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Immobility and Mobility Seen Through Trip-Based Versus Time-Use Surveys

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1. INTRODUCTION

Several data sources deal with individual diaries, thus giving insights on trip making [Noble, 2001, Pas and Harvey, 1997], and immobility. Two approaches, associated with two kinds of surveys, are often adopted to describe mobility:

- Travel surveys collect information on movements (time and location of departure and arrival, purpose, mode, etc.) by trip-based diaries for a given day; in case of an empty diary, there are sometimes questions about the reasons for staying at home that day.
- Time-use surveys (TUS) register all activities (including trips) on a pre-coded time grid with 10-minute or longer units.

A score of countries in the world have conducted nationwide transport surveys over the last ten years, generally using specific national methodology [Bonnell et al., 2005], with the goal of describing trips made by household members all over the country, either in rural or urban regions, conducted over a whole year to neutralize seasonal effects. Specifically, the surveys attempt to capture all trips made, whatever their purpose, mode of transportation, length, period in the year, or time of day. At the end of the 90's, EUROSTAT initiated a project of harmonized European time-use surveys (HETUS), which was followed by most European Union countries for their nationwide surveys. Given the similarities between the two kinds of surveys, it is worth inquiring whether these two sources tell the same story in terms of trip making and immobility controlling for their respective data qualities. If they diverge, this may be due to methodological points that have to be studied. If it is possible to make them converge, it represents an opportunity for new studies on travel behaviour and its evolution in many countries. The present study is based on six national surveys – travel and time-use – conducted in Belgium, France and Great Britain. It is accepted that trip- and activity-based diaries yield different results [Stopher 1992]. This paper first examines the differences in their methodologies that may impact comparisons between the six surveys (section 2). It then presents some parallel analyses of both kinds of surveys and tries to explain the discrepancies. Section 3 deals with immobility rates and section 4 with two indicators of mobility intensity: daily travel time and number of trips per day.

2. DATA SOURCES USED

Three pairs of nationwide survey datasets are used, with the following characteristics. They are summarized in annex 1 below.

2.1 National Travel-based Surveys (NTS)

The 1999 Belgian national mobility and travel survey (“MOBEL”) is the only one of its kind ever conducted in the country [Hubert and Toint 2002]. Statistics Belgium provided a sample of about 3,000 households, approached over the course of the year. All household members age 6 and over were asked to describe their mobility for one given day, randomly chosen with equal probability.

The French NTS (*Enquête nationale transports et communications* “ENTC”) 1993-94 is the fourth survey conducted by INSEE since mid-sixties on this topic. During a face-to-face interview, a randomly chosen household member (age 6 and over) was requested to record all trips made the day before the visit and motorised trips of the previous weekend. A sample of more than 14,000 respondents was spread over 8 waves from May 1993 to April 1994 [Madre and Maffre, 1994 and 1999; Madre and Armoogum, 1997 and 1998].

British NTS is a continuous survey conducted in Great Britain (but not in Northern Ireland) since 1988. The 1999/2001 NTS dataset gathers information collected from January 1999 to December 2001. About 23,000 individuals of all ages have completed a seven-day travel diary within an allocated month.

2.2 Time use - based Surveys (TUS)

Time Use Surveys (TUS) started in the 60’s, on behalf of a United Nations project. At the end of 90’s EUROSTAT coordinated the Harmonized European Time Use survey (HETUS, Eurostat 2000), conducted in most of European countries.

Its primary goal is to measure the amount of time spent by the population on various activities. The main instrument is an activity diary where the respondent describes what he or she does on a 10-minute grid. Activities are classified into different basic categories: professional work, homework, free time, social time, personal care/hygiene, and travel.

During the year 1999, Statistics Belgium conducted a time-use survey (BTUS) – the second of its kind since 1966 – along the HETUS lines. The sample of about 4,300 respondent households was spread over the year. All household members of 12 and over recorded their activities for one weekday and a Saturday or Sunday fixed at random by the interviewers.

The French TUS 1998-99 (*Enquête emploi du temps* “EdT”) is the third survey of this type conducted by INSEE since the mid-seventies. It retains the original definitions and the essential principles previously used, but did not exactly follow HETUS methodology. All household members of 15 and over recorded their activities for one day fixed at random by the interviewers employing the

time-use diary. The sample of more than 15,000 respondents was spread over 8 waves to neutralize seasonal effects.

United Kingdom Time Use Survey 2000 (UKTUS) was the first large-scale study of its kind to be conducted in Britain. It had a sample base of about 6,500 respondent households and 11,700 individuals aged 8 and over, including respondents in Northern Ireland. The fieldwork was carried out under contract by IPSOS-RSL between June 2000 and September 2001. The UK Time Use Survey was designed, where possible, to provide results comparable to other European studies.

