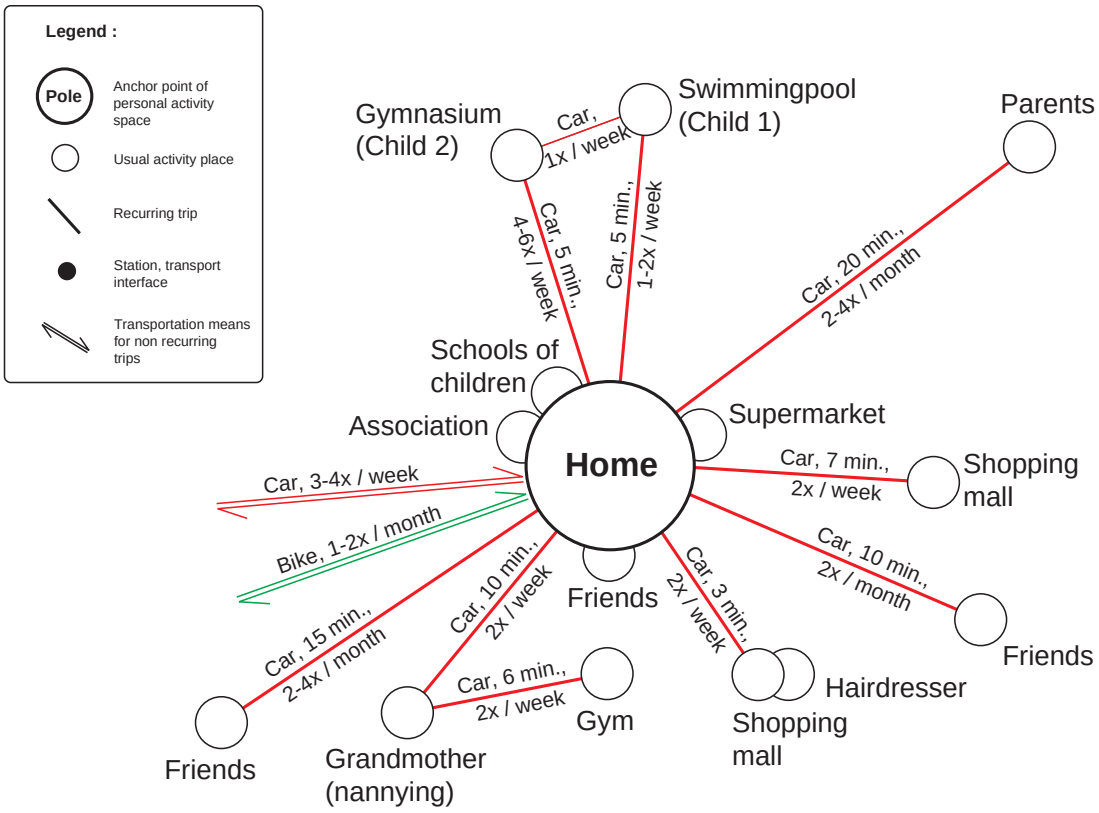

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The concept of *personal network of usual places* as a tool for analysing human activity spaces: A quantitative exploration

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Abstract

For the analysis of human activity spaces, different theoretical concepts have been proposed. In this paper, we want to investigate the usefulness of the concept of *personal network of usual places*. This concept has been introduced as an instrument to grasp all the places an individual visits on a recurring basis corresponding to a social rhythm (for example once a day, once a week, once a month, etc.) as well as the routes he or she usually takes between those fixed geographical points. This network of usual places and of usual routes forms a geographical system in which it is possible to identify a certain number of daily life centres. In this paper, we explore quantitatively the relevance of the concept of *personal network of usual places* with an existing large scale travel behaviour data set, namely the Mobidrive 6 week travel diary.

Acknowledgments: We are very grateful to Prof. Kay W. Axhausen and his IVT-Team for giving us access to the Mobidrive data set and for the accompanying advices.

Keywords

Human activity spaces – Travel behaviour – Conduct of everyday life – Theoretical concepts – Quantitative Analysis

1. Introduction

A growing number of authors suggest that, in order to get a comprehensive understanding of individual travel behaviour, research has to focus not only on trips but also on activity spaces. Indeed, a wide part of daily travel occurs between fixed points which structure one's activity space, as for example the place of residence or the place of work. It is therefore necessary to also investigate how individuals have structured their personal activity space, that is to understand long term spatial decision making.

For the analysis of human spatial behaviour, different theoretical concepts have been proposed. Golledge & Stimson (1997) have presented and discussed the different approaches developed in the past. Individual spatial practices are essentially grasped with reference to the concept of *activity space*, which aims to represent the set of places an individual visits over a period of time by way of a geometric description. In order to explain spatial decision making and to understand how people appropriate themselves realms of possibilities with regard to specific destination choices, additional concepts which describe individual potentials of travel are taken into account (*action space*, *mental maps*, *space-time prisms*, etc.).

Schönfelder & Axhausen (2002a; 2002b; 2003) have underlined that newly available long-duration, travel diary or GPS-based data sets offer unprecedented opportunities for the analysis of human activity spaces. They have proposed a set of theoretical concepts aimed at measuring individual activity spaces, such as *confidence ellipses* (a two-dimensional version of the well known confidence interval), *kernel density* estimates of activity density and a *shortest path network* approach connecting the visited locations. These concepts are used to measure activity space sizes by way of continuous space representations that encompass the locations an individual visits over time. These authors have also analysed the stability and variability of individual activity spaces and travel behaviour, looking at clustering and innovation rates within the individual sets of visited locations (Löchl et al., 2005; Schönfelder & Axhausen, 2004).

While these concepts and analyses provide useful indications for travel behaviour modelling, we believe that they are not so well suited for a more comprehensive travel behaviour analysis, which aims at a better understanding of individual behaviour and decision making processes. This latter approach is needed in order to assess the possibilities of travel behaviour change and in order to develop mobility management strategies. So, we shall present another theoretical concept which is based on sociological findings.

Since the beginning of the 1990s, German sociologists have thoroughly studied how individuals organize their everyday activities and manage their life priorities (Projektgruppe "Alltägliche Lebensführung", 1995) and they have elaborated the theoretical foundations of the concept of *conduct of everyday life*. They have demonstrated that the conduct of everyday life builds, amongst others, on two fundamental polarities: Habits, on one side, and will to innovate on the other side. For travel behaviour research, this means that two distinct types of spatial practices have to be differentiated: Those regular practices that occur within a network of usual places and, on the other hand, those spatial practices which are motivated by the will to discover new locations and thus could be characterized as "tourist practices" or as "extraordinary practices". Obviously, these two different types of spatial practices derive from distinct rationalities and they should thus be investigated separately. Doing so, it should be easier to build a coherent typology of individuals and of households.

2. Personal networks of usual places: concept definition

Building on proposals from Pinson (2001, 2002), we suggest the concept of *personal network of usual places* as an instrument to grasp individual activity spaces. Figure 1 illustrates the concept with three examples reconstructed from qualitative interviews and helps us to precise our concept definition (Flamm, 2004):

- A *personal network of usual places* encompasses all the places an individual visits on a recurring basis, as well as the routes he or she usually takes between those fixed geographical points. In general, only a rather small number of recurring activity places are interconnected through such routes, because people tend to reproduce specific activity sequences in their daily life organisation, for practical reasons or simply by routine. This network of usual places and of usual routes forms a geographical system.

- Among the activity places, it is possible to identify a certain number of daily life centres, i.e. places where individuals usually spend considerable time and which they consider important in the conduct of their everyday life, either for symbolical or for practical reasons (typically, the home and the workplace, but it could also be a place of a passionate leisure activity or a parents' home). It can be assumed that these daily life centres represent "territorial anchor points" of the personal activity space and that they are the most interconnected by travel routes to other activity places.

