electronic International Journal of Time Use Research

volume 11
number 1
december 2014
ISSN 1860–9937
dx.doi.org/10.13085/eIJTUR.11.1

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 1-12 dx.doi.org/10.13085/eIJTUR.11.1.1-12

Social status differentiation of leisure activities variation over the weekend – Approaching the voraciousness thesis by a sequence complexity measure

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Abstract

Sullivan and Katz-Gerro (2007) as well as Katz-Gerro and Sullivan (2010) argues that engaging in a variety of leisure activities with high frequency is a distinct feature of omnivorous cultural consumption. And like omnivorousness it bears a status-distinctive characteristic. The authors reported, that high status social categories show a more voracious leisure time-use pattern, i.e. engage in a greater number of activities with higher frequency over the period of one week. In this paper we are examining the voraciousness thesis by utilizing a newly proposed measure of activities variety, namely the sequence complexity index, which is developed by Gabadinho et al., 2011. Using data from German Time Use Survey (2000/2001) we focus on cultural leisure activities reported for the weekend. Our results show that complexity as a measure of time-related variety captures significant social differentiation of leisure activities over the weekend. But our complexity-based findings do not support that, that voraciousness understood as high levels of time used for varied leisure activities is also significant at weekend. Beyond that the results support the assumption, that there is social structural framing of a Saturday, where gender, age and marital statues effects on leisure variation come into effect.

JEL-Codes: D13, D19, J17, Z1, Z13

Keywords: Time use, leisure, social inequality, complexity, time pressure, Germany

A related paper has been published as a GESIS-Working Paper: Papastefanou, Georgios; Jarosz, Ewa (2012): Complexity of Leisure Activities over the Weekend: Socio-economic status differentiation and effects on satisfaction with personal leisure. GESIS-Working Papers 2012/26. GESIS: Mannheim.

1 Introduction

Twentieth century faced a substantial growth in the average amount of leisure time in post-industrial societies. Comprehensive analyses by Gershuny (2011) show that the time of paid work in the developed countries has declined on average by 27% net over the four decades from 1961 to 2001. Over that time, working patterns have also changed substantially and – it seems – irreversibly.

It seems obvious, that this social change in time use affects social status differentiation and distinction patterns. Most prominent Katz-Gerro and Sullivan (2010) and Sullivan and Katz-Gerro (2007) extend the argument, that in the context of egalitarian consumption resources a social differentiation pattern is characterized by cultural omnivorousness (see Peterson and Kern (1996)). Accordingly cultural omnivores are *"an upper class that experiences and appreciates a variety of cultural tastes: highbrow, middlebrow, and lowbrow."* (see Katz-Gerro und Sullivan (2007, p. 124)).

As the trend of acceleration encompasses all areas of human life, the increased temporal fragmentation is not expected to be restricted to professional realm only. The efficiency-maximizing attitude might make people willing to use their leisure time 'to the fullest', tempted also by the multiple time-spending options available in the market. The possibility to benefit from them depends, naturally, also on the financial and cultural resources, which correlates with social status. People with more socio-cultural and economic resource will engage in a greater number and variety of activities, not only because they are more able to, but also because they need an additional line of status distinction. As Sullivan and Katz-Gerro write: *'In a setting characterized by fluctuations and discontinuities, individuals assert a personality by adopting habits, styles, and fashions that make them stand out'* (see Katz-Gerro and Sullivan (2010, p.125)). Compression and intensification of experiences becomes thus not only a way to keep up with the accelerated pace of life but also a means to ascertain one's social position.

From this background Katz-Gerro and Sullivan (2007) proposed an extension of the omnivorousness thesis by introducing the concept of voraciousness as a theoretical variation of omnivorousness (see Katz-Gerro und Sullivan (2007, p.123f.)). While cultural omnivorousness (as defined by Peterson and Kern (1996)) distinguishes between highbrow and lowbrow tastes in assessing the range of consumers' tastes, the concept of voracious cultural consumption is based on the *extent of participation* in various out-of-home leisure activities, and relates both to the range of those activities (reflecting the diversity of an individual's cultural repertoire) and the frequency of participation in them (characterizing the turnover rate, or 'pace') (see Sullivan and Katz-Gerro (2010, p.193)).

As Katz-Gerro and Sullivan (2010) contend, voraciousness, like omnivorousness, is associated with being better educated, being located in an upper-class position, and having a higher

income (Peterson and Kern (1996); Warde et al. (1999); Van Eijck, (2001); López-Sintas and Garcia-Álvarez (2002)). In particular, the voracious consumer has high social status in terms of human capital, economic capital, and cultural capital. Moreover, voraciousness, like omnivorousness, is also particularly characteristic of adults living alone or younger couples without children. In other words, it seems that omnivorousness and voraciousness represent two related dimensions of the consumption of leisure and tastes in contemporary western societies.

We see several shortcomings in the empirical corroboration of the concept of voraciousness as social status differentiating behavior as being claimed by Katz-Gerro and Sullivan (2010) and Sullivan and Katz-Gerro (2007).

First, it seems not meaningful to prefer self-reported data over time-use data, if one is interested in the actual activity patterns and their differentiation by social status. Katz-Gerro and Sullivan (2010) and Sullivan and Katz-Gerro (2007) used data from the first wave of 'Home OnLine'[2], a representative British national panel study of adult individuals in households, which was conducted in 1998.

Although the 'Home OnLine' data set provide face-to-face interviews were conducted with all adult members of the household. In addition, interviewed respondents were provided with a week-long diary in which to record what they were doing each day of that week every fifteen minutes of that day. A comparison of the diary and the questionnaire measures showed similar means and distributions (see Sullivan and Katz-Gerro (2007, p.128) for further details) indicating that, from this data, the diary and questionnaire responses show a good fit for the weekly frequency with which people participate in particular activities. The advantage of the questionnaire measure is that, as is usually found, a larger number of respondents answer the survey questions than complete their diaries.

By using self-report data one cannot exclude their mixing self-presentation expressions and actual behavioural patterns. Therefore it seems more adequate for examine actual cultural consumption to rely on time-use data instead of self-report data, even the sample size is lower of time-use data then for self-report data. In that case, a smaller sample provides a conservative empirical test of assumed group differences.

Second, we see a significant shortcoming by using the number of different out-of-home activities, which are practiced at least once a week. Actually this measure does not take the core aspect of voracious behaviour into account, namely the amount of time which is invested in different activities. By focusing on people, which are doing the leisure activities at least once a week, they exclude those groups with less activity frequencies. So they limited the range of variation by pre-selection. Further, they do not take into account that in characterizing variety of activities, time consumption is also significant. It blurs substantial differences in variety, if for example one treats these two patterns a) and b) of three different activities with the same class of variety: in pattern a) one of the three activities would occupy 80 percent and the other

two 10 percent each of the time budget, while in pattern b) for all three activities the same amount of the time budget would be used.

In sum, the empirical indicators of frequency of different activities do not adequately operationalize their conceptual features of voraciousness of high time variation in leisure activities.

Third, it seems necessary to take social organization of leisure time into account for social status differentiation of leisure time activities.

Increase in the amount of time free from work has certainly owed much to the popularization of the two-day weekend. What now might be taken as an axiom in the developed economies is a relatively recent development. Previously, the traditional one day of rest stemmed from religious norms and was meant to enable people to engage in religious celebrations.

In the 20th century consumer society, a single day of rest turned out to be insufficient. When new (secular) needs came into play, a change in social time use patterns was needed. Greater amount of leisure time became an economic and social necessity – the growing number of goods required time to be sold. Leisure – previously regarded as idle and futile – has eventually come to be seen as economically productive. Another day off work was in line with the expectations of the consumer market, policy makers and social actors calling for greater consideration for the working population.

Since working hours differ greatly even across the working/ learning population, leisure time available within the week may be a subject to high variance. However, weekend is a relatively long period of theoretically undisturbed leisure that is time, when most of the population does not perform any paid work (see Gershuny (2011)). At weekend there is high prevalence of participation in discretionary activities over the weekends (see Lockwood et al. (2005)), as well as much more joint activity participation on weekend days relative to weekdays (see Srinivasan and Bhat (2006)).

So from this background weekend days seem to be the social time arena, where manifestation of social status differentiation by leisure activities could be expressed most significantly. We deliberately decided to concentrate on the usual weekend activities and not to claim representativeness for usual activities over the whole week.

So our study is aimed at examining the voraciousness thesis by overcoming the shortfalls of the Sullivan/Katz-Gerro approach, namely by a) using time-use data on main activities, b) focusing the analysis to leisure activities over the weekend, and c) applying an index of variety, namely the complexity index proposed by Gabadinho et al. (2011), which takes time consumption variation into account.

2 Data and methods

We used the 2001-2002 dataset of the German Time Use Survey (GTUS), a study carried out on the representative quota sample of private households in Germany (including also

foreigners' households) [1]. Social categories excluded from the research were persons without permanent home, and persons living in collective dwellings or institutions. In total, it covered the sample of 5 400 households, whose members aged 10 years or older filled in a diary for three week days. It covered two consecutive days and one day of the weekend (Saturday or Sunday). To avoid seasonal distortion it was carried out over the year – split into four samples covering four different periods. This led up to a sample size of 12 600 persons and about and 37 700 diaries.

Time-use diaries provide information on the authentic 24-hours routines disaggregated in 10-minutes time slots. The data was collected using open questions and the records are episode-based, hence avoiding numerous biases being a problem in survey-based time accounts. For each time slot, GTUS time use diary recorded main activity, secondary activity, persons present, location and means of transport (if applicable).

While the study design allows for household context effects by capturing multiple members of a household, we selected randomly one person of each household to be included in our data set, because the theoretical approach we are dealing with is focused on individual voracious behavior.

Further, we restricted the age distribution of the data set to be analyzed in this paper, because GTUS 2000/2001 covers the sample of people aged 10 and older. From the background of the voraciousness concept, which is focused on life patterns mainly organized by full time labor market or educational activities, it seemed reasonably to analyze leisure time patterns of only respondents older than 16 and below or equal 65 years.

Leisure activities

In relation to leisure activities we follow Sullivan and Katz-Gerro by selecting five activities to be examined according their time-related variety, namely:

- going to the cinema/concert/theatre or other live performance
- eating/drinking out in a restaurant, café or pub
- playing sport/keeping fit/walking
- watching live sport
- participating leisure activity groups.

The GTUS, like other The HETUS[2]-type studies, recorded up to two activities for each time slot, yet, for the simplicity of analysis we decided to take into account only the primary activity. Secondary activity is regarded as one that accompanies the primary one (they are conducted simultaneously within the same time slot), however, it is the primary activity that mostly

[1] The Survey was carried out by the Federal Statistical Office, on behalf of the Federal Ministry of Family Affairs, Senior Citizens, Women and Youth.

[2] HETUS: Harmonized European Time Use Survey carried out in the EU countries and coordinated by the Eurostat.

determines the character of particular time slot and sets it within a particular context (in this case: leisure/ non-leisure). Moreover, the practice of recording primary activities only has been widely used, e.g. in the American Time Use Surveys. Excluding secondary activity, however, has numerous drawbacks that we are aware of, and they become problematic in case of more complex studies incorporating the elements of interference between the prime and secondary activities. Nevertheless, primary activity record is sufficient for our analysis at its present stage, namely describing time sequences of primary activity over the weekend in terms of their time and category and variability of activities, which amounts to the general leisure complexity.

Measuring time-related variety in activities

We found the complexity index by Gabadinho et al. (2011) fitting best to the conceptual definition of voraciousness as it is designed to grasp both the variation of activities within a sequence of activities as well as the amount of time, which is consumed for each kind of activity. The following equation was proposed by Gabadinho et al.,

$$C = \sqrt{\left(q/q_{\max}\right)^2 \Big/ \left(h/h_{\max}\right)^2} \tag{1}$$

where q means the transition rate of change between spells of activities over one individual activities sequence and $q_{\max}$ is the maximum transition rate in sequence. $q_{\max}$ actually captures the time length of activities sequence. Further, h denotes the entropy of a sequence of activities and $h_{\max}$ denotes the maximum entropy of a sequence built by a specific set of different activities. It might support the understanding of the complexity index by going into the meaning of the different parts of the C equation.

The first sub-indicator $q/q_{\max}$ captures the time variation of activities over some period of time, by counting the number of the actual number of transitions in the sequence q, and normalizing them to the maximum number of possible transitions in one sequence $q_{\max}$. Transitions are changes of activity type from one moment to next moment. As the used data of GTUS recorded activities on a 10 minute time scale, transitions are changes of activities from one 10 minute interval to the next 10 minute interval. Actually the maximum number of transitions denotes the total length of the observation time period (minus 1). So by dividing the actual overall number of activity changes by the maximum possible number of change, the individually differing total measurement time (which is the waking time) is taken into account. It is a kind of normalizing the individual variety in time use. The larger this sub-index, the more people change their activities over the day.

The second sub-indicator $h/h_{\max}$ is aimed at grasping the variety of activities itself. Gabadinho et al. utilize the entropy concept to get an adequate measure of type of activity variation. Similar to the first sub-indicator, the actual entropy of activities in a sequence is normalized by dividing it by the maximum possible entropy, which is determined by the size of the set of leisure activities.

To get more insight into this feature it might be helpful to explicate the meaning and calculus of entropy. Gabadihno et al. use the concept of Shannon entropy.

