Key events and multimodality: A life course approach

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A B S T R A C T

Since the large majority of households have access to one or more cars in the developed world, encouraging multimodal travel behaviours has become a goal for many cities. Multimodality refers to the use of more than one transport mode within a given period of time. While correlates of multimodality have been identified from cross-sectional data, there is very little known about the circumstances over time in which individuals become more or less multimodal. This paper is the first to fully adopt the mobility biography approach to study changes in multimodality over time at the individual level. Multimodality is measured using four continuous indicators of mode use in a seven-day period: the share in trips made by the most commonly used mode (primary mode), the Herfindahl-Hirschman Index, Shannon's entropy, and the number of modes used. The paper uses the German Mobility Panel (GMP) for the period 1994–2012. The results demonstrate that some of the life course events studied are significantly associated with changes in multimodality. Specifically, a child moving out of the household increases the multimodality of parents. Leaving the labour market increases multimodality, while entering the labour market conversely reduces multimodality. Changes in car access and driver licence holding have significant effects as well. An improvement to the public transport system in the neighbourhood increases multimodality, and vice versa. Reduced parking space availability also increases multimodality. The latter two findings endorse 'carrot and stick' transport policies as means of creating a more balanced use of transport modes.

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1. Introduction

Whereas the focus of travel behaviour research has long been on explaining differences in behaviour between individuals (interpersonal variability), there is an increasing interest in intrapersonal behavioural variability (Huff and Hanson, 1986; Chatterjee, 2011; Scheiner and Holz-Rau, 2013; Susilo and Axhausen, 2014; Heinen and Chatterjee, 2015). Intrapersonal variability in this research refers to short-term (day-to-day) variability as well as longer-term variability over the life course. In terms of travel mode use, variability has been considered in the literature using the terms mode choice variability or modal variability (Heinen and Chatterjee, 2015), or multimodality (Kuhnimhof et al., 2012). This is an important development in research, as travel mode choice has for a long time been (and still continues to be) considered in terms of a discrete choice at the trip level. Research on multimodality highlights that individuals may choose to use different modes when their preferences or circumstances vary. Such circumstances may include trip purposes, destinations visited, weather conditions, resources available, or family members involved.

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Multimodality has been referred to as the use of more than one transport mode within a given period of time (Kuhnimhof et al., 2012). This definition implies that the prevalence of multimodality increases with the duration of the definition period. The use of more than one mode within a trip is typically referred to as intermodality and can also be considered in the measurement of multimodality. The concept of multimodality is typically applied to individuals, but can also be used for households or population groups. It has been studied in terms of its prevalence, trends over time and its correlates (Heinen and Chatterjee, 2015).

Multimodality has become a growing issue of interest because rising car ownership and use in many parts of the world have led to a range of problems that need addressing by encouraging a more balanced use of different transport options. Encouraging car owners to use alternatives to the car, at least for some of their travel, has become a specific goal for cities in Europe with the 'Do the Right Mix' campaign (EC, 2014). They consider it more realistic to encourage their citizens to make a change to their relative use of different transport modes than to replace the use of one mode with another. Furthermore, it has been shown that multimodal travellers are more inclined to respond to interventions to encourage use of alternatives to the car than individuals with more repetitive mode choices (Heinen and Ogilvie, 2016). These points highlight the practical value of understanding the circumstances in which individuals increase (or decrease) the mix of transport modes they use. Such an understanding will assist with developing effective transport mode change policies.

While correlates (or predictors) of multimodality have been identified from cross-sectional data, there is little known about the circumstances over time in which individuals become more or less multimodal. This can be studied at the individual level using the mobility biographies (or life course) approach. The mobility biographies approach argues that travel behaviour changes are linked to life course events or changes in the urban environment and associated accessibility. Such events and changes may cause mismatch between an individual's situation and his/her behaviour that results in stress, and this stress may trigger short-term or longer-term (lagged) learning and adaptation processes that eventually lead to behaviour change (Clark et al., 2016).

This paper utilises ideas of the mobility biography approach (Müggenburg et al., 2015; Chatterjee and Scheiner, 2015) to study changes in multimodality over time at the individual level. There has been extremely little research on this topic to date (Kroesen, 2014a; Chatterjee et al., in press). Multimodality is measured using four continuous indicators of mode use in a seven-day period: the share in trips made by the most commonly used mode (primary mode), the Herfindahl-Hirschman Index, Shannon's entropy, and the number of modes used. The paper uses the German Mobility Panel (GMP) for the period 1994–2012, in which respondents are asked three times in three consecutive years to complete trip diaries for a week. This is accompanied by personal and household sociodemographic and geographical context information for each of the three survey years which allows reconstruction of life course events based on changes reported in socio-demographics and accessibility. Hence, this paper seeks to: (1) understand travel behaviour change over the life course, with a specific focus on (mid- to longer-term) changes in (short-term) modal variability, (2) contribute to the rare attempts to quantify modal variability using continuous indicators, (3) inform policy makers and practitioners about travel behaviour change and interventions to promote increased multimodality.

The next section reviews research to date on multimodality and longer-term variability in mode use. This is followed by a description of the data, the analysis approach and the variables used. Subsequently the results are presented, including regression models of changes in multimodality over time. The paper finishes with conclusions for further research and policy.

2. State of the research

2.1. Multimodality

In this review we first consider different ways of measuring multimodality before summarising findings on predictors of multimodal behaviour. We identify that there has been very little research investigating the factors that lead to a change in individual-level multimodality over time. Given this gap, we return to transport mode use and summarise what is known about the predictors of a change in transport mode use over time to inform a new analysis of change in multimodality over time.

2.1.1. Measuring multimodality

Multimodality may, broadly speaking, be characterised in two ways. The first way is to classify individuals into nominal categories based on the combination of transport modes they use. Classification can be based on predefined conceptualisation, or determined by the data itself. The second way of characterising multimodality is by quantitative indicators which describe the extent of variability in mode use. The measurement of multimodality is also affected by data available and how it is used. Studies of multimodality have varied in the number of transport mode types considered and in the duration of time over which transport mode use is considered. Information on transport mode use is collected in different ways. Studies have usually used travel diary data, but in some cases asked survey respondents to indicate their typical frequency of using transport modes.

Differences in measurement present difficulties for making comparisons between studies. This is evident from Buehler and Hamre (2015) who estimated from 2009 National Household Travel Survey (NHTS) that 78% of the American population were monomodal car users from one-day travel diary data but only 28% were monomodal car users from respondents' stated