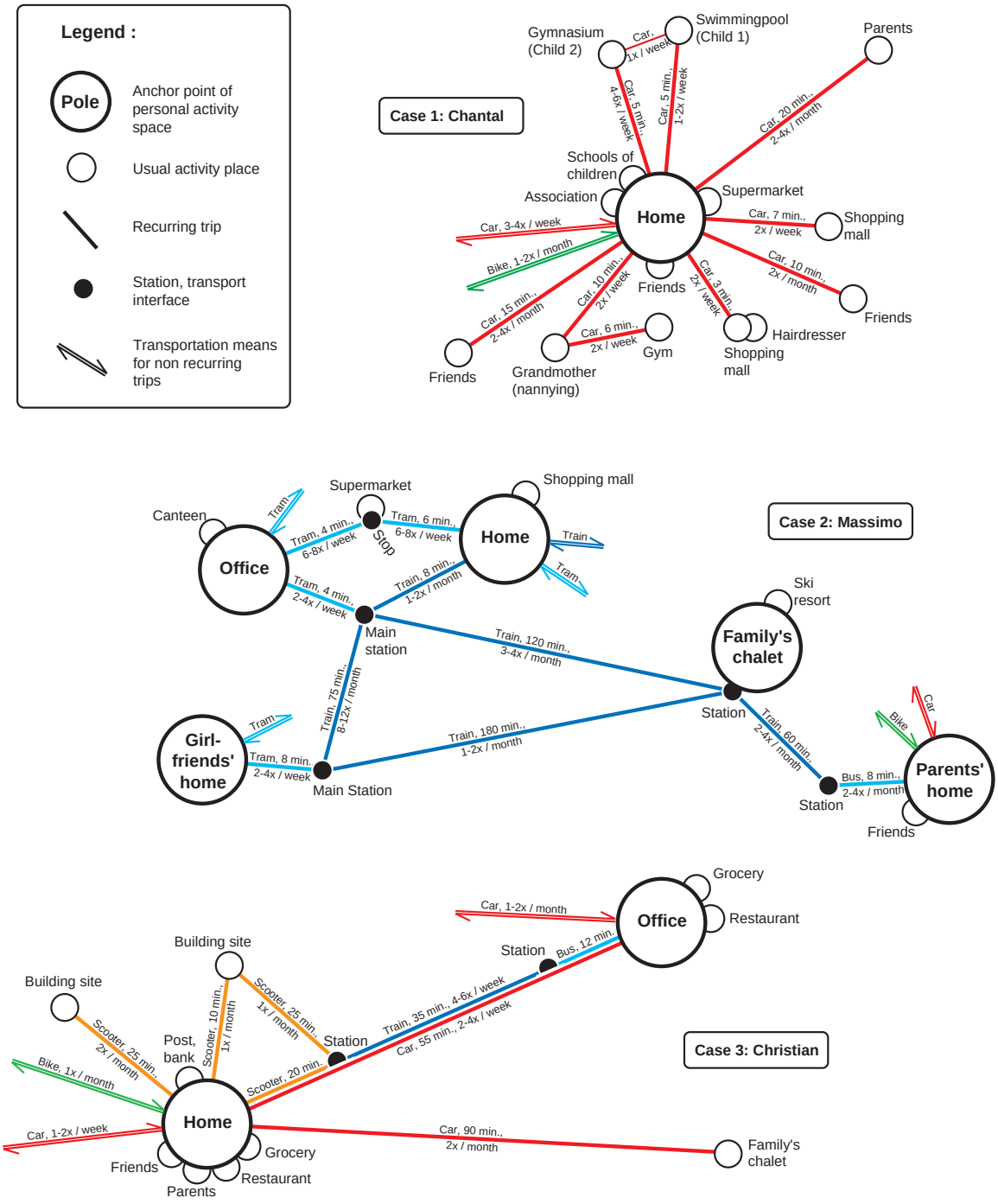
- Our qualitative interviews suggest that individuals often create clusters of activity places in order to easily travel between them on foot or, possibly, by bike. These localized clusters are influenced by the localisation of the daily life centres and result from localisation choices for less important activities (daily shopping, services like a bank, an automatic teller machine, restaurants, etc.). So, it can be expected that this process of clustering is especially strong around daily life centres.

- The routes between usual activity places can be considered as "circulation corridors" that individuals get very familiar with (after initial trial and error learning processes when a new route is included in individuals' spatial habits). Our qualitative interviews suggest that people develop strong travel mode habits in function of the destination, i.e. they most of the time use specific means of transportation for a given route[1] (Figure 1 shows only one case where an interviewee alternately uses different means of transportation for a given route, i.e. the home-office trips).

- When people combine different means of transportation on a given route, they usually spend some time in transport interfaces (stations, mass transit interchange poles, park and ride facilities, etc.). As people usually take opportunity of some services provided in those places for "micro-activities" like buying a newspaper, drinking a coffee, posting mail in a mailbox, getting cash from an automatic teller machine, etc. (Kaufmann et al., 2000), we believe that these locations should be included in the personal network of usual places as well.

[1] Of course, some variations exist in the effective travel behaviour of an individual, but these variations probably often correspond to extraordinary practices.

Figure 1 Three examples to illustrate the concept of network of usual places



Some details about these case studies might help to understand the graphs above: Chantal* is a housewife and mother of three children; Massimo* is a doctoral student living and working in Zurich, originally coming from Ticino and has a girlfriend living in Basle; Christian* is a full-time engineer, young father and since recently owner of an individual house.

Source: Flamm (2004); * Given names are fictitious.

After these explanations, one major question remains open: How many activity places should be included in the personal network of usual places? Or, more precisely, which criteria should we adopt to define an activity place "usual"? With regard to the data that is usually collected in travel behaviour research, we believe that the most appropriate criterion is the frequency of visits (even though we have to acknowledge that people visit some usual places very rarely: For example, think of the visits to one's doctor, to family members that live far apart, etc.). In Figure 1, we have retained only the activity places that interviewee told to visit at least once a month, a temporality that seems appropriate to differentiate activity places belonging to "daily life routines" from those which correspond to "extraordinary" practices. However, we would like to emphasize that the concept of network of usual places (NUP) can not be comprehensive without any temporal reference. So, we shall define the NUP more precisely as *the set of places an individual visits on a recurring basis corresponding to a social rhythm (for example once a day, once a week, once a month, etc.) as well as the routes he or she usually takes between those fixed geographical points*.

