Transport costs seen through the lens of residential self-selection and mobility biographies

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Abstract: This position paper places transport costs in a longitudinal, life-course oriented perspective. It argues that travel behaviour and the choice of residence may be considered two intertwined decision frameworks made by individuals/households that in turn can be understood within the broader context of mobility biographies. The interrelations between mobility biographies and transport costs are on multiple levels. Firstly, they refer to different types of cost, including user costs, costs for transport provision and external costs. Secondly, mobility biographies and, specifically, residential self-selection may be affected by transport (user) costs, while at the same time they work as input factors for transport costs on all cost levels. The paper outlines these thoughts and discusses the consequences for spatial planning and transport planning. It suggests a strong planning system in which guidelines for travel and residential choice are set by public planning organisations rather than by the market. This is likely to help spare future households increasing transport costs, and costs for transport provision and external costs will be reduced as well. Further, it argues for a shift away from the happiness debate and towards the notion of dignity in transport studies.

Keywords: transport costs; residential self-selection; life course; travel behaviour; happiness; dignity

1 Introduction

Two related research fields have emerged in transport studies in the past fifteen years: the role of residential self-selection in travel behaviour, and the mobility biographies approach to travel. Both of these fields stress the idea of a longitudinal, process-oriented microscopic perspective on travel, even though many empirical studies on the residential self-selection/travel link are realised in a cross-sectional fashion. Longitudinal perspectives have also been used to study transport costs, e.g. in terms of the accumulated life cycle costs of infrastructure (including investment and maintenance) or external costs that may need to be covered some time in the future. Yet, links between people's mobility biographies and transport costs have to date hardly been addressed.

This paper posits that the study of transport costs can benefit from mobility biographies (Lanzendorf, 2003; Chatterjee and Scheiner, 2015; Müggenburg et al., 2015) and residential self-selection (RSS) studies (Handy et al., 2005; Cao et al., 2007; Scheiner and Holz-Rau, 2007;

Chatman, 2009; Bohte, 2010), in that these approaches help understanding of the long-term accumulation, stabilisation and self-reinforcement of transport costs, and help ascribe responsibility for transport costs to those who cause them. The paper does not present original research. It rather draws upon literature from a range of subfields in travel behaviour, residential choice, transport economics, and elsewhere to build a narrative. It cannot provide a review of the literature on any of the stated fields. The paper makes a case for a strong planning system in which guidelines for travel and residential choice are set by public planning organisations rather than by the market. It argues that this would be likely to help relieve future households from increasing transport costs and contribute to sustainability by reducing transport provision costs and external costs as well. It also suggests shifting the well-being debate in transport studies to focus on the notion of dignity rather than looking at happiness. The paper argues primarily from a European, specifically German, perspective, as some points raised are based on certain premises of urban form, and the housing and transport markets (e.g. the degree of choice in modes). Still, the conclusions can be generalised to other countries as far as the premises are similar today or could achieve some similarity in the future.

The next two sections introduce the concepts of RSS and mobility biographies, with a focus on discussing a number of questions relevant for the subsequent discussion. This is followed by introducing three types of transport costs (user costs, costs of transport provision, and external costs) and a discussion on how mobility biographies and RSS are related to these costs. Possible consequences for 'happiness approaches' in transport are outlined briefly in the next section. The paper closes with some conclusions for policy and future research.

2 Residential self-selection in travel behaviour

The RSS-travel debate originated from the land-use/transport debate. In essence, it seeks to answer the question: What if it is not urban form and the opportunities it provides that cause geographical differences in travel behaviour[1], but rather the individual, social or psychological characteristics of people that make them choose a particular place of residence that in turn determines the spatial context they live in? The focus is therefore on the unequal spatial distribution of people with different social and personal characteristics, specifically on that spatial distribution which is motivated by people's preferences (i.e. subjective dispositions, or attitudes) towards the residence, neighbourhood, accessibility, and travelling. This research went hand in hand with the study of lifestyle effects on travel (Kitamura et al., 1997; Bohte, 2010; Van Acker et al., 2014). Lifestyles may be understood as preferences as well, but have been conceptualised in terms of various dimensions such as consumption and leisure behaviour, values, life goals, aesthetic taste, cultural affiliation or social networking (Aero, 2006; Scheiner and Holz-Rau, 2007). Taken together, attitudes, preferences and lifestyles may be understood to reflect subjective elements in people's travel needs (Scheiner and Holz-Rau, 2007).

It should be noted that the unequal spatial distribution of different population groups was controlled for much earlier in transport analysis by including personal and household sociodemographic variables, i.e. by accounting for socio-economic and demographic segregation. However, the new focus on the direct measurement of preferences accounted for the possibility that life situation may not adequately reflect these preferences. The term life situation reflects

[1] Variables of interest may include household or individual car ownership, car availability or public transport season ticket ownership, all of which are not travel behaviour variables, but reflect pre-decisions on intended travel behaviour (specifically on mode choice). I deliberately use the term travel behaviour here to include the availability or ownership of mobility tools.

more objective, longer-term circumstances such as resources, social roles and personal ties that can hardly be changed on a day-to-day basis (Scheiner and Holz-Rau, 2007). These are formally reflected in sociodemographics.

The RSS-travel debate is based on a number of implicit premises (Chatman, 2009). One of them is the idea that preferences play a major role in travel as well as in residential choice. This idea presupposes that people/households (a) have distinct preferences for certain ways of travelling that guide their travel and residential decisions and (b) have options to satisfy these preferences when they relocate in terms of their own resources and constraints in housing supply. Hence, two questions may be raised at this point.

(a) Do preferences play a relevant role in travelling?

(b) Do households have the choice on the housing market to meet their travel preferences?

2.1 Do preferences play a relevant role in travelling?

From numerous studies there is general agreement that travel preferences – sometimes called mobility styles – have a significant effect on travelling, even when confounding factors are controlled (e.g. Ohnmacht et al., 2009; Van Acker et al., 2014).

Travel preferences have also been found to play a significant role in residential choice. This is the main achievement of the RSS-travel debate (see special issues of Journal of Transport and Land Use 7(3), 2014, and Transport Reviews 29(3), 2009). However, they may not play an equally important role for all. The observation that households tend to deliberately accept high transport costs for the sake of residential quality (see Section 4.2) suggests that residential choice is largely driven by residential preferences, rather than travel preferences (see also Ettema and Nieuwenhuis, 2015). The role of preferences in residential choice is further discussed in Section 2.2.