Accordingly entropy denotes the distribution of informational states in a sequence of states. If the different possible states (which are given by a specific set of states, or "alphabet") are distributed evenly over the whole sequence of observed states, the entropy has its maximum score, which means that the probability of observing a specific state is independent of the timing in the sequence of activities. So, given an alphabet of 2 distinct states, very high entropy is reached if at every moment of the sequence both distinct states of the alphabet are observed. A very low level of entropy is given, if there is only one distinct state is observed over the whole sequence. In this the case the probability of observing this state would be 1, which means no variation.

The entropy measure to indicate variety of activities has an important difference to the mere counting the number of different activities over some defined period of time, namely the time extension of one activity. The frequency of different activities does not take into account the time extension of an activity. For example, if someone does two different activities over his leisure time period of 10 time intervals, he gets the frequency score of 2, nevertheless if he uses 9 time units for one activity and 1 time unit for the other activity. A person dividing his time of 10 units equally two both activities (with 5 for the one activity and 5 for the other activity) would have also been assigned to them same variety score of 2. But his entropy score of variety would different, namely lower, because time is more varied distributed over the two activities or vice versa. It seems straightforward, that a person who follows two different activities with the same amount of time is characterized with more variety preference than a person, who actually focuses on one activity and marginally practices a second activity.

One might made objection against the complexity index, because of following methodological reasons. As complexity is assessed over waking time, whereby time spent on the five selected leisure activities can vary across individuals. Hence, the numerator of the first sub-indicator included in C is going to be increasing in the amount of time spent on those five activities, and the resulting indicator contaminated by a dimension of leisure (its quantity) whose relation to complexity is unknown. It seem reasonable, that amount of time spent for leisure activities overall is determined by the total amount of waking time. But the construction of the complexity index takes this methodological problem into account by normalizing the individual transition rate and entropy by the total transition rate, which actually is the waking time.

In sum, from our point of view, the complexity index seems to be the most adequate operationalization of the voraciousness concept.

Indicators of socio-economic status

Like the omnivorousness hypothesis the voraciousness hypothesis is linked to social class status differentiation. Katz-Gerro and Sullivan follow Bourdieuvian theory (Bourdieu (1984); Katz-Gerro (2004); Chan and Goldthorpe (2007)) in measuring social status by socio-

economic and cultural resources, namely educational status, occupational status and economic status as it is indicated by net household income. Additionally they use information on the kind of newspaper people are reading as indicator for cultural capital.

Given by the GTUS 2001 dataset, we could utilize highest general educational status, occupational status and net income status as indicators for cultural, social and economic capital. Data on newspaper reading preferences were not available.

To control confounding with age, gender, household size and family status, we included these variables as covariates in a multiple regression model.

Estimation method

The complexity index of diurnal cultural out-of-door activities by construction, ranges from 0 to 1, so it seems adequate to apply fractional regression approach to take into account ceiling and floor effects of the distribution (Papke and Wooldrigde (1996)). To accomplish this we used a generalized linear model (glm) with a logit link and the binomial family. We included the robust option in the glm model to obtain robust standard errors which will be particularly useful if we have miss-specified the distribution family.

Because in some cases participants filled in the time use diary for Saturday and Sunday, the data are inflated by repeated measurements, which cluster on the case id. To take this into account without a loss of data, and not to negate the need for independent observations, we used the STATA's VCE-approach, `which` requires only that from cluster to cluster the observations are independent.

3 Results

In a straightforward step of analysis we estimated complexity scores of higher socio-economic status groups with lower economic status groups in a multivariate fractional regression model, controlling for gender, age, household size and marital status.

With this model we did not find the expected net positive social status effects on the complexity, which means kind and time variation of leisure activity complexity over Saturday and Sunday.

Instead we find that middle educational groups show a less complexity score than low and high education status groups. For blue collar and white collar classes as indicators for lower and middle class status we do not find significant differences. Self-employed tentatively show a less varied leisure patterns on the weekend than people with blue collar occupations.

From the background of these unexpected results, and because there might be a differentiation to different social organization of Saturday and Sunday activities, we split the data set into activities done on Saturday vs. Sunday.

Table 1
Effects of education occupation and income status on complexity of leisure activities by weekend overall and day of weekend

Reference category predictor	Weekend overall	Complexity of leisure activities on Saturday	Complexity of leisure activities on Sunday
Education status			
High education status	-0.16	-0.88	-0.08
Middle education status	-0.14*	-0.07	-0.17*
No education status	-0.00	0.07	-0.03
Household net income	-0.02	-0.08	0.04
Household net income squared	0.00	0.01	-0.00
Occupational status			
Self-employed	-0.20*	-0.39**	-0.07
Official	0.04	0.03	0.04
White collar	0.03	0.06	0.03
Commercial. technical apprentice	-0.11	-0.26	0.12
Industrial apprentice	-0.47*	-0.58*	-0.38
Gender	-0.16**	-0.16*	-0.17*
Age	-0.07**	-0.10**	-0.04*
Age squared	0.0007**	0.001**	0.0005*
Household size	0.05*	0.08*	0.01
Marital status			
Single	0.16*	0.30*	-0.00
Divorced	0.23*	0.49**	-0.06
Widowed	-0.02	-0.08	0.09
Living apart	0.59**	0.85**	0.33
n	4177	2132	2127
Log pseudolikelihood	-1218.14	-492.45	-687.67

Note: Reference categories: low education status; blue-collar worker; man; married.
** denotes p<.01. *p<.05. +p<.10. Weekend stands for Saturday and Sunday.
Control variables: Gender, age, family status and household size,
Method of estimating b-coefficients: Fractional Regression, ML.
Source: GTUS 2000/01, own calculation.

We find that the comparatively lower complexity of middle education status group is significant only for Sunday activities not for activities on Saturday.

Age, household size and marital status seem to be social structures which are related to leisure complexity only on Saturday activities. The well-established gender effect on leisure, with men showing more leisure activities than women (Katz-Gerro and Sullivan (2010, p.209)) could be also found for leisure complexity with women showing less leisure complexity than men, for Saturday and Sunday leisure activities.

In sum we find little support for the voraciousness thesis by using complexity as an indicator for time and type of activity variation on weekend days.

This result – together with the finding that the social structural indicators like age, sex, family status and household size are effective on Saturday only, underline the social setting of Saturday as weekday which offers opportunities and restrictions for leisure activities, by which social differentiation gets effective.

That social status by occupation does not find expression in leisure variation might be due to being social categories of blue collar and white collar, which are not valid and any more in 2000 because of increased heterogeneity.

Interestingly our results show that, low and high educational status groups show up similar higher complexity scores than middle educational status only for activities followed on Sunday. The reasons for this unexpected pattern of social inequality might be rooted in in similar needs for entertainment variety but different needs for entertainment quality with people in lower educational status have more entertainment variation interest and high education status groups more cultural variation interest. People of middle educational status could be understood as belonging to petty bourgeois. According Bourdieu (1979) a typical life style of petty bourgeois is characterized by temporarily relinquishment of consumption, aimed at distinction from lower classes and aspiration to climbing up to higher social class. So people with family oriented leisure patterns would focus more on in-home rather than out-of-home leisure activities.

4 Conclusion

Indicating variability of out of home time use of leisure activities at weekend by using the complexity index of Gabadinho et al. (2011) we could not replicate generally the results of Katz-Gerro and Sullivan (2007, 2010) about the social status thesis of voraciousness. Interestingly there is a hint to social class differentiation by our finding that middle educational status group has a leisure activity pattern with reduced complexity, which seems to be in line with petty bourgeois life style described by Bourdieu.

In general our scarce support of the social status hypothesis of voraciousness could be understood from several points of view: a) the complexity index of leisure activities does not capture social class differences, because time opportunities and time constraints at weekend produce similar time variations. On the other side we find differentiation by non-vertical social structural status. We further found horizontal differentiation by age and family and household life cycle on the time complexity of leisure activities over the weekend, especially by our result, that women have less complex leisure activity patterns on weekend, we could corroborate findings, that women relative to men show up less active, intensive, individual leisure time (see Mattingly and Bianchi (2003)); b) focusing on the weekend time use might be a too narrow time span for opportunities to express social status differences, as the amount leisure frequencies needs to pile up over longer time spans to get socially significant. On the other side, weekend by social organization provides most free time to be used for leisure activities;

c) as the data represent German population it might be, that social class differentiation of time and category variability is not that significant like in UK, where social status differentiation is more expressed in life style and d) it might be that the reason for no social differentiation of out of home activities is due to the fact, that activities like going to a restaurant or cinema, theatre or sport performance usually are embedded in organizational settings, where time fragmentation is heavily prevented.

Overall our findings support the assumption, that voraciousness measured by a complexity indicator of leisure activities variety is reflected also in weekend activities. Socio-structural conditions of restricted time budgets given by like family status, gender, age and household size seem to be more effective than hierarchical social status categories like economic or educational resources. Social status effects on leisure activity variations seemed to be more related on structural time budget restrictions as we found reduced leisure activity variety for self-employed, whose working time usually is not restricted by law and social regulation to reach into weekend. This result is in accord with findings of Merz and Rajthen (2011), who found that professionals and entrepreneurs are to be classified as time-poor compared to employees.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 13-42 dx.doi.org/10.13085/eIJTUR.11.1.13-42

Has the digital divide been reversed? – Evidence from five EU countries

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Abstract

This paper examines whether there is a digital divide in the use of the internet in general and of specific websites (leisure, improving human capital and obtaining goods and services). It uses a unique dataset which covers the entire clickstream of almost 20,000 internet users in the five largest EU economies during 2011. Our main finding is that, for those who have access to the Internet, the income-based digital divide in internet use at home has been reversed. Low-income internet users spend more time on the internet at home than high-income users on all types of websites. There is some evidence of an education-based digital divide in the use of human capital and goods & services websites. Tertiary education has a negative effect on time spent on leisure websites and a positive effect on time spent on human capital and goods & services websites. Using quantile regressions, we find that the negative effect of income and the positive effect of education for human capital and goods & services websites hold for the entire conditional distribution of these online activities. Moreover, these effects are stronger for more intensive internet users. We discuss several possible explanations for these results.

JEL-Codes: L86, D12, D13

Keywords: Internet use, time allocation, leisure

The IPTS is one of the Joint Research Centers (JRC) of the European Commission. The views and opinions expressed in this paper are the authors' and do not necessarily reflect those of the JRC or the European Commission. Previous versions of this paper where presented at Applied Economics Meeting 2013, ZEW Conference on the Economics of Information and Communication Technologies 2013, NBER Summer Workshop on Economics of IT and Digitization, EARIE 2013, Jornadas de Economia Industrial 2013. The authors are grateful to discussants and participants in these conferences for helpful comments. They also thank Marc Bogdanowicz, Russell Cooper, Pierre Montaigner and Bernarda Zamora for detailed comments and suggestions. Errors and omissions remain the responsibility of the authors.

1 Introduction

There is considerable policy concern about the digital divide between people with different socio-economic characteristics, especially different income and education levels. The digital divide in access to internet has been extensively documented. However, less is known about the digital divide in internet use for people who have access to the internet, especially in Europe, and where it exists it is based mainly on survey data (Demoussis and Giannakopolous, 2006; Orviska and Hudson, 2009; Montagnier and Wirthmann, 2011).

This paper contributes to this area by studying the digital divide in internet use in the five largest countries in the EU. More precisely, it studies how, for those who have access to the Internet, income and education affect internet use at home in general and the use of specific websites (leisure, improving human capital and obtaining goods and services). It uses a unique dataset that covers the entire clickstream on the home computers of almost 20,000 internet users in the five largest EU economies during the year 2011. It builds on Goldfarb and Prince (2008) who study the role of income and education levels in internet use patterns in the US. We extend this study in several ways. First, we study the determinants of time spent online in the five largest EU economies using data on internet users' online behaviour (their entire clickstream), which is more objective and precise than survey data. Second, we study the determinants of time spent on three specific types of websites: (a) human capital improvement, such as career, education and health-related sites, (b) obtaining goods and services and (c) leisure. Third, we study whether the effects of income and education differ with intensity of internet use and employment status.

The main finding is that, for those who have access to internet, the income-based digital divide in internet use has been reversed: low income internet users spend more time online at home than high income internet users on all types of websites considered. However, we find evidence that there may be an education-related digital divide for specific internet uses such as websites related to human capital and to obtaining goods and services. Our robustness tests show that these results hold true for a variety of demographic subgroups: internet users in each of the five countries, internet users in one person households and internet users with different intensity of internet use. However, we find that the magnitudes of the effects differ by the intensity of use: the effect of income on time spent online is stronger for more intensive than for less intensive users, and the effect of education on time spent on human capital on human capital and goods and services websites is stronger for more intensive users than for less intensive users of these websites. We also find that access to internet outside home and employment status and occupation do not affect the effect of income on internet use. These results are surprising in the view of opportunity cost of time hypothesis.

The paper is organised as it follows. Section 2 reviews the related literature. Section 3 describes the data used and presents some preliminary evidence on the relationship between time spent online and income and other demographic characteristics. Section 4 describes the empirical methodology. Section 5 discusses the results of the estimation and Section 6 offers conclusions.