2.3 Comparison of the methodologies

It is common knowledge that trip- and activity-based diaries give different results, for several methodological and technical reasons:

Transport surveys require a description of each new trip, meaning more work for the respondent filling in a trip diary and/or a longer interview in a face-to-face context. In a time-use survey, a new trip takes no more time or effort than reporting any other new activity on the grid. This major methodological difference may bias travel survey results. It is in the interest of a tired respondent to simplify his/her activity and mobility pattern, or, worse, to claim having stayed at home the whole day and made no trip. There are also methodological differences between surveys, especially on the transport side (see annex 1): reporting trips for one day or seven in the UK, of one individual per household (France) or all members; self-administered diary with or without contacts with a member of the survey team versus face-to-face interviews; and, on the time-use side, various methods for encoding activities (manual, automatic...). Last, sampling methods and non-response correction methods can differ from a country to another, but not inside a country, except in Great Britain (ONS 2002, ONS 2003). All surveys are calibrated to national population characteristics after an analysis of non-respondent households (Armoogum 2002, Hubert and Toint 2002, Glorieux and Vandeweyer 2002), except the British NTS. Since people who travel a lot are more difficult to interview, immobility rates or average daily travel time might be lower with non-weighted data. In fact, weighting does not much influence these indicators in the five calibrated surveys. Weighting cannot explain the differences between TUS and NTS indicators, which are much larger and more statistically significant (see tables A and B in annex 3)

There are several technical problems in making the data compatible because descriptions of travel times and trips, as well as their definitions, are not exactly the same. For this analysis, it was necessary to fix the lower age limit to 15 years old - the lowest common limit of the six surveys -, to limit the analysis to weekdays - from Monday to Friday -, and to remove Northern Irish households from the UKTUS sample because British NTS did not survey that region. The comparisons on mobility intensity and on immobility are tricky. Trips too short to appear as a main activity (lasting 10 minutes) should not be recorded in a TUS, although they should be in a NTS. Trips during working hours, for work purposes, are not always recorded in a TUS. These working-hours, for-work trips were not recorded in Belgian TUS, but were in France and the UK. In a TUS, walks are counted as a specific activity included in leisure time, but that activity integrates actions other than simple travel. Furthermore, while a NTS counts a new trip when a vehicle just stops for a passenger to get

in or off (e.g. 'kiss and ride'), a TUS will generally count only one trip (1).

The Belgian surveys have been comprehensively studied in order to harmonize the definitions of trips in NTS and TUS [Toint et al. 2006]. The study showed that more than half of one trip per day could be subtracted from the "normal" Belgian NTS estimation for the purposes of comparison. But the TUS numbers of trips were also susceptible to significant corrections due to a very large number of place changes without travel time, which should have meant one very short trip. There is also a problem with time measurement in TUS. An attempt was made to convert MOBEL data in order to conform to the BTUS conventions. This increased the daily travel times by nearly 10 minutes on average, mainly because it increased travel times of trips lasting less than 15 minutes, which are the most frequent (see table 3).

The two kinds of survey serve different purposes. It should not be expected to find exactly the same numbers of trips in a NTS as in a TUS. Interestingly, however important the corrections were in the Belgian study, they did not change the main conclusions. Moreover, we may wonder whether the times declared by NTS respondents, the coding of trip purposes in a NTS, or places and activities in a TUS are precise and reliable enough to allow such corrections. These are some of the reasons why we did no further harmonization work for this paper than that mentioned above on age and geographic scope.

3. THE SHARE OF PERSONS WITH NO TRIP (IMMOBILES)

3.1 Definitions of immobility

In a NTS, an immobile person is somebody who has not declared any trips at all. The share of persons with no trip, or immobility rate, shows significant variations from one survey to another and declared immobility can sometimes be untrustworthy, being diversely biased by a "soft refusal" to participate in trip reporting [Axhausen et al., 2003].

In a TUS, an immobile person can be defined either as someone who has remained at home the whole day, or as someone with no travel activity. The first definition is stricter since a travel activity has to "fill" a 10-minute slot to be visible. Thus, people with only very short trips around home might appear as immobile with the second definition. But it is very difficult to control whether a change of place without at least 10 minutes of travel in the dataset actually means one real very short trip or not. The discrepancy ranges from 1.5 in Great Britain to 18 points in France where the immobility rate according to definition 2 seems questionable (2). Immobility rates (according to the two definitions) are, however, highly correlated, even in France, surprisingly, where one rate is three times as high as the other (see table 1 and table 2b in annex 2). With the first definition, immobility rates are more consistent among the three TUS's. Time-use publications, however, generally base the "participation rate for transport activity", which means the share of mobile people, on the travel time, *i.e.* our second definition. That definition, though commonly used, raises another problem because travels are indicated by specific codes of two variables: location and activity. When somebody travels, the activity code yields the type of trip (e.g. "home to work"), the location code, and the means of transportation, except for France where it also gives, grossly, the type of trip. Unfortunately, the codes of activity and place during travel are not always totally consistent. We can base the immobility rate on the union of the two variables (definition 2a), or on activity code only (2b), or place code only (2c).