The idea that preferences play an important role is also supported by theoretical considerations on individualisation and modernisation in developed societies. Sociological studies suggest that late modern welfare societies have lost their former rigid structure that was based on classes and traditional norms rooted in religion, political affinity, gender and intra-family hierarchy (Beck, 1992; Elzinga and Liefbroer, 2007). The increasing degrees of freedom are not least subject to increased large-scale access, more mobility and weakened ties to the immediate environment (Schmitz, 2001; Haugen et al., 2012). A declining role of social circumstances for travel behaviour over time can also be concluded from regression models. Scheiner (2006a) demonstrates that life situation constraints tend to lose the power to impact behaviour over time, although research consistently shows that they remain significant (Handy et al., 2005; Cao et al., 2007; Scheiner and Holz-Rau, 2007; Bohte, 2010; Scheiner 2010; Aditjandra et al., 2012; Van Acker et al., 2014).

On the other hand, some arguments challenge the idea that neighbourhood, travel or accessibility preferences play a major role for people. Firstly, looking at descriptives of such preferences suggests only minor variation either between scales or between different urban areas. In Cologne, seven preference scales (measuring access to the nearest centre, the social neighbourhood, highway access, parking, child facilities, shopping facilities, and the residence) have all resulted in very similar mean values, and most differences between distinctly different inner-city and suburban neighbourhoods were only minor. For instance, the author concludes that "proximity to shopping facilities is equally important in all study areas" (Scheiner, 2006b, p. 69, author's translation). Taken overall, this suggests a universal, high level of expectation for multiple criteria.

Secondly, variations in preferences are likely to reflect objective circumstances. For instance, a low preference for public transport use is likely to occur when public transport performs poorly. Still, preferences were found to be significant in various studies when objective urban context was held constant. However, preference measurement typically follows exposure to spatial context. This means that preferences may have adapted to circumstances.

There is little direct evidence on travel preference adjustment or change. Studies on preference change in other fields may help. For instance, in childless couples the desire to have a child declines over time (Gray et al., 2013), attitudes towards safety management become more positive after a volcano eruption (Bird and Gisladottir, 2012), prejudice towards Muslims increased in Amsterdam after Theo van Gogh was killed by a Islamic fundamentalist (Gautier et al., 2009), while socioeconomic or ethnic diversity in the neighbourhood decreases prejudice (Wessel, 2009). Preferences are known to be adjusted to social context in terms of attitude and lifestyle alignment in couples (Arránz Becker and Lois, 2010, for lifestyles; Kalmijn, 2005, for gender roles). Studies by Wahl (2003) and Isengard (2011) suggest that lifestyles change over the life course. E.g., Isengard (2011) finds that people tend to become less active in out-of-home leisure over the life course due to labour market, family, and social network composition effects. Spatial context changes perhaps play only a minor role here. According to Spellerberg (2011), residential moves between different geographical contexts ranging from urban to rural have little effect on lifestyles (measured as leisure activities). Conversely, structural equation models estimated by Van Acker et al. (2014) suggest that people adjust their residential preferences to the residence chosen, but are based on cross-sectional data. The cross-sectional models developed by Bohte (2010, pp. 81-109) similarly suggest that the effects of travel behaviour on preferences is stronger than vice versa. She concludes that people adjust their preferences to circumstances, as suggested by Festinger's (1957) cognitive dissonance theory.

Direct evidence on preference change in travel is rare. Wang and Chen (2012) find that those who switch from carpooling to solo driving (negatively) adjust their attitudes to carpooling to support their self-justification of solo driving. Vugt et al. (1996) find a decrease in support for carpooling by non-carpoolers after the first road lane in Europe was dedicated to carpooling. However, to the best of my knowledge, there are no studies on individual change in more general travel preferences over time. From the above evidence on attitude and lifestyle change such change appears very likely. This is also supported by findings on short-term variability in travel preferences (Börjesson et al., 2013), variations in realised travel ('revealed preferences') over time in the short-term (Heinen et al., 2011; Kamruzzaman et al., 2015) and in the long-term, as found in mobility biographies studies (Scheiner and Holz-Rau, 2013b). These findings suggest that people are flexible in adapting their behaviour to their needs as well as to changing circumstances (e.g. when they enter or leave the labour market, when they relocate etc.), rather than sticking with the travel preferences they developed earlier. This idea also seems reasonable from a theoretical perspective on human action.

At the bottom line, travel preferences are likely to play an important role for people in general, but it seems unlikely that they can be considered a stable predisposition for travel behaviour. Rather it is probable that they are continually adapted to changing needs and circumstances.

2.2 Residential decisions between choice and constraint

Residential choice clearly depends on housing supply and the budgetary constraints of households (Blasius and Friedrichs, 2011; Rössel and Hoelscher, 2012). However, in markets that allow choice more criteria are likely to be important. The idea that lifestyles and preferences play a role in residential choice dates back to the 1960s, when suburbanisation in the US was explained (to some extent) by households' desire to live near people who shared similar tastes

and norms (see Aero, 2006, for a brief overview). In the 1990s studies pointed out the importance of young people's housing preferences for urban regeneration in downtown Canadian cities (Caulfield, 1994; Ley, 1996).

While there is no ultimate way to establish the extent to which a residential decision is based on deliberate choice or constraint, one may argue that freedom of choice may predominantly be reflected in subjective variables such as preferences and lifestyles, while constraints should be seen in more objective measures of resources, 'hard' social roles and context, as reflected in life situation, car ownership or housing supply. Establishing the degree of choice or constraint from variables that indirectly represent one of the two extremes requires studies that consider both. However, despite the overwhelming body of literature on residential choice few studies meet this requirement. For instance, car availability is a key resource for freedom in residential choice, but is rarely considered in residential choice studies simultaneously with other variables (for recent examples see Rössel and Hoelscher, 2012; Vasanen, 2012; Smith and Olaru, 2013; Liao et al., 2015).

Hesse and Scheiner (2009) estimate regression models of residential choice (inner city versus suburban neighbourhood) in the region of Cologne. They find that 54% of explained variance is based on life situation. Another 35% is based on subjective variables, including lifestyles (17%) and preferences (18%), and 11% is based on transport options (car and public transport season ticket availability). Using structural equation modelling with the same data, Scheiner (2009, pp. 97-156) studies various measures of travel behaviour. His models simultaneously include the effects of life situation, lifestyle, preferences, and car availability on residential location. Averaging these models suggests that 41% of explained variance in residential choice is explained by life situation. Another 33% is due to subjective variables (13% lifestyle, 20% accessibility preferences), and a respectable 26% is due to car availability.