2 Related literature

Our study is mostly related to studies that examine internet use measured as time spent online and its welfare effects (Goolsbee and Klenow, 2006; Goldfarb and Prince, 2008; Brynjolfsson and Oh, 2012). In these studies, in line with Becker (1965), consumer utility depends on his consumption, which requires income obtained partly through labour, and on his leisure. Individuals choose the time spent on online leisure, offline leisure and work in order to maximise their utility subject to budget and time constraints (the sum of the amounts of time spent daily on each of these activities cannot be higher than 24 hours). Internet pricing consists of fixed cost of subscription and zero use fees. Then, conditional on internet adoption, the marginal cost of internet use is given only by the opportunity cost of time, which is determined by the income that the internet user could earn on the labour market. Therefore, the opportunity cost of spending time online is higher for high income earners than for low income ones. If both low and high income users benefit equally from internet, than given the higher opportunity costs for high income users, they will spend less time on internet.

Goolsbee and Klenow (2006), Goldfarb and Prince (2008) and Brynjolfsson and Oh (2012) test empirically this hypothesis on a sample of US internet users. All these studies find that, conditional on internet access, income has a negative effect on time spent online. Most of these studies suggest that higher opportunity costs of spending time online of the high income internet users explain this negative relationship. However, Goldfarb and Prince (2008) notices that there are several alternative explanations which are consistent with this negative relationship: (1) the opportunity cost hypothesis explained above (2) internet is more useful to low-income people, because they have different preferences or because they do not have better offline alternatives (3) low income earners have more leisure time, which leads them to spend more time online even if they have the same opportunity costs as high income people (4) cost of adoption of internet is an important cost barrier for low income individuals, but not for higher income and therefore only low income earners which place a higher value on internet will adopt internet, but most of high income people will adopt internet (including those who do not place a high value on it). It is important to mention these explanations do not exclude each other. The authors find that the selection and the amount of leisure time are not driving their results, but they find some evidence of differences in usefulness of internet for different income groups.

We explore more in detail the opportunity cost hypothesis and the differences in usefulness of internet for different income groups[1].

There are several studies that examine the use of the internet for specific purposes such as: e-commerce, job search, entertainment etc. (Demoussis and Giannakopolous, 2006; Goldfarb and Prince, 2008; Orviska and Hudson, 2009; Montagnier and Wirthmann, 2011; Pérez-Hernández and Sánchez-Mangas, 2011). Due to differences in data sources and in the dependent and explanatory variables they are not directly comparable. However, they show some common patterns. The most relevant for our study is that income, education, and other demographic characteristics have different effects on participation in different online activities. Goldfarb and Prince (2008) find that for US internet users, income and university/college education is negatively associated with using internet for activities related to leisure (chat, online games) and e-health, but positively associated with using it for activities related to buying (research purchases and ecommerce). Pérez-Hernández and Sánchez-Mangas (2011) found similar effects of education on online shopping for Spain. Demoussis and Giannakopoulos (2006) and Montagnier and Wirthmann (2011) find that education and household income are important determinants of the frequency of internet use in Europe. Although we draw on these studies, we differ from them in that our study does not examine the determinants of using internet for a specific purpose or with a certain frequency, but of the time spent on different online activities.

In conclusion, there is a very heterogeneous empirical literature related to the internet use, including a few studies on the relationship between income and/or education and internet use. However, most of these empirical studies are based on US survey data and most of them do not take into account several aspects of this relationship documented in other strands of literature (different types of online activities, intensity of use, and differences across different demographic groups). In this paper, we study different aspects of the effect of income and education on internet use using objective clickstream data from five largest EU countries.

3 Data description

The data used in this paper have been collected by Nielsen NetRatings through voluntary online consumer panels. The dataset contains information on all web pages clicked on from their home computers by 25,000 internet users in the five largest EU economies (France, Germany, Italy, Spain and United Kingdom) during the entire year 2011.

The data only covers internet use at home. However, it is important to notice that internet access took place largely at home in 2011 (OECD, 2012). Therefore, while our results are not

[1] We cannot explore the selection hypothesis (4) and (3) because our sample consists entirely of active internet users the dataset and it does not contain information on total leisure time of internet users. However, we control for total leisure through proxy variables such as users' occupation, household size, marital status and presence of children.

informative about internet use from all places of access, they are informative about the most important way of accessing it.

The data covers only individuals who are active internet users. Acording to Nielsen, the sample of internet users is representative of the online population in these countries in terms of gender and age[2].

For each click it contains information on the URL, the time and date the website is accessed and time spent on the website. The data on the online activity is collected through a piece of software that internet users in the online panel voluntarily install on their PC. The data collection procedure uses information in the computer about which webpage is in focus (the page to which the keyboard and mouse activity is directed to). This helps correct for errors in measurement of the time spent on websites due to minimizing tabs, tabbed browsing and periods of inactivity. The websites visited are classified into subcategories and categories based on the content of the websites using a methodology developed by Nielsen. The dataset also contains information on basic social and economic characteristics of each user[3] (age, gender, marital/cohabitating status, presence of children in the household, size of household, household income range, highest educational level attained, and occupation) gathered through a questionnaire when the user installs the Nielsen software.

The sample used in the empirical analysis excludes records with missing information on the website category and on the demographic characteristics of the internet user, records of internet users younger than 16 or older than 74[4] and of self-employed internet users[5] and outliers[6]. The sample remaining after excluding these observations is still large covering close to 18680 users, which represent close to 80% of the initial user sample and more than 700 million clicks in each country, which represent more than 70% of the initial clickstream sample.

The dataset classifies each website in 15 categories and 85 subcategories. We group these categories and subcategories based on how each activity contributes to consumer utility, in line with Becker (1965) and Gronau (1977): leisure (contributes directly to the utility), human capital websites, such as career, health and education (contributes to the utility through future in-

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2 Nielsen provides incentives to participate and to remain in the panel in the form of vouchers and points which can be redeemed from their reward website or used in online games and sweepstakes(prize drawing), which might bias our sample towards people who are more likely to value these activities. As a robustness check we repeated the estimations excluding time spent on online games and gambling websites to make sure that our results are not driven by time spent on these websites. These estimations are not reported here.

3 There are households where more than one user is registered with Nielsen. In these households the meter prompts the internet user to log in; however the match between user profile and his online activity is likely to be imperfect. To ensure that our results are not affected by this problem, we estimated our model also on the sample of one person households and the results were similar to those for the whole sample.

4 We will focus on this age group to ensure comparability with Eurostat for Information Society Indicators and previous empirical studies.

5 We do not know how much of their time online is work and how much is leisure. The main results are not affected by this exclusion.

6 We exclude internet users who spend an implausible large or small amount of time online (internet users in the highest and the lowest 1% of average weekly time spent online). The main results are not affected by this exclusion.

come which can be spent of future consumption) and goods & services websites (contributes to the utility as an input in the production of the final goods/services consumed). Leisure activities include websites classified by Nielsen as Entertainment, Family and Lifestyle (except subcategory Health, Nutrition and Fitness), News & Information, Member Communities and Targeted Member Communities from Portals & Communities Internet Services. Human capital websites include websites classified by Nielsen as related to Education& Careers, Corporate[7], Health, Nutrition and Safety. Goods & services websites included websites related to obtaining goods and services, such as, Home & Fashion, Ecommerce, Travel, Government & Non-profit, Finance, Search Engines, General Portals & Search (subcategories General Portals and Search from Search Engines, Portals & Communities category), Special Occasions, Automotive, Computers & Electronics.

Table 1 presents summary statistics on the main variables used in this study for the sample used in the empirical analysis. The table shows that the average person spends 5 hours per week online: close to 3 hours and half on leisure websites, more than one hour on goods & services websites and around 8 minutes per week on websites related to work, education and health. The most popular leisure websites are, in order, social networks, online games, videos/movies and adult websites, the most popular goods & services websites are general portals and search and e-commerce websites and the most popular human capital websites are career websites.

Table 1
Summary statistics

Variable	Mean	Std. Dev.	Min	Max
Time on all websites (minutes/week)	306.02	320.30	1.78	1973.38
Time on leisure websites (minutes/week)	214.05	270.18	0.02	1838.78
Time on human capital websites (minutes/week)	8.79	18.53	0	556.86
Time on goods & services websites ((minutes/week)	83.18	93.62	0.04	1479.06
Clicks on all websites (per week)	697.15	889.64	1.37	11161.60
Clicks on leisure websites (per week)	482.83	758.66	0.08	11028.79
Clicks on human capital websites (per week)	20.01	51.60	0	2630.19
Clicks on goods & services websites (per week)	194.31	242.47	0.17	3562.83
Female	0.51	0.50	0	1
Single	0.25	0.43	0	1
Age (years)	41.68	13.57	16	74
Children in the household	0.31	0.46	0	1
Household size 1-2	0.52	0.50	0	1
Household size 3-4	0.41	0.49	0	1
Household size >5	0.08	0.27	0	1

[7] We assume that people searched this category mainly for finding information about job vacancies. However, classifying it as a residual category or as goods & services website does not change the results.

Table 1 (Cont.)

Variable	Mean	Std. Dev.	Min	Max
Income ≤18000	0.21	0.41	0	1
Income 18-27000	0.23	0.42	0	1
Income 27-36001	0.17	0.38	0	1
Income 36-54000	0.22	0.42	0	1
Income 54-72000	0.10	0.30	0	1
Income >72000	0.06	0.23	0	1
Below secondary education	0.26	0.44	0	1
Secondary education	0.26	0.44	0	1
Tertiary education	0.48	0.50	0	1
Employed	0.66	0.47	0	1
Clerical/administrative	0.17	0.37	0	1
Craftsman/craftswoman	0.01	0.11	0	1
Education	0.04	0.20	0	1
Executive/managerial	0.09	0.29	0	1
Military	0.01	0.09	0	1
Operator/labourer	0.07	0.25	0	1
Other	0.06	0.24	0	1
Professional	0.04	0.20	0	1
Sales	0.04	0.19	0	1
Service	0.07	0.25	0	1
Technical	0.06	0.24	0	1
Unemployed	0.09	0.29	0	1
Student	0.09	0.29	0	1
Retired	0.10	0.29	0	1
Homemaker/carer	0.07	0.25	0	1

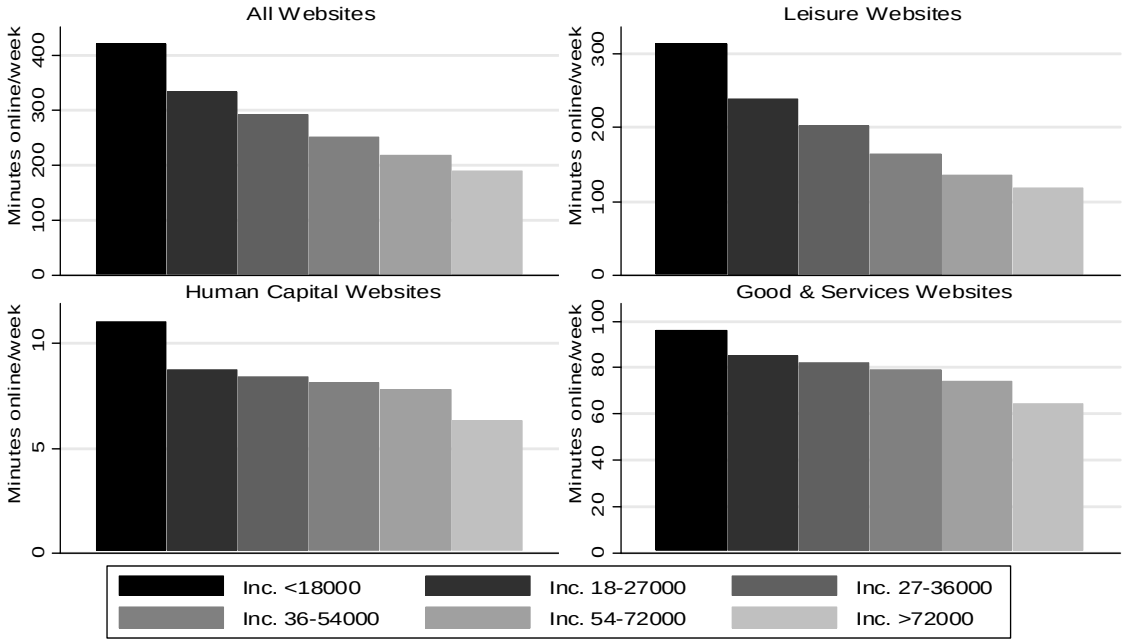
Source: Nielsen Clickstream data 2011, own calculations.

The summary statistics of the demographic characteristics of the internet users also presented in Table 1 show that the sample used in the empirical analysis includes a large variety of internet users in terms of education, occupation, income and other demographic characteristics.

In Figure 1, we present some patterns that show how time spent online at home is linked to income. It shows that total time spent online and time spent on the specific online activities considered decreases with income. This relationship is strongest for all time spent online and for time spent on leisure websites, for the other two types of websites it is weaker. These patterns are consistent with the hypothesis that high income users have a higher opportunity cost of time and therefore spend less time on these online activities.