Definition :	Share of immobile (%)			Daily travel time for mobile (minutes)		
	Belgium BTUS 1999	France EdT 1998-99	Great Britain UKTUS 2000	Belgium BTUS 1999	France EdT 1998-99	Great Britain UKTUS 2000
Activity or place (2a)	14.2%	26.6%	8.2%	97	86	112
Activity only (2b)	14.2%	27.0%	10.4%	97	83	96
Place only (2c)	14.2%	29.7%	8.2%	97	80	112
One place (1)	9.1%	8.3%	6.7%	92	69	110
<i>Def 2a - Def 1</i>	<i>5.1</i>	<i>18.4</i>	<i>1.5</i>	<i>5</i>	<i>17</i>	<i>2</i>

Table 1: Immobility rate and daily travel time of mobile individuals (age ≥15), a weekday, from three TUS's, according to different definitions of immobility

Sources: *Statistics Belgium: BTUS 1999; Insee: EdT 1998-99; Statistics UK: UKTUS 2000.*

It is worth noting that a person identified as mobile according to definition 1 can have a travel time equal to nil. The choice of definition for immobility

substantially influences, therefore, the level of mobility indicators, such as the average daily travel time, even if they are restricted to mobile persons. In the rest of this paper, we will use definition 2a, which corresponds to the highest mobility indicators (travel time and number of trips per day). Definition 1 may seem more suitable for the analysis of immobility rates, especially in France, but tables in annex 2 make comparison possible for TUS indicators based on the two definitions.

3.2 Immobility according to the different kinds of surveys

In the three countries, immobility rates given for a weekday by the two kinds of surveys are statistically different. TUS respondents report much lower immobility shares, except in France, though not with the alternate definition mentioned above. The gap is larger for women than for men. When considering this difference by age (see table 2), immobility reaches its minimum in working age groups and increases for younger and older groups accordingly. This U-shape is pronounced in France and the United Kingdom, but less visible in the Belgian data.

Weekday immobility patterns are comparable across surveys and countries, but TUS's are clearly more consistent than NTS's. The largest shares of mobility participation are reported for Friday, though the difference from the rest of the week is small, except in Belgium. The low share reported for Mondays in France stands, while in Belgium the shares for the first days of the week are comparable. It should be noted that there is no school for children on Wednesday in France and that, in Belgium, there is no school on Wednesday afternoons.

	Belgium			France			Great Britain		
	MOBEL 1999	BTUS 1999	TUS-NTS	ENTC 1993-94	EdT 1998-99	TUS-NTS	NTS 1999-01	UKTUS 2000	TUS-NTS
All ≥15	22.2%	14.2%	-8.0	16.9%	26.6%	9.7	22.6%	8.2%	-14.4
Male	18%	10%	-7.5	13%	23%	9.6	19%	7%	-12.0
Female	26%	18%	-8.3	20%	30%	9.9	26%	9%	-16.5
15 – 19	18%	6%	-12.4	14%	19%	4.9	23%	7%	-16.7
20 – 29	15%	6%	-8.7	7%	13%	5.4	18%	4%	-13.5
30 – 39	12%	7%	-5.0	8%	13%	5.5	16%	4%	-12.1
40 – 49	17%	6%	-10.6	10%	18%	8.3	15%	4%	-10.9
50 – 59	23%	15%	-8.1	18%	26%	7.7	18%	6%	-11.5
60 – 69	31%	23%	-7.9	28%	45%	16.9	27%	11%	-15.6
Over 70	46%	39%	-7.5	44%	60%	15.7	44%	23%	-20.7
Monday	27%	15%	-12.0	20%	26%	5.2	24%	10%	-14.9
Tuesday	21%	11%	-9.6	14%	27%	12.4	23%	8%	-14.6
Wednesday	23%	16%	-7.4	18%	30%	11.9	23%	9%	-13.5
Thursday	22%	14%	-8.0	16%	25%	8.2	22%	7%	-15.2
Friday	18%	11%	-6.6	16%	26%	10.6	21%	7%	-13.9

Table 2: Immobility rate of individuals (age ≥15) a weekday from three TUS's and three NTS's

Sources: *Statistic Belgium: BTUS 1999, BelSPO: MOBEL 1999; Insee: EdT 1998-*

The proportions of immobile persons given by transport surveys are regularly more than twice those given by TUS's in Belgium and Great Britain, and it would be the same for France with the alternate immobility definition based on unity of place. Because of the inherent bias of TUS against short duration trips due to the 10 minute grid, one would have expected that a time use survey would lead to higher shares of immobility. The significant reversal of this expectation raises the question whether travel diaries encourage soft refusals by respondents, *i.e.* answering the socio-demographic questions but refusing the travel diary itself by claiming falsely to have stayed at home. Regarding the Belgian gap, it is probably increased by the self-administered questionnaire; face-to-face interviews do give more protection against soft refusal. It is well known that respondents with few or short trips are more likely to be non-responders. The higher shares of immobile travel diary respondents among the elderly are consistent with this pattern.