One may conclude that structural impacts are substantial in residential choice, but the same is true for preferences and lifestyles. There seems to be substantial freedom of choice in residential decisions, the more so as life situation does not exclusively represent constraints, but also reflects preference decisions to some extent. This is despite the fact that Cologne has a rather supply-driven housing market with limited options for relocating households. Preferences may be expected to play an even larger role in regions with a less constrained provision of housing.

Similar to travel behaviour, people's ability to adapt to the residential situation they live in is considerable. Aero (2006) finds in Denmark that the overwhelming majority of his respondents prefer single-family detached housing. Still most of them are highly satisfied with the dwelling chosen, regardless of dwelling type (low or high rise) or neighbourhood (high or low density). Preferences are fluid; people tend to adjust their aspirations to what they have in order to reduce cognitive dissonance, a finding that helps explain why people tend to be satisfied in various housing situations (Jansen, 2014).

The RSS-travel debate has clear links to a process-oriented, longitudinal understanding of travel, as it suggests temporally ordered links on the individual level: residential choice is based on preferences, and travel is based on residential choice and hence, indirectly, on preferences. This temporal understanding suggests linking the RSS-travel debate to the broader idea of mobility biographies, as RSS itself is embedded in people's life courses (Chen and Lin, 2011).

3 The idea of mobility biographies

The mobility biographies approach is by definition dedicated to a long-term process-oriented understanding of travel behaviour. The term was introduced by Lanzendorf (2003) while at the same time similar ideas were developed in various places (Axhausen, 2002; van der Waerden et

al., 2003; Scheiner, 2003). Understanding how and why behaviour changes over people's life courses may help disentangle cause and impact in complex relationships and improve understanding of how people make decisions, and to what extent and how these decisions can be affected by planning or policy strategies.

The theoretical ideas of this approach are based on three main elements:

1. Habits, which are reflected in the routine character of daily (travel) action, resulting in strong behavioural stability over a long time,
2. Close relationships between individual mobility biographies and other domains of the life course,
3. Significant changes in mobility that are motivated by transitions, events and learning processes, and associated breaks in routines that occur in an individual's biography.

There has been less emphasis in this approach on 'linked lives' (Elder et al., 2006). Linked lives approaches combine ideas related to social networks and life courses. Links between an individual's mobility biography and significant other persons suggest that socialisation is at work in mobility. Accordingly, one could add a fourth element:

4. The impact of socialisation agents in biographical processes in mobility.

The majority of empirical work focuses on the third point. The emphasis of these studies is on the impact of key events (or life events, life-cycle events, life course events) and transitions on mobility, i.e. mostly on mode choice (see Chatterjee and Scheiner, 2015, Müggenburg et al., 2015, for reviews). One may suggest that the flow of events, experiences, and learning over the life course is much broader and more continuous than the idea of abrupt changes associated with key events suggests.

Similarly, RSS-travel studies consider spatial mobility as a process of interrelated mobility decisions people make to navigate their life paths. They are based on the idea that travel behaviour is embedded in the long-term aspirations and decisions of individuals or households about how and where to live, and how and where to get around in daily life. However, the RSS-travel debate focuses on residential choice and travel, while the mobility biographies approach is much wider in scope, acknowledging that the mutually related decisions on residential choice and daily travel are themselves embedded in stability and change in the spatio-temporal and social context in which an individual lives. Hence, the mobility biographies approach is a more open and holistic framework for understanding interdependencies between travelling and other spheres of an individual's life, similar to Zhang's (2014) life-oriented approach. It gives consideration not only to residential location choice and relocation, but to employment biographies including workplace locations, to household and family biographies as well as to wider personal networks. Lifestyles (Lanzendorf, 2003), health issues and critical incidents such as accidents (Chatterjee and Scheiner, 2015) have also been identified as worthwhile fields of mobility biography studies.

Figure 1 serves as a starting point for a framework for empirical studies. The upper row shows a cause-impact chain at a certain point in time (t1) as is typically assumed in RSS-travel studies. Repercussions (dotted arrows) occur due to factors typically considered outcomes in RSS-travel studies and affect what are typically considered causes. These reverse causality effects may lead to changes in life situation or preferences, to residential relocation, or to the purchase or disposal of mobility tools, at a later point in time (t2). State dependency is shown by arrows directed from a concept in the upper row to changes in the same concept in the lower row.

This scheme is individualist (or household-related) in nature, but it is embedded in a wider social environment ('linked lives'), shown by shadow effects. In line with the limited scope of any empirical study, the shadows may also indicate that each concept in this figure may represent

several measures rather than links between individuals. Furthermore, the whole process is embedded in a technological, economic and political context and, specifically, in regional housing supply (which particularly affects choice of residence), and transport supply (which particularly affects mobility tool ownership and travel behaviour).

