes to adapt to the idea of (and actuality of) injury, illness or retirement; the period for which a new transport facility is perceived as 'new', or the time before and after a home move when travel arrangements are subject to conscious deliberation.
- **Moments of change vary across a range of characteristics:** how concentrated an event is in time and place; how voluntary is participation in the change; its predictability; how rapidly it develops, and the persistence of changes in Opportunity and Capability associated with the event. Practitioners would benefit from an awareness of these factors because they affect the planning requirements, resource needs and political viability of behavioural interventions. For example:

- concentration in time and space influences how easy it is to target people and, hence, the type and scale of resource needed to do so

- predictability affects how much time practitioners will have to plan for a moment of change (and whether they will need to have an intervention – and the necessary resources for its implementation – on stand-by)

- how voluntary it is affects the political risk associated with an intervention and the likelihood of politicians/senior managers supporting its implementation

- rapidity of development affects the time available to initiate an intervention when it becomes apparent that a moment of change is approaching

- persistence of changes affects the importance of measures to maintain new behaviours when the moment of change has passed

- **Impact on motivation is the main mechanism of action that makes moments of change good opportunities for behaviour change interventions**
- **Within any individual moment of change, there will be one or more periods when intervention is likely to be most effective:** the point/s at which the motivation to change is at its greatest. Practitioners should try to time their interventions accordingly. (Note that the literature on moments of change sometimes terms these 'windows of opportunity'.)

Characteristics of moments of change that most influence the planning, resourcing and design of behaviour change interventions

The concept ‘moment of change’ covers events that vary across a range of characteristics. The use of the word ‘moment’ has the potential to cause some confusion when it is applied to a phenomenon that is sometimes of protracted duration. For example, some practitioners queried whether the category ‘moment of change’ covers events that occur over extended periods – such as changes in the cost of living. Whilst recognising this as a limitation, we have chosen to use ‘moment of change’ because it holds a dominant position in the literature and – as we found in our research – has greater traction in the discourse of stakeholders than do the alternatives.

The literature review conducted for this report identified five characteristics of moments of change that are particularly relevant to transport practitioners: the geographical concentration of the people experiencing them; the predictability of whether and when they will occur; how rapidly they evolve; the extent to which people have engaged in them voluntarily, and the persistence of the changes they bring to travel Opportunities and Capabilities.

Moments of change vary along five key dimensions: geographical concentration; predictability; how rapidly they evolve; whether people exercise choice over whether to experience them, and how long-lasting are the changes they bring to travel Opportunities and Capabilities. The position of a moment of change on the spectrum for any of these characteristics should be considered during the design of behavioural interventions.

Each of these characteristics varies along a spectrum. For example, workplace relocation can be more voluntary (e.g. when someone chooses to change job) or less voluntary (e.g. when it is a consequence of redundancy). **Error! Reference source not found.**³ depicts the five characteristics and illustrates the ends of the spectrum for each.






Characteristic		Example: one end of the spectrum	Example: the other end of the spectrum
 Concentration in time and space (whether it impacts on many people at the same time and in the same location)		Dispersed in time and place (e.g. personal accidents – which injure people at different times and in different places)	Concentrated in time and space (e.g. music festivals – which affect many people at the same time and location)
 How voluntary the moment of change is		Voluntary (e.g. self-initiated job move)	Involuntary (e.g. relocation required by an employer)
 Predictability of the moment of change		Predictable (e.g. sporting events)	Less predictable (e.g. flash floods)
 How rapidly a moment of change develops		Fast (e.g. extreme weather events)	Drawn-out (e.g. cost of living changes)
 Persistence of the changes in travel Capabilities and Opportunities that are brought by the moment of change		Short duration (e.g. temporary closure of a bus service)	Long duration (e.g. permanent closure of a bus service)

Figure 3 Characteristics of moments of change

The position of a moment of change on the spectrum for any of these characteristics could affect intervention design and implementation decisions. The following sections expand on the nature of each characteristic and possible considerations for practitioners. Note that no attempt is made to quantify the importance of these characteristics or make judgements about relative importance.

Characteristic 1: How concentrated the change is in time and place

A moment of change can be experienced by numerous people at the same time and place (high concentration) or at different times and in different places (low concentration).

Mass participation events, for example, are concentrated in time (e.g. the coronation of Charles III) and often also in place (e.g. a music festival). Most people will book tickets for a music festival at around the same time and on the same webpages, travel to the festival at similar times and converge on the same venue to experience the festival. This allows the resources for an intervention to be focussed on short periods of time (e.g. when tickets go on sale) and a limited number of touchpoints (e.g. the main ticketing websites and the venue itself). In contrast, although most people will have experienced the coronation at the same time (concentration in time) many spectators were geographically dispersed across homes, pubs, community centres etc.

Resources for interventions are usually easier to organise for moments of change that are more concentrated in time and space.