Madre et al [2007] assume that best estimate for the true share of immobile persons is about 10-15%, which is within the interval yielded by the two time-use numbers. TUS immobility rates seem more realistic than those yielded by NTS, provided that travel activity has been carefully encoded.

4. MOBILITY-INTENSITY

In this section, we compare TUS's and NTS's only in terms of daily travel times and number of trips per mobile person, because of discrepancy on the immobility rates. This comparison tries to ascertain whether the survey methods are consistent on time measuring and trip reporting. Our aim is to take a first look at some relevant findings.

As described previously, a TUS should not mention any transport activity when a trip lasts less than 5 minutes, while a NTS is supposed to collect all trips. It seems unlikely that these very short trips might substantially bias the comparison of daily travel times, although very short trips are common in NTS's (3), see table 3. One reason is that short trips have a small impact on the total travel time of one day. Secondly, some 3 or 4-minute trips can form one loop of more than 10 minutes, interrupted by very short stops (for example to fetch a child at school and go back home), and that loop should be counted by TUS in the daily travel time.

	Belgium	France	Great Britain
	MOBEL 1999	ENTC 1993-94	NTS 99-01
1 to 4 minutes	10%	4%	3%
5 minutes	15%	23%	13%
6 to 14 minutes	28%	23%	24%
15 minutes and more	47%	50%	60%

Table 3 : Distribution of trips duration in three NTS's a weekday (age ≥ 15)

Sources: BelSPO: MOBEL 1999; Insee: ENTC 1993-94; Statistics UK: NTS 1999-01.

4.1 Daily travel times

The measuring of travel times is crucial for this comparison because the instruments are different: either a fixed grid of 10 minutes, or a self-reported departure and arrival time. The first instrument systematically rounds times but it is understood that NTS respondents also round times when reporting them [Madre and Armoogum., 1997; Rietveld 2002; Hubert and Toint 2007]. In any case, daily travel times are always much longer in TUS's: by about 10 minutes in France, 20 minutes in Belgium and 30 minutes in Great Britain (see table 4).

	Belgium			France			Great-Britain		
	MOBEL 1999	BTUS 1999	TUS-NTS	ENTC 1993-94	EdT 1998-99	TUS-NTS	NTS 1999-01	UKTUS 2000	TUS-NTS
All ≥15	79	97	18	77	86	9	80	112	32
Male	87	103	16	83	90	7	87	113	26
Female	72	91	19	71	80	9	74	112	38
15 – 19	66	97	31	75	86	11	74	113	39
20 – 29	89	108	19	83	94	11	84	116	32
30 – 39	84	104	20	81	90	9	83	118	35
40 – 49	80	100	20	85	87	2	86	111	25
50 – 59	71	94	23	75	86	11	81	110	29
60 – 69	82	92	10	67	71	4	77	117	40
Over 70	65	72	7	54	61	7	66	96	30
Monday	73	93	20	75	85	10	78	111	33
Tuesday	89	95	6	78	81	3	78	110	32
Wednesday	81	94	13	75	83	8	81	112	31
Thursday	69	93	24	76	88	12	81	109	28
Friday	80	112	32	83	90	7	83	119	36

Table 4: Daily travel time in three TUS's and three NTS's by age and day of the week

Sources: *Statistic Belgium: BTUS 1999, BeISPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01* (includes trips under 5 min in NTS).

In the three countries and both kinds of surveys, men have longer travel times, travel times increase with age up to the 20- to 29-year-old age group and then decrease (except in NTS99-01). On Friday, time dedicated to travel is the longest, while Monday is generally the day with shortest travel times. It is noteworthy that TUS figures are generally more regular. For instance, travel times by age group change less in TUS data than NTS data. There is only one maximum for age group 20-29, or 20-39 in Great Britain, and the curve always goes down after that point. The curve is more irregular for NTS data (see age groups 30-39 in France, 60-69 in Belgium and 40-49 in UK).