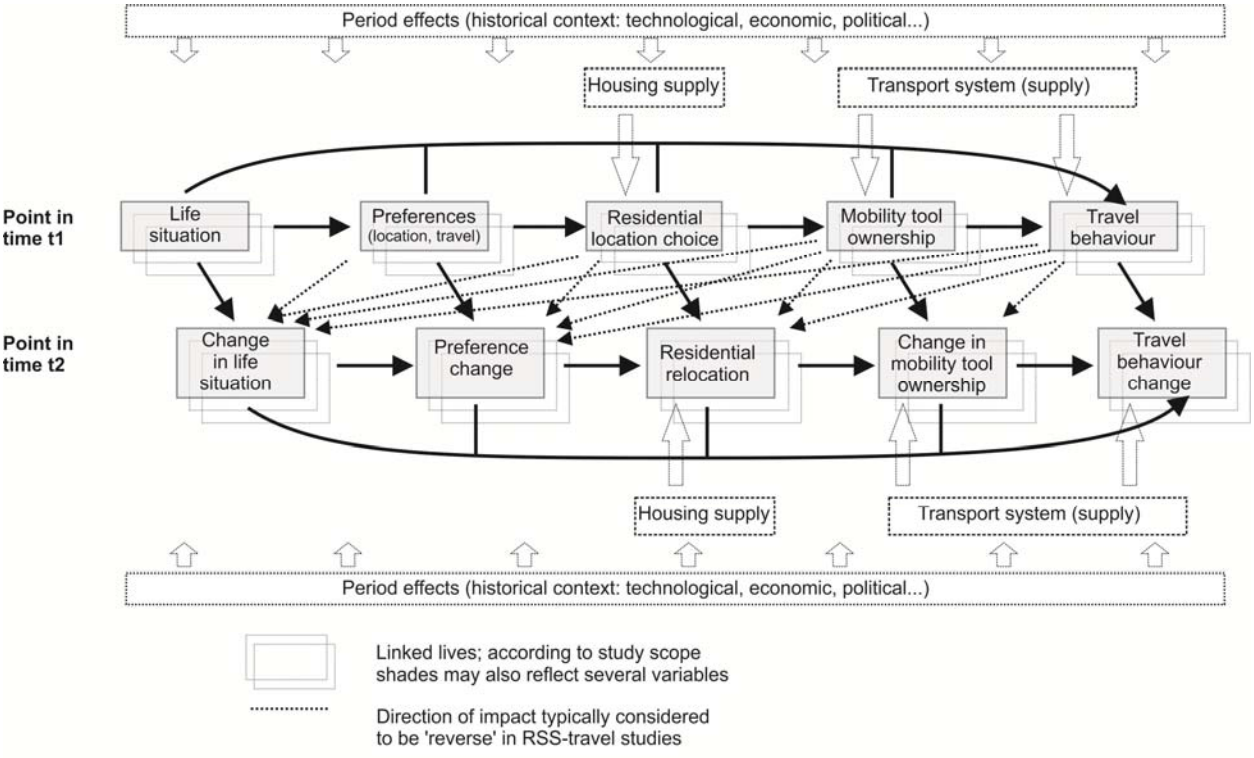

Figure 1: Process model for the study of mobility biographies including residential self-selection. Source: author's concept.

It can be seen that the mobility biographies idea also gives more consideration to bidirectional cause-impact relationships than the RSS approach (again, this is in line with the life-oriented approach suggested by Zhang, 2014). For instance, the RSS-travel debate has hardly contributed to understanding of the emergence of the variables that are supposed to reflect RSS. This is true for preferences as well as for life situation. While authors contributing to the RSS-travel debate have long recognised that preferences may follow changes in circumstances, they are still typically treated as exogenous control variables in RSS studies. The lack of attention given to the emergence of preferences is not surprising, as RSS studies are mostly interested in the marginal effect of spatial context that remains after controlling for preferences, rather than being interested in the preferences themselves.

This also applies to life situation to some extent, which is typically relatively robust against change. For instance, one may well assume that sex is an exogenous variable that would hardly change when circumstances change. On the other hand, the literature clearly shows that commuting has economic benefits, but comes at a social cost (Sandow, 2014; Sandow et al., 2014). That is to say, travel may alter life situation. This idea turns the cause-impact structures commonly assumed in the RSS-travel debate upside down, and it provides a link to the transport-poverty debate, more specifically to studies that investigate the effects of transport on employment and income generation (Matas et al., 2010; Tyndall, 2016).

Linking mobility biographies to RSS requires

(a) looking at residential relocation as a specific type of key event. This is undertaken in the following.

Linking the whole to (long-term) transport costs requires

(b) looking at the possible accumulation and self-reinforcement of transport cost effects of residential and travel choices in the long term. This is discussed below by highlighting socialisation effects.

3.1 Residential relocation and travel behaviour

In travel studies it is standard to consider residential location choice as a long-term decision that precedes travel behaviour. On the other hand, the RSS-travel debate points out that residential location choice itself is affected by travel preferences, options and behaviour, e.g. in terms of daily destinations and car availability.

A number of studies have focussed on the effects of residential relocation on travel behaviour. The reason for such effects is that access to destinations as well as to transport systems typically changes after relocating. This suggests that two distinct features of relocation are important here:

- Firstly, the combination of the pre-move and post-move home locations, as a change in accessibility is as much influenced by neighbourhood/location attributes at the former place of residence as by those of the new place;
- Secondly, distance of the move indicates the extent to which existing activity places can be maintained after the move.

Several studies have found that car availability and travel mode use change after residential moves (Handy et al., 2005; Cao et al., 2007, for the US; Aditjandra et al., 2012, for the UK; Scheiner and Holz-Rau, 2013a; Matthes, 2015; Klinger and Lanzendorf, 2016, for Germany), and the changes are typically in the expected direction – relocating towards a less dense, less urban, less mixed-use, more remote place tends to be associated with more frequent driving and/or longer distances driven. This counters the idea of RSS in travel behaviour to some extent and rather suggests some adaption to the built environment in terms of mode choice and travel distances.

Destination choice, activity spaces and related trip distances (before and) after residential moves have been examined less frequently. The few studies available appear to be mostly from Germany. They suggest lingering spatial ties to the former place of residence after a move in terms of commuting (Geier et al., 2001; Scheiner, 2009) as well as trips for shopping, personal errands, leisure and private visits (Albrecht, 2014; see Carpentier, 2012, for work and non-work trips after cross-border relocations from Luxembourg to Belgium). These ties are associated with relatively long trips of in-movers, compared to long-term dwellers. Distances may decrease over time (Geier et al., 2001; Albrecht, 2014) or not (Scheiner, 2009); results are inconclusive here. Notably, Buchanan and Barnett (2006) report substantial increases in trip distances after relocating to a remote residential development in Christchurch, New Zealand, regardless of whether trip destinations changed or not.

These findings suggest that people adapt to their environment in terms of mode use at least to some extent, but deliberately accept relatively long trips when relocating. This is particularly true for those households who move from an urban to a more remote location. There is little quantitative evidence for those moving in the opposite direction ('reurbanisation') (see Matthes, 2015, for a qualitative approach).

3.2 Socialisation effects in residential and travel choice

The results on changes in mode use, travel distances and destination choice refered to above suggest that household transport costs tend to increase after relocation, particularly when a household moves from an urban to a suburban, or from a central to a more remote, place.

However, they also suggest that cost increases may be relieved over time due to changes in destination choice.

Conversely, other strands of research in the field suggest that social interactions and habitualisation may contribute to the stabilisation and self-reinforcement of travel behaviour (and associated costs) in the long run. Firstly, recent studies have shown socialisation effects in travel behaviour (Tully and Baier, 2011; Mjahed et al., 2015) from a range of angles in terms of positive relationships between an individual's behaviour and peers' behaviour. Various peer agents have been found to be relevant, including the parents (Haustein et al., 2009; Döring et al., 2015; Susilo and Liu, 2015), partners (Kroesen, 2015), and mobility cultures on the neighbourhood level (Mitra and Buliung, 2014) and urban level (Weinberger and Goetzke, 2010; Klinger and Lanzendorf, 2016).