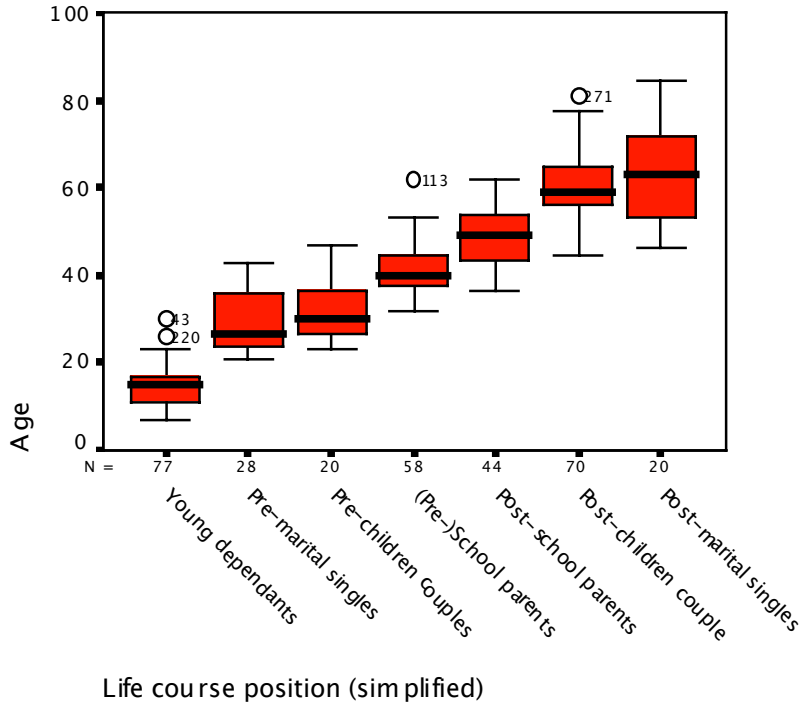
In this paper, we propose to explore quantitatively the relevance of the concept of *personal network of usual places* with existing large scale travel behaviour data sets. Indeed, a growing number of long duration data sets with geo-coded trips are available for secondary analysis, as for example the Mobidrive 1999 or the Thurgau 2003 diaries. With these data sets, spatial practices of several hundred persons can be explored and compared, and the most pertinent indicators for analysing individual activity spaces can be identified.

3. The Mobi*drive* data set

In the present study, the analysis was based on the Mobi*drive* data set (Chalasani & Axhausen, 2004; Mobidrive, 2001). The project Mobi*drive*, funded by the German ministry of Research and Education, conducted in 1999 a six-week continuous, paper-based travel diary in Karlsruhe and Halle, with a total of 317 persons over 6 years of age from 139 households participating in the main study. The data set was kindly made available by the ETH Travel Data Archive led by Prof. K. W. Axhausen. It consists of four files with relevant data about (1) households, (2) persons, (3) individual trips of each respondent and (4) the vehicles available in each household.

Table 1 synthesizes the socio-demographics of the Mobi*drive* main study sample. The sample includes an equilibrated number of respondents with regard to sex and city. With regard to life course position, a variable that we calculated on basis of the algorithm proposed by Levy et al. (1997), it appears that four categories predominate in the sample: Young dependant individuals (foremost adolescent children), family parents and post-children couples. The distribution is similar in both survey cities. Figure 2 shows the relationship between life course position and age. The working status is also rather unevenly distributed, with three dominant categories: Pupils, full-time employees and retirees. The category of the unemployed includes almost exclusively respondents from Halle, whereas house makers (house wives) and part-time employees mainly are female inhabitants of Karlsruhe.

Figure 2 Relationship between life course position and age



Source: Life course positions were determined on basis of the algorithm proposed by Levy et al. (1997, p. 419)

Table 1 Overview of the socio-demographics of the available study sample

Variables	Karlsruhe		Halle		Total	
	n	%	n	%	n	%
Sex						
Male	80	49.7%	78	49.4%	158	49.8%
Female	79	50.3%	80	50.6%	159	50.2%
Total	159	100.0%	158	100.0%	317	100.0%
Life course position						
Young dependants	37	23.3%	40	25.3%	77	24.3%
Pre-marital singles & co-habitants	18	11.3%	10	6.3%	28	8.8%
Pre-children couples	10	6.3%	10	6.3%	20	6.3%
Pre-school & school parents	26	16.4%	32	20.3%	58	18.3%
Post-school parents	22	13.8%	22	13.9%	44	13.9%
Post-children couples	36	22.6%	34	21.5%	70	22.1%
Post-marital singles & elderly	10	6.3%	10	6.3%	20	6.3%
Total	159	100.0%	158	100.0%	317	100.0%
Working status						
Pupil	27	17.0%	28	17.7%	55	17.4%
Student (College)	7	4.4%	5	3.2%	12	3.8%
Apprentice	6	3.8%	5	3.2%	11	3.5%
House maker	10	6.3%	2	1.3%	12	3.8%
Retiree	28	17.6%	25	15.8%	53	16.7%
Unemployed	1	0.6%	20	12.7%	21	6.6%
Part-time employee	22	13.8%	7	4.4%	29	9.1%
Full-time employee	50	31.4%	61	38.6%	111	35.0%
Self-employed	8	5.0%	5	3.2%	13	4.1%
Total	159	100.0%	158	100.0%	317	100.0%
Location of household						
Central business district	4	2.5%	15	9.5%	19	6.0%
Inner city	36	22.6%	53	33.5%	89	28.1%
Suburbs & elsewhere	119	74.8%	90	57.0%	209	65.3%
Total	159	100.0%	158	100.0%	317	100.0%
Automobile disposal						
Main car user	70	44.0%	59	37.3%	129	40.7%
Not a main car user	89	56.0%	99	62.7%	188	59.3%
Total	159	100.0%	158	100.0%	317	100.0%

Source: own calculations

The households' homes are mainly localised in the suburbs (especially in Karlsruhe), with only one third of them living in the inner city or the central business district (in total, only 6%). This distribution notably limits analyses looking at correlations between home localisation choice and activity spaces. Moreover, the category of people living in the central business district includes foremost inhabitants of Halle. A bit less than half of the respondents have a car at their main disposal, with a slight difference between Karlsruhe and Halle. Automobile

disposal is clearly gendered, since half of men are main car users whereas only 28% of women.

The trip data file contains information related to 45 531 trips made by the 317 respondents participating in the main study. The destinations of the trips are geo-coded with a varying degree of resolution, depending on the area of the destination. Within the urban cores of the case study regions, the destination addresses provided by the respondents have been geo-coded on the basis of (small) street blocks, whereas outside the urban boundaries the addresses are available only as geo-codes of the municipality centroids. The geo-coding was effective for about 98% of the trips.

Given the varying resolution of the geo-codes, *unique locations* are identified as activity places with a given geo-code and a specific trip purpose code, in order to differentiate activities happening in the same street block (resp. the same municipality for destinations outside the urban boundaries). For the 317 respondents, a total of 10 758 unique locations can be identified, from which 2 292 display an identical geo-code.

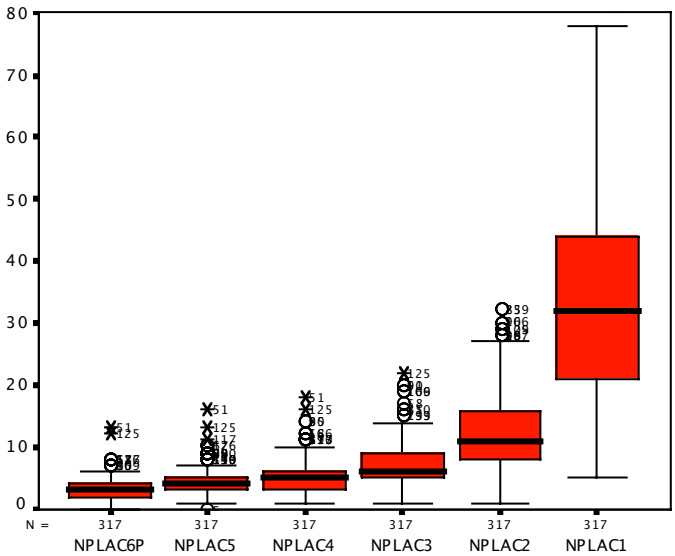
4. Analysis method

For the analysis of the personal networks of usual places of the Mobidrive respondents, a Pascal programme was developed, running under freepascal / Xcode / Mac OSX programming environment. The programme processes the geo-coded trip data and outputs a synthesis file containing a number of possibly relevant indicators (one case for each person) as well as four files per person, listing (1) the unique activity places, (2) the routes travelled between those places, (3) the places included in the personal network of usual places and (4) the routes travelled in between this subset of activity places. These latter files can be used for visualisation of individual activity spaces with a standard GIS application.