The longer times in TUS's can have many causes. It is possible that a TUS collects more trips; this will be examined in the next section. At trip level, however, TUS methodology generally estimates travel times higher than NTS, as previously noticed in Belgian data. Table 5 shows that an average trip is about 30% longer in a TUS than in a NTS.

minutes	Belgium	France	Great-Britain
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	MOBEL 1999	BTUS 1999	TUS-NTS	ENTC 1993-94	EdT 1998-99	TUS-NTS	NTS 1999-01	UKTUS 2000	TUS-NTS
All ≥ 15	19.8	26.6	6.8	19.8	29.3	9.5	24.2	33.6	9.4

Table 5: Average trip duration in three TUS's and three NTS's (including trips of less than 5 minutes)

Sources: *Statistic Belgium: BTUS 1999, BeISPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01.*

It might then be assumed that TUS's are collecting a higher proportion of long travel times, but figures 1 and 2 (showing the distribution functions of daily travel times) invalidate that assumption. On figure 1, daily travel times measured in minutes diverge: the higher the mean daily travel time, the faster the distribution function of a dataset increases. A TUS does collect more long travel times than a NTS but figure 2 shows that the divergence is strictly proportional to the mean level. The distribution functions of normalized daily travel times (*i.e.* times divided by the mean value for each survey) are almost identical. In figure 2, TUS's no longer diverge from NTS's: there are as many short, medium, or long daily travel times in proportion to the mean in the six surveys; maybe even slightly fewer very long daily travel times (more than 1.5 of the mean value) in the TUS's. This tends to show again that a TUS and a NTS measure the same behavioural variations but at a systematically different level.

Figure 1: Daily travel time distributions of the six surveys in minutes

Figure 2: Daily travel time distributions of the six surveys in proportion to the mean value

Sources: *Statistic Belgium: BTUS 1999, BelSPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01.*

4.2 Daily trip frequency

Unlike the previous indicators presented above, the average number of trips per day per mobile person is not systematically higher or lower in either of the two kinds of surveys. The proportions of persons making 1, 2, 3, or more, trips per day vary considerably between the two kinds of surveys (table 6).

Daily number of trips (all ≥ 15)		1	2	3	4&5	6 and more
Belgium	MOBEL 1999	6%	34%	10%	26%	24%
	BTUS 1999	7%	30%	16%	30%	17%
France	ENTC 1993-94	2%	38%	7%	32%	21%
	EdT 1998-99	11%	40%	15%	27%	7%
Great-Britain	NTS 1999-01	3%	48%	9%	27%	13%
	UKTUS 2000	8%	32%	17%	29%	14%

Table 6: Distribution of the number of daily trips per mobile person on a weekday in three NTS's and three TUS's

Sources: *Statistic Belgium: BTUS 1999, BelSPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01.*

A TUS always gives more respondents with only one or three trips, while a NTS has more even numbers of trips, perhaps because NTS respondents favour the two-way trip pattern when asked to fill their travel diary. Another reason may be that TUS cannot always separate trips linked to short activities, such as accompanying a child to school or buying bread at the bakery. A TUS counts only one trip while a NTS counts two. An odd number can be a sign that two trips within a short time have been aggregated in TUS forms. The lower proportion of days with a lot of trips in TUS may also result from trip aggregation. This seems to invalidate the assumption that trips more tiring to declare in a NTS could be more easily forgotten - at least, it does not seem to

be the case for people who have made more than 6 trips in one day. Trip aggregation in TUS could also mean that what is regarded as an average trip in TUS might represent more than one real trip, which would partly explain why the average TUS trip is so long compared to the NTS average trip. In such conditions, it seems impossible to say whether TUS or NTS yield the more correct numbers.

Table 7 shows that the larger the gap between TUS and NTS average daily travel times, the smaller the difference between mean numbers of trips per day. But the difference is sometimes favourable to the NTS (France and Belgium), sometimes to the TUS (Great Britain).

In France and Belgium, with both methodologies, daily trip frequency increases with age up to the 30- to 39-year-old age group and then decreases (see table 7). The maximum frequency is 4.5 trips per day (yielded by travel survey) and the minimum is 2.8 or 2.9 trips for elderly people (over 70 years old). In Great Britain, as for daily travel times, the maximum spreads over two age groups (29-49).

In all countries, Friday is a day with more trips, in both types of survey. Only in Belgium is Wednesday a day with many trips.