Secondly, while socialisation is attributed to relationships between an individual and other individuals or organisations that work as socialising agents, earlier individual experience in travel has been found to affect travel behaviour in later life as well. This has been discussed using terms such as state dependency, path dependency, fatigue or inertia (Weinberger and Goetzke, 2010; Scheiner and Holz-Rau, 2013b), with the former two terms not necessarily suggesting habitualisation, while the latter two do.

The studies discussed thus far directly refer to travel. There are related findings on demographic life paths (Liefbroer and Elzinga, 2012) and residential choice. Blaauboer (2011) and Albrecht et al. (2015) find inter-generational similarities in the choice of residential environment. Similarly, Aero (2006) and Chen and Lin (2011) report that experiencing a particular type of neighbourhood in earlier life increases the likelihood of moving to a similar neighbourhood later.

Taken overall, these findings suggest positive relationships between experiences made in earlier life and later behaviour, and likewise between parents' and their descendants' behaviour in terms of residential choice and travel. This means that certain types of travel behaviour may be 'inherited' from parents directly as well as indirectly (mediated via inherited residential choices). These considerations contribute to understanding how individual behaviours may accumulate into collective, norm-driven behaviours and, hence, reinforce themselves in the long run. A well-known example is the affinity between the suburban single-family detached home and the private car that has become a norm in the second half of the 20th century in Western countries (Wachs and Crawford, 1992; Schmitz, 2001).

This reinforcement applies to costs associated with such behaviours as well. Still, it is important to note that the relationships discussed here are contingent and relatively loose rather than determinate. North American studies on gentrification and reurbanisation from the 1990s demonstrate that people may deliberately opt for dense, urban residences just because they grew up with their parents in remote, suburban homes (Caulfield, 1994; Ley, 1996). Hence, there are options for change in one or another direction. Medicine and psychology use the concepts of resilience and salutogenesis to point out that even severe disruptions in circumstances and extremely burdensome experiences do not necessarily result in stress, disorder or another determined type of reaction or behaviour (Antonovsky, 1987; Bowler et al., 2012). People have different ways of coping with stress, and there are many options to overcome boundaries. Another interpretation would be that early socialisation allows children and adolescents to develop spatial skills or 'spatial capital' (Duchêne-Lacroix, 2013) to enable them to finally make informed decisions as adults. In some cases these decisions may not be the same as those that their parents made.

In a mobility biography context, Scheiner and Holz-Rau (2013b) highlight the looseness in associations between key events and travel behaviour changes. For instance, increases in fuel

prices do not necessarily imply that a household is stuck or trapped in a remote setting, but may motivate the household to various reactions, including more efficient driving, joint trips, or visiting more proximate destinations (Gertz et al., 2009). Having no car available in a remote setting may encourage residents to relocate to escape car dependence (Motte-Baumvol et al., 2010).

4 Mobility biographies and transport costs

So far this paper has mainly argued on the individual and household level. This should not limit cost considerations to this level. Before reflecting on the transport cost links of mobility biographies (including RSS), the scope of transport costs needs to be clarified.

4.1 Types of transport costs

Transport costs are a complex phenomenon. They can be categorised by various criteria (Button, 1993; Rodrigue and Notteboom, 2013), e.g. by their potential to be monetarised (tangible versus intangible costs), market coverage (internal versus external costs), investment or operation (fixed versus variable costs), cost component (e.g., for the private car: car purchase, energy, insurance, capital cost...) or parties responsible for payment (users, suppliers, the general public...). A mobility biographies approach suggests a user-centred cost perspective. However, from a policy perspective it is important to keep in mind that some costs caused by users need to be paid by others. Hence, it seems reasonable to distinguish here between (1) user costs, (2) costs for transport provision, and (3) external costs.

User costs are costs users have to pay to participate in transport. In passenger transport they are mainly determined by the number of cars in the household, and the amount of driving. In the US, 42% of household transport costs are for vehicle purchase, 52% for vehicle operation, and 6% for transport services (Rodrigue and Notteboom, 2013). Although European countries are known to be less car-dependent, figures are not overwhelmingly different. In Germany, 49% of household transport costs are fixed car costs, 39% are car operational costs, and 12% are spent on transport services (calculated from Gertz et al., 2009, p. 58). In a wider sense, 'generalised transport (user) costs' include time costs for trip-making and other social and health costs associated with travelling (Sandow, 2014; Sandow et al., 2014).

The **costs for transport provision** can be subdivided in various ways, e.g. in fixed and operating costs. For infrastructure provision, fixed costs mainly refer to the acquisition of land and construction, while operating costs are for maintenance. For transport services fixed costs refer to vehicles, while operating costs include labour costs, fuel etc. It has been found that road users do not fully account for the public cost of road provision in the US, while this is the other way round in most European countries due to higher fuel taxes and other differences in finance (Delucchi, 2007). For Germany the degree of cost coverage in road transport has been estimated to be 149% (Link et al., 2009).

External costs are costs that are not covered by a market mechanism. They include, e.g., health costs caused by transport accidents and emissions of noise, waste gas and particulate matter, and costs of climate change caused by CO2 and other emissions. It is important to note that only some of these costs are external. E.g., some health costs are covered by insurances (Brenck et al., 2015). Although the actual figures per kilometre travelled strongly depend on various assumptions, there is general agreement that external costs are considerably higher for car and air travel than for rail or bus/coach in passenger transport, and are higher for roads than for rail and waterways in freight transport (e.g., CE Delft et al., 2011, pp. 71-73).

4.2 Transport costs, residential location choice and the life course – a long-term perspective

Besides the distinction made above, linking transport costs to mobility biographies and RSS requires distinguishing between transport costs seen as a (direct or indirect) effect of, and as an input variable for travel behaviour and, specifically, residential choice.

4.2.1 Transport costs as an input variable

As an input variable for either travel behaviour or residential choice, transport costs are largely limited to user costs. Theoretically speaking, the costs of transport provision, and the environmental and societal costs of transport may well impact on travel behaviour. In practice, however, environmental awareness and moral considerations seem to have only limited, though (mostly) significant, effects on travel behaviour, although the evidence is not fully consistent (Hunecke, 2000, Bamberg and Schmidt, 2003, for Germany; Seebauer, 2011, for Austria; Susilo et al., 2012, for the UK; Enaux and Gerber, 2014, for Luxembourg). Pro-environmental attitudes have also been found to have limited, though significant effects on residential choice in the US (Liao et al., 2015), Germany (Rid and Profeta, 2011) and Belgium (Van Acker et al., 2014).

User costs are a key factor in individual and household demand for transport. Over time, they have declined substantially (Schmitz, 2001, p. 174-185; Gertz et al., 2009; Rodrigue and Notteboom, 2013) relative to welfare level, and the range of choice in daily travel has accordingly increased, which has resulted in the well-known increase in car ownership, activity spaces and distances travelled in the past two centuries (Knowles, 2006; Wegener, 2013).