Other moments of change are dispersed in both time and place. For example, although many people experience personal injuries that affect the ability to drive, each experiences this at a different time and trauma centres are dispersed across numerous medical settings. Such low levels of concentration require a different approach to the design of a behavioural intervention than is required for a high concentration moment of change –

interventions need to be deliverable over extended periods and at a range of touchpoints (e.g. numerous trauma clinics).

Case study 1: Starting a degree course – a moment of change concentrated in time and place

At the University of California Los Angeles (UCLA), researchers emailed 1,600 incoming graduate students a transportation guide featuring a map of the campus and surrounding neighbourhoods and each of the nine public transport routes that served the campus. Amongst the three-quarters of the students that received the intervention and moved home to start their studies, 8% more used public transport to travel to the campus than did those that did not receive the intervention (Ralph & Brown, 2019).

The intervention was facilitated by the fact that the moment of change (the beginning of a university course) was concentrated in both time and place. The students all needed to travel to the UCLA campus, so it was only necessary to develop a single map and was possible to keep the design simple and accessible. Furthermore, all 1,600 recipients could be accessed via a single touchpoint: UCLA Registrar's Office. As all the students began their studies at around the same time, the maps could be sent out in a single mailing.

Characteristic 2: How voluntary the change is

How voluntary a moment of change is refers to the extent to which it is intentionally initiated by, and subsequently controlled by, the individual who experiences it. For instance, workplace relocation is voluntary if it is a consequence of a decision to move jobs but involuntary if it is the result of a decision by an employer to move someone to a different factory or office. The experience of transport disruption caused by labour strikes or severe weather is also likely to be involuntary. How voluntary a moment of change is influences Motivation and people's receptivity to interventions.

If participation in a moment of change is involuntary, people will often be less motivated to use it as an opportunity to change their travel behaviours.

Involuntary exposure to a moment of change sometimes reduces Motivation to take up new behaviours and renders people less receptive to some types of intervention. This is because the innate desire for self-determination means that people who feel they have lost control in one part of their life tend to be more resistant to loss of control in other aspects of their life (Deci & Ryan, 1985). In addition, as suggested by participants in our qualitative research, interventions at less voluntary moments of change could be seen as insensitive and inappropriate. To minimise resistance and avoid exacerbating negative emotions associated with unwelcome changes, interventions during such moments of change will need to be designed with particular care (see Case study 2).

Case study 2: Job relocation - an example of an involuntary moment of change

A quick literature search for this report found no evidence on the comparative impacts of voluntary and involuntary job relocations. Below, however, is an illustration of an intervention applied during an involuntary job relocation.

In 2010, the World Wildlife Fund (WWF) announced that it would be moving its UK headquarters from one outer London commuter town to another in 2013. The new location was 18km away from the old location by road. Work to prepare staff had a particular focus on encouraging sustainable travel after the move. 21% of affected staff (n=70) completed surveys before the move, a week after the move and four weeks after the move. Of these 70 staff members, 55% drove to work before the move and only 29% did so four weeks after the move; 19% travelled by train before the office relocation and 56% did so four weeks after it (Walker et al., 2015).

This intervention included financial support measures that counteracted the potentially de-motivating influence of the involuntary office move. For six months after the move, people who always travelled by train received the price difference between their old and new rail fare if this had increased. People who moved from driving to rail received the price difference between the two modes. Staff who continued to drive received up to £90 per month to pay parking costs at work for the first 6 months (the new workplace, unlike the old, did not have free parking).

Characteristic 3: The predictability of the change

Predictability refers to the degree to which practitioners can use information and knowledge to anticipate a change. For example, the timing of changes associated with major sporting events is predictable; that of some weather events (such as flash floods), less so.

A predictable moment of change is more easily anticipated by practitioners, making it easier to prepare interventions and allocate resources.

Major organised events are usually scheduled in advance and have predetermined venues and start/finish times. This gives practitioners the time and opportunity to win stakeholder support for intervention, garner the necessary resources and tailor interventions to the characteristics of such events. Each of these steps is made more difficult if the probability, timing or scale of a change is in doubt. For example, any intervention intended as a response to flash flooding would need to be capable of being implemented quickly, at any one of several locations and to an unpredictable number of people.

Case study 3: Moving home – a moment of change that can be predicted by practitioners

There is lots of evidence to suggest that home moves are associated with changes in travel behaviour. In a survey of one-/two-adult households that had moved into properties in Bristol in the previous 12 months, 27% reported having changed their main commuting travel mode since moving home (Stanbridge & Lyons, 2006). A study in Belgium showed a statistically significant increase in self-reported cycling frequency, walking frequency and public transport frequency after a move to an urban or suburban location – with the biggest reported changes being amongst participants who moved from a suburban area to a more urban area (De Vos et al., 2018). Qualitative research in Sydney, Australia, suggests that domestic relocation can contribute to the decision to car share (Kent et al., 2017).