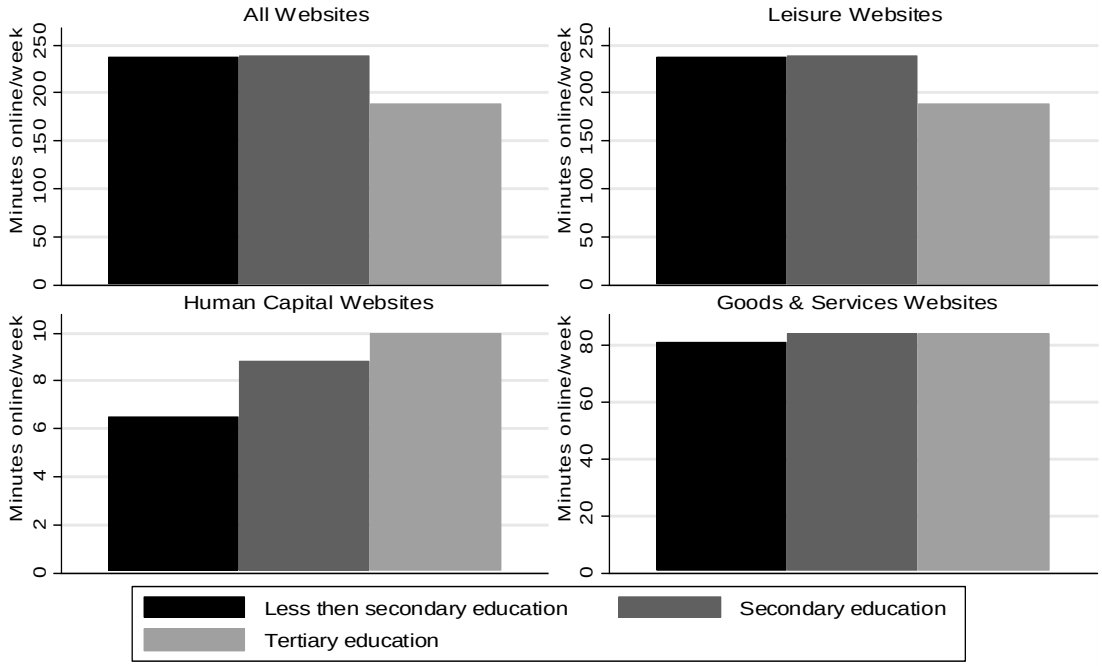
Figure 2 presents how average time spent online varies with educational attainment. Internet users with tertiary education spent less time online at home than users with lower educational attainment.

Figure 1
Time spent on different websites and household income



Source: Nielsen Clickstream data 2011, own illustrations.

Figure 2
Time spent on different websites and education



Source: Nielsen Clickstream data 2011, own illustrations.

This pattern might indicate higher opportunity cost of time for internet users with tertiary education. There is a clear positive relationship between human capital websites and time spent online, which suggests that there might be a digital divide in the ability to use these websites

according to education levels. Finally, there is no relationship between time spent online on goods & services websites and education.

In summary, our descriptive analysis shows that there is a negative relationship between income and time spent online at home and mixed relationship between education and time spent online.

4 Methodology

Following Goldfarb and Prince (2008), we assume that time spent online is a function of total leisure time, total income, price of internet and other individual characteristics. We include controls for occupational and demographic characteristics related to life stage (being married/cohabitating and having children) to control for leisure time. Household income is our proxy for total money available. We also include several demographic characteristics which previous studies have shown to have an effect on time spent online. We estimate the following regression:

$$(1) \qquad TimeOnline_i = \alpha_0 + \beta_I' Income_i + \beta_E' Education_i + \beta_x' x_i + \varepsilon_i$$

$TimeOnline_i$ is the average time spent online per week on all or on a specified type of websites by internet user i. It is measured in minutes. Since we do not have a continuous income variable but only income groups, $Income_i$ is measured as a set of dummies for household income in a given interval. $Education_i$ are dummy variables that control for the highest educational attainment of the internet user. x_i are other social and economic characteristics of the internet user. Informed by previous empirical studies on the topic, we include the following characteristics of the internet user: gender, age, marital status, presence of children in the household, household size, occupation. The descriptive statistics for these variables are in Table 1. We also include country and region specific fixed effects.

The main variables of interest are *Income* and *Education*. The opportunity cost of time hypothesis[8], predicts that the opportunity cost of spending time online is higher for high income earners. Consequently, they will spend less time online overall and possibly also on different types of internet activities. Finding negative and significant coefficients on the income dummies ($Income_i$) will be interpreted as confirming this hypothesis. However, income may affect time spent online though preferences or access to internet outside home. We will examine these effects by estimating equation (1) on subsamples which differ with regard to these characteristics.

Education affects the ability of using internet for different purposes, the opportunity cost of time and also preferences. Previous studies showed that there is a strong relationship between

[8] We assume fixed monthly internet subscription fees and consequently a zero marginal financial cost of internet use. Van Dijk (2012) found that more 80% of the internet access offers in the EU were unmetered.

education and digital skills[9]. If an online activity requires certain digital skills/abilities we would expect the coefficient of education to be positive. Thus, we would expect the coefficient of education to be positive for human capital and goods & services websites, which includes e-commerce and the use of different online services such as online banking or government websites, but not necessarily for most of leisure activities. Education may affect time spent online also through opportunity cost of spending time online. Controlling for income should account for this effect. In addition, high and low educated individuals may differ in their preferences regarding different online activities. However, in the empirical part we will examine aggregated groups of activities and a large number of detailed online activities, which would allow us to distinguish between these two possible explanations.

Trying to identify the relationship between income and times spent online using equation (1) could be problematic if income is not exogenous. In particular, there is a possibility that the intensive users of internet may have better ICT skills, which might be correlated with higher wages. This would result in reverse causality bias. This is not likely to be a problem for the data used in this study because the data on social and economic characteristics of the internet users, including income, was collected when the person installed the Nielsen meter on their computer and, thus, *before* the recording of their clickstream.

The sample used in this study consists of individuals who have access to internet at home and were active users of internet during the period studied. Therefore, we cannot examine the determinants of adoption of the internet or control for selection into subscription to internet. Moreover, the descriptive statistics presented in the previous section show that all users spent positive amounts of time on leisure and goods & services websites and 98.6% do so on human capital websites. Given that our dependent variable is not censored, or in the case of human capital websites it is be very little affected by censoring, we conclude that least squares estimation is the appropriate estimation method[10].

However, the error terms from estimating equation (1) for time spent on different types of websites might be correlated. Therefore, we estimate them as a system of seemingly unrelated regression (SUR) using a generalized least squares estimator. This method takes into account the possible correlation of error terms and yields more efficient results (Greene, 2002). As this estimator is feasible only for linearly independent equations, we have to exclude one of the equations. We use iterated seemingly unrelated regressions (ISUR) to ensure that estimates are invariant to the equation excluded (Zellner, 1962). We use the fact that ISUR estimates are invariant to the equation excluded to obtain the coefficients for all equations. We do this by estimating equation (1) for different groups of equations in which the dependent variables is time spent on different types of websites (or all websites).

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9 After learning by doing, formal education is the most important way in which individuals acquire digital skills (Eurostat Information Society Indicators, 2013).

10 We have estimated the equation (1) using tobit for aggregated and detailed online activities and the marginal effects were very similar to the OLS results.

To test whether the effects of income and education are robust to the presence of outliers and whether they vary across the distribution of internet use we will use quantile regressions. In addition, we will carry out several other robustness checks which will be discussed in the results section. Most regressions are estimated on the pooled sample of the five countries described in Section 3[11].

5 Results

Table 2 reports the results of the estimation of equation (1). The results for time spent on all websites (reported in the first column of Table 2) confirm that all income coefficients are negative and statistically significant. The household income group 0-18,000 Euros is taken as the reference group. Ceteris paribus, internet users in the second lowest household income group (18,000 - 27,000 Euros) spend on average 50 minutes per week less online at home than users in the lowest income group (less than 18,000); users in the highest income group (above 72.000) spend 2.5 hours per week less online at home. The differences between the coefficients of income intervals are statistically significant (see the bottom part Table 2).

Table 2
Baseline Model

	All websites	**Leisure websites**	**Human capital websites**	**Goods & services websites**
Income 18-27000	-50.48	-43.04	-1.62	-5.82
	[7.48]***	[6.44]***	[0.41]***	[2.13]***
Income 27-36001	-65.76	-59.91	-1.64	-4.20
	[7.95]***	[6.86]***	[0.47]***	[2.17]*
Income 36-54000	-99.47	-88.55	-2.14	-8.78
	[7.80]***	[6.53]***	[0.46]***	[2.33]***
Income 54-72000	-122.48	-107.49	-2.52	-12.47
	[9.33]***	[7.65]***	[0.58]***	[2.99]***
Income >72000	-148.03	-123.43	-3.80	-20.80
	[10.21]***	[8.41]***	[0.61]***	[3.23]***
Secondary educ.	17.71	6.34	2.33	9.03
	[7.29]**	[6.23]	[0.35]***	[2.01]***
Tertiary educ.	-1.85	-16.66	3.39	11.43
	[6.96]	[5.77]***	[0.35]***	[1.99]***

[11] We found the same relationships between income and education and time spent online in all countries and therefore we decided to focus on the pooled sample.

Table 2 (Cont.)

	All websites	**Leisure websites**	**Human capital websites**	**Goods & services websites**
Female	-1.84	-8.48	2.77	3.87
	[4.88]	[4.17]**	[0.30]***	[1.40]***
Age	-1.18	-1.59	0.04	0.37
	[0.22]***	[0.19]***	[0.02]***	[0.07]***
Single	76.89	59.48	1.86	15.54
	[7.03]***	[6.09]***	[0.42]***	[1.97]***
Children	-7.75	-7.54	-0.95	0.74
	[6.53]	[5.40]	[0.40]**	[1.87]
Household size 3-4	-30.31	-22.37	-0.43	-7.51
	[7.08]***	[5.85]***	[0.42]	[2.14]***
Household size >5	-32.53	-22.10	-0.83	-9.60
	[10.31]***	[8.65]**	[0.63]	[3.20]***
Constant	360.09	311.18	6.25	42.66
	[51.48]***	[45.04]***	[5.98]	[14.63]***
N	18680	18680	18680	18680
R^2	0.10	0.10	0.03	0.05
F tests of differences in income coefficients (p values)				
$\beta_{\text{Inc. 18-27000}}=\beta_{\text{Inc. 27-36000}}$	0.03	0.00	0.94	0.47
$\beta_{\text{Inc. 27-36000}}=\beta_{\text{Inc. 36-54000}}$	0.00	0.00	0.21	0.02
$\beta_{\text{Inc. 36-54000}}=\beta_{\text{Inc. 54-72000}}$	0.00	0.00	0.46	0.11
$\beta_{\text{Inc. 54-72000}}=\beta_{\text{Inc. >72000}}$	0.00	0.02	0.04	0.01

Notes: ISUR estimates with bootstrapped standard errors in brackets. Dependent variables are average time spent per week on all and on a specific type of websites, measured in minutes. Other covariates: occupation, country and region fixed effects. *, ** and *** indicate significance at 10%, 5% and 1%. Source: Nielsen Clickstream data 2011, Own calculations.

The results suggest that time spent online at home decreases almost monotonically with the household income. These results are consistent with the opportunity cost hypothesis and with previous studies (Goolsbee and Klenow, 2006; Goldfarb and Prince, 2008; Brynjolfsson and Oh, 2012). They suggest that, among those who have access to internet at home, there is a reverse in the income-based digital divide in internet use: low-income users use internet more at home than high-income users. Columns 3, 4 and 5 in Table 2 show that this negative relationship between income and time spent online at home holds for each type of website considered. For leisure, the differences between the coefficients for the income intervals are statistically significant, suggesting a monotonically increasing negative income effect. This is consistent with the opportunity cost hypothesis, and with previous empirical studies on leisure online (Goolsbee and Klenow, 2006; Goldfarb and Prince, 2008; Brynjolfsson and Oh, 2012) and with studies on similar leisure activities such as TV watching (Frey et al., 2007). The tests for differences between income coefficients reported in the bottom part of Table 2 suggest that for inter-

net users above the lowest income interval there is no relationship between time spent online on human capital and goods & services websites.

Education is negatively associated with time spent on leisure websites and a positively associated with time spent on human capital and goods & services websites. These results are in line with Goldfarb and Prince's (2008) findings that education has a negative effect on time spent on leisure, but a positive effect on e-commerce and research prior to purchases. The results for human capital and goods & services websites suggest that there might be a divide in terms of ability to use these types of websites.

The other variables included have the expected signs. Women spend less time on leisure websites, but more time on human capital and goods& services websites than men. Age has a mixed impact. The presence of children is associated with a negative, but mostly insignificant effect due to the high correlation with household size variables. Large household size is associated with less time spent online. Being single is associated with more time spent on all online activities. Overall, the results for the demographic characteristics are plausible and have the expected signs based on previous studies on internet use and time allocation.

These estimations are based on aggregated groups of activities. Aggregation of different types of websites that correspond to online activities may result in smoothing the effect of income and education. Therefore, we repeat the estimations at a more disaggregated level of categories of websites. These results are reported in Table 3.

Income is negatively associated with time spent on most leisure websites, except news websites. Education coefficients remain negative for entertainment and social networks, but turn positive and significant for more sophisticated leisure categories (news and internet services). Income is negatively associated with time spent on careers, education, corporate and health websites, while education is positively associated with time spent on these websites. Income coefficients vary significantly for different goods & services websites. They are negative and significant for e-commerce and general portal & search websites, but insignificant for government and non-profit websites and positive and significant for travel and online banking websites. The positive coefficients of income for the last two categories suggest that these categories of websites are used more by high income users than low income ones. The coefficients of education are always positive and significant for each of the goods & services categories. Overall, the results are in line with those obtained from more aggregated categories, but they differ for a few categories. They provide further evidence that education is positively associated with time spent on complex online activities.