The decrease in transport costs not only increased households' range in travel, but also in residential choice. Household suburbanisation has been largely attributed to increasing car ownership and use in the US as well as in Europe (Schmitz, 2001; Banister, 2011). Residential choice can be seen as a trade-off between housing costs and transport costs. Suburbanising households typically realise their housing needs at a relatively low housing cost at the expense of high transport costs (Coulombel et al., 2007; Palm et al., 2014). People may accept the high transport user costs that are associated with a particular place of residence and opt for this place anyway, because it offers other amenities. They may need to save money in other consumption domains, but this is not necessarily at the expense of their happiness or quality of life as a whole (see Section 5).

The more energy and transport prices increase presently and in the future, the more residential choice may be expected to shift towards the cities where transport costs are low, and housing prices are higher. This is what can be observed presently in Germany and other countries (Brake and Herfert, 2012, for Germany; Wachs, 2013, for the US). However, when people move towards the cities, housing prices in the cities increase and limit the influx, and this can also be observed empirically (Schürt and Göddecke-Stellmann, 2014).

Over recent decades, the dominant type of residential decisions in most developed countries was typically in favour of remote places with high transport costs, but low residential costs. This is the suburbanisation pattern. In a life course perspective, such decisions may turn out less than perfect with hindsight. The reasons are unforeseen increasing transport costs, while land values in remote places often tend to stagnate or even fall. Living in a detached single-family house with a large garden in a remote place with long distances to facilities may turn into a 'trap' or 'lock in' for an elderly household whose children have long left home.

However, this household is likely to have enjoyed many advantages of the decision they made, perhaps over several decades: the owner-occupied residence they had wished for at low cost, located in a green, quiet environment at a distance from urban social problems. In Germany they

would have received enormous housing subsidies from the federal government for construction, plus considerable tax refunds for commuting[2]. These subsidies disproportionately benefitted those located in rural, remote areas (Ausschuss für Wohnungswesen, 2002). To put it somewhat polemically, people would have been subsidised despite contributing to long car trips, trafficked cities and high investment costs for transport infrastructure.

Blaming former policies and those who benefitted from them would clearly be unjustified for those who did not make such decisions based on their preferences, but based on financial constraints, or on their local origin and family. Are there such people? In major German cities poor neighbourhoods are typically not disadvantaged in terms of accessibility. Rather they are either located in the inner city or they are well connected by public transport. In the countryside the picture is different, as public transport is often limited to a basic service, while even groceries and other daily facilities are lacking in villages and many small towns. Indeed, there is some evidence that:

- Depending on the type of municipality, 5-13% of people in rural municipalities live in households without a car, another 22-28% (including children) have no access to the household car, and 7-14% of adults are not licensed (Bauer et al., 2013, p. 48).
- 5-6% of individuals in small rural municipalities (< 5,000 inhabitants) have difficulties accessing daily grocery shopping, and 9-10% have problems accessing their workplaces (ibid., p. 37).
- One third (32%) of households in small rural municipalities are renters, which counters the idea that even low-income households in the countryside make a good living because they live in their own paid-off property (ibid., p. 65).
- People in rural areas, and even more so in small municipalities, are disproportionally affected by social disadvantage such as low income, low education or unemployment (ibid., p. 32). Still, poverty in rural areas is a largely neglected, invisible phenomenon (Winkler, 2010).

Any social/transport policy should be informed by knowledge about the extent to which accessibility-related (geographical or transport) disadvantage is driven by either (earlier) preferences or constraints, and the extent to which such disadvantage is associated with earlier or present benefits in the same or other domains. A life course perspective could help disentangle the cause-impact links between preferences and constraints, and the associations of both with housing, accessibility, quality of life, and travel, including user costs in transport and housing. Further it can help understanding of the cumulative development of these costs and associated benefits on the individual or household level as well as on the societal level in the long run.

4.2.2 Transport costs as an output variable

Transport costs are also an output variable of travel behaviour and residential choice, and this refers to all cost types distinguished above. Notably, all cost types largely point in the same direction with respect to geographical differences.

- Transport user costs are considerably lower for city dwellers than for those living in more remote, rural areas (Gertz et al., 2009) and, within a region, lower for inner city residents than for those living in outer suburban areas (Coulombel et al., 2007; Mattingly and Morrissey, 2014, Li et al., 2015). This is due to lower levels of car ownership, less frequent driving and the shorter distances driven by urban dwellers. The higher levels of public transport use in cities do not fully outweigh this cost gap (Gertz et al., 2009). Public transport user costs may even be higher in surburban areas (Li et al., 2015, for Brisbane, Australia). This cost gap is

[2] The amount and structure of the subsidies changed over the years. From 1996 to 2004 the maximum was 5% of the construction cost per year over a period of eight years. Tax refunds for commuting were considerably higher in most cases for car commuting than for public transport use until the year 2000.

not necessarily a social problem as long as it is counterbalanced by savings elsewhere. But it may become a problem once it goes along with transport cost-related social exclusion (Li et al., 2015).

- Transport provision costs are higher in areas where high transport investment is needed for relatively low levels of demand. This is mainly in low-density areas. While the effects for the provision of other (public) transport are in the opposite direction, road transport costs as well as total costs for public infrastructure remain negatively associated with density (Carruthers and Ulfarsson, 2003). What is more, provision costs are higher in car-dependent cities than in cities with a well-developed public transport system (Kenworthy and Laube, 1999). For Germany, the cost of providing technical infrastructure (transport, water, wastewater, electricity, gas) per housing unit roughly doubles when residential density decreases by 50% (Gutsche, 2007). Again, costs are lower in cities than in remote areas.
- External costs of transport predominantly increase with the level of car and truck transport. Hence, areas with a low per capita level of car travel (passenger) and truck transport (freight) are associated with low external costs per passenger served (or goods unit transported). As an outcome, external costs are again lower in cities compared to remote areas, in compact urban areas compared to those with more sprawl, and in cities with a well-developed public transport system compared to more car-dependent cities (Newman and Kenworthy, 1999; Veneri, 2010; for energy consumption see Nichols and Kockelman, 2015). This not only refers to environmental, but also to accident costs (Holz-Rau and Scheiner, 2013; Kittelson and Meyer, 2011). This is to some extent counterbalanced, but not fully outweighed, by higher congestion costs in large metropolitan areas. Gutsche (2007) demonstrates that the costs for technical infrastructure in remote, low-density residential developments are not fully covered by residents, but by the general public.

