

## Housing careers and dynamic activity-travel patterns

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# Housing Careers and Dynamic Activity-Travel Patterns: The Mediating Role of the Built Environment

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**Abstract:** This paper describes the contribution of a project on housing careers to the U4IA research program. Based on a critical literature review which suggests that the relationship between the built environment and activity-travel patterns is relatively weak, it is argued that to better understand and qualify the relationship between the built environment and activity-travel patterns a life trajectory perspective may offer some advantages. Such a life trajectory perspective will primarily view housing demand in function of life cycle stages. This broader perspective allows a more detailed analysis of the influence of the built environment on dynamic activity-travel patterns.

## 1. INTRODUCTION

The focus of the U4IA research program is to develop a model of *dynamic* activity-travel patterns. These dynamics involve different time horizons: long-term, mid-term and short-term. Long-term dynamics are most of all triggered by life trajectory events, which may cause individuals and households to reconsider their current activity-travel patterns. For example, the birth of a child implies that taking care of the child is added to the

household activity program. This may imply that participation in other activities should shift, which in turn may lead to changes in activity-travel patterns. Similarly, a job change will likely impact activity-travel patterns. If the change involves long distance travelling, it may trigger residential relocation (even to another city), implying that the household should develop completely new ways of organising activities in time and space. If the new job is still within the action space of an individual, perhaps no residential move is involved, but the timing and duration of activities and travel, and perhaps travel mode choice of this individual may change.

The project described in this paper deals with one long-term decision: housing move. Such decision may be triggered by a change in current job, demographics or housing preferences. If the move involves a considerable distance, a continuation of the current activity-travel patterns will lead to stress (lower utility), and therefore such housing moves often trigger a process of adaptation of the current activity-travel pattern. Such dynamics may involve different timing and duration, but also change of transport mode, destination, or of a combination of these.

Because the U4IA linked different kinds of dynamics to different policy issues, the long-term housing choice decision and its impact on the dynamics of activity-travel patterns was positioned in the context of the study of the relationship between urban form and (facets of) activity-travel patterns. This relationship has received an overwhelming attention in transportation, urban design and urban planning research. The resulting body of research is highly relevant for policies related to new urbanism, compact city, mixed land use and other urban policies, framed in the context of resilient cities and sustainable urban development. These policies have assumed implicitly or explicitly that compact city forms and mixed land use will reduce mobility and trigger a shift in usage from private to public and slow transport modes. However, empirical evidence to that effect is conflicting: some research claim to find a relationship between urban form and activity-travel behaviour, while others argue the opposite.

Analyzing the empirical evidence reported in this literature is complicated by the weak methodological basis of many studies. Even where evidence of the impact of the built environment on activity-travel patterns was found, the causal interpretation of this relationship is quite problematic, as virtually all studies have used a cross-sectional approach (Pontes de Aquino and Timmermans, 2010). Cross-sectional statistical relationships between characteristics of the built environment and travel patterns are insufficient to conclude whether urban form is just the décor of unfolding activity-travel patterns and housing careers, or if features of the environment indeed trigger people to behave in sustainable ways.

This project will therefore apply the life trajectory approach and thus acknowledge that during their life course, individuals and households will develop various careers: housing career, job career, mobility career etc. Dynamic activity-travel patterns can be understood as shorter-term actions that should largely be consistent with these careers and their underlying plans, and that may be driven by a combination of these careers. Considering this, the project will examine the relationship between urban form and travel behaviour in a larger context, starting from the premise that the built environment plays a mediating role in this relationship.

The paper is organised as follows. First, we will summarize the literature on the relationship between urban form and activity-travel patterns. Next, we will explain the life trajectory approach and present the larger conceptual framework that will guide this research project. The paper will be completed with a short conclusion.