An important issue was to define the parameters used to identify centres of daily life and to differentiate usual activity places from other ones. We retained the following criteria:

- *Centres of daily life*: Activity places where an individual spent at least 67 hours over the whole survey period of six weeks. This value was chosen in order to include all places which correspond to a 20% employment.
- *Usual places*: Activity places that were visited at least three times during the survey period, i.e. places with at least a bimonthly visit frequency. This criterion appeared most appropriate since the survey period of six weeks does not allow to detect a monthly visit frequency (as discussed in Section 2). Figure 3 confirms that this choice is sound, since there exists a significant growth of the number of places visited twice in 6 weeks with respect to those visited three times.

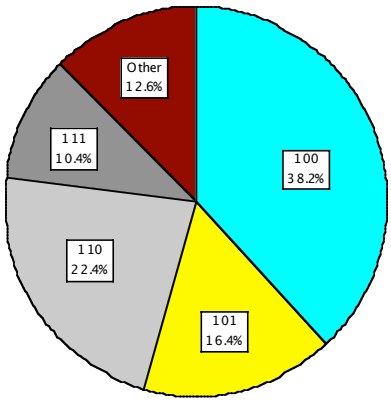
Figure 3 Boxplot distribution of the number of places each respondent visited 6 times or more during the survey period (nplac6p), at least 5 times (nplac5), at least 4 times (nplac4), at least 3 times (nplac3), at least twice (nplac2) and only once (nplac1; outliers not shown)



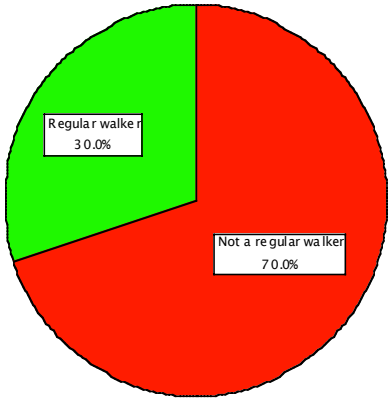
The variables that the analysis programme produces are listed in Annex 9.1.

In order to categorize travel mode behaviours, a system with three variables is used: dommodes indicates which travel modes are used on a weekly basis (i.e. at least 12 times during reporting period), secmodes indicates which additional travel modes are used on a monthly basis (i.e. at least 3 times during reporting period) and regwalkr indicates if the person travels significantly by foot (minimum walking travel time budget of 15 minutes per day during the whole reporting period). For dommodes and secmodes, the coding is: 100 = car ; 10 = public transportation ; 1 = Bicycle. Figure 4 shows that the Mobidrive sample includes over 87% of people that do regularly travel by individual motorized transport (car driver, car passenger, motorbike). Half of the interviewees however display a dominant multimodal behaviour, regularly using mass transit and/or a bicycle. Unfortunately, this distribution strongly restricts the possibilities to look for correlations between activity space indicators and travel mode behaviour. 30% of the interviewees are regular walkers.

Figure 4 Distribution of dominant travel mode behaviour and of walking behaviour



Dominant travel modes



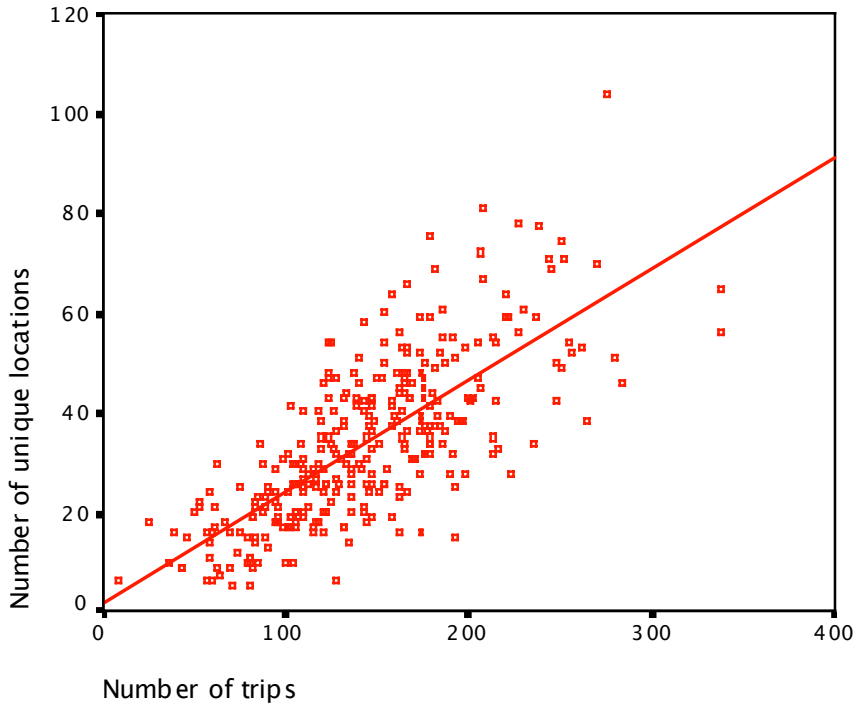
Walking behaviour

5. Selected results

Analysis is still work in progress. However, we present here first selected results.

Figure 5 shows the relationship between the number of trips of a person and the number of unique locations frequented. Comparing several long duration travel data sets, Schönfelder and Axhausen (2004) have shown that the number of unique locations grows consistently with the number of trips, with a ratio of about five trips to one unique location. This ratio gives an indication about the relative importance of routine and variety seeking in the destination choice behaviour of people.

Figure 5 Relationship between the number of trips and the number of unique locations



Source: Own calculation; linear regression fit line: Slope = 0.224; R^2 = 0.548

The total travel time budget of interviewees is correlated with the number of trips (see Figure 6). The correlation is rather independent of car disposal. Instead, the total travel time budget increases faster with the number of trips when considering regular walkers with respect to non regular walkers (chart on the right). A boxplot analysis (Figure 7) suggests some interdependence with the working status: Self-employed appear to be the most mobile social category, whereas unemployed are the least mobile (both in terms of number of trips and of travel time budget).

Figure 6 Scatter distributions of the total travel time budget in function of the number of trips