trips/day	Belgium			France			Great-Britain		
	MOBEL 1999	BTUS 1999	TUS-NTS	ENTC 1993-94	EdT 1998-99	TUS-NTS	NTS 1999-01	UKTUS 2000	TUS-NTS
All ≥15	4.0	3.7	-0.3	3.9	3,0	-0,9	3.3	3.5	0.2
Male	4.0	3.7	-0.3	3.9	3,0	-0,9	3.3	3.4	0.1
Female	4.0	3.6	-0.4	3.9	2,9	-1,0	3.4	3.6	0.2
15 – 19	3.7	3.6	-0.1	3.5	2,9	-0,6	2.9	3.5	0.6
20 – 29	4.2	4.1	-0.1	4.2	3,1	-1,1	3.2	3.5	0.3
30 – 39	4.5	4.0	-0.5	4.5	3,3	-1,3	3.5	3.7	0.1
40 – 49	4.3	3.7	-0.6	4.2	3,0	-1,1	3.6	3.5	-0.1
50 – 59	3.7	3.5	-0.2	3.7	3,0	-0,7	3.3	3.5	0.2
60 – 69	3.7	3.4	-0.3	3.4	2,5	-0,9	3.2	3.5	0.2
Over 70	2.9	2.8	-0.1	2.8	2,4	-0,4	2.9	3.1	0.2
Monday	3.8	3.5	-0.4	3.8	3,0	-0,8	3.2	3.3	0.1
Tuesday	4.0	3.5	-0.5	4.1	2,9	-1,1	3.3	3.4	0.1
Wednesday	4.2	3.7	-0.6	3.8	2,9	-0,8	3.3	3.4	0.1
Thursday	3.8	3.6	-0.2	4.0	3,0	-1,0	3.3	3.5	0.2
Friday	4.1	4.1	0.0	4.0	3,1	-1,0	3.4	3.7	0.3

Table 7: Average daily number of trips per mobile persons in three NTS's and three TUS's

Sources: *Statistic Belgium: BTUS 1999, BeISPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01.*

5. CONCLUSION

Comparing these two pairs of travel and time use surveys, it is clear that they tend to tell parallel stories when the results are disaggregated by age groups and other details. It has also become clear that the levels of variables analysed (immobility, travel times and trips) are systematically different. Some of the differences are due to both the particular forms employed and to coding procedures. In all cases, the 10 minute grid led, in turn, either to a substantial

overestimation in trip duration and then of the total travel times, or to a substantial underestimation of daily trip frequency due to aggregation of short trips, or both. It is very difficult, if not impossible, to discover from this analysis what the truly accurate data is between or behind these parallel stories.

The results also again highlight the fact the travel diaries in NTS encourage under-reporting of out-of-home activities, leading to overestimation of the immobile persons share, despite a possible exception in the French case. Some respondents might not participate at all, or deem their travel to be without merit for the study. The time-use surveys do not raise that dilemma for the respondents, as travel is just one activity among others, and should obtain more realistic shares of immobile persons. One then wonders about the quality of travel behaviour indicators that include immobile persons.

This initial analysis has shown the usefulness of a parallel analysis of travel diary and time use surveys. It has also shown that TUS's can obtain relatively realistic trip rates, perhaps at the cost of less realistic total travel times, and realistic variations of travel behaviour among the different social or age groups. Provided that interviewers and statisticians use great care in separating travel from subsequent activities, time use surveys can be a very valuable data source for travel behaviour analysis. This is particularly true in Europe, where nationwide travel surveys are rare and not harmonized, contrary to time-use surveys. More work is needed to combine the advantages of these two daily life survey approaches to obtain high quality estimates of the level and intensity of daily travel. Last, we can hope that widespread use of GPS data loggers for measuring mobility, as in the 2007-08 French transport survey, will soon make it possible to reliably compare data from both kinds of surveys.

(1) If long enough, such travel should be described by two activities in TUS: one trip made with a passenger and another one made, before or after, with no passenger. Frequently, however, the trips are not long enough to fill one (or more) 10-minute slot each. Information on participants' travel cannot reveal 'kiss and ride' trips in those cases.

(2) This assumption is based on examination of the first 25 daily activity reports for the 2,200 individuals in the French dataset who report no travel and, at the same time, presences in different places. For 23 of them, there is no doubt that the respondents did leave their homes and make some trips, although the automatic data processing indicated the contrary. These mistakes fall into three categories. In some cases, the machine wrongly coded answers due to faulty recognition of keywords. Incomplete answers were another source of errors (e.g. "I am going out" without any other information). Finally, some answers did not distinguish between the activity and the trips (e.g. "I am going shopping" just followed by "I am preparing meal"); it would have been necessary to separate them clearly either in the time of the interviews or when the data were analysed (e.g. "I am going to the store; I am doing my shopping; I am going back home").

(3) It is clear that 5-minute trips are, by far, too numerous. Respondents round times. In the Belgian case, the only postal survey, this behaviour also led to many non-responses when departure and arrival times were very close. Missing times were imputed according to distance and transport means, and this method has smoothed the frequency distribution a little.