We carry out several robustness tests. To address possible problems with the measurement of time spent online, we re-estimate equation (1) using average number of clicks per week as dependant variable. The results (reported in Table 9, in Appendix) confirm the results for time spent online. As indicated in footnote 3, the match between user profile and online activity may not be perfect in households with several individuals. Therefore, we re-estimate the baseline model on the sample of one person households, which are not affected by this problem.

Table 3
Detailed website categories

	Leisure websites				Human capital websites			Goods & services websites				
	Entertain-ment & Lifestyle	News	Social networks	Internet services	Careers & education	Corporate	Health	Ecom-merce	Search & general portals	Travel	Online banking	Gov. & nonprofit
Income 18-27000	-16.42	0.49	-22.41	-4.71	-0.97	-0.51	-0.14	-4.20	-2.11	0.59	-0.06	-0.05
	[3.46]***	[0.79]	[4.07]***	[1.23]***	[0.28] ***	[0.26]*	[0.11]	[1.53]***	[0.73]***	[0.25]**	[0.41]	[0.20]
Income 27-36001	-20.46	-0.90	-32.37	-6.18	-0.93	-0.58	-0.14	-3.09	-2.66	1.09	0.39	0.08
	[3.59]***	[0.71]	[4.20]***	[1.32]***	[0.31] ***	[0.28]**	[0.10]	[1.53]**	[0.75]***	[0.28]***	[0.44]	[0.24]
Income 36-54000	-32.91	0.07	-46.10	-9.61	-1.30	-0.77	-0.08	-6.82	-4.32	1.19	1.10	0.08
	[3.38]***	[0.72]	[4.03]***	[1.30]***	[0.32] ***	[0.25]***	[0.11]	[1.57]***	[0.73]***	[0.25]***	[0.60]*	[0.23]
Income 54-72000	-42.68	-0.59	-50.69	-13.54	-2.00	-0.48	-0.04	-9.46	-5.41	1.12	1.31	-0.03
	[3.66]***	[0.88]	[4.67]***	[1.47]***	[0.40] ***	[0.39]	[0.13]	[1.87]***	[0.97]***	[0.33]***	[0.67]*	[0.24]
Income >72000	-52.80	-0.13	-52.24	-18.26	-2.45	-1.23	-0.12	-13.92	-8.22	1.41	0.35	-0.41
	[3.92]***	[1.24]	[5.36]***	[1.66]***	[0.45] ***	[0.31]***	[0.18]	[2.05]***	[1.00]***	[0.42]***	[0.76]	[0.28]
Secondary educ.	-1.69	3.36	0.76	3.92	1.18	0.90	0.25	3.54	2.21	1.30	1.28	0.70
	[3.26]	[0.63]***	[3.67]	[1.06]***	[0.22] ***	[0.25]***	[0.10]***	[1.36]***	[0.65]***	[0.22]***	[0.39]***	[0.14]***
Tertiary educ.	-12.47	4.89	-16.40	7.32	2.63	0.49	0.27	3.28	2.97	1.65	2.39	1.12
	[3.17]***	[0.64]***	[3.29]***	[1.09]***	[0.24] ***	[0.21]**	[0.09]***	[1.33]**	[0.63]***	[0.20]***	[0.47]***	[0.14]***
Constant	139.71	1.46	163.72	6.29	6.49	0.82	-1.06	20.72	14.92	2.20	2.51	2.30
	[34.77]***	[3.30]	[20.19]***	[6.59]	[5.59]	[1.16]	[0.20]***	[9.26]**	[3.36]***	[1.68]	[3.67]	[1.36]*
N	0.07	0.03	0.10	0.05	0.05	0.01	0.02	0.06	0.04	0.04	0.03	0.05
R^2	18680	18680	18680	18680	18680	18680	18680	18680	18680	18680	18680	18680

Notes: ISUR estimates with bootstrapped standard errors are in brackets. Dependent variable is average time spent per week on a specific category of websites, measured in minutes. Other covariates: other demographic characteristics and country and region fixed effects. *, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

The results (reported in Table 10, in Appendix) are qualitatively similar to the baseline results. To examine whether the baseline results are driven by one country or a group of countries, we estimate equation (1) separately for each country. These results are reported in Table 11 to Table 14. The results indicate that in all countries there is a negative and significant relationship between time spent online and income and a positive relationship between education and time spent on human capital websites, although the magnitudes of the effects differ. Overall, these results confirm the baseline results.

Next, we use quantile regressions to examine whether our results for income and education are not driven by a few very intensive users (users that spend large amounts of time online). In addition, this method provides a more complete characterisation of the conditional distribution of time spent online by allowing the effect of income and education and other explanatory variable that to vary for different quantiles. The estimation results for the 10_{th}, 25_{th}, 50_{th}, 75_{th} and 90_{th} quantiles, for the four categories of websites, are reported in Table 4-Table 7.

Table 4
Quantile regressions – All websites

	Q10	Q25	Q50	Q75	Q90
Income 18-27000	-8.17	-26.95	-62.21	-86.49	-82.65
	[2.37]***	[5.39]***	[9.40]***	[14.25]***	[26.18]***
Income 27-36001	-11.63	-35.80	-70.40	-102.03	-135.86
	[2.42]***	[5.63]***	[8.66]***	[14.01]***	[26.68]***
Income 36-54000	-14.15	-44.39	-103.37	-141.80	-198.08
	[2.37]***	[4.93]***	[8.55]***	[13.96]***	[26.52]***
Income 54-72000	-15.93	-51.99	-118.13	-174.02	-260.99
	[2.55]***	[5.62]***	[9.59]***	[15.25]***	[29.25]***
Income >72000	-19.29	-63.28	-132.38	-206.48	-290.30
	[2.66]***	[5.66]***	[11.41]***	[16.43]***	[36.96]***
Secondary educ.	5.71	14.57	18.77	30.16	23.30
	[1.56]***	[3.39]***	[7.55]**	[13.02]**	[24.07]
Tertiary educ.	4.83	15.59	23.62	2.86	-48.10
	[1.47]***	[3.07]***	[7.08]***	[12.83]	[23.55]**
Constant	40.19	138.52	343.44	521.07	888.79
	[25.31]	[22.76]***	[68.57]***	[76.88]***	[185.45]***
N	18680	18680	18680	18680	18680
Pseudo R^2	0.02	0.04	0.06	0.08	0.10

Notes: Quantile regression estimates with bootstrapped standard errors in brackets.
Dependent variable is average time spent per week on all websites, measured in minutes.
Other covariates: other demographic characteristics, country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

The online activity of the very intensive internet users is itself of interest because they account for a large part of online activity. For instance, the top 10% internet users in the distribution of the online activities studied account for 40% of time spent on leisure online, 36% of time spent

on goods & services websites, and for more than 50% of total time spent on human capital websites.

Table 5
Quantile regressions – Leisure websites

	Q10	Q25	Q50	Q75	Q90
Income 18-27000	-4.68	-17.08	-50.55	-76.44	-103.85
	[1.41]***	[3.15]***	[6.79]***	[13.43]***	[26.08]***
Income 27-36001	-6.33	-23.20	-65.46	-106.45	-144.41
	[1.34]***	[3.05]***	[6.75]***	[12.51]***	[26.75]***
Income 36-54000	-7.37	-28.02	-81.86	-145.23	-211.52
	[1.28]***	[2.88]***	[6.21]***	[12.38]***	[25.47]***
Income 54-72000	-8.63	-32.99	-92.40	-166.67	-261.85
	[1.28]***	[3.11]***	[6.40]***	[13.62]***	[27.60]***
Income >72000	-9.81	-37.26	-101.24	-175.13	-280.67
	[1.32]***	[3.13]***	[6.83]***	[13.63]***	[31.24]***
Secondary educ.	2.32	4.25	15.72	11.92	-4.95
	[0.83]***	[1.97]**	[4.81]***	[9.68]	[25.37]
Tertiary educ.	1.99	5.97	9.33	-13.03	-70.66
	[0.70]***	[1.64]***	[4.11]**	[8.82]	[24.20]***
Constant	22.24	95.13	235.01	494.03	663.89
	[9.64]**	[15.50]***	[52.15]***	[47.92]***	[153.08]***
N	18680	18680	18680	18680	18680
Pseudo R^2	0.01	0.03	0.06	0.08	0.11

Notes: Quantile regression estimates with bootstrapped standard errors in brackets.
Dependent variable is average time spent per week on leisure websites, measured in minutes.
Other covariates: other demographic characteristics, country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

The results show that the coefficients of income variables are significant across the entire conditional distribution of time spent online for all four activities considered. This confirms that our OLS results are not driven by a few very intensive internet users. We also tested and confirmed that these differences in the income coefficient for different quantiles are statistically significant. These results suggest that income has a greater effect for more intensive users. These results are consistent with the hypothesis of Nie and Hillygus (2002) that heavy use of internet crowds out other activities and light use does not. For overall time and leisure, education has a positive effect on the lower quantiles of these distributions but an insignificant and even negative effect on the higher quantiles of these distributions. For time spent on human capital and goods & services websites, education has a positive and significant effect across the entire distributions of these online activities and it has a greater effect for higher quantiles of these distributions, in line with OLS results.

Finally, we examine more in detail what drives the negative relation between time spent online and household income. Differences in access to internet at work, in opportunity cost of time

and different usefulness of internet for users with different income levels could all lead to a negative relationship between time spent online and household income[12] (Goldfarb and Prince, 2008). Internet users who have access to internet at work may use it also for personal reasons and they may not need to use it as much at home as users without access to internet at work.

Table 6
Quantile regressions – Human capital websites

	Q10	Q25	Q50	Q75	Q90
Income 18-27000	-0.07	-0.30	-0.77	-1.74	-4.13
	[0.03]**	[0.07]***	[0.16]***	[0.42]***	[0.98]***
Income 27-36001	-0.10	-0.36	-0.81	-2.17	-4.04
	[0.03]***	[0.07]***	[0.18]***	[0.46]***	[1.31]***
Income 36-54000	-0.16	-0.47	-1.05	-2.59	-5.15
	[0.03]***	[0.08]***	[0.17]***	[0.43]***	[1.08]***
Income 54-72000	-0.16	-0.55	-1.49	-3.85	-8.03
	[0.03]***	[0.08]***	[0.19]***	[0.51]***	[1.26]***
Income >72000	-0.22	-0.72	-2.04	-4.70	-9.22
	[0.03]***	[0.08]***	[0.19]***	[0.57]***	[1.34***
Secondary educ.	0.11	0.30	0.89	2.15	4.06
	[0.02]***	[0.05]***	[0.11]***	[0.28]***	[0.78]***
Tertiary educ.	0.16	0.45	1.44	3.88	7.44
	[0.02]***	[0.05]***	[0.12]***	[0.31]***	[0.72]***
Constant	0.17	0.95	1.92	8.54	22.71
	[0.37]	[0.40]**	[0.90]**	[4.97]*	[30.78]
N	18680	18680	18680	18680	18680
Pseudo R^2	0.01	0.01	0.03	0.04	0.05

Notes: Quantile regression estimates with bootstrapped standard errors in brackets.
Dependent variable is average time spent per week on human capital websites, measured in minutes.
Other covariates: other demographic characteristics, country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

Users who have access to internet at work are likely to be employed in skilled occupations which are associated with higher wages, which may lead to a spurious correlation between household income and time spent online. Internet users with higher income may have higher opportunity costs of time and therefore they spend less time online. Finally, Goldfarb and Prince (2008) suggest that internet could be more useful to lower income internet users because

[12] Another possible explanation is that high income internet users are more likely to have access to internet from portable devices, which are not covered by the Nielsen meter. However, OECD (2012) suggests that internet traffic from such devices accounted for 6.8% of internet traffic in UK, 4% in Spain and less than 3% in France of all internet traffic in these countries in August 2011. To the extent that these figures are representative of other months of the year and of other two countries, they suggest that the internet traffic on these devices represented only a small share of total internet activity and cannot by itself explain the large differences in time spent online by high and low income internet users.

they can obtain services which are not available/affordable to them offline or they have different preferences.

Table 7
Quantile regressions – Goods & services websites

	Q10	Q25	Q50	Q75	Q90
Income 18-27000	-0.27	-1.73	-3.36	-5.95	-12.96
	[0.58]	[1.23]	[1.74]*	[3.16]*	[7.04]*
Income 27-36001	-0.88	-1.92	-2.81	-1.86	-4.58
	[0.60]	[1.25]	[1.94]	[3.51]	[7.14]
Income 36-54000	-1.59	-4.59	-7.84	-11.19	-13.85
	[0.56]***	[1.14]***	[1.94]***	[3.68]***	[6.86]**
Income 54-72000	-1.69	-5.35	-10.06	-20.36	-27.13
	[0.65]***	[1.37]***	[2.26]***	[3.93]***	[9.18]***
Income >72000	-2.90	-9.73	-16.14	-25.07	-41.38
	[0.62]***	[1.56]***	[2.72]***	[4.65]***	[8.97]***
Secondary educ.	2.04	4.79	10.23	14.20	18.74
	[0.43]***	[0.90]***	[1.53]***	[3.31]***	[5.87]***
Tertiary educ.	2.37	6.46	13.36	17.46	26.35
	[0.44]***	[0.96]***	[1.45]***	[3.05]***	[5.34]***
Constant	5.76	29.10	35.78	74.95	147.79
	[4.34]	[10.55]***	[19.51]*	[23.23]***	[39.98]***
N	18680	18680	18680	18680	18680
Pseudo R^2	0.03	0.04	0.04	0.04	0.05

Notes: Quantile regression estimates with bootstrapped standard errors in brackets.
Dependent variable is average time spent per week on goods & services websites, measured in minutes.
Other covariates: other demographic characteristics, country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

We examine whether access to internet at work drives the results by estimate equation (1) for individuals with different access to internet at work. Based on users' occupations we distinguish between: (1) users employed in occupations where they are likely to have access to internet at work, (2) individuals employed in occupations where they are not likely to have access to internet at work, (3) internet users who are homemakers, retired and unemployed, who are likely to have access to internet only from home[13]. We classified the occupational groups provided by Nielsen and reported in Table 1 into those likely to provide or not access to internet at work based on the OECD broad definition of ICT-skilled occupations (OECD, 2010) [14].