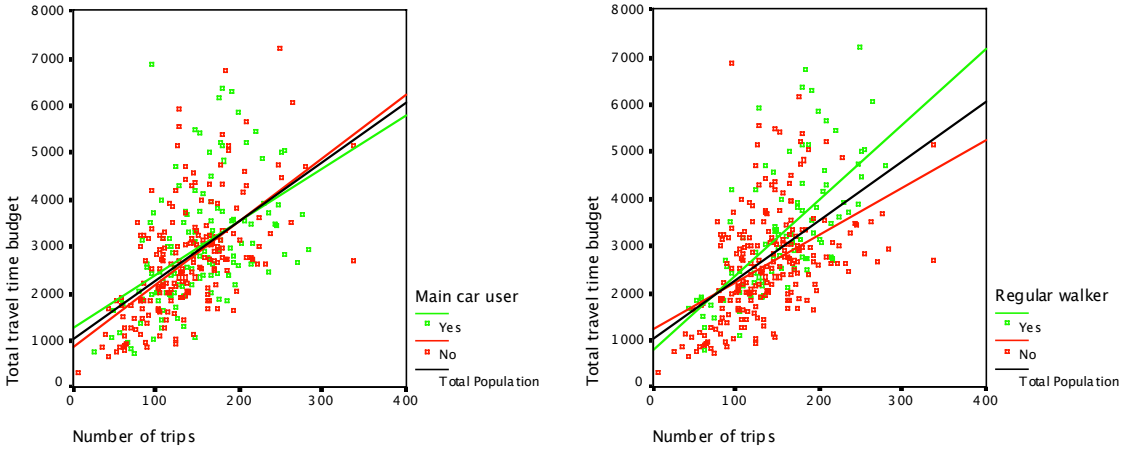
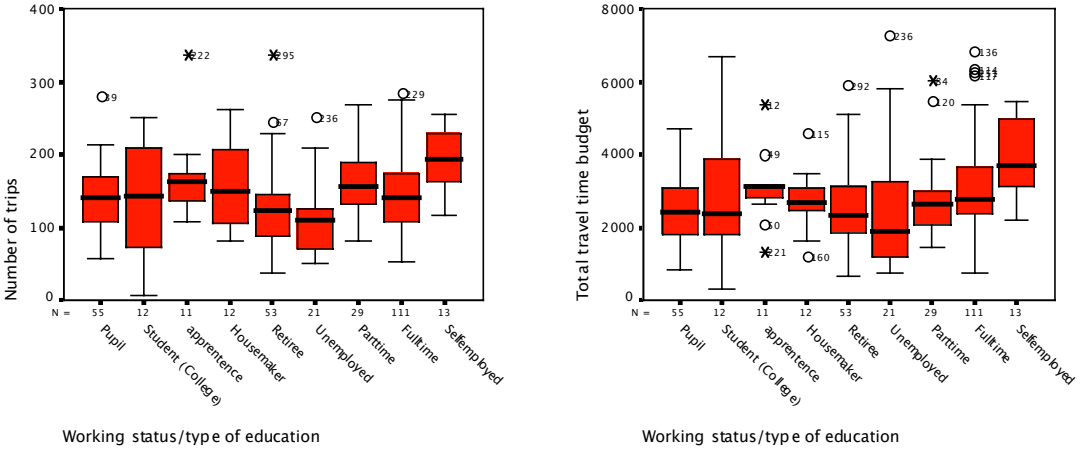


Figure 7 Boxplot distributions of the number of trips and the total travel time budget in function of the working status



Regarding the spatial extension of individual NUPs, two indicators have been compared: The mean distance of NUP trips and the NUP confidence ellipse surface, according to Schönfelder & Axhausen (2002b). An histogram analysis (Figure 8) reveals that the latter indicator increases very rapidly when the NUP of an interviewee includes an activity place located relatively far from home, making it a rather unpractical indicator (the histogram shows only the distribution on the lower end of the scale, so a large number of outliers are not shown; See also the mean and standard deviation values!).

Figure 8 Boxplot distributions of the number of trips and the total travel time budget in function of the working status

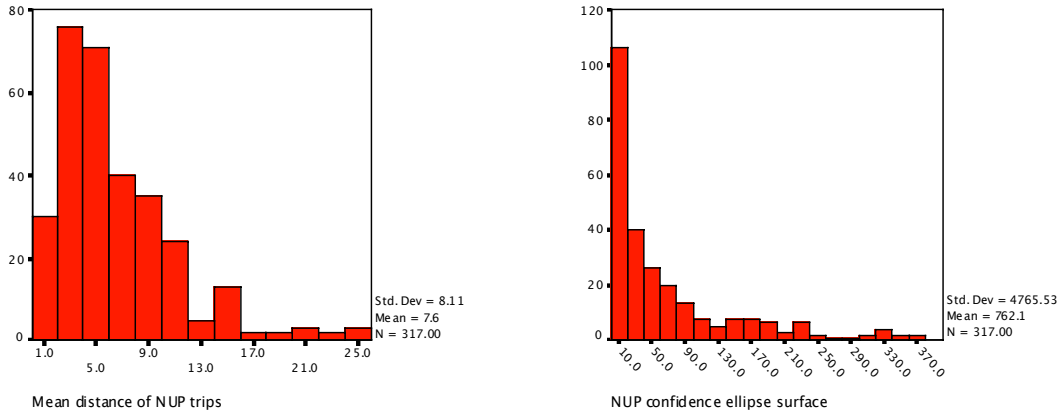
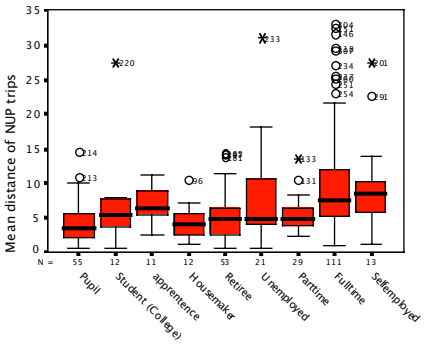
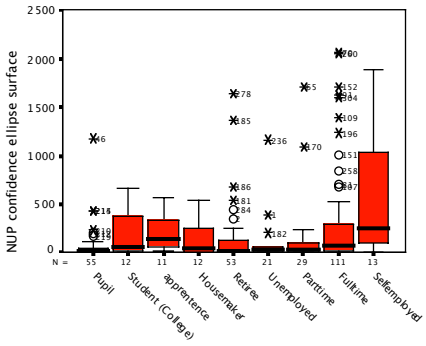


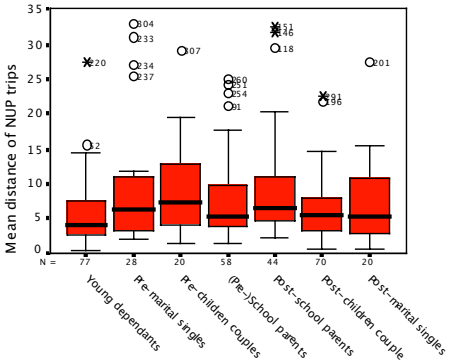
Figure 9 shows a selection of boxplot distributions of both indicators. They suggest that self-employed and full-time workers have comparatively more extended usual activity spaces, whereas pupils and house wives have the least extended ones. Also, pre-marital singles and pre-children couples seem to display slightly greater usual activity spaces, but with regard to life course position, no strong differentiation exists.

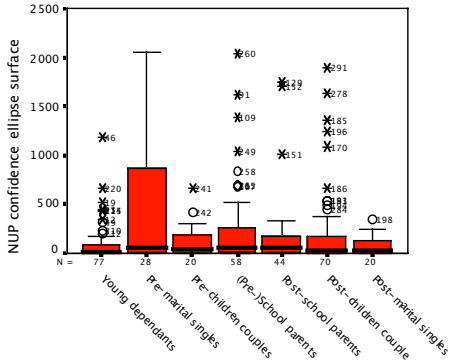
As one could expect, car disposal favours significantly the extension of the personal usual activity space. Last but not least, there also seems to exist a relationship between the geographical size of personal NUPs and the relative location of the household: Inhabitants of the central business district display the smallest distances / sizes, whereas people living in the suburbs obviously travel longer distances in order to get to their usual activity places.