This moment of change has the advantage, for practitioners, of being predictable. Residential relocation is usually prefigured by lengthy formal processes such as property advertisement, credit history checks and, in the case of changes in ownership, conveyancing and land searches. Access to intelligence on these processes can alert practitioners to forthcoming relocations and allow them to predict this moment of change. The more predictable such relocations are, the more able practitioners will be to dedicate resources to travel interventions. New large-scale residential property developments are one situation that can offer a high degree of predictability because developers will often know when their properties are coming onto the market.

Characteristic 4: How rapidly a change develops

How rapidly a change develops refers to the length of the transition between one set of circumstances and another.

A moment of change that develops quickly and with little warning requires practitioners to develop and implement interventions quickly if they wish them their effectiveness to be enhanced by the moment of change.

In slow-moving events such as domestic relocation or a gradual rise in the cost of living, there will be more time to gather resources, design interventions and apply interventions. Extreme weather events, in contrast, have relatively short gestation and enaction periods (an extreme case being flash floods). In the former cases, practitioners have an extended time in which to identify people who are experiencing the moment of change. In the latter case, the short gestation period requires practitioners to react much more quickly if they wish their interventions to coincide with the period of flux and maximise the effectiveness of make their interventions.

Case study 4: Learning to drive – an extended moment of change

One such extended transition occurs when young people reach the age at which they can learn to drive a car. Although the entitlement to drive occurs immediately on their birthday, the Capabilities and Opportunities necessary for independent driving (driving confidence, driving skills, entitlement to drive unaccompanied and access to a car) are usually achieved over a period of months or years.

In a randomised controlled experiment in Australia, Meuleners et al. (2023) tested an intervention with teenagers who had a provisional licence. The duration of the provisional stage of the driving licence allowed the intervention to utilise measures that were repeated with each young person, thereby facilitating the reinforcement of learning (participants were provided with weekly telemetric feedback on the frequency with which they exceeded a speed limit or accelerated/decelerated harshly).

No statistically significant changes were detected in participant behaviours. However, it is possible that there was an effect but that it could not be detected because of the small sample (72 participants).

Characteristic 5: The persistence of changes in Opportunity or Capability

Persistence of the change in circumstances refers to the duration of changes in Capability or Opportunity that emerge during the period of flux. In some moments of change, such as becoming a parent, the period of flux leads to enduring changes; in others, such as temporary closures of bus routes, changes are of shorter duration.

When changes in Opportunity or Capability are short-lived (e.g. when engineering work temporarily disrupts a rail service) it is particularly important to focus on how behavioural interventions enable people to sustain changes in travel behaviour.

Any moment of change can impact people's longer-term travel behaviours – even if the changes in Opportunity or Capability are of short duration (e.g. see case study 5). However, persistent changes in Opportunity or Capability are more likely to lead to long-term behaviour change.

Practitioners will want to consider how their intervention can enable people to sustain new behaviours. This consideration will be especially important when changes in Opportunity and Capability are expected to be of short duration.

Case study 5: Transport disruption - an example of when changes in Opportunities or Capabilities are transient

Transport strikes are usually of short duration but can nevertheless cause lasting changes in travel behaviour. Here we provide two examples where long-lasting behaviour change occurred without any external reinforcement and one case where short-term behaviour change might have been sustained if action had been taken to sustain it.

During the London Tube strike of February 2014, only 37% of underground stations remained open and wet weather discouraged active travel. Many passengers therefore experimented with the use of stations they would not otherwise have frequented. Analysis of the usage of Oyster Cards (a smart card that facilitates pay-as-you-go on the London transport system) indicated lasting changes in travel behaviour among a significant fraction of commuters. This can be interpreted as suggesting that some commuters found more optimal ways of using the Tube network (Larcom et al., 2017).

In 2014, Germany experienced one of its largest ever rail strikes. Usage of coaches in the affected areas was 8% higher after the strike (Beestermöller et al., 2023).

In the absence of some intervention to sustain short-term behaviour change, disruption does not always bring long-term changes in behaviour. In 2013, a storm caused a 6-day closure of New Zealand's Hutt Valley rail line. 11% of users changed their mode or departure time for a month after the incident (New Zealand Ministry of Transport, 2013). No longer-term changes were observed (the report authors offered no explanation as to why).

Conclusion

Moments of change have both short-term and long-term effects on the Capabilities and Opportunities that influence travel behaviour. This report suggests that the short-term effects are of greatest relevance to those designing behaviour change interventions. If this hypothesis is correct, travel interventions will be more effective when they are timed to coincide with the period when these short-term effects occur – i.e. immediately before, during and after change, in what we have called the period of flux. The motivation to change, the report suggests, is at its greatest at this time because the period of flux causes a rise in motivation that wanes when the changes to Capability and Opportunity become familiar, habitual and embedded in daily practices.