## **2. REVIEW**

Over the years, hundreds of studies have been conducted to examine the relationship between urban form and travel behaviour. As we have argued (Pontes de Aquino and Timmermans, 2010), the term urban form has, at large, been loosely used in this literature, encompassing many urban function variables. Some studies have however focused on morphological differences between neighbourhoods (or cities) in terms of street network (e.g. grid-like vs. cul-de-sac), or mixture of such features (e.g. Crane and Crepeau, 1998; Schwanen and Mokhtarian, 2005). Some research found a positive relationship between urban form and travel behaviour. Cervero and Radish (1996), for example, concluded that pedestrian-oriented design and compact neighbourhoods in the San Francisco area, USA encourage people to drive less and walk or ride transit more. Pan et al. (2007) also concluded that urban form slowed down the level of motorization in four neighbourhoods in Shanghai. Other researchers, however, found a weak relationship between urban form of neighbourhoods and travel behaviour (e.g., Handy et al., 2005; Cao et al., 2006; Cao et al., 2009; and Schwanen and Mokhtarian, 2005). Crane and Crepeau (1998) found no significant effect on travel mode when controlling for land uses and densities around the trip origin, trip costs and traveller characteristics. Similarly, Snellen et al. (2001; 2002) concluded that the effect of urban form on activity-travel behaviour is negligible in nine cities in the Netherlands. Focusing on the shape of the cities, and the street network for motorized transportation, they concluded that "individuals and households tend to organize their daily

activity-travel patterns according to their personal preferences and ability of adjustment", and that urban form exerts no significant influence on that.

The number of studies that purely focused on morphological aspects is relatively limited. Most studies have examined the influence of variables such as density, mixed land-use, and distance to bus and train stations, with density and (mixed) land-use characteristics usually prevailing. Some studies found a significant relationship between aspects of urban function and activity-travel behaviour. For example, Frank and Pivo (1994) concluded that urban function characteristics have an effect on mode choice when controlling for non-urban factors. Similarly, Cervero (1995) found that density has a stronger influence on motorized transport mode while land use exerts more influence on non-motorized commuting. Naess and Sandberg (1996) studying the interdependencies between workplace location, modal split, and energy use in Oslo, Norway concluded that public transportation facilities and parking conditions directly affect car travel. Handy (1996b) analyzing how accessibility influences travel behaviour for non-work travel in San Francisco Bay Area, USA found that higher accessibility is associated with shorter average trips, a greater range of destinations, higher trip frequencies, and a greater number of walking trips.

On the other hand, Cervero and Kockelman (1997) found evidence of a weak relationship between urban functions and travel demand, while Maat and Timmermans (2009) found that the work location has more effect on commuting mode choice than the residential environment. Maat et al. (2005) pointed out that high density and mixed land-use do not induce people to travel less or to travel in a more sustainable way. Krizek (2003) found that change in urban function does not trigger changes in overall modal split, what leads him to support the self-selection theory. According to this theory, "a household with a predisposition toward a certain type of travel 'self-selects' a residential location enabling the pursuit of that preferred type of travel" (Schwanen and Mokhtarian, 2005).

The fact that in many cases the strength of the effect of the built environment has been weaker than expected led some researchers to adopt a broader perspective. Even though individuals may live in the same neighbourhood, and may share common socio-demographics, their travel behaviour may differ because they have different attitudes with respect to sustainability and may have different lifestyles. Consequently, in more recent studies, several scholars have examined the role of attitudes. Handy (1996a) and Kitamura et al. (1997) found that attitudes related to travel exert a stronger influence on travel behaviour than urban function, although urban function still plays an important role in travel distance and transport mode choice. Several studies even suggest that attitudes towards transportation better explain people's travel behaviour than the built environment (Handy et

al., 2005; Cao and Mokhtarian, 2005; Kitamura et al., 1994; Bagley and Mokhtarian, 2001). Most of these studies found some relationship between urban form and travel behaviour, nevertheless they claim that attitudes exert a stronger influence or may have a more direct effect than urban form.

### **3. THE LIFE TRAJECTORY APPROACH**

To contribute to the literature and to better understand how long-term housing choices decisions influence activity-travel patterns, this project will apply a life trajectory approach. We argue that the relationship between urban form and activity-travel behaviour should be seen within a larger context: considering people's life trajectory. People have certain goals in life they wish to pursue or to achieve. They may wish to have a family, make sufficient money, travel, have friends, play a role in society, entertain and be entertained, have an inspiring job, live in a nice house, etc. They have certain needs, desires, aspirations and expectations. In trying to realise these aspirations, people will go through a life trajectory, or life course, which is composed of multiple careers individuals have in their lives and their developmental implications (Elder, 1998). Careers are the consistent paths formed by the stages or statuses people have and take over time according to different aspects of their lives (Mulder, 1993). During a lifetime, people develop various careers in different aspects of life: education, work, family, house, mobility, and others.