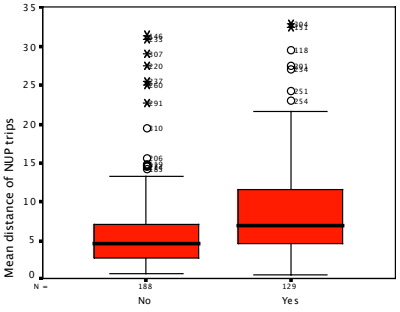
Figure 9 Boxplot distributions of the mean distance of NUP trips and of the NUP confidence ellipse surfaces

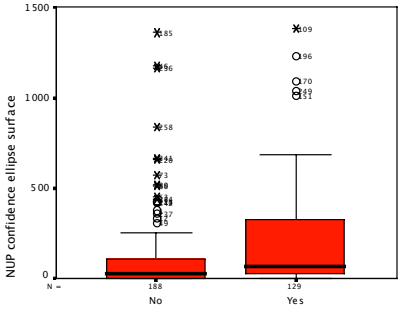


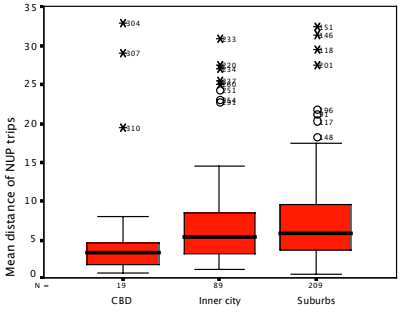












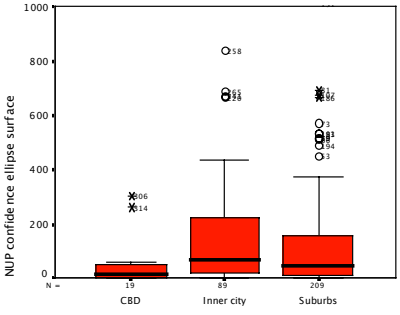


Figure 10 shows the frequency distribution of the number of daily life centres and of usual places in the NUPs of the Mobi*drive* interviewees. These distributions reveal an interesting variety of situations. A boxplot analysis (not shown) reveals that there is no significant correlation between the number of daily life centres and the number of usual places.

Figure 10 Frequency distribution of the number daily life centres and of usual places in the individual NUPs

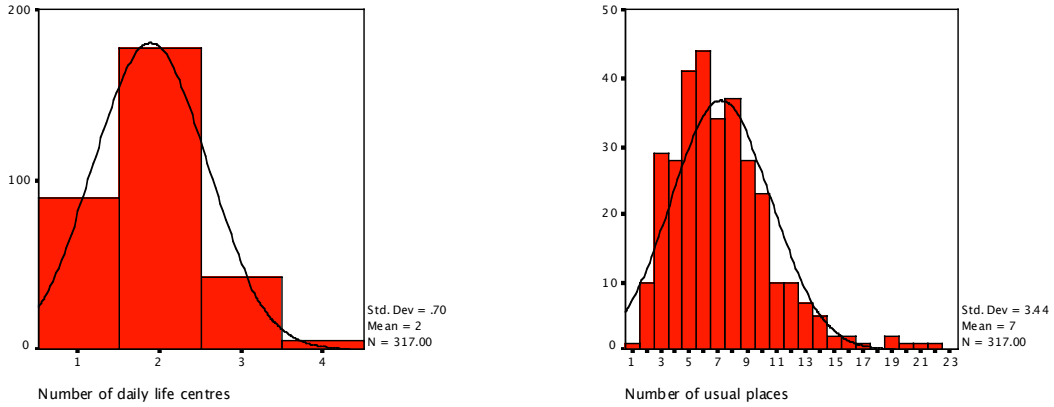
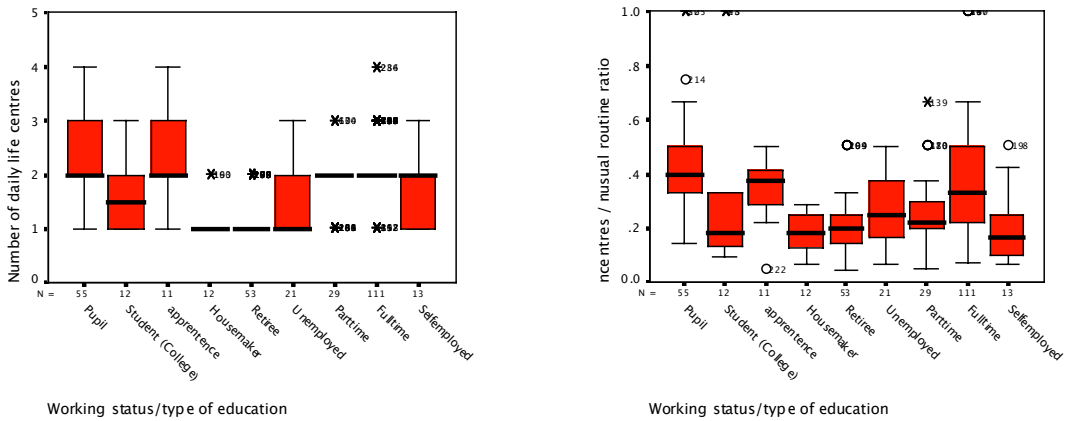


Figure 11 shows that house wives and retirees mostly have only one centre of daily life (their home). Unemployed also predominantly have only one centre of daily life, whereas most professionally active persons display two centres of daily life (home and workplace – except for the self-employed working at home). Pupils and apprentices display the greatest number of daily life centres: Besides home and school, specific leisure activities can be so important that one or even two additional daily life centres must be taken into account. At the same time, it appears that the daily life of pupils and apprentices is indeed centred in those specific activity places (see chart on the right, displaying the routine ratio ncentres / nusual).

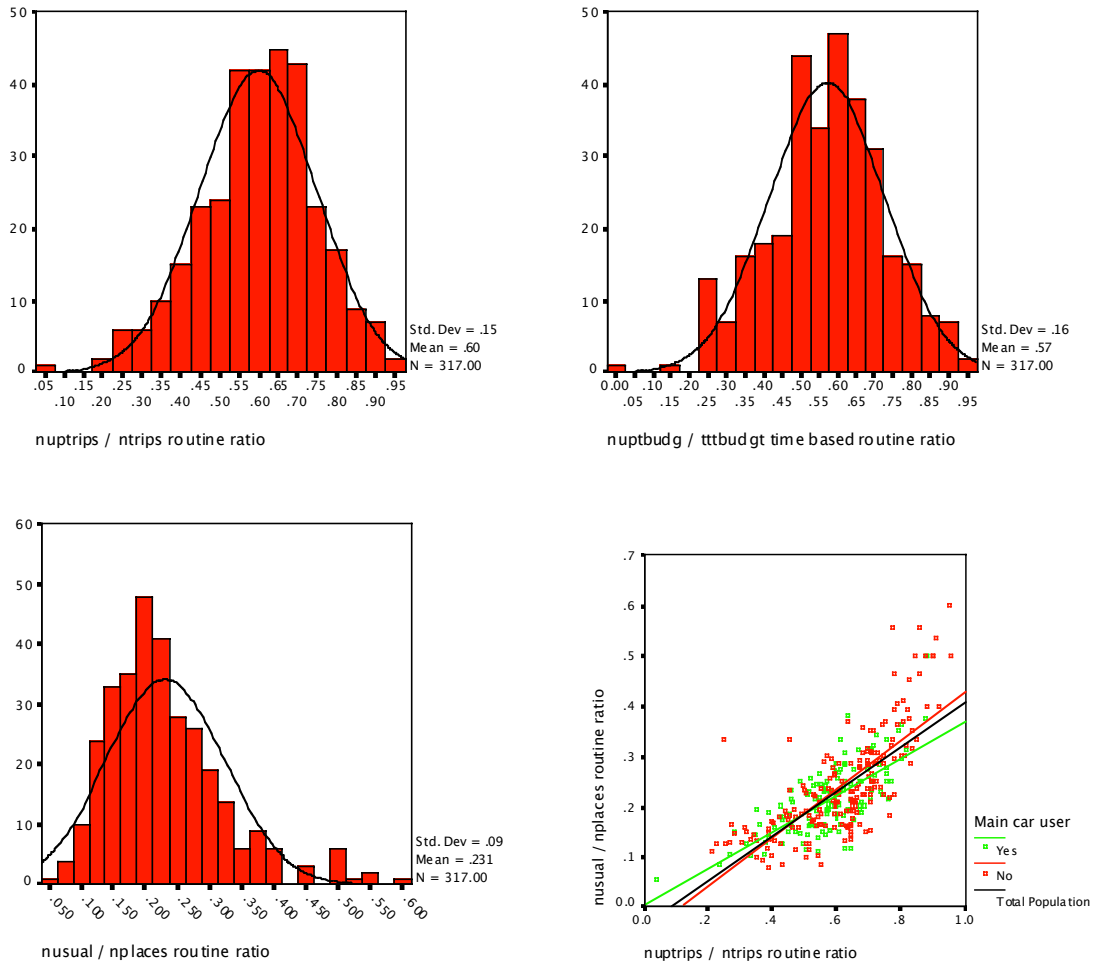
Figure 11 Boxplot distribution of the number daily life centres and of the ncentres / nusual ratio, in function of the working status / type of education