[13] It is important to mention, that all internet users may access internet from public libraries, internet cafes, etc. However, internet use from these places is not likely to account for a large part of their internet use and there is no reason while such use would vary systematically with household income.

[14] OECD definition is based on three digit ISCO 88 codes and occupations provide by Nielsen are similar to one digit ISCO 88 codes. Thus, we classified the occupational categories provided by Nielsen in occupations ICT skilled ones if they included an ICT skilled occupation. Thus, clerical/administrative, executive/managerial, professionals, education and technical were classified as occupations where users are likely to have access to

We examine whether the opportunity cost drives the results by comparing the results of estimating equations (1) separately for employed internet users, whose opportunity cost of time is most likely to be related to wages and hence income, and internet users who were not employed at the time of the survey (full-time students, retired, homemakers and unemployed internet users) whose opportunity cost of time is not related with the income they could earn in labour markets. In the latter estimations the coefficients of income indicate the differences in time spent online between students (or retired, homemaker or unemployed users) from households with different income levels.

Given that all tests are based on comparing the coefficients of income for different occupational groups we report all these regression in Table 8. These equations were estimated jointly using OLS. For expositional reasons we report here only the results for all time spent online.

The results show that income has a negative effect on overall time spent online for employed internet users with access to internet at work and without, for employed and not employed internet users, and for specific categories of not employed internet users: students, homemakers, unemployed or retired. Moreover, almost all differences in the coefficients of income between different occupational groups are not statistically significant, as reported in Table 16. This suggests that the income has a similar effect on time spent online for internet users in all these occupational groups.

More specifically, the across equation tests of the differences in coefficients indicate that we cannot reject the hypothesis that income has the same effect on time spent online by users employed in ICT skilled occupations (who likely have access to internet at work), those employed in non ICT skilled occupations (who likely do not have access to internet at work), students (who may have access to internet at university) and homemakers, retired and unemployed internet users (who likely only have internet access at home). The fact that income does not have statistically different effects on time spent online internet users with different access to internet outside home, suggest that access to internet outside home is not a main driver of our results.

The tests in the lower panel of this table indicate that the differences in the effects of income on time spent online for employed internet users and for not employed users (students, homemakers, retired and unemployed) are statistically insignificant.

computers at work and craftsman/craftswoman, military, operator/labourer, sales and services as occupations where users are not likely to have access to computers at work. Internet users who indicated their occupation as "other" were not included in any of these groups.

Table 8
Time spent online on all websites – Differences between occupational groups

Internet users' occupations	Employed in ICT skilled	Employed in non ICT skilled	Employed	Not employed	Students	Home-makers	Retired	Un-employed
Income 18-27000	-39.03	-41.43	-50.70	-45.02	11.17	-60.45	-45.93	-52.25
	[14.54]***	[15.78]***	[10.01]***	[12.79]***	[26.77]	[31.60]*	[24.23]*	[21.96]**
Income 27-36001	-52.19	-44.89	-55.20	-83.44	-85.41	-64.83	-61.77	-104.78
	[14.71]***	[17.24]***	[10.51]***	[13.63]***	[23.99]***	[36.04]*	[24.58]**	[29.13]***
Income 36-54000	-88.63	-98.28	-97.23	-101.41	-102.54	-179.56	-61.09	-41.60
	[14.05]***	[16.54]***	[9.92]***	[13.98]***	[24.01]***	[34.03]***	[24.95]**	[36.08]
Income 54-72000	-116.76	-113.81	-121.77	-118.78	-114.11	-164.76	-62.91	-77.05
	[15.41]***	[21.82]***	[11.35]***	[16.59]***	[27.73]***	[41.51]***	[30.07]**	[56.62]
Income >72000	-146.26	-207.39	-154.44	-121.86	-99.46	-160.61	-119.33	-27.95
	[15.97]***	[23.53]***	[12.25]***	[21.80]***	[34.66]***	[55.82]***	[33.38]***	[72.58]
Secondary educ.	-8.55	5.14	-1.94	37.17	39.74	31.74	38.14	11.58
	[13.66]	[14.50]	[9.31]	[11.69]***	[20.26]**	[30.28]	[21.24]*	[26.25]
Tertiary educ.	-35.88	-10.92	-22.71	18.28	39.94	-9.99	8.50	-13.83
	[12.51]***	[15.01]	[8.92]**	[10.72]*	[22.30]*	[29.01]	[17.36]	[24.31]
Constant	441.08	340.73	415.33	482.58	281.33	498.54	707.72	422.66
	[31.20]***	[43.12]***	[25.27]***	[36.17]***	[60.45]***	[107.10]***	[105.30]***	[59.59]***
N	7573	3604	12311	6369	1688	1227	1780	1674
R^2	0.09	0.10	0.09	0.10	0.19	0.15	0.12	0.09

Notes: OLS estimates with heteroskedasticity robust standard errors are in brackets. Dependent variable is average time spent per week, measured in minutes. Other covariates: other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1%.
Source: Nielsen Clickstream data 2011, own calculations.

These results cast doubt on the opportunity cost of time hypothesis. They could be interpreted as lending support to the hypothesis that low income internet users benefit more from internet than high income internet users who may have better alternatives or different preferences as suggested by Goldfarb and Prince (2008). Our model does not allow us to distinguish between these possible explanations. A further research step would be to specify a model which allows doing this.

6 Conclusions

This paper contributes to the debate regarding digital divide in access and use of internet between individuals with different socio-economic characteristics. While there is a large amount of literature on the digital divide in access, less is known about the digital divide in use. The evidence that exists is based on survey data and focuses on US.

We build on Goldfarb and Prince (2008), who study the role of income and education levels on internet use patterns in the US, which we extend to study the determinants of three specific online activities: leisure, human capital improvement and obtaining goods and services. In addition, we study whether the relationship between income and education and time spent online differs by users' intensity of use and occupation.

Our main finding is that, for those who have access to internet, the income based digital divide in internet use has been reversed: low income internet users spend more time online overall and on websites related to leisure. Internet users in the lowest income group also spend more time on human capital and goods & services websites. However, we find evidence of an education-related digital divide in the use of human capital and goods & services websites. The robustness checks show that these results hold true for a variety of demographic groups: internet users in each of the five countries, internet users in one person households, internet users who are employed, unemployed and out of the labour force (unemployed, students, retired people and homemakers) and internet users with different intensity of internet use.

Overall, the results suggest that for those with access to internet, there is a reversal in the income-based digital divide and that currently the main digital divide in internet use is driven by education and that it concerns not the internet in general, but specific uses such as those related to career, education and health and obtaining goods and services. These are the online activities generally regarded as valuable by policy makers and that they seek to encourage by increasing access to internet. These results highlight the importance of education for enabling internet users to participate in these online activities.

Appendix

Table 9
Robustness checks – Clicks

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-112.24	-95.87	-4.34	-12.04
	[20.97]***	[18.37]***	[1.26]***	[5.40]**
Income 27-36001	-139.19	-128.17	-4.41	-6.62
	[22.55]***	[19.99]***	[1.30]***	[5.63]
Income 36-54000	-222.31	-199.64	-5.32	-17.34
	[21.52]***	[18.65]***	[1.24]***	[5.94]***
Income 54-72000	-269.12	-234.43	-6.24	-28.44
	[26.32]***	[22.48]***	[1.64]***	[7.49]***
Income >72000	-349.42	-291.44	-9.88	-48.09
	[26.32]***	[22.79]***	[1.67]***	[7.94]***
Secondary educ.	53.70	24.57	5.85	23.28
	[20.66]***	[17.69]	[1.21]***	[5.51]***
Tertiary educ.	-17.41	-49.35	7.54	24.41
	[18.67]	[15.81]***	[0.94]***	[5.22]***
Constant	1003.54	837.99	25.73	139.82
	[170.65]***	[161.62]***	[18.51]	[36.09]***
N	18680	18680	18680	18680
R^2	0.08	0.08	0.02	0.03

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average number of clicks per week. Other covariates: Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1
Source: Nielsen Clickstream data 2011, own calculations.

Table 10
Robustness checks – One person households

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-24.42	-18.26	-1.90	-4.26
	[13.29]*	[11.87]	[0.75]**	[3.82]
Income 27-36001	-57.84	-51.12	-2.34	-4.38
	[15.88]***	[14.30]***	[0.84]***	[4.59]
Income 36-54000	-75.65	-71.01	-0.75	-3.89
	[16.03]***	[13.99]***	[1.08]	[4.66]
Income 54-72000	-97.17	-94.91	-1.37	-0.89
	[20.89]***	[17.74]***	[1.65]	[6.89]
Income >72000	-123.72	-106.89	-4.13	-12.70
	[24.31]***	[20.64]***	[1.35]***	[6.97]*
Secondary educ.	-63.29	-57.47	1.95	-7.78
	[17.39]***	[15.47]***	[1.06]*	[4.57]*
Tertiary educ.	-88.27	-87.52	1.76	-2.51
	[16.21]***	[14.36]***	[0.81]**	[4.61]
Constant	529.00	450.68	8.58	69.74
	[84.54]***	[74.43]***	[5.57]	[35.24]**
N	4671	4671	4671	4671
R^2	0.11	0.12	0.04	0.03

Notes: ISUR estimates with bootstrapped standard errors are in brackets
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1
Source: Nielsen Clickstream data 2011, own calculations.

Table 11
Country specific results – Germany

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-82.32	-60.13	-2.27	-19.93
	[17.52]***	[15.78]***	[0.89]**	[4.95]***
Income 27-36001	-79.88	-67.79	-2.31	-9.78
	[18.88]***	[16.67]***	[0.82]***	[6.02]
Income 36-54000	-130.72	-110.02	-2.80	-17.91
	[17.93]***	[15.78]***	[0.92]***	[5.84]***
Income 54-72000	-141.96	-128.78	-3.70	-9.47
	[21.13]***	[17.50]***	[1.10]***	[7.63]
Income >72000	-188.31	-153.64	-4.48	-30.19
	[23.61]***	[19.79]***	[1.44]***	[7.74]***
Secondary educ.	-20.76	-24.11	0.85	2.50
	[16.75]	[14.04]*	[0.57]	[5.23]
Tertiary educ.	-50.44	-49.35	2.16	-3.25
	[16.06]***	[13.49]***	[0.79]***	[5.11]
Constant	462.36	361.91	2.95	97.50
	[85.41]***	[72.28]***	[1.72]*	[25.73]***
N	3928	3928	3928	3928
R^2	0.10	0.11	0.04	0.04

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1.
Source: Nielsen Clickstream data 2011, own calculations.

Table 12
Country specific results – Spain

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-38.56	-39.47	-0.33	1.24
	[14.28]***	[12.39]***	[0.81]	[3.76]
Income 27-36001	-36.95	-40.45	-0.55	4.06
	[14.94]**	[13.09]***	[1.04]	[3.97]
Income 36-54000	-73.94	-73.70	-1.98	1.74
	[15.52]***	[13.30]***	[0.89]**	[4.58]
Income 54-72000	-84.92	-79.16	-1.68	-4.08
	[21.25]***	[18.53]***	[1.64]	[5.53]
Income >72000	-130.32	-108.62	-4.13	-17.57
	[22.19]***	[18.81]***	[1.09]***	[5.76]***
Secondary educ.	69.09	51.42	3.91	13.77
	[16.41]***	[14.53]***	[0.79]***	[3.71]***
Tertiary educ.	40.51	19.95	4.86	15.71
	[13.99]***	[12.72]	[0.65]***	[3.33]***
Constant	227.01	200.71	4.69	21.62
	[71.48]***	[61.53]***	[6.39]	[15.01]
N	3767	3767	3767	3767
R^2	0.08	0.08	0.08	0.08

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1.
Source: Nielsen Clickstream data 2011, own calculations.

Table 13
Country specific results – France

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-42.14	-28.69	-3.31	-10.14
	[17.93]**	[14.65]*	[1.40]**	[4.94]**
Income 27-36001	-67.94	-58.65	-2.81	-6.48
	[17.31]***	[13.93]***	[1.39]**	[5.28]
Income 36-54000	-95.86	-77.41	-4.00	-14.45
	[17.06]***	[13.43]***	[1.35]***	[5.05]***
Income 54-72000	-111.19	-89.80	-3.03	-18.37
	[16.95]***	[13.96]***	[1.73]*	[5.07]***
Income >72000	-128.99	-103.18	-4.36	-21.44
	[18.97]***	[14.93]***	[1.54]***	[5.84]***
Secondary educ.	17.52	9.82	2.21	5.49
	[14.23]	[11.58]	[1.09]**	[4.01]
Tertiary educ.	0.02	-11.54	2.30	9.26
	[10.27]	[8.34]	[0.72]***	[3.28]***
Constant	227.47	185.60	2.42	39.44
	[37.54]***	[28.41]***	[2.89]	[13.16]***
N	4028	4028	4028	4028
R^2	0.10	0.11	0.06	0.09

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1.
Source: Nielsen Clickstream data 2011, own calculations.