This report suggests that behaviour change interventions will be most effective immediately before, during and after changes to travel Capabilities or Opportunities. That is because this period is often characterised by an enhanced motivation to change travel behaviours.

These periods of flux occur in a wide range of different types of moments of change, including:

- residential or workplace relocation
- starting a new job
- starting at a new educational institution
- becoming a parent
- personal injury, illness or loss of mobility
- change in eligibility for a vehicle licence or concessionary travel pass
- entering retirement
- retirement from driving (e.g. for health reasons)
- gaining a provisional driving license

- road closures and transport strikes
- extreme weather events
- fuel shortages
- supply chain issues (e.g. a shortage of lithium batteries)
- pandemics
- vehicle damage or breakdown
- cost of living crises
- seasonal changes
- purchasing a vehicle
- introduction of new transport policies (e.g., low emission zones)
- significant calendar events (e.g. New Year)
- major travel events (e.g. festivals or sporting events).

All of these moments of change can bring long-term changes to one of the three types of factor that constrain or facilitate travel: psychological and physical capacities (which we have termed “Capability”), the physical and social environment (which we have termed “Opportunity”) and deliberative decision-making, automatic decision-making, emotions and habits (which we have termed “Motivation”).

Research evidence on the effectiveness of intervening in these moments of change is provided in a separate report. Unfortunately, little such evidence exists.

In the absence of substantive research evidence, the decision on whether to coincide an intervention with a moment of change should be informed by the nature of the moment of change on the most salient characteristics. These include whether the moment of change allows practitioners to focus their resources in time and space (the characteristic of ‘concentration’); whether it allows them to predict when they will need to operationalise the intervention (the characteristic of ‘predictability’), whether intervention design needs to take account of particular public and stakeholder sensitivities (the ‘voluntary’ characteristic), and the duration of the period of flux (the ‘rapidity’ characteristic). The resources and outline design of an intervention should be designed accordingly.

The substantive content of the intervention should usually correspond to the mechanisms of action associated with the moment of change in question. For example, if the mechanism of change is fluctuation in social norms, it is a good idea to consider using a social norms intervention. Similarly, if the mechanism of action is changed attention and focus, the intervention should harness the changes in awareness that these bring. As a final example, if the mechanism of action is raised anxiety, the intervention should address

this anxiety (e.g. where there is anxiety about climate change, interventions should harness climate change considerations).

As in many aspects of intervention design, there is some subjectivity in the selection of a suitable moment of change, the elements that are most likely to promote the desired change and the population for whom an intervention is likely to be most effective. The contents of this report will help inform that subjective process. Workshop material prepared for DfT (forthcoming) provides further support with this challenge.

References

- Aguiléra, A., Wenglenski, S., & Proulhac, L. (2009). Employment suburbanisation, reverse commuting and travel behaviour by residents of the central city in the Paris metropolitan area. *Transportation Research Part A: Policy and Practice*, 43(7), 685–691. <https://doi.org/10.1016/j.tra.2009.06.004>
- Bardi, A., Buchanan, K. E., Goodwin, R., Slabu, L., & Robinson, M. (2014). Value stability and change during self-chosen life transitions: Self-selection versus socialization effects. *Journal of Personality and Social Psychology*, 106(1), 131–147. <https://doi.org/10.1037/a0034818>
- Beasley, L. J., Hackett, A. F., & Maxwell, S. M. (2004). The dietary and health behaviour of young people aged 18–25 years living independently or in the family home in Liverpool, UK. *International Journal of Consumer Studies*, 28(4), 355–363. <https://doi.org/10.1111/j.1470-6431.2004.00394.x>
- Beestermöller, M., Jessen-Thiesen, L., & Sandkamp, A.-N. (2023). Striking Evidence: The Impact of Railway Strikes on Competition from Intercity Bus Services in Germany (SSRN Scholarly Paper 4472927). <https://doi.org/10.2139/ssrn.4472927>
- Beige, S., & Axhausen, K. W. (2012). Interdependencies between turning points in life and long-term mobility decisions. *Transportation*, 39(4), 857–872. <https://doi.org/10.1007/s11116-012-9404-y>
- Ben Clark, Clark, B., Kiron Chatterjee, Chatterjee, K., Steve Melia, Melia, S., Gundi Knies, Knies, G., Heather Laurie, & Laurie, H. (2014). Life Events and Travel Behavior: Exploring the Interrelationship Using UK Household Longitudinal Study Data. *Transportation Research Record*, 2413(2413), 54–64. <https://doi.org/10.3141/2413-06>
- Chatterjee, K., Sherwin, H., & Jain, J. (2013). Triggers for changes in cycling: The role of life events and modifications to the external environment. *Journal of Transport Geography*, 30, 183–193. <https://doi.org/10.1016/j.jtrangeo.2013.02.007>
- Chung, A. C. A., & Rimal, R. N. R. N. (2016). Social Norms: A Review. *Review of Communication Research*, 4, 01–28.

