Activity modeling with GPS tracking data: new assumptions for the age of ICT

Helen Couclelis
Department of Geography
University of California
Santa Barbara
cook@geog.ucsb.edu

Introduction

One highly promising use of dense-tracking data captured by GPS is in the area of activity-based modeling of travel behavior. A few pilot studies (e.g., Bradley et al., ND; Wolf et al. 2005) have already demonstrated the validity of the approach in helping reconstruct daily activity schedules, or in complementing travel diary data. Much of the interest of the transportation studies community in the activity-based approach is based on a small number of basic assumptions about the relationships holding in industrialized urban societies among space, time, and individual or household activity. Time geography and its signature model, the space-time prism, have long provided a fruitful conceptual framework around which much of that research has developed. While these assumptions have proved very robust in the past, the increasing penetration of ICT in virtually all aspects of everyday life invites us to rethink some basic premises of the activity-based modeling approach. Three of these assumptions, and the challenges these pose in the information age, are outlined below.

Space and Activity in the Information Age

A basic aspect of time geography that needs to be reexamined in the age of ICT is the underlying assumption of a strong correspondence between a person's movement across space and time, and that person's activity schedule over the same period. It used to be that the location of a person in daily urban space was a reliable proxy for the activity that person was engaged in at the time: if at home then personal and family activities; if at the workplace then work; if at the mall then shopping; if in a car then moving between activities; and so on. Tell me where you are, and I'll tell you what you are doing (Wolf et al., 2005). Conversely, knowledge of a person's or group's activity schedule, along with knowledge of the spatial structure of the corresponding facilities and land uses, used to provide strong clues as to where that person or group might be found at different times of the day. For decades that premise was reliable enough to drive urban planning and land use modeling. For the vast majority of people and activities this is still by and large the case. However, ICT-induced anomalies are proliferating so rapidly that they can no longer be ignored. There is a growing disconnect between activities and adapted spaces as people can shop from their home or workplace, carry on business transactions from their car, socialize while walking alone down the street, or work for a living while sipping cappuccinos at the corner café.

Time and Activity in the Information Age

As long as it is possible to assume a reliable correspondence between activities and adapted spaces, it naturally follows that switching from one activity to the next usually involves some form of physical travel, so that peoples' daily space-time trajectories as

represented in the space-time prism correspond fairly closely to the flows from activity to activity in their daily time budgets. Moreover, to the extent that travel is a cost, switching between activities must be kept at a minimum. This makes for lengthy continuous blocks of time when people stay at the same place doing the same thing. By driving the cost of switching between certain kinds of activities to near zero, ICT remove one major reason (there are many others, of course) for the eight-to-five workday, or the Saturday morning shopping expedition. This does not mean that we have already reached the age of 'anything, anywhere, any time': there are practical constraints of place, and social requirements of presence, that limit a person's freedom to shuffle around his or her activities at will. No one doubts though that the flexibility to do so is increasing, and that people are taking advantage of the newly available opportunities in creative and often unexpected ways.

Households or individuals?

Another assumption that may need to be partially reconsidered is that the household, rather that the individual, is the fundamental decision-making unit. The assumption is largely based on the availability of cars and drivers within the household, and the need for the activity schedules of other household members to adapt to those of the car drivers. However, these days dad can do the shopping on-line from home while mom is driving the car to work, and little Susie can check the references she needs for her homework without having to wait for either parent to drive her to the library. While there are many physical, practical and social reasons why household members will continue to coordinate their daily schedules, this is another area where certain taken-for-granted constraints are likely to become less and less relevant as we move deeper in the information age.

The fragmentation of activity

In principle, then, as ICT-supported activities spread in a society, we can expect to see three things. First is a weakening association between activity and place, meaning that the same activity may be performed at many different places, and the same place may temporarily harbor many different activities. Second, we expect to see a weakening association between activity and time, as in the absence of a need to travel to another place, the cost of switching between activities is drastically reduced. Third, we may see the individual, rather than the household, emerging as the basic decision making unit in activity-based travel modeling. With the increasingly commonly available option of travel-less access to information, goods, and services, people are free to schedule certain activities – and especially the discrete tasks and subtasks that make up the main daily activities – according to any number of other considerations. An activity thus becomes more likely to be performed individually, in discontinuous chunks at arbitrary times. For example, the activity of shopping consists of the tasks of gathering information about a product, comparing prices, trying things out, making a purchase, transferring the item home, exchanging or returning the item, and so on. Each of these tasks may be carried out relatively independently of the others either by physically visiting stores or remotely, with the help of ICT, and with or without the cooperation of other household members. When, how and where these different tasks will be carried out can obviously be very different for a person with access to ICT than for a person without such access. These

observations form the basis for the 'fragmentation of activity' hypothesis proposed by Couclelis (2000, 2003). Instead of occupying compact chunks inside the daily prism, ICT-aided activities tend to disintegrate into sets of discrete tasks that get spread out across places and over time.

Some research challenges for GPS-based tracking in the age of ICT

To the extent that these speculations have an empirical basis, they suggest that GPS tracking would have been a perfect data-capture device for travel behavior research some thirty years ago, when ICT was not yet a major player in people's daily lives. What about today? I would be interested in discussing questions along the following lines:

- How could we test the modified assumptions proposed in this abstract?
- If there is some basis to them, what are the implications for transportation research in general, and for GPS tracking in particular?
- Is the space-time prism still an appropriate model for conceptualizing the relationships between people's spatio-temporal trajectories and their activities?
- What can GPS tracking data tell us about choices people make between ICT and travel, for different purposes?

References

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Dr. Helen Couclelis is Professor of Geography at the University of California, Santa Barbara. She holds a Doctorate from the University of Cambridge, England, a Diploma in Urban and Regional Planning from the Technical University of Munich, Germany, and an MA. equivalent in Architecture from the Technical University of Athens, Greece.
Prior to joining UCSB in 1982, she spent several years as a professional planner and policy advisor in Greece. She also represented Greece on several European Union and UN meetings and task forces on urban issues. Her research interests are in the areas of urban and planning theory and modeling, in behavioral geography and spatial cognition, in geographic information science, and increasingly, in the geography of the information society. She was Associate Director of the National Center for Geographic Information and Analysis (NCGIA) from 1993 to 1996 and currently serves on the executive committee of the Center for Spatially Integrated Social Science (CSISS, see www.csiss.org).