Table 14
Country specific results – Italy

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-42.39	-35.54	-1.68	-5.16
	[16.44]***	[13.90]**	[0.72]**	[4.75]
Income 27-36001	-76.66	-66.81	-1.53	-8.31
	[16.07]***	[13.88]***	[0.80]*	[4.70]*
Income 36-54000	-112.74	-99.08	-1.72	-11.95
	[16.08]***	[13.19]***	[0.82]**	[5.00]**
Income 54-72000	-88.65	-83.66	-0.15	-4.84
	[20.65]***	[17.08]***	[1.36]	[6.25]
Income >72000	-131.47	-112.71	-1.49	-17.28
	[25.25]***	[20.11]***	[1.84]	[8.07]**
Secondary educ.	33.44	11.72	2.20	19.52
	[15.79]**	[13.91]	[0.57]***	[4.06]***
Tertiary educ.	30.33	5.10	3.91	21.31
	[18.26]*	[16.15]	[0.68]***	[4.61]***
Constant	400.89	340.94	7.93	52.02
	[73.97]***	[67.07]***	[4.28]*	[12.52]***
N	3535	3535	3535	3535
R^2	0.08	0.08	0.04	0.05

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1.
Source: Nielsen Clickstream data 2011, own calculations.

Table 15
Country specific results – United Kindom

Websites	All	Leisure	Human capital	Goods & services
Income 18-27000	-53.39	-50.22	-2.00	-1.17
	[20.21]***	[16.94]***	[1.32]	[5.31]
Income 27-36001	-76.98	-68.72	-2.82	-5.44
	[23.51]***	[20.38]***	[1.45]*	[6.69]
Income 36-54000	-98.28	-92.24	-1.14	-4.91
	[21.30]***	[17.75]***	[1.43]	[6.32]
Income 54-72000	-163.29	-138.83	-3.72	-20.74
	[24.93]***	[20.62]***	[1.51]**	[7.38]***
Income >72000	-145.82	-126.94	-4.52	-14.36
	[34.69]***	[28.89]***	[1.65]***	[10.63]
Secondary educ.	35.19	17.94	3.07	14.18
	[26.02]	[22.52]	[1.49]**	[7.35]*
Tertiary educ.	15.57	-8.80	3.89	20.48
	[24.25]	[21.21]	[1.36]***	[6.71]***
Constant	477.98	408.93	2.25	66.80
	[52.41]***	[43.97]***	[3.41]	[14.53]***
N	3422	3422	3422	3422
R^2	0.09	0.11	0.02	0.04

Notes: ISUR estimates with bootstrapped standard errors are in brackets.
Dependent variable is the average time spent per week. Other covariates:
Other demographic characteristics and country and region fixed effects.
*, ** and *** indicate significance at 10%, 5% and 1.
Source: Nielsen Clickstream data 2011, own calculations.

Table 16
T-tests of differences in coefficients across equations in Table 8 (p-values)

		Employed in ICT skilled occupations minus				
	Employed in non ICT skilled occupations	**Not employed**	**Student**	**Homemaker**	**Unemployed**	**Retired**
Income 18-27000	0.91	0.76	0.10	0.54	0.62	0.81
Income 27-36001	0.75	0.12	0.24	0.75	0.11	0.74
Income 36-54000	0.66	0.52	0.62	0.01	0.22	0.34
Income 54-72000	0.91	0.93	0.93	0.28	0.50	0.11
Income >72000	0.03	0.37	0.22	0.81	0.11	0.47
Secondary educ.	0.49	0.01	0.05	0.23	0.50	0.06
Tertiary educ.	0.20	0.00	0.00	0.41	0.42	0.04
		Employed minus				
		Not employed	**Student**	**Homemaker**	**Unemployed**	**Retired**
Income 18-27000		0.73	0.03	0.77	0.95	0.86
Income 27-36001		0.10	0.25	0.80	0.11	0.81
Income 36-54000		0.81	0.84	0.02	0.14	0.18
Income 54-72000		0.88	0.80	0.32	0.44	0.07
Income >72000		0.19	0.14	0.91	0.09	0.32
Secondary educ.		0.01	0.05	0.23	0.50	0.06
Tertiary educ.		0.00	0.00	0.41	0.42	0.04

Notes: P-values of the t-tests of differences in coefficients on income and education across equations for different occupational groups in Table 8. Source: Nielsen Clickstream data 2011, own calculations.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 43-56 dx.doi.org/10.13085/eIJTUR.11.1.43-56

Explaining sleep time – Hungarian evidences

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Abstract

We spend about one-third of our life sleeping, which is essential for our physical and mental health. Research verified that both too much and too little sleep is associated with poor health, while the "golden mean" seems to be ideal. In general, sleep time forms a U-shaped curve over the life span. In our busy lifestyle, we can observe the conversion of sleep time to waking activities. In addition, some dimensions of social inequality may influence sleeping habits. At the same time, sleeping has a relation with families' lifecycles, with working time, and with income, as well. In this paper we focus on the relationship between sleep and work-related time. Studies of sleep time are based on two types of theoretical traditions, one of which relies on rational choice theory, while the other emphasizes the role of the social structural elements. We argue that the two theoretical frameworks do not contradict. Our results, that based on the Hungarian Time Use Survey, reveal that rational calculation is determinant, but we also found evidences of structural effects.Our main finding is that sleep time is strongly linked to the degree of integration in the labour market.

JEL-Codes: I1, J1, J2, Z1

Keywords: Health, time allocation, sleeping time, labour market, family, gender, childcare

1 Introduction

It is an unquestionable fact – everyday experience and research show – that sleep is essential for physical and mental health (Kripke et al. 2002, Metlaine et al. 2005) as well as for productivity at workplace (Metlaine et al. 2005, Hale 2005, Hurst 2008, Hale and Hale 2010). In this study our aim is to examine the social aspects of inequality in the duration of sleep. Our question is that the time spent sleep is some kind of resource that is expendable on other, more lucrative activities, or we would rather regard sleeping as something valuable in itself, something that one can maximalize and thus it is a new dimension of social inequalities.

The duration of sleep is associated with physical and mental health: both too long (more than 8 hours) and too short (much less than 7 hours) sleep is related to the poor health status. The ideal sleep duration is somewhere in the middle range (Basner et al. 2007). Beside duration, the quality of sleep is also decisive, and in addition to that, it seems the latter is at least as important as the former. While the duration of sleep can be measured easily in time use surveys, its quality cannot. Mostly the interruption of sleep can be grasped (Burgard 2011), and recently some time use data collections also recorded the subjective value of the action judged by the respondent (Ricroch 2011). However, these solutions do not reflect insomnia, though it is a quite common phenomenon (Leger et al. 2000). Insomnia is not equal to short sleep. Often people with insomnia lie in bed without sleeping. This activity is recorded mostly as sleeping in time use diaries. This is one of the reasons why time use surveys overestimate the time spent on real sleeping. Metlaine et al. (2005) discuss the possible and empirically proven socio-economic consequences of insomnia in detail.

Although the length of sleep is mostly biologically determined, it is remarkable that some effect of certain social factors is detectable. Following Jeffrey Alexander's (1987) meta-theoretical concept[1] there are two theoretical traditions in the research on sleep time. One of them is rational (methodological) individualism (i.e. voluntarism) and the other is methodological collectivism. Some of the research studies emphasize that people do their best to exploit individual opportunities, and the management of time plays an important role in this process. Other studies address the restrictive aspects of social structures.

First, we review authors who can be classified under the approach of methodological individualism or (social) exchange theory. Biddle and Hamermesh (1990) studied the relationship

[1] According to Alexander (1987), different ideological orientations, general assumptions about reality are in the background of these theories. The different theoretical traditions are mediated by these a priori elements. Two dimensions appear particularly important for Alexander; these are the assumptions about the issues of social action and order. In the case of the first, we may either believe that people are basically rational (or if you like selfish), or we may think that they are irrational (normatively or affectively oriented, idealists). The second assumption refers to whether the actions of actors create and shape social institutions (methodological individualism), or if it is social institutions that define actions, which can only reinforce already existing structures (methodological collectivism).

between working time and sleep time, and they were the first who indicated that men with higher income sleep less. Studying this relationship among women showed a weaker effect. The negative relationship between sleep time and education as well as income was studied later by others, too (Szalontai 2006). These studies assume that time is a resource of limited availability, so its management can be described on the basis of the rational choice theory (Becker 1965, Robinson 1987). According to this school of thought, the duration of sleep is influenced by monetary incentives. If the marginal cost of sleep is high enough, people will choose to be awake, or precisely, an income-generating activity instead of sleeping. However, this is limited by the fact that sleeping is essential for the production of energy required for waking activities. Thus, people cannot exploit themselves infinitely because there is a threshold, and over that, productivity will decline. This concept of sleep can explain many relationships found earlier, e. g. why sleep time by age shows a U-shaped curve or why women sleep slightly more than men in most countries, while they also have lower mean wages. Dinges et al. (2005) examined the annual data of 2003 of the American Time Use Survey to see which other activities sleep time is the most reciprocally related to. According to them, sleep is regarded as a flexible temporal commodity which can be converted to other waking activities. The results show that sleep time had the strongest reciprocal relation with working time, and the next two most powerful factors were travel time and time spent on housework. An extended version of the same research was published by Basner et al. (2007).

Unlike the previously discussed authors, Hale and Hale (2010) highlight the social structural determination of poor sleep beside the individual (biological or behavioural) reasons. The lack of autonomy converts social inequities to health inequality through the mechanism of poor sleep. In this concept, sleep quality is also an indicator of health status. The authors argue that limited autonomy (or lack of autonomy), which can be identified at least roughly as low-level positions in social inequality (e.g. poor housing, low educational level, unemployment), leads to poor sleep. At a first glance, this seems to contradict the previously described negative association between education (or income) and sleep duration. However, poor sleep does not necessarily imply a short sleep. As earlier studies demonstrated, the relationship between sleep and health is not linear, but rather U or even more J-shaped. The duration of sleep is acceptable in a relatively wide range, and a too long (more than 8 hours) sleep has even stronger associations with health problems than a too short (less than 7 hours) one (Kripke et al. 2002). In this concept, the unemployment resulting from low education, or even the voluntarily chosen inactivity – which is caused by the poor income opportunities – are structural constraints and not the results of freely chosen factors, leading to passivity and ultimately to a deterioration of health status. This deterioration is accelerated in the case of insomnia by disfunctional answers, e. g. alcohol-use, tv-watching and sleeping pills (Metlaine et al. 2005). Burgard and Ailshire (2009) investigated the impact of social stratification on sleep through bad work conditions (low control, perceived job insecurity and feeling upset on job). According to their results, being bothered or upset at work is one of the three factors that mostly impair the quality of sleep.

However, the quality and quantity of sleep can be examined not only as response variables. Deterioration in the quality of sleep may cause the decline of productivity at work (Metlaine 2005). Therefore, the relationship between work and sleep is circular in nature. Poor working conditions (shift work, night work, work-related stress) can result in poor sleep, while in the long run, lack of sleep will cause weak job performances, higher rates of absenteeism, and will increase the risk of accidents.

2 The current study

On the basis of the two theoretical traditions described, we wish to examine whether the management of time in the individual's life or the structural theory is more closely supported by the data of the Hungarian Time Use Survey 2009-10.

On the one hand, based on the economic theory of sleep we expect that a higher level of education and a stronger embeddedness in the labour market reduce the time spent on sleep. This is presumed to be a linear relationship. This theory suggests that as the presence of women in the labour market is smaller, they sleep slightly more than men. At the same time, based on this theory, we would expect that young and older people, the age-groups outside active age, sleep more than those who are economically active.

On the other hand, based on the structural theory we expect that the social groups with a lack of autonomy (or with a low autonomy) have less freedom for this transaction. Typically, these groups consist of people with low levels of education, poor housing conditions, and economically inactive or unemployed statuses. Moreover, their timetable is constrained by family life. However, a lack of autonomy may result in less sleep or more sleep, depending on the type of the restrictive mechanism. Certain factors, like family life, generate activities which compete with work, while other factors directly affect the sleep-work exchange. Based on structural theory, we would expect that married people and people with young children sleep less; at the same time, we would also expect that poor housing conditions and the occurrence of chronic diseases increase the duration of sleep.

In the further part of the study we will try to answer the question whether the sleep-work tradeoff or rather structural factors influence the sleep duration. As the results show, we can find evidences for both theory, but we can argue more persuasive for one side. In the third part of this paper we briefly describe the background of the analysis, which is Hungarian Time Use Survey, while the fourth part includes the descriptive statistics for the variables used in the analysis. Then in the fifth section regression models based on the theoretical question and the results of the multivariate analysis are described. Finally, conclusions are drawn from the results.

3 The Hungarian time use survey – The data

Time use surveys in Hungary have a relatively long tradition. The first national data collection was implemented by the Hungarian Central Statistical Office (HCSO) in 1963. The first time use research conducted within the framework of an international cooperation was headed by Hungarian sociologist Sándor Szalai between 1965-1966 (Szalai 1972, 1984) and HCSO also had an important role in this. After this starting point, HCSO organised time use data collection and provided a descriptive analysis on a regular basis (Falussy and Zoltánka 1995, Harcsa and Sebők 2002).

