Position Paper: Urbanism on Track Meeting

Davy Janssens, Els Hannes and Geert Wets

Universiteit Hasselt, Campus Diepenbeek,
Agoralaan - Gebouw D, B-3590 Diepenbeek
Email: {davy.janssens; els.hannes; geert.wets}@uhasselt.be

In this position paper, the first topic deals with the question about how knowledge developed through the use of new tracking technologies, can have an impact on the (spatial) ***planning process***.

Originally, planning policies focused on mastering the massive growth in car mobility. These policies were adopted in an immediate response to the predicted growth in (car) mobility. The estimation and forecasting of travel demand and behaviour were handled by a standard methodological approach, commonly referred to as the four-step modelling approach (Ruiter and Ben-Akiva, 1978). However, increased concerns about phenomena such as congestion, emission and changing land-use patterns, have motivated governments to consider policies aimed at reducing and controlling them (Dijst, 1997). These policies are commonly referred to as travel demand management (TDM) measures, which objective is to (i) alter travel behaviour without necessarily embarking on large-scale infrastructure expansion projects, (ii) encourage better use of available transport resources and (iii) avoid the negative consequences of continued unrestrained growth in private mobility (Krygsman, 2004). Examples of such measures are the spreading of peak-period traveling through relaxing working, school and shopping hours, congestion charging, and the like. However, those TDM measures also implicate the evaluation of spatial planning measures such as spatial-concentration scenario's, which can be implemented by moving facilities from smaller concentrations and merging them with larger clusters of facilities in the neighborhood. Obviously, the opposite; spatial-separation scenario's can also occur in reality. In order to effectively implement and analyze these more complex TDM measures, an increasing amount of awareness emerged with respect to the need for an improved understanding of travel behaviour. Obviously, the four-step methodologies that were adopted in the past, mainly focused on policies of infrastructure expansion and were insufficiently able to achieve this. This resulted in a need for travel demand models that embody a realistic representation and understanding of the decision-making process of individuals and that are responsive to a wider range of transport policy measures. The major insight that enabled researchers to gain this better understanding is the idea that travel demand is derived from the activities that individuals and households need or wish to perform. Travel is merely seen as a means to pursue goals in life but not as a goal in itself. Therefore, modelling efforts should merely concentrate on modelling activities or on a collection of activities that form an entire agenda which triggers travel participation, also commonly referred to as the activity-based modeling approach. These approaches enable transportation forecasting through the evaluation of TDM measures and aim at predicting which *activities* are conducted *where*, *when*, for *how long*, *with whom*, and the *transport mode* involved.
Obviously, accurate data is needed for all these facets in order to be used in an activity-based transportation model. A hand-held GIS-based logging system can be used to collect data for all these facets. The paper-and-pencil questionnaire, asking people for their average behaviour during a certain time period, has long been and in fact still is the dominant form of data collection in transportation research. Alternatively, desktop computer-assisted data collection tools may be used for filling out scheduling surveys in order to provide activity-travel diary data. However, these systems are not able to trace the actual activity-travel execution in real time due to their limited portability. In order to solve this problem, a Personal Digital Assistant (PDA) equipped with GPS technology can be used to enhance the data collection tool's mobility (Kochan *et al.* 2005). The portability of a PDA data collection tool enables in-situation data input

while preserving the ability to perform consistency checks on the data provided by the respondent.
The potential advantages of equipping a Personal Digital Assistant with GPS technology to supplement activity-travel data are numerous: 1) when using a desktop computer-assisted data collection tool, the respondents have to remember the exact locations of their start and end positions, whereas with a PDA with GPS, trip origin, destination, and route data are automatically collected without burdening the respondent for the data; 2) as the respondent may forget to report an activity trip, another advantage exists in recovery of unreported trips, as all routes are recorded; 3) accurate trip start and end times are automatically determined, as well as trip lengths; 4) the GPS data can be used to verify self-reported data; 5) both the data entry cost and the cost of pre- and post-processing the data, constitute a significant share of the total data collection cost (Zhou, 2004). Fortunately, both can be reduced to a minimum with computer-assisted forms of data collection. All arguments mentioned above are particularly valuable for the (spatial) planning process because they should –ceteris paribus– result in higher quality data. Higher quality data is obviously a precondition for more reliable travel demand modeling. The latter may even be more applicable for spatial scenario's because they are highly dependent on accurate spatial information, which can only be provided by means of a PDA with accurate GPS technology.
Unfortunately, the evaluation of a PDA with GPS technology has only been rarely evaluated in the context of transportation research but the topic is gaining increased attention in recent years. Two well-known examples are the semiautomatic data collection device that is used in the Lexington Travel Survey (1997), and the computer-based intelligent travel survey system that is used by Resource Systems Group, Inc. (1999), which used interactive geo-coding and other intelligent functions that can be provided by GIS to reduce the reporting burden on the survey respondents.
Currently, a comprehensive and extensive research program that has been funded by the IWT, which is an Institute for the Encouragement of Innovation through Science and Technology in Flanders, contributes to this line of research (see Janssens and Wets, 2005). The data that will be collected within this program include 2401 households. Approximately one half of the sample will receive a PDA-module; the other part of the sample will be questioned by means of a traditional paper-and-pencil method. This choice enables us to carry out comparative studies with respect to the behaviour of both target groups in terms of response rates, experience, etc.. The households has been selected using a stratified cluster technique, which ensures a geographical and spatial distribution in the sample which is representative for the study area of Flanders. The survey asks the members of the selected household to fill out a diary and to report rescheduling decisions (the reasons for rescheduling are reported as well) during a one-week period. In comparison with other activity-based studies, the survey period is particularly long, especially in combination with the high number of households that will participate in the survey. Finally, detailed cost estimates have already been made and a description of logistics and needed CATI-support are currently being investigated and will be reported in the study as well. The data will be used as input for an activity-based transportation model, which will enable us to calculate the impact of spatial planning scenario's and other TDM measures.