The realisation of these aspirations involves activities. To some extent, these activities involve spatial decisions in the sense that the facilities to conduct the activities are unequally spatially distributed, and this involves travel. The built environment offers opportunities and at the same time constraints. The availability of a bus stop close to one's house means that an individual can easily decide to use public transportation. The non-availability of a bus stop at close range means that public transportation is not a realistic option. Available budgets also represent constraints. In the beginning of careers, when individuals tend to have less money, they will face more constraints in terms of affordable housing, availability of car(s), etc. Later during the life course, they may have more to spend and thus are less constrained in where to live, choice of transport mode, activities to conduct and how much to spend on these activities.

In a life career, there are major events occurring, such as marriage, birth of child, change of job location, etc. When an event happens, we assume that people enter a process of reconsideration of their current behaviour and if necessary adapt to the new life context (see also Verhoeven et al., 2005).

This adjustment is a function of the relative importance of the various careers, viewed from a longitudinal perspective. For example, consider the job search process. If an individual does not truly need a new job and receives an offer that would only make a marginal difference, it is unlikely that it will be accepted. If, however, this is a dream job, probably everything else (house, social network, travel etc) will be ignored and the opportunity will be taken. Analogously, we assume that all major decisions in a life trajectory will be implicitly or explicitly evaluated in terms of the multiple careers, of the different household members and a decision, not necessarily optimal, will be made, given the constraints faced by the individual and the household. In the meantime, individuals and households will cope as best as possible with the situation and organize their daily activities accordingly. Lifting constraints may also cause shifting behaviour. For example, if the office is relocated from the middle of the city to the main train station, the commute time will be reduced. Consequently, using the same budget, this may open up new opportunities for more preferred housing further away from work. If the relative importance of housing for the quality of life is higher than that of other facets, the reduced travel time will likely be used to realize housing aspirations rather than reducing travel time.

Different modalities in the relevant processes also play an important role in this context. The first housing choice of many individuals is made when they do not have much money, are perhaps still single, may have a temporary job or a first job in the job career etc. Hence, the choice may be heavily constrained, satisfactory, and made considering that it is very likely that a housing move will follow (soon). In contrast, the second or third house in many cases will be more permanent. Even though the housing decision may have been made such as to maximize household utility, characteristics of the neighbourhood will change: economies of scale may imply that certain types of stores will disappear, the social composition may change, and often small design aspects are changed over time as the neighbourhood needs revitalisation and maintenance. It does imply however the existence of inertia and different generations of movers, characterised by different preferences and/or constraints. Consequently, the strength of the relationship between urban form and travel behaviour may be less than one might expect or planners would like to believe.

Due to such constraints, to exogenous change, and to events, individuals and household will experience discrepancies between aspirations and their actual situation, and they will need to cope with such discrepancies. Over time, the stress to realize their aspirations and/or to cope with organising their daily activities in time and space due to a busier agenda or increasing travel time may grow. They will try to deal with this situations, and enforce relatively easy-to-make changes (e.g. departing earlier, less free time) until

some more dramatic change is required. These dynamics take place against the background of the same attributes of the built environment, especially at the level of basic urban form indicators. Thus, activity-travel patterns and housing careers are unfolding; the built environment is merely the décor.

A broader, unified conceptual framework will potentially have some advantages. First, the probability of finding spurious or confounding effects is smaller. Secondly, the choice of residence and housing moves are considered in the larger context of lifecycle and quality-of-life decisions, which give meaning to these decisions. Thirdly, the analytical capabilities of the approach will increase, including the options for more behaviourally oriented approaches and the methodologically richer set of causally-oriented analysis given the longitudinal nature of the involved data. For example, alternative Bayesian decision networks can be learned and estimated, perhaps ruling out particular causal processes underlying the data. Fourthly, by explicitly collecting data on aspirations, careers, context- and lifecycle-dependent preferences, etc. richer explanations can be provided and alternative hypothesis can be tested.

The existing literature on life trajectory suggests that key events in the life careers such as marriage and the birth of child (e.g., Courgeau, 1985; Deurloo et al, 1993) may trigger housing moves to a different location. The choice of the house location is also affected by the job location (e.g. Ham et al., 2001), not only of the individual concerned but also of spouses (e.g. Borgers and Timmermans, 1993; and Timmermans et al., 1992), place of birth (e.g., Feiten et al., 2007; Mulder, 2007) and the place where parents live (e.g., Mulder, 2007). Similar effects of key events have been found for first-time homeownership. Because the spatial distribution of rented versus owner housing is not uniform, spatial effects may be observed. Deurloo et al. (1993), for example, concluded that main triggers for a move into homeownership are the transition from couple to family and a significant positive income change. Family-related reasons were also mentioned by Feijten and Mulder (2002) as a decisive factor for the change to a long-stay dwelling. Smits and Mulder (2008) found that the likelihood of becoming a first-time homeowner was greater for singles, cohabiters and those starting cohabitation than for married people.