This general spatial pattern mainly refers to daily trips. There are few studies on geographical patterns in long-distance trips. These studies show that the low costs in denser, more urban areas may be counterbalanced to some extent by more frequent long-distance trips made by urban residents (Holden and Linnerud, 2011; Holz-Rau et al., 2014). However, to date little is known about the causes of spatial differences in long-distance trips, while the causal effects of urban form on daily travel are generally well understood, despite much debate in terms of detail. The hypotheses discussed by Holz-Rau et al. (2014) refer to economics, traffic infrastructures, lifestyles and social networks, while there is little reason to assume that urban density in itself causes long-distance travel (see Naess, 2006, for further discussion).

To put it a bit crudely, one may summarise that households locating in remote settings cause high transport costs in all three cost dimensions: user costs, provision costs, and external costs. A **long-term, mobility biographies perspective** could contribute to clarifying how these costs may accumulate due to earlier travel and residential decisions that serve the self-reinforcement of costs because of path dependencies on various levels:

- On the individual level, as travel behaviour at a given point in time depends on earlier travel behaviour, and the same is true for residential choice,
- On the intergenerational level, as an individual's travel and residential choices tend to positively depend on his or her parents' choices,
- On the aggregate level of transport provision costs, as (1) mass individual behaviour may turn into a societal norm and reinforce itself into longer-term stability, and (2) regional development structures cannot be easily reversed even if external circumstances (e.g. energy costs) change and, hence, any decision made for a particular location to be developed is a long-term, if not ultimate, decision,

- On the aggregate level of external costs, for the same reasons plus the unlikelihood of a political willingness to fully integrate external costs in the near future[3].

5 A note on residential choice, travel, happiness and dignity

It has been proposed above that people continually adapt their preferences and aspirations to changing needs and circumstances, and that they adapt to changes in their environment. Still, limitations to individual freedom in residential choice or travel may compromise happiness or well-being.

Quality of life, well-being, life satisfaction, and happiness are closely related terms that have recently received considerable attention in transport studies (Steg and Gifford, 2005; Delbosc, 2012; De Vos et al., 2013; Nordbakke and Schwanen, 2014). There is no space here to adequately review the multiple facets of this debate, or even the nuances of these terms. Suffice to say that this debate sets out by arguing that the ultimate goal of any transport policy is not to improve mobility or access, but to improve people's well-being (Delbosc, 2012). Consequently, research focuses on the effects of transport policies, travel behaviour, and accessibility on well-being.

Results are inconsistent but tend to suggest that individual happiness may be moderately improved by enhancing mobility (Morris, 2015; reviews in Delbosc, 2012, and De Vos et al., 2013). Hence, should policies facilitate travel in societies that enjoy extremely high levels of access and travel anyway? Three arguments can be raised against this proposition.

Firstly, while increasing happiness intuitively appears to be an attractive policy goal, happiness is only part of the story of quality of life. Related studies are heavily biased towards a hedonic notion of well-being (i.e. they focus on happiness or life satisfaction), while a eudaimonic understanding would shift the focus from enjoyment and consumption to values, meaning and 'doing' as ultimate goals in life (De Vos et al., 2013; Nordbakke and Schwanen, 2014), and perhaps from an individualist to a societal understanding.

Secondly, the very modest (and sometimes adverse, see Stutzer and Frey, 2008) effects of travel on well-being (in Western welfare societies) cast doubt on the efficiency of any investment made to enhance mobility based on the reasoning of well-being.

Thirdly, motorised travelling has detrimental effects on the environment, on the climate and on equity, the latter because improvements in mobility tend to disproportionally benefit those who are most mobile while increasing the risk of more inequality and possible social exclusion for the least mobile. Increasing car travel may be seen as a social dilemma that benefits individual travellers in the short term at the expense of long-term losses to society as a whole (Steg and Gifford, 2005).

Given that a majority of the global population will not in the near future have a chance to participate in travelling on high-speed transport networks, and that Western standards of mobility cannot be extended to the global poor, sustainable transport policies should be guided by the goal of achieving a dignified life for all, rather than aiming for more happiness among those who are already very well off. This does not, of course, preclude supporting mobility among the low-mobile within a society.

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[3] The EU permits its member states to charge users for external costs of air pollution and noise emissions, but only to a limited extent (Guideline 2011/76/EU). For Germany it has been calculated that the maximum charge equals 13% of the actual external costs of air pollution and noise emissions in 2013, 48% in 2015, and 39% in 2017. The strong jumps are caused by variations in the car types that are excluded from being charged (Alfen Consult et al., 2014, p. 159).

Dignity as a term has not yet entered the transport debate, and the implications of using this term as a guideline need to be explored in future studies. As a start, one can say that dignity can only be defined by those whose dignity has been hurt (Davy, 2014). It is hence impossible to politically prevent all violations of any conceivable dignity criteria. This means that dignity, or a dignified life as opposed to a happy life, needs to be defined as a policy guideline on a basic level, as has been done in the field of human rights (Davy, 2014, discussing the propositions made by Margalit, 1996). The role of access and travel in a dignified life needs to be explored. In other words: transport policies need to be assessed with respect to their consequences for a dignified life for all, rather than with respect to their effects on happiness for some.

6 Conclusions

This paper has made a case for looking at transport costs from a mobility biographies perspective, with a focus on RSS. The relevance of these approaches to transport costs are, firstly, via the close link of household transport costs to travel behaviour (including mobility tool ownership). Secondly, costs for transport provision and the external costs of transport are related to travel behaviour as well as to residential choice in that choosing a remote place of residence and choosing to drive are associated with high costs on both levels. Conversely, household transport costs affect residential choice and travel behaviour, but this is less true for transport provision costs and external costs that do not directly impinge on a household's budget. Drawing policy conclusions requires considering all transport costs, rather than just user costs. A number of research findings can help.

From RSS-travel studies and wider research on preferences two basic conclusions can be drawn. Firstly, empirical findings as well as theoretical considerations on travel behaviour and residential choice suggest that spatial mobility in welfare societies is based on preferences to a substantial extent, rather than just being driven by constraints.

Secondly, there are convincing theoretical reasons and empirical evidence suggesting that policies need not take preferences as givens. People are flexible in adapting their behaviour to their needs as well as to changing circumstances, rather than sticking with the travel or residential preferences they developed earlier in life. Energy prices are very likely to increase sharply in the future and, hence, constraints will gain importance. Policy needs to place less focus on preferences, and more emphasis on constraints (Wegener, 2013). Note that this is not necessarily true for research where a focus on preferences can aid understanding of decision making and behavioural processes.