Clark, B., Chatterjee, K., & Melia, S. (2016). Changes to commute mode: The role of life events, spatial context and environmental attitude. *Transportation Research Part A: Policy and Practice*, 89, pp 89-105. <https://doi.org/10.1016/j.tra.2016.05.005>

Coates, D., & Humphreys, B. R. (2005). Novelty Effects of New Facilities on Attendance at Professional Sporting Events. *Contemporary Economic Policy*, 23(3), 436–455. <https://doi.org/10.1093/cep/byi033>

De Vos, J., Ettema, D., & Witlox, F. (2018). Changing travel behaviour and attitudes following a residential relocation. *Journal of Transport Geography*, 73, 131–147. <https://doi.org/10.1016/j.jtrangeo.2018.10.013>

Denzin, N. K. (1989). *Interpretive interactionism* (p. 160). Sage Publications, Inc.

Diaz, B. A., Fent, T., Prskawetz, A., & Bernardi, L. (2011). Transition to Parenthood: The Role of Social Interaction and Endogenous Networks. *Demography*, 48(2), 559–579. <https://doi.org/10.1007/s13524-011-0023-6>

Dong, H., Ma, S., Jia, N., & Tian, J. (2021). Understanding public transport satisfaction in post COVID-19 pandemic. *Transport Policy*, 101, 81–88. <https://doi.org/10.1016/j.tranpol.2020.12.004>

Gramsch, B., Guevara, C. A., Munizaga, M., Schwartz, D., & Tirachini, A. (2022). The effect of dynamic lockdowns on public transport demand in times of COVID-19: Evidence from smartcard data. *Transport Policy*, 126, 136–150. <https://doi.org/10.1016/j.tranpol.2022.06.012>

Haggag, P., Whitmarsh, L., & Skippon, S. M. (2019). Habit discontinuity and student travel mode choice. *Transportation Research Part F: Traffic Psychology and Behaviour*, 64, pp 1-13. <https://doi.org/10.1016/j.trf.2019.04.022>

Hansen, P. G., & Jespersen, A. M. (2013). Nudge and the Manipulation of Choice: A Framework for the Responsible Use of the Nudge Approach to Behaviour Change in Public Policy. *European Journal of Risk Regulation*, 4(1), 3–28. <https://doi.org/10.1017/S1867299X00002762>

Hards, S. (2012). Tales of transformation: The potential of a narrative approach to pro-environmental practices. *Geoforum*, 43(4), 760–771. <https://doi.org/10.1016/j.geoforum.2012.01.004>

Herath, C. (2010). ELICITING SALIENT BELIEFS ARE CRITICAL TO PREDICT BEHAVIOURAL CHANGE IN THEORY OF PLANNED BEHAVIOUR. *E-Psychologie*, 4, 24–36.

Jamal, S., & Newbold, K. B. (2020). Factors Associated with Travel Behavior of Millennials and Older Adults: A Scoping Review. *Sustainability*, 12(19), 8236. <https://doi.org/10.3390/su12198236>

Job van Exel, van Exel, J., van Exel, N. J., Piet Rietveld, Rietveld, P., & Rietveld, P. (2001). Public transport strikes and traveller behaviour. *Transport Policy*, 8(4), 237–246. [https://doi.org/10.1016/s0967-070x\(01\)00022-1](https://doi.org/10.1016/s0967-070x(01)00022-1)

Kent, J., Dowling, R., & Maalsen, S. (2017). Catalysts for transport transitions: Bridging the gap between disruptions and change. *Journal of Transport Geography*, 60, 200–207. <https://doi.org/10.1016/j.jtrangeo.2017.03.013>

Kirkman, E. (2019). Free riding or discounted riding? How the framing of a bike share offer impacts offer-redemption. *Journal of Behavioral Public Administration*, 2(2), Article 2. <https://doi.org/10.30636/jbpa.22.83>

Klein, N. J., & Smart, M. (2019). Life events, poverty, and car ownership in the United States: A mobility biography approach. *Journal of Transport and Land Use*, 12(1). <https://doi.org/10.5198/jtlu.2019.1482>

Lanzendorf, M. (2010). Key Events and Their Effect on Mobility Biographies: The Case of Childbirth. *International Journal of Sustainable Transportation*, 4(5), 272–292. <https://doi.org/10.1080/15568310903145188>

Larcom, S., Rauch, F., & Willems, T. (2017). The Benefits of Forced Experimentation: Striking Evidence from the London Underground Network. *The Quarterly Journal of Economics*, 132(4), 2019–2055.