The second topic of this position paper will discuss what kind of "***spatial intervention***" can be expected due to the use of new tracking technologies. Four related application areas can be identified in this respect.

As briefly mentioned before, the use of a PDA with GPS technology will enable one to track the route which has been followed to reach a particular destination. This information has a number of important advantages. First of all, it will be possible to achieve a more realistic behaviour modelling of route choice in transportation models. While this latter component is mainly lacking in activity-based models, it is often over-simplified (using for instance shortest-path algorithms) in current four-step transportation models. When PDA information is coupled with diary data, it will be possible to make a relationship between route choice and the activity that has been conducted, which will enable one to implement more robust traffic assignment approaches in transportation modelling. Second, in addition to this, it will also be possible to specifically determine the spatial factors that influence route choice. Indeed, when this can be achieved, it will be possible to evaluate and model the effects of future spatial interventions in cities in order to influence route choice behaviour (e.g. at the city traffic network level, what are the effects of a cut in certain links in the network). Third, static (infrastructure) and dynamic factors (night – day, seasons, events, traffic conditions) of the environment can be taken into account because the route choice at a given point in time (within certain environmental circumstances) is observed.

Another important concept which can be better evaluated due to the use of a PDA tracking device, is the concept of accessibility. The accessibility measure represents the ease of access to certain destinations. In econometric models, accessibility is expressed as a certain cost which can be compound of travel distance, travel time, travel costs, etc. causing some form of disutility for the agent. In activity-based models, accessibility is also a measure to test the feasibility of generated schedules. Sometimes the accessibility measure is computed in a simple way, for example by multiplying the distance from the core of the origin zone to the core of the destination zone with an average measure of car speed. More advanced methods like calculating logsums are used as well, taking detailed specifications of the accessibility into account, such as mode choice, time of day (peak and off-peak), travelled route over the network, level of service (LOS), travel purpose, route choice options, individual differences, etc. Important improvement in the measurement and computation of "accessibility" can be established through the integration of GIS in the travel demand model (Kim and Kwan, 2003). There is a strong tendency to disaggregate measurement, using space-time constraints to generate potential path area's (PPA) and to identifying feasible opportunity sets (FOS) within there.

Third, on an individual level it can be said that the relationship between travel decisions and spatial characteristics of the environment is established through the individual's perception and cognition of space. As an individual observes space, for instance through travel, the information is added to the individual's mental map (spatial learning). Subsequently the mental map shapes – amongst others – the individual's travel decisions, since it reflects what an individual knows and thinks about the environment and its transportation systems (spatial planning). When stated travelled routes and stated distance estimates can be compared to actual travelled routes and actual distance information as recorded from GPS tracks, one can get an idea about how the mental map is formed and how it affects individual future decision making when operating in a spatial environment. This insight will enable spatial planners to take this information into account in their spatial design decision making.

Finally, a topic which is comparable with the idea of the mental mapping of locations, is the physical mapping or enumeration of the places visited in the past. The analysis of individual activity spaces (using longitudinal travel data) can be motivated by an interest in spatial behaviour from a planning point of view. Indeed, the enumeration of daily-life activity locations and the analysis of the distribution of such places reveals both, the supply structure of activity opportunities in space and the destination choice behaviour of travellers given their perceived supply. This invites transport planning and research to once more evaluate and present future urban structures from the perspective of sustainable transport policy. This includes for example measures to increase the amount of opportunities (i.e. potential destinations) to satisfy the activity demand in the household's neighbourhood which eventually reduces travel expenses, further congestion and emissions. There is evidence that local accessibility oriented land-use planning matters (Banister, 2000). One does however not need to neglect, though, that the there are complexity and non-linearities within the interaction between locational supply and the actual choice of destinations (Schönfelder and Axhausen, 2003).

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