One of the most promising aspects of the NUP concept for activity space analysis is the differentiation between habitual and extraordinary travel practices. A basic approach to tackle this issue is to analyse the ratio of the number of usual trips with respect to the total number of trips, or alternately the ratio of the travel time devoted to usual trips with respect to the total travel time budget. Generally speaking, the importance of routine is confirmed, as most cases display ratios between 0.5 and 0.75 (see Figure 12). The time based ratio is slightly lower. A possible explanation is that the travel diaries include longer leisure trips to extraordinary locations. For further analyses, the occurrence based ratio appears therefore more relevant.

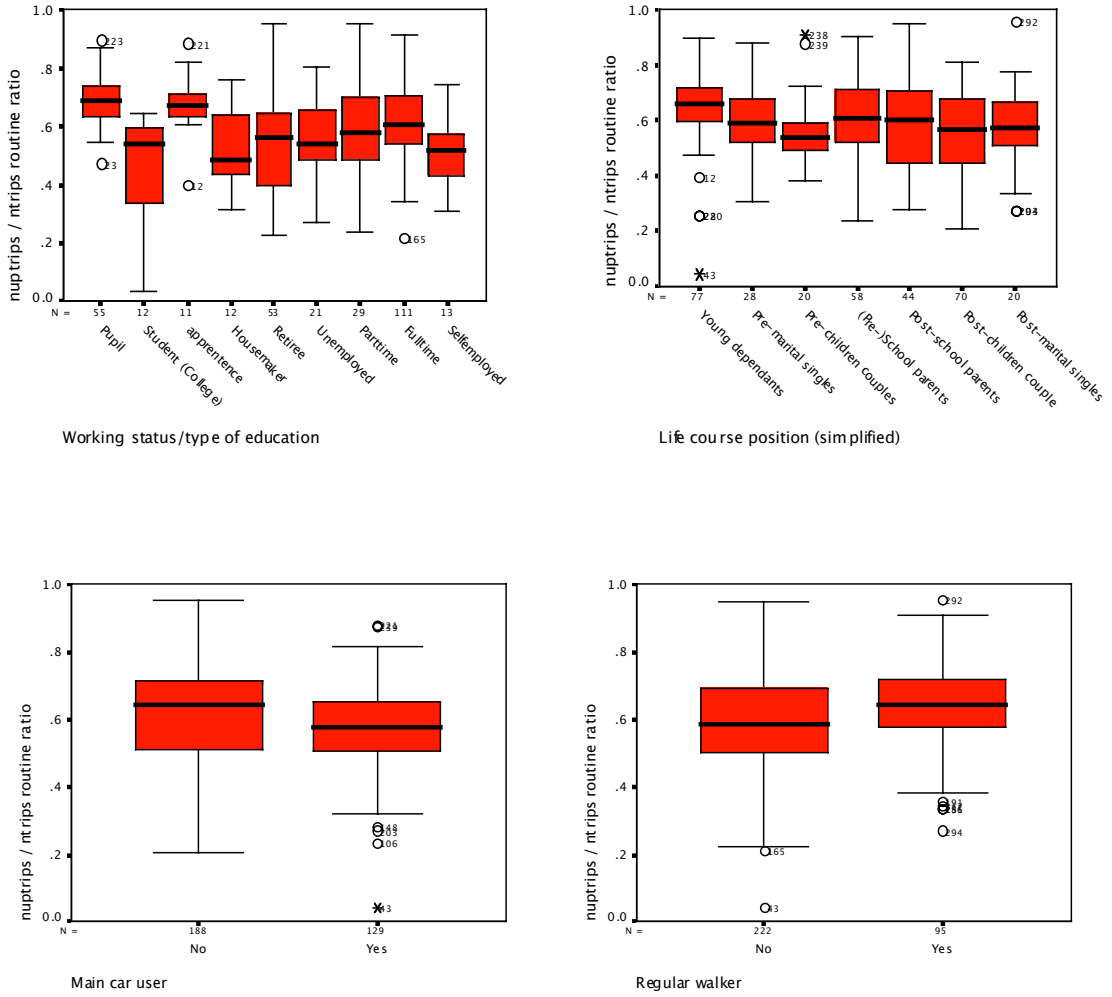
Another interesting view on the respective importance of routine and variety seeking is to look at the ratio between the number of usual places and the total number of unique locations visited during the reporting period. Here also some variety exists, with a mean ratio of 0.231. A look at the correlation between this place based routine ratio and the travel occurrence based ratio suggests that both ratios are rather interdependent, which implies that individual tendencies towards habitual practices involve both spatial decision making and travel behaviour.

Figure 12 Histograms of possible routine ratios and correlation between the place based and the occurrence based ratios



Our first analyses indicate no strong correlation with any of the reference variables. Figure 13 suggests that pupils and apprentices present the most routinized travel practices, whereas house wives, students and self-employed seem to be the least routinized social categories. However, the differences are not considerable at all. This is even more apparent when considering the relationship with the life course position. Car disposal seems to slightly favour non routinized travel practices. On the contrary, regular walkers are somewhat more routinized. In general, these findings tend to demonstrate that routine and variety seeking are a personal trait of conduct of everyday life and that it is not significantly related to social categories.

Figure 13 Boxplot distributions of the occurrence based routine ratio



6. Conclusion

In this paper, we have investigated quantitatively the usefulness of the concept of *personal network of usual places (NUP)*. This concept has been introduced as an instrument to grasp all the places an individual visits on a recurring basis corresponding to a social rhythm (for example once a day, once a week, once a month, etc.) as well as the routes he or she usually takes between those fixed geographical points. This network of usual places and of usual routes forms a geographical system in which it is possible to identify a certain number of daily life centres.

The analyses conducted so far have shown promising prospects for the analysis of human activity spaces. Indeed, indicators related to the NUP concept show interesting distributions and some of them are clearly related to reference variables typically used in travel behaviour research. At the same time, our analyses suggest that the relative importance of routine and variety seeking in travel behaviour and in destination choice making is a personal trait, which must be considered as an additional lifestyle variable. In this point, our analyses tend to confirm the sociological findings about the importance to include the concept of conduct of everyday life in the standard set of reference variables.

In our opinion, the NUP concept is a relevant concept in several perspectives:

First, this concept has an evident descriptive value as NUPs are sociologically coherent simplifications of individuals' activity spaces. For further quantitative analysis, finding additional relevant indicators that synthesize the structure of NUPs and individuals' travel behaviour within their NUP is needed. Graph theory analysis methods might be used in this respect.

Second, the NUP concept and its associated indicators might allow to build relevant typologies and market segmentations, both for a more comprehensive behaviour analysis and for a more effective travel behaviour modelling. This issue too is "work in progress" and the Mobidrive data set is probably insufficiently large and differentiated in order to produce significant results with this respect.