Larsen, N. M. (2021). Can the Covid-19 Pandemic Function as a "Moment of Change" for Vacation Air-Travel? – The Influence of Past Behaviour, Social Norms, and Efficacy Beliefs [Master thesis, The University of Bergen]. <https://bora.uib.no/bora-xmloi/handle/11250/2837352>

Laura McCarthy, McCarthy, L., Alexa Delbosc, Delbosc, A., Graham Currie, Currie, G., Andrew Molloy, & Molloy, A. (2019). 'Transit Faithfuls' or 'Transit Leavers'? Understanding mobility trajectories of new parents. *Transport Policy*, 78, 105–112. <https://doi.org/10.1016/j.tranpol.2019.04.007>

Lawson, P. J., & Flocke, S. A. (2009). Teachable moments for health behavior change: A concept analysis. *Patient Education and Counseling*, 76(1), 25–30. <https://doi.org/10.1016/j.pec.2008.11.002>

Lohmann, P. M., & Kontoleon, A. (2023). Do Flood and Heatwave Experiences Shape Climate Opinion? Causal Evidence from Flooding and Heatwaves in England and Wales. *Environmental and Resource Economics*, 86(1), 263–304. <https://doi.org/10.1007/s10640-023-00796-0>

Margalit, Y. (2019). Political Responses to Economic Shocks. *Annual Review of Political Science*, 22(Volume 22, 2019), 277–295. <https://doi.org/10.1146/annurev-polisci-050517-110713>

Marsden, G., & Docherty, I. (2013). Insights on disruptions as opportunities for transport policy change. *Transportation Research Part A: Policy and Practice*, 51, pp 46-55. <https://doi.org/10.1016/j.tra.2013.03.004>

McBride, C. M., Emmons, K. M., & Lipkus, I. M. (2003). Understanding the potential of teachable moments: The case of smoking cessation. *Health Education Research*, 18(2), 156–170. <https://doi.org/10.1093/her/18.2.156>

McDonald, M. G. (2008). The Nature of Epiphanic Experience. *Journal of Humanistic Psychology*, 48(1), 89–115. <https://doi.org/10.1177/0022167807311878>

Meuleners, L., Fraser, M., Stevenson, M., & Roberts, P. (2023). Personalized driving safety: Using telematics to reduce risky driving behaviour among young drivers. *JOURNAL OF SAFETY RESEARCH*, 86, 164–173. <https://doi.org/10.1016/j.jsr.2023.05.007>

Michie, S., van Stralen, M. M., & West, R. (2011). The behaviour change wheel: A new method for characterising and designing behaviour change interventions. *Implementation Science*, 6(1), 42. <https://doi.org/10.1186/1748-5908-6-42>

Moniruzzaman, Md., Páez, A., Nurul Habib, K. M., & Morency, C. (2013). Mode use and trip length of seniors in Montreal. *Journal of Transport Geography*, 30, 89–99. <https://doi.org/10.1016/j.jtrangeo.2013.03.007>

Musselwhite, C. B. A., Calcraft, M. J., Roberts, M., Fox, R., Swinkels, A., Turton, P., & Young, S. (2016). Breaking the habit: Does fracturing your wrist change your travel and driver behaviour? *Transportation Research Part F: Traffic Psychology and Behaviour*, 38, 83–93. <https://doi.org/10.1016/j.trf.2016.01.008>

Nash, N. C., Whitmarsh, L., & Whittle, C. (2020). Rapid review of ‘moments of change’ & food-related behaviours. Food Standards Agency.

New Zealand Ministry of Transport. (2013). The Transport Impacts of the 20 June 2013 Storm. New Zealand Ministry of Transport.

Olde Kalter, M.-J., La Paix Puello, L., & Geurs, K. T. (2021). Exploring the relationship between life events, mode preferences and mode use of young adults: A 3-year cross-lagged panel analysis in the Netherlands. *Travel Behaviour and Society*, 24, pp 195-204. <https://doi.org/10.1016/j.tbs.2021.04.004>

O'Loughlin, J., Larouche, R., Rodriguez, U. C., Nayakarathna, R., & Scott, D. R. (2020). Effect of Major Life Events on Travel Behaviours: A Scoping Review. *Sustainability*, 12(24), 10392. <https://doi.org/10.3390/su122410392>

Papagiannakis, A., Baraklianos, I., & Spyridonidou, A. (2018). Urban travel behaviour and household income in times of economic crisis: Challenges and perspectives for sustainable mobility. *Transport Policy*, 65, 51–60. <https://doi.org/10.1016/j.tranpol.2016.12.006>

Park, T., Londakova, K., Brennan, I., Schein, A., Reynolds, J., Whincup, E., Chan, E., Pelenur, M., & Halpern, D. (2023). How to build a Net Zero society. The Behavioural Insights Team. <https://www.bi.team/publications/how-to-build-a-net-zero-society/>

Puleo, G. E., Borger, T., Bowling, W. R., & Burris, J. L. (2022). The State of the Science on Cancer Diagnosis as a “Teachable Moment” for Smoking Cessation: A Scoping Review. *Nicotine & Tobacco Research*, 24(2), 160–168. <https://doi.org/10.1093/ntr/ntab139>

Ralph, K. M., & Brown, A. (2019). The role of habit and residential location in travel behavior change programs, a field experiment. *Transportation*, 46(3), 1–16. <https://doi.org/10.1007/s11116-017-9842-7>

Ramos, A., Pereira, C. R., & Vala, J. (2016). Economic crisis, human values and attitudes towards immigrants. *Values, Economic Crisis and Democracy*, 104–137.