Other studies have provided some evidence that activity-travel behaviour may be affected by the life trajectory. Beige and Axhausen (2006) concluded that residential mobility is influenced by the ownership of the different mobility tools and vice-versa. Beige (2008) pointed out that spatial changes and changes in mobility tools are considerably connected to one another. Verhoeven et al. (2005; 2006; 2007) using Bayesian Belief Networks



showed that life trajectories are related to changes in car availability and transport mode choice decisions.

Together, these limited results suggest that life career events affect directly and indirectly activity-travel behaviour. This may again imply that needs and constraints of individuals and households will have a bigger influence than urban form characteristics on housing choice, re-location decision, and activity-travel behaviour. Our hypothesis is that the influence of the life trajectory on activity-travel behaviour is determinant, and that urban form characteristics are only a mediator in this relationship.

The conceptual framework, depicted in Figure 1, captures the relationship between urban form and activity-travel patterns in this larger context, considering events that occur during people's life trajectory. These events can directly affect people's activity-travel behaviour and their choice of housing location. For example, a change in work location can lead to increasing travelling time and distance as well as a change in mode choice. With the increasing travel time, this person may consider changing the housing location closer to work. The changing house location, in turn, may trigger this person to reconsider his common travel patterns to suit the distances for their main destinations from the new place of residence. At the same time, people might choose the place they want to live according to their already established travel patterns.

The choice of the housing location can be also influenced by the urban form characteristics. People chose the place where they want to live according to the characteristics of the house, the neighbourhood and relative location vis-à-vis various kinds of facilities, family, etc. Thus, in this example, urban form has a mediating role in people's activity-travel behaviour.

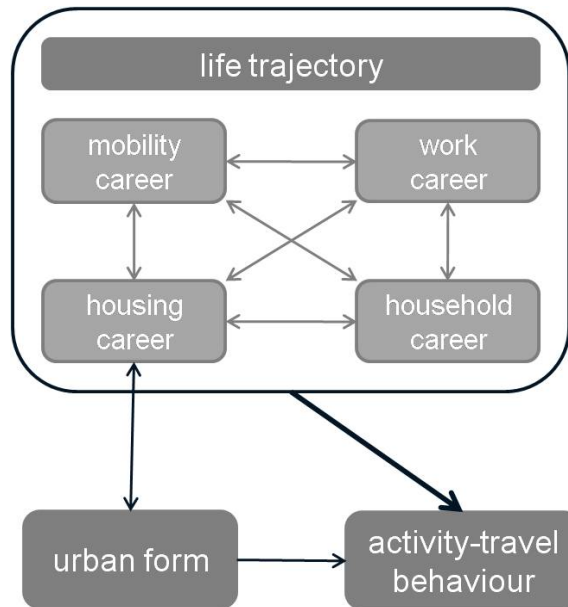


Figure 1. Conceptual Framework

With this framework it is possible to test whether there is a direct relationship between urban form characteristics and activity-travel behaviour or that any positive relationship found may be a spurious relationship that occurs because these two variables are related to life trajectory events.

#### 4. DATA COLLECTION CONSIDERATIONS

Within this framework, we need to analyze long-term decisions, which require longitudinal data about people life courses. To collect this data, we decided to do a retrospective survey about events that occurred in the individual and the household during the last 20 years. Data on three topics of the framework will be acquired: life trajectories, choice of housing location, and travel behaviour. We will analyze the urban form according to the places of residences and work given by the respondents.

Although this type of survey is important to analyze long-term decisions and to see which were the triggers to change house, such as family reasons, economic reason, job reasons, this type of survey has a problem of memory recall: people might not remember exactly all changes in the different careers. To deal with the problem of remembering past events, especially dates, we made the questionnaire in a way that people can recall the past

events according to the house they lived in. Therefore, people will remember easier when they bought their second car because they will link this event with the place they had to park the car, for example. In the end, we ask which future events people expect in their lives. In this way, we can have data with a complete overview of the life course of respondents.

## 5. CONCLUSIONS

This paper has briefly explained the positioning and the conceptual framework underlying a project on housing choice and dynamic activity-travel patterns. This project which is part of the U4IA program will focus on the long-term dynamics of activity-travel programs. The use of a life trajectory framework will however also imply a broader perspective from which the relationship between the built environment and activity-travel patterns can be re-examined.

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