Finally, the NUP concept will help to reflect on the genesis of individuals' travel practices. It is obvious that travel behaviour is strongly correlated with one's network of usual places, as its structure largely determines the individual ability to choose between different travel modes in the organisation of daily mobility. For example, if the network of usual places spreads widely in geographic space, a strong dependence on fast transport modes is ineluctable. In a similar way, if people have arranged their network of usual places on the sole basis of automobile accessibility, a strong car dependence exists. Comparatively, people who have structured their personal activity space with respect to public transportation accessibilities often have more freedom of travel mode choice. These observations show how important it is to understand the way in which the activity space of an individual is established in the built environment and, more specifically, to understand the motivations and/or the constraints responsible for the choices of location of the home and of recurring activities.

7. Acknowledgments

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8. References

Chalasani, V.S. et Axhausen, K.W. (2004), *Mobidrive: A six week travel diary*, Travel Survey Metadata Series, 2, Institute for Transport Planning and Systems (IVT), ETH Zürich.

Flamm, M. (2004), *Comprendre le choix modal – Les déterminants des pratiques modales et des représentations individuelles des moyens de transport*, Thèse de doctorat, Ecole Polytechnique Fédérale de Lausanne.

Golledge, R.G. et Stimson, R.J. (1997), *Spatial behavior: a geographical perspective*, New York [etc.], The Guilford Press.

Kaufmann, V., Jemelin, C. et Joye, D. (2000), *Entre ruptures et activités: vivre les lieux du transport - De la sociologie des usages à l'aménagement des interfaces*, Berne, Direction du PNR-41 & EDMZ.

Levy, R., Joye, D., Guye, O. et Kaufmann, V. (1997), *Tous égaux? De la stratification aux représentations*, Zürich, Seismo.

Löchl, M., Schönfelder, S., Schlich, R., Axhausen, K.W., Buhl, T. et Widmer, P. (2005), *Untersuchung der Stabilität des Verkehrsverhaltens*, Bern, Eidgenössisches Departement für Umwelt, Verkehr, Energie und Kommunikation / Bundesamt für Strassen.

Mobidrive (2001), *Dynamik und Routinen im Verkehrsverhalten - Pilotstudie Rhythmik*, Karlsruhe, Forschungsbericht im Auftrag des Bundesministeriums für Bildung und Forschung (BMBF).

Pinson, D. (2002), « De la maison-mon(a)de à la ville-maison », *in* Bonnin, P. (ed.), *Manières d'habiter (Communications No73)*, Paris, Seuil.

Pinson, D. et Thomann, S. (2001), *La maison en ses territoires: de la villa à la ville diffuse*, Paris, L'Harmattan.

Projektgruppe "Alltägliche Lebensführung" (ed.) (1995), *Alltägliche Lebensführung - Arrangements zwischen Traditionalität und Modernisierung*, Leske und Budrich, Opladen.

Schönfelder, S. et Axhausen, K.W. (2002a), *Measuring the size and structure of human activity spaces – The longitudinal perspective*, Arbeitsberichte Verkehrs- und Raumplanung, No135, Institut für Vekehrsplanung, Transporttechnik, Strassen- und Eisenbahnbau der ETH Zürich.

Schönfelder, S. et Axhausen, K.W. (2002b), *On the variability of human activity spaces*, Arbeitsberichte Verkehrs- und Raumplanung, No149, Institut für Vekehrsplanung, Transporttechnik, Strassen- und Eisenbahnbau der ETH Zürich.

Schönfelder, S. et Axhausen, K.W. (2004), *Structure and innovation of human activity spaces*, Arbeitsberichte Verkehrs- und Raumplanung, No258, Institut für Vekehrsplanung, Transporttechnik, Strassen- und Eisenbahnbau der ETH Zürich.

Schönfelder, S. et Samaga, U. (2003), « Where do you want to go today? More observations on daily mobility », *Paper presented at 3rd Swiss Transport Research Conference*, Ascona.

9. Annexes

9.1 Description of produced variables

Variable	Description
index	Case number
city	Mobidrive case identifier : survey city (1 = Karlsruhe, 2 = Halle)
hhold	Mobidrive case identifier : household number
person	Mobidrive case identifier : person number (within household)
nplaces	Number of unique activity places (defined by way of their geo-localisation AND by way of travel purpose codes)
nusual	Number of usual activity places (e.g. visited at least 6 times in 6 weeks)
ncentres	Number of daily life centres (time spent there is equivalent or greater than 67.2 hours over the whole reporting period)
ntrips	Number of reported trips
nuptrips	Number of reported trips from one usual place to another
ntours	Number of tours (travel chains from home to home)
nroutes	Number of routes travelled (e.g. unique origin-destination pairs, in one way or another)
nmultmod	Number of routes that have been travelled by using alternate travel modes (multimodal routes)
nuprouts	Number of routes that are part of the NUP (e.g. unique origin-destination pairs, in one way or another, between usual places)
nupmultm	Number of multimodal routes that are part of the NUP
nretrips	Number of round trips from home
nhomrts	Number of routes connected to the home
nuphmrts	Number of NUP routes connected to the home
dommodes	Dominant travel modes, used at least once a week (e.g. 12 times during reporting period) : 100 = car ; 10 = public transportation ; 1 = Bicycle
secmodes	Secondary travel modes, used at least once a month (e.g. 3 times during reporting period) : 100 = car ; 10 = public transportation ; 1 = Bicycle
regwalkr	Indicator for importance of walking in travel behavior (trips travelled mainly on foot represent at least 15 minutes per day during the whole reporting period) : 1 = regular walker ; 0 = non regular walker
tttbudgt	Total travel time budget during reporting period, in [min]
nuptbudg	Travel time budget allotted to trips on NUP routes, in [min]

ttdist	Total travel distance during reporting period, in [km]
nuptdist	Total distance travelled on NUP routes, in [km]
totelps	Surface of total confidence ellipse, in [km^2]
nupelps	Surface of NUP confidence ellipse, in [km^2]
varelps	Surface of confidence ellipse including all non NUP places, in [km^2]
vusual	Number of activity places with a valid geo-code (non zero)
nsamplac	Number of activity places displaying an identical geo-code (i.e. only differentiated by way of the travel purpose code)
nplac1	Number of activity places visited at least once during reporting period
nplac2	Number of activity places visited at least twice during reporting period
nplac3	Number of activity places visited at least three times during reporting period
nplac4	Number of activity places visited at least four times during reporting period
nplac5	Number of activity places visited at least five times during reporting period
nplac6p	Number of activity places visited six times or more during reporting period
maxdur1	Time spent in activity place with longest stay duration
maxdur2	Time spent in activity place with 2^{nd} longest stay duration
maxdur3	Time spent in activity place with 3^{rd} longest stay duration
maxdur4	Time spent in activity place with 4^{th} longest stay duration
maxdur5…10	Time spent in activity place with 5^{th} … 10^{th} longest stay duration
purpos1	Purpose code of activity place related to maxdur1
purpos2	Purpose code of activity place related to maxdur2
purpos3	Purpose code of activity place related to maxdur3
purpos4	Purpose code of activity place related to maxdur4
purpos5	Purpose code of activity place related to maxdur5
ncar	Number of trips made using an individual motorized mean of transportation (car driver, car passenger, motorbike)
nupncar	Number of NUP trips made using an individual motorized mean of transportation
tcar	Travel time budget related to individually motorized trips
nuptcar	Travel time budget related to individually motorized NUP trips
dcar	Distance travelled using an individual motorized mean of transportation
nupdcar	Distance travelled on NUP routes using an individual motorized mean of transportation