Rau, H., & Manton, R. (2016). Life events and mobility milestones: Advances in mobility biography theory and research. *Journal of Transport Geography*, 52, pp 51-60. <https://doi.org/10.1016/j.jtrangeo.2016.02.010>

Schäfer, M., Jaeger-Erben, M., & Bamberg, S. (2012). Life Events as Windows of Opportunity for Changing Towards Sustainable Consumption Patterns? *Journal of Consumer Policy*, 35(1), 65–84. <https://doi.org/10.1007/s10603-011-9181-6>

Scheiner, J. (2014). Gendered key events in the life course: Effects on changes in travel mode choice over time. *Journal of Transport Geography*, 37, 47–60. <https://doi.org/10.1016/j.jtrangeo.2014.04.007>

Service, O., Hallsworth, M., Halpern, D., Algate, F., Gallagher, R., Nguyen, S., Ruda, S., & Sanders, M. (2014). EAST Framework: Four Simple Ways to Apply Behavioural Insights. The Behavioural Insights Team. <https://www.bi.team/publications/east-four-simple-ways-to-apply-behavioural-insights/>

Soebbing, B. P., Mason, D. S., & Humphreys, B. R. (2016). Novelty effects and sports facilities in smaller cities: Evidence from Canadian hockey arenas. *Urban Studies*, 53(8), 1674–1690. <https://doi.org/10.1177/0042098015576862>

Solaymani, S., Kardooni, R., Kari, F., & Yusoff, S. B. (2015). Economic and environmental impacts of energy subsidy reform and oil price shock on the Malaysian transport sector. *Travel Behaviour and Society*, 2(2), 65–77. <https://doi.org/10.1016/j.tbs.2014.09.001>

Stanbridge, K., & Lyons, G. (2006, August 16). Travel behaviour considerations during the process of residential relocation. 11th International Conference on Travel Behaviour Research, Kyoto, Japan.

Thomas, G. O., Poortinga, W., & Sautkina, E. (2016). Habit Discontinuity, Self-Activation, and the Diminishing Influence of Context Change: Evidence from the UK Understanding Society Survey. *PLOS ONE*, 11(4), 1–16. <https://doi.org/10.1371/journal.pone.0153490>

Thompson, S., Michaelson, J., Abdallah, S., Johnson, V., Morris, D., Riley, K., & Simms, A. (2011). 'Moments of Change' as opportunities for influencing behaviour. Defra, London.

Tiikkaja, H., & Viri, R. (2021). The effects of COVID-19 epidemic on public transport ridership and frequencies. A case study from Tampere, Finland. *Transportation Research Interdisciplinary Perspectives*, 10, 100348. <https://doi.org/10.1016/j.trip.2021.100348>

Tubadji, A., & Nijkamp, P. (2019). Cultural attitudes, economic shocks and political radicalization. *The Annals of Regional Science*, 62(3), 529–562. <https://doi.org/10.1007/s00168-019-00906-1>

Verplanken, B., Roy, D., & Whitmarsh, L. (2018). Cracks in the wall: Habit discontinuities as vehicles for behaviour change. *The Psychology of Habit: Theory, Mechanisms, Change, and Contexts*, 189–205.

Verplanken, B., Walker, I., Davis, A., & Jurasek, M. (2008). Context change and travel mode choice: Combining the habit discontinuity and self-activation hypotheses. *Journal of Environmental Psychology*, 28(2), 121–127.

Verplanken, B., & Wood, W. (2006). Interventions to Break and Create Consumer Habits. *Journal of Public Policy & Marketing*, 25(1), 90–103. <https://doi.org/10.1509/jppm.25.1.90>

Walker, I., Thomas, G. O., & Verplanken, B. (2015). Old habits die hard: Travel habit formation and decay during an office relocation. *Environment and Behavior*, 47(10), 1089–1106.

Wee, B. V., & Hoorn, T. V. D. (2002). Effects of office relocations to public transport nodal points on passenger mobility. In *Travel Behaviour*. Edward Elgar Publishing. <https://www.elgaronline.com/display/1840647078.00024.xml>

West, R. and Michie, S. (2020). A brief introduction to the COM-B Model of behaviour and the PRIME Theory of motivation [v1]. *Qeios*.