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List of acronyms

BelSPO: Belgian Science Policy

BTUS: Belgian Time-use Survey

EdT: Enquête emploi du temps

ENTC: Enquête nationale transports et communications

HETUS: Harmonized European Time Use Survey

Insee: Institut national de la statistique et des études économiques

MOBEL: Enquête nationale sur la mobilité des ménages -Nationale enquête over mobiliteit van huishoudens

NTS: National Travel Survey

ONS: Office for National Statistics

TUS: Time Use Survey

UKTUS: United Kingdom Time Use Survey

Annex 1: Methodologies of NTS and TUS in France, Belgium and Great-Britain

	Belgium		France		Great-Britain / United Kingdom	
	B - MOBEL 1999	B - TUS 1999	F - NTS 1993-94	F - TUS 1998	GB - NTS 1999- 01	UK - TUS 2000
Data collection	Postal, self administrated diary with telephone calls for explanation, reminders, etc.	Self administrated form with two face to face interviews	Face to face interview	Self administrated diary with a face to face interview	Self administrated diary with a face to face interview	Self administrated diary with a face to face interview
Data collection period	From November 1998 to December 1999	From December 1998 to February 1999	From May 1993 to April 1994.	From May 1998 to April 1999.	From January 1999 to December 2001	From June 2000 to September 2001
Number of interview per Household	All member of the households aged 6 and over	All member of the households aged 12 and over	One member of the household aged 6 and over, randomly selected	All member of the households aged 15 and over	All member of the households whatever the age	All member of the households aged 8 and over
Respondent sample size	7,025	8,382	14,150	15,441	23,004	11,667
Type of questionnaire	Trip diary	Activity diary	Trip diary	Activity diary	Trip diary	Activity diary
Unit of time	Continuous time	10 minutes interval	Continuous time (e.g. Trip from 14h13 to 14h26)	10 minutes interval (e.g. 14h00 to 14h09: activity)	Continuous time	10 minutes interval
Activity encoding	Reasons for travel are pre-coded by activity type	Open description of activities manually encoded	Reasons for travel are pre-coded by activity type	Open description of activities automatically encoded	Reasons for travel are pre-coded by activity type	Open description of activities
Geography	Precise locations and addresses	Rough geographical indications	Precise locations	Poor geographical indications	Precise locations	Rough geographical indications
Mode of transport	Descriptions of various means of transport used successively	Main mean of transport during 10 minute interval	Descriptions of various means of transport used successively	No indication	Descriptions of various means of transport used successively	Main mean of transport during 10 minute interval
Day under report	One day chosen at random	One week day and one weekend day chosen at random	One day chosen by the interviewer and the respondent	One day chosen by the interviewer and the respondent	Seven consecutive days	One week day and one weekend day chosen at random
Weighted data	Yes	Yes	Yes	Yes	No	Yes

Annex 2: TUS indicators according to two definitions for immobility

	Belgium			France			England		
	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1
All ≥15	9,1%	14,2%	5,1	8,3%	26,6%	18,3	6,7%	8,2%	1,5
Male	6%	10%	4,6	6%	23%	17,2	6%	7%	1,4
Female	12%	18%	5,6	11%	30%	19,2	8%	9%	1,6
15 – 19	4%	6%	2,1	5%	19%	14,1	5%	7%	1,8
20 – 29	4%	6%	2,2	3%	13%	10,0	3%	4%	0,9
30 – 39	4%	7%	2,8	4%	13%	9,7	3%	4%	1,1
40 – 49	3%	6%	3,0	4%	18%	14,2	3%	4%	1,0
50 – 59	9%	15%	6,0	7%	26%	18,4	5%	6%	1,4
60 – 69	16%	23%	6,6	13%	45%	32,3	10%	11%	1,9
Over 70	25%	39%	13,5	26%	60%	33,9	20%	23%	3,3
Monday	11%	15%	4,1	9%	26%	16,6	8%	10%	1,7
Tuesday	9%	11%	2,4	8%	27%	18,6	7%	8%	1,5
Wednesday	8%	16%	7,7	9%	30%	20,7	7%	9%	1,9
Thursday	9%	14%	4,9	8%	25%	16,5	5%	7%	1,3
Friday	8%	11%	2,9	8%	26%	18,2	6%	7%	1,3

Correlation between Def1 and Def2a	Belgium	0.985	France	0.966	Great Britain	0.999
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Table 2b: Immobility rates a weekday from three TUS's with two definitions of immobility by age and day of week

Sources: *Statistic Belgium: BTUS 1999; Insee: EdT 1998-99; Statistics UK: UKTUS 2000.*

	Belgium			France			Great-Britain		
	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1
All ≥15	92	97	5	68	86	18	110	112	2
Male	98	103	5	74	90	16	111	113	2
Female	86	91	5	63	80	17	110	112	2
15 – 19	95	97	2	74	86	12	111	113	2
20 – 29	106	108	2	84	94	10	115	116	1
30 – 39	101	104	3	81	90	9	116	118	2
40 – 49	97	100	3	74	87	13	110	111	1
50 – 59	88	94	6	69	86	17	109	110	1
60 – 69	85	92	7	45	71	26	114	117	3
Over 70	59	72	13	33	61	28	93	96	3
Monday	89	93	4	69	85	16	109	111	2
Tuesday	89	95	6	65	81	16	109	110	1
Wednesday	86	94	8	64	83	19	110	112	2
Thursday	88	93	5	72	88	16	107	109	2
Friday	108	112	4	72	90	18	117	119	2