From mobility biography studies, two more major points may be added. Firstly, key events studies reveal that people adapt to their environment in terms of mode use at least to some extent, but deliberately accept relatively long trips when relocating. It seems that people typically tend to realise benefits in housing (e.g. large lots at low prices), while accepting high transport costs and long travel distances in the mid- to long-term. Households locating in remote settings cause high transport costs in all three cost dimensions: user costs, provision costs, and external costs.

Secondly, the effects of travel and residential choices are likely to accumulate in the long-term due to path dependencies on various levels: on the individual, the intergenerational ('inheritance' of mobility), and the aggregate level of transport provision costs and external costs. These path dependencies occur via socialisation agents, habitualisation and long-term investments and commitments made (e.g. in planning decisions). Socialisation effects may contribute to self reinforcement of behaviour and cost outcomes. Still, it is important to note at this point that many relationships discussed here are contingent and relatively loose rather than determinate. Hence, change is possible.

How can a life course-related perspective on travel, residential choice and associated costs be made fruitful in terms of informing policy? There is a need to better understand cause-impact relations between travel, accessibility and residential preferences, residential choice, and travel behaviour (i.e. RSS-travel studies), and their relationship with other important life domains. This includes the family and household, wider social networks, employment, health, and lifestyle as well as policy contexts (planning, infrastructure provision). Socialisation and peer effects suggest that policies may make use of social spillover effects that may contribute to self-reinforcement of desirable behaviour. Research in the field needs to be undertaken using a dynamic long-term perspective that also includes the possible long-term accumulation of costs on the levels outlined above. This in turn suggests the need for long-term panel observations of individuals and households. However, it is unlikely that it will be possible in the near future to observe all the life domains linked to travel in sufficient detail over long periods in people's life courses. On the other hand, retrospective surveys tend to be very limited in nuances. One way out is to integrate the ideas outlined above in land-use transport interaction models and continuously validate the results with empirical studies. What is more, it is also useful to inform policy makers from various sectors (transport, housing, social affairs, health, finance) on key issues in mobility biographies and the RSS-travel link even without presenting the 'full picture'.

To date, low transport user costs have contributed to unsustainable land-use and transport patterns. The unfavourable (from today's perspective) residential decisions that dominated past decades caused urban sprawl which is associated with access problems for some households in the long term, particularly for those with mobility problems in later life (lower income, health issues). The more transport user prices increase, the more even residences at a mid-range distance from services and facilities may become vulnerable. This should not, however, imply that there is a need to reduce transport costs as long as external costs are not internalised, and low transport user costs contribute to further unsustainable trends. One may consider individualised funding schemes for those disadvantaged in accessibility. An equity perspective, however, needs to take into account the advantages many households have gained from their past decisions in various life domains and in terms of housing and subsidies received for commuting and housing, at the cost of the negative environmental and social effects of transport, and often to the disadvantage of those who stayed in the cities where they could not afford property and bore the pollution and traffic risks caused by in-commuters.

In order to judge the actual need for support for such households it is helpful to reflect on households' trajectories beyond the point where they are, and the past costs paid and benefits gained from earlier decisions made on travel and place of residence. This is a substantial research challenge for the future. To put it crudely, the crucial question here is: to what extent, or in which cases, are residential and transport decisions based on constraint versus preference, on 'freedom or constraint'? While this question clearly cannot ultimately be answered, it may well serve as a guideline for policy action to support those in constraint situations but not necessarily those who ended up in such situations because they made preference choices. Is there really a need to provide care for people who at some point in the past made a disfavourable residential decision in order to achieve residential qualities and amenities that are individually beneficial at the cost of environmental and social damage elsewhere? From a policy perspective that takes responsibility for all (including those who stayed in well-connected areas, those who travel by public transport, those not yet alive...) there is rather a need to prevent such decisions and, hence, to limit residential choice to those areas recognised to be compatible with sustainable spatial development.

These words may sound rigid in a liberal, market-driven democracy. However, there is general agreement in politics as well as research on the need to achieve sustainability. Why should

people adjust their behaviour towards more sustainability as long as there is little motivation to do so except for the plea for good will? It is unlikely that people will accept comparative disadvantage – in terms of using slow and uncomfortable public transport or in terms of accepting high-price, small-lot, high-density residences while others do not – as long as there are no regulations that are perceived as fair for all (Visschers and Siegrist, 2012). The ecological threats caused by unregulated private liberty necessitate an authoritative planning system with binding top-down components, accompanied by bottom-up processes to ensure acceptability and democratic procedure, in which guidelines for residential choice are set by democratically legitimate public planning organisations rather than leaving options for residential choice exclusively open to the interests and preferences of private stakeholders (Wegener, 1999). It should be borne in mind that the problem of affordability of transport for households is mainly a problem of multiple private decisions to locate in remote places poorly served by public transport and at a distance from daily facilities and workplaces, i.e. a problem of past market failure. Guiding regional development by reasonable collective principles is likely to help relieve future households from increasing transport costs, while costs for transport provision and external costs will be reduced as well.

On the other hand, we need balanced land-use development in that a country cannot be composed exclusively of dense, mixed-use, centrally located, urban areas. There will always be some people who live in areas with a comparative disadvantage in accessibility. The capacity of a democratic system to manage urban and regional development is limited. Researchers typically tend to urge politicians to develop more consistent policies, but politicians depend on majorities, and the concepts they propose are constrained by majority preferences.

It should also be pointed out that restrictions in choice may compromise individual happiness. However, increasing happiness as regards freedom of choice in residence and travel for those who are already well off and have multiple options is not sustainable as long as the majority of the present and, probably, future world population are unable to enjoy dignified lives. As it seems impossible to achieve the levels of freedom in mobility and residential choice enjoyed in the developed world for all, we need to face limits. In a situation of extreme levels of global inequality, the idea of dignity for all seems to be a more appropriate starting point than the idea of maximising happiness for the well-off.

While the basic principles and requirements of sustainability in land-use and transport have been well recognised, we are far from realisation. A dynamic, long-term perspective on people's and household's decisions on housing and travel may help better understand and evaluate the development of unsustainable land-use and travel. As mobility biographies are to some extent affected by circumstances that can be impacted on by policy and planning, there are options to manage change. Doing so requires taking into account that the present land-use/transport system not only has to be affordable for private households but also for the (collective) public, and it needs to include the external costs of past and present actions related to travel and residential choices in order to be affordable for a future society.

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