Whittle, C., Whitmarsh, L., Nash, N., & Poortinga, W. (2022). Life events and their association with changes in the frequency of transport use in a large UK sample. *Travel Behaviour and Society*, 28, pp 273-287. <https://doi.org/10.1016/j.tbs.2022.04.007>

Wood, W., Tam, L., & Witt, M. G. (2005). Changing circumstances, disrupting habits. *Journal of Personality and Social Psychology*, 88(6), 918–933. <https://doi.org/10.1037/0022-3514.88.6.918>

Zarabi, Z., & Lord, S. (2019). Toward More Sustainable Behavior: A Systematic Review of the Impacts of Involuntary Workplace Relocation on Travel Mode Choice. *Journal of Planning Literature*, 34(1), 38–58. <https://doi.org/10.1177/0885412218802467>

Appendix A: Literature review method

This report was informed by a narrative review of the literature. This review covered moments of change and how moments of change affect travel behaviours. The research questions for this review were:

- what is a moment of change?
- how can practitioners distinguish between types of moments of change in a way that helps them ascertain the design of effective behavioural interventions?
- what behavioural mechanisms underpin moments of change? (Why are people likely to make different choices during moments of change?)

Most of the texts included in the review were papers in academic journals. However, the review also included a book chapter, a conference paper, a master's thesis and publications by the Food Standards Agency, the Behavioural Insights Team and the New Zealand Ministry of Transport.

Appendix B: qualitative research method

Between September and November 2023 **TRL conducted group discussions and interviews, primarily with people who are involved in developing transport policies and communications.** The purpose of this stage was to learn which findings from the literature review were useful to transport practitioners and how best to communicate these findings.

Sampling and recruitment

Participants were sought from across the transport sector, recruited through existing networks and targeted outreach via publicly available email addresses. Either DfT or TRL made an initial contact by email, providing some background information and asking potential participants to indicate their interest. If participants felt like they could not contribute (due to their role remit or availability), they were encouraged to forward the email to another colleague or team. Following confirmation of interest, TRL sent an email requesting participants preferred time and day to attend a group discussion or interview. Availability information was collected using Smart Survey.

TRL recruited participants from central government and arm's length bodies, sub-national transport bodies, transport authorities, local councils, transport operators and academia. A total of 66 individuals from 34 organisations were contacted and 43 individuals from 22 organisations participated. Table B1 provides an overview of the participants.

Organisation type	Number of organisations	Number of participants
Central government department (DfT) and arm's length bodies	4	20
Sub-national transport bodies	2	2
Transport authorities	4	7
Local councils	4	5
Transport operators	2	3
Academia	2	2
Other national bodies	3	5
TOTALS	22	43
Text	Text	Text

Table 4 Achieved sample

Data collection

TRL facilitated four group discussions with transport practitioners. Each participant attended a single group discussion. Where possible, participants were grouped according to the type of organisation they worked in. The sessions were conducted via MS Teams and lasted around 90 minutes during which time two facilitators promoted discussion on the following topics:

- understanding moments of change
- what is a moment of change?
- are there other terms you've heard of or use?
- can you think of any other moments of change?
- application of interventions at moments of change
- have you/your organisation thought about timing new policies / interventions to coincide with moments of change – events in people's lives or society?
- have you come across work by others?
- relevance of moments of change
- how useful do you think would be for you/your team to consider timing new policies / interventions to coincide with moments of change?
- what would considering moments of change help your team/ organisation to achieve? What KPIs might they relate to?
- how do you see moments of change being used in your organisation/team?
- barriers to considering moments of change
- what do you think the barriers to using moments of change in your team/ organisation are?
- can you tell me anything that has stopped you/ your team / organisation from using moments of change in the past?
- what might stop you/your organisation from using them in the future?
- overcoming barriers
- have a think about what solutions might overcome the barriers to using moments of change in your work. Any suggestions?
- tell me about some of the solutions you said you might find useful – why?

- how could the solution be delivered?
- what existing resources / programs / organisations could the solutions be linked with?

A fifth discussion took place with two academics with expertise on moments of change. During this discussion, TRL and BIT presented the emerging project findings and the academic experts offered their insights.

In addition, TRL conducted four interviews to gather in-depth insights from those who could either not attend the group discussions or who TRL identified would be useful to have a more detailed conversation with based on their contributions in the group discussions. These interviews used a similar topic guide to the group discussions but allowed for more detailed discussion.

During each group discussion and interview, TRL made notes to capture participants' insights. In addition, these sessions were recorded and transcribed for analysis.

Following each session, TRL sent participants a Smart Survey link to request case studies of interventions that have been implemented at moments of change. The survey comprised the following questions:

- What is your name and organisation?
- Who was the policy/ intervention done by? (team / organisation)
- What was the moment of change? Why was this selected?
- Please describe what was done? Please include where possible: What was the intervention? Why was this type of intervention selected? How was it rolled out? With who (target audience)? When?
- What were the results, if known? How effective was it?
- Please provide links to website/ report if available.