Correlation between Def1 and Def2a	Belgium	0.992	France	0.981	Great Britain	0.996
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Table 4b: Daily travel times in three TUS's with two definitions of immobility by age and day of week

Sources: *Statistic Belgium: BTUS 1999; Insee: EdT 1998-99; Statistics UK: UKTUS 2000.*

	Belgium			France			Great-Britain		
	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1	Def 1	Def 2a	Def 2a - Def 1
All ≥15	3.5	3.7	0.2	2,4	3,0	0,6	3.4	3.5	0.1
Male	3.5	3.7	0.2	2,4	3,0	0,5	3.3	3.4	0.1
Female	3.4	3.6	0.2	2,3	2,9	0,6	3.5	3.6	0.1
15 – 19	3.5	3.6	0.1	2,5	2,9	0,4	3.4	3.5	0.1
20 – 29	4.0	4.1	0.1	2,8	3,1	0,3	3.4	3.5	0.0
30 – 39	3.8	4.0	0.1	2,9	3,3	0,3	3.6	3.7	0.0
40 – 49	3.6	3.7	0.1	2,6	3,0	0,4	3.5	3.5	0.0
50 – 59	3.3	3.5	0.2	2,4	3,0	0,6	3.5	3.5	0.1
60 – 69	3.1	3.4	0.3	1,5	2,5	0,9	3.4	3.5	0.1
Over 70	2.3	2.8	0.5	1,3	2,4	1,1	2.9	3.1	0.1
Monday	3.3	3.5	0.2	2,4	3,0	0,5	3.3	3.3	0.1
Tuesday	3.3	3.5	0.2	2,3	2,9	0,6	3.4	3.4	0.1
Wednesday	3.3	3.7	0.3	2,3	2,9	0,7	3.3	3.4	0.1
Thursday	3.4	3.6	0.2	2,4	3,0	0,5	3.5	3.5	0.1
Friday	3.9	4.1	0.1	2,5	3,1	0,6	3.6	3.7	0.1

Correlation between Def1 and Def2a	Belgium	0.989	France	0.980	Great Britain	0.993
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Table 7b: Daily numbers of trips in three TUS's with two definitions of immobility by age and day of week

Sources: *Statistic Belgium: BTUS 1999; Insee: EdT 1998-99; Statistics UK: UKTUS 2000.*

Annex 3: Confidence intervals and influence of weighting on the indicators

	Belgium		France		Great Britain	
	MOBEL 1999	BTUS 1999	ENTC 1993-94	EdT 1998-99	NTS 1999-01	UKTUS 2000
95% confidence intervals						
Immobility (%)	21.0-23.4		16.2-17.5		22.3-22.9	
TUS: def2a		13.4-15.0		25.8-27.4		7.6-8.8
TUS: def1 (%)		8.5-9.7		7.8-8.9		6.1-7.2
travel time for mobile (mn)	77-82	96-99	76-79	84-87	79.6-80.7	110-114
Trips per day for mobile	3.9-4.1	3.6-3.7	3.9-4.0	2.9-3.0	3.29-3.32	3.4-3.5

Table A : Confidence intervals for average immobility, daily travel time and number of trips in three TUS's and three NTS's

	MOBEL 1999		BTUS 1999		ENTC 1993-94		EdT 1998-99		NTS 1999-01	UKTUS 2000	
	weighted	Non-weighted	weighted	Non-weighted	weighted	Non-weighted	weighted	Non-weighted	Non-weighted	weighted	Non-weighted
Immobility	22.2%	22.0%			16.9%	17.8%			22.6%		
TUS: def2a			14.2%	11.3%			26.6%	26.8%		8.2%	8.1%
TUS: def1			9.1%	7.1%			8.3%	8.3%		6.7%	6.6%
travel time for mobile	79	78	97	101	77	78	86	85	80	112	113
Trips per day for mobile	4.0	4.1	3.7	3.8	3.9	3.9	3.0	3.0	3.3	3.5	3.5

Table B : Average immobility, daily travel time and number of trips in three TUS's and three NTS's with weighted and non-weighted

dd/11/yyyy

data

Sources: *Statistic Belgium: BTUS 1999, BeISPO: MOBEL 1999; Insee: EdT 1998-99 and ENTC 1993-94; Statistics UK: UKTUS 2000 and NTS 1999-01.*