Time use diary data have a privileged place in social statistics, since researchers try to grasp the full spectrum of lifestyle with these. There are many fields which could only be examined by special surveys in the absence of time use surveys.

Nevertheless, the overall nature of the survey also has disadvantages, which may cause some limitations for this study. Such a drawback in connection with our current issue is that only the length of sleep can be examined, while its quality cannot, (although it has become possible recently with the development of time-use survey techniques; Ricroch 2011)). Another disadvantage is that the estimation of the amount of time spent on certain activities is based on self-reporting. It should be noted that there is some difference between data gained from objective observation and those derived from self-reporting (Lauderdale et al. 2008); namely, compared to health or medical data collections, the real time spent sleeping is usually overestimated by time use surveys. The reason for this is that actual sleep is not distinguished from the time spent in bed with insomnia or from intervals of falling asleep or awakening. This is caused by the fact that the details of diary entries as well as the activity codelists are limited (Dinges 2005).

Time use surveys in Hungary are conducted by the HCSO broadly every 10 years. The last survey spanned the period between October 2009 and September 2010; it covered a full 12 months period, i.e. 365 consecutive days. The survey, which was based on a multistage clustered sample, covered the population aged 10–84 years, and a total of 8391 people were interviewed using paper-based questionnaires. Its methodology corresponded to the relevant EU recommendations although only one person in a household had to fill in a questionnaire with the exception of households with a child under the age of 15. The response rate was 75% compared to the primary sample frame, but considering the extended sample framework with extra addresses, it was 54%. To eliminate a systematic error caused by non-response, the attributes of non-response were monitored, and the people who refused to answer were superseded with new addresses from a second (backup) sample. After data collection, weighting was assigned based on region, gender and age-groups. The analysed subsample was constricted to 5451 people aged 25-64. In this study unweighted data and one diary per respondent are used, because only a small subsample provides diaries for two days.

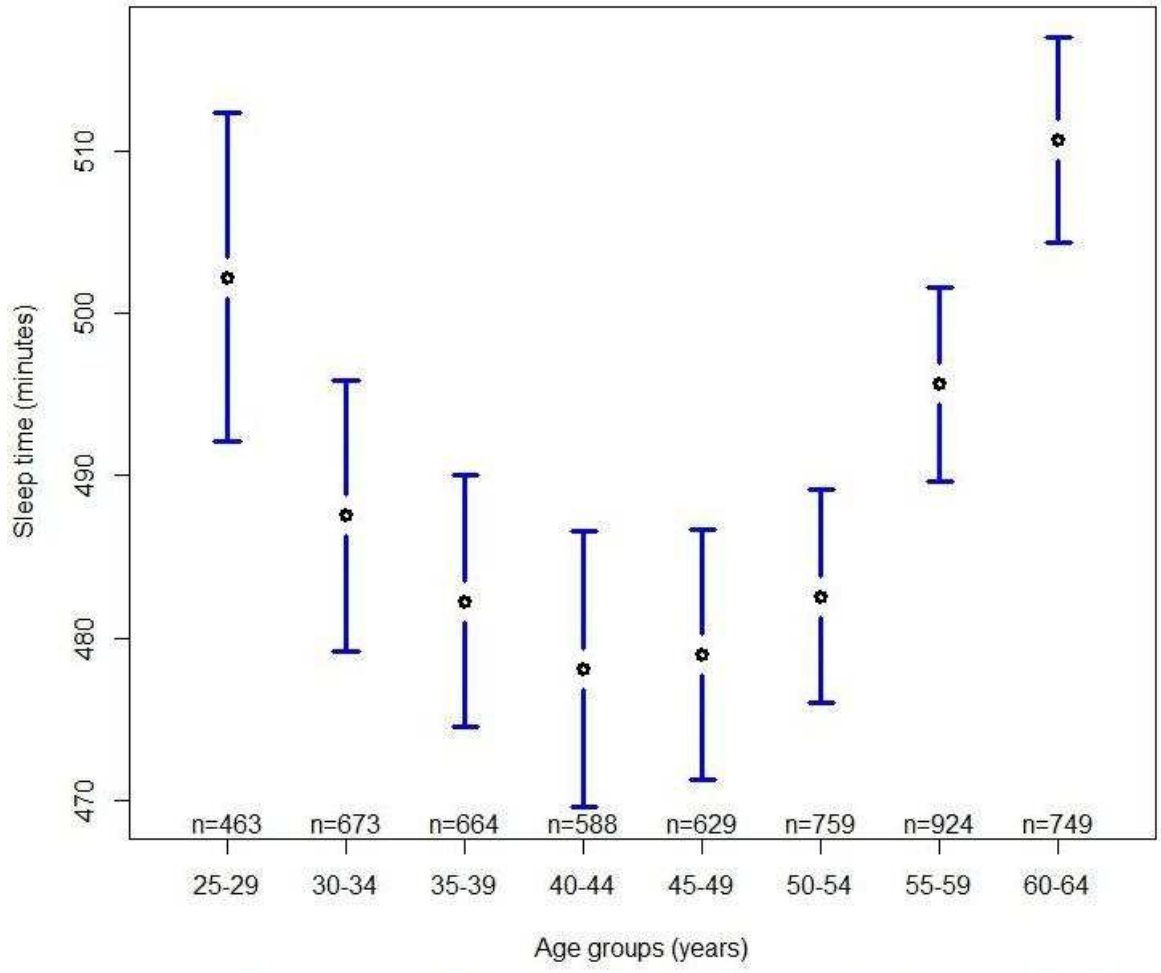
In the coding process of the time use diaries, a detailed activity coding list was applied consisting of 548 primary activities. In the analysis, we used the primary category of sleeping without

relaxation, but we added all the sleeping activities which occurred during the day. The explanatory variables were derived from the household and personal questionnaires, with the exception of working time, which was also a diary-based activity. This work activity encompasses all the earning activities that were carried out by a respondent.

4 Descriptive results

The analysis was restricted to the 25-64 year-old population. This is the economically active age (or working age) population, which – although it is still a broad category – is a relatively homogeneous group from the viewpoint of the lifestyle. The tradeoff between work and sleep in this agegroup is a relevant question. Based on the results collected in Hungary, sleep time by age is characterised by a moderately U-shaped curve (Figure 1).

Table 1
Mean sleep time by age-groups with standard errors

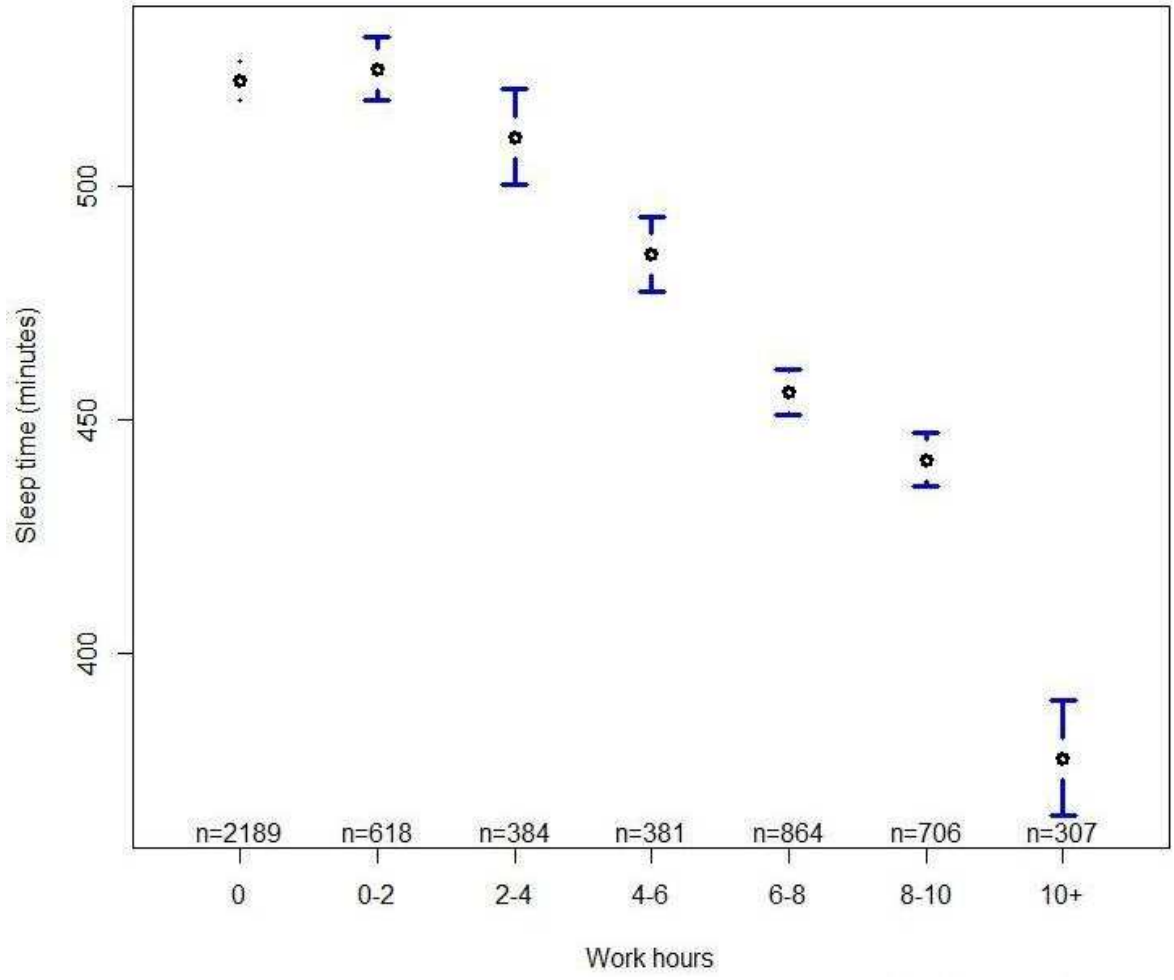


Source: Hungarian Time Use Survey 2009-2010, own illustration.

Thus younger and older people tend to spend more time with this basic activity, while the middle generation spends less time on it. The difference is significant between the terminals and the mid age-groups, but it is not between the groups next to each other.

Figure 2 shows that there is an inverse relationship between the time spent working and the time spent sleeping. People who work a lot sleep definitely less than those who do not work or work for just a few hours (2 hours at the most). As figure 2 indicates, there is no difference between the group without work and those who work only a few hours per day, mostly as part time workers.

Figure 1
Mean sleep time by working time categories with standard errors



Source: Hungarian Time Use Survey 2009-2010, own illustration.

In Table 1 we summarized the descriptive statistics of sleep time broken down by categorized explanatory variables. This shows that women sleep slightly more than men. It is well known from other studies, and it is also confirmed by our data that the surplus in women's sleep disappeares in old age. Women's sleep surplus in the population aged 25-64 was altogether 8 minutes (their total sleep length was 8 hours 14 minutes). According to marital status, married persons spend less amount of time sleeping than unmarried people; the difference was 15 minutes.

Table 2
Descriptive statistics of sleep time by categorized explanatory variables and one-way anovas by single variables (unweighted sample, population aged 25-64)

Variables	Categories	N	Min	Max	Mean	Median	Std dev.	F-value	P-value
Gender	Male	2473	15.0	1110.0	485.7	480.0	107.3	8.44	0.004
	Female	2976	5.0	945.0	493.6	490.0	92.5		
Marital status	Not married	2224	5	945.0	497.1	495.0	105.0	19,37	0.000
	Married	3225	10	1110.0	485.1	480.0	95.3		
Education	Below lower secondary education	117	165.0	810.0	524.2	540.0	109.2	8.90	0.000
	Lower secondary education	915	5.0	875.0	499.2	505.0	100.7		
	Upper secondary education	3338	10.0	1110.0	488.2	480.0	101.2		
	Tertiary education	1079	60.0	810.0	484.1	480.0	90.7		
Chronic diseases	Without chronic illness	3398	5.0	1110.0	483.1	480.0	99.8	43.06	0.000
	With chronic illness	2051	60.0	910.0	501.3	500.0	98.0		
Child under 7 years	Has no children	4326	10.0	1110.0	490.2	480.0	98.4	0.05	0.815
	Has children	1123	5.0	920.0	489.4	480.0	103.6		
Quality of housing	Standard or higher	5071	10.0	1110.0	489.1	480.0	98.7	5.61	0.018
	Sub standard	378	5.0	945.0	501.7	495.0	109.7		

Source: Hungarian Time Use Survey 2009-2010, own calculations.

Mean sleep time changes in the reverse direction by educational attainment. People belonging to the lowest category of educational attainment (Below lower secondary education) sleep 40 minutes longer than the most educated (tertiary education). The biggest difference between the averages of sleep time was at lower secondary education and below this level. The presence of a child seemingly does not have a remarkable impact on the duration of sleep in the total population (we will see from the multivariate analysis that in the case of women it is not true). People who have children under 7 years sleep only 1 minute less than those who do not have children, and this difference was not significant. Among people living under unfavourable housing conditions[2] (which can be regarded as an indicator of living standards), we found an average of 13 minutes longer sleep. The average daily sleep time of those suffering from a chronic (outstanding for at least 6 months) disease is 18 minutes longer than that of the healthier majority.

To sum it up, data support the exchange-theory hypothesis of sleep time being converted to activities pursued awake (namely to work), but also allow the existence of other (structural) mechanisms.

Multivariate methodology and regression results Source: Hungarian Time Use Survey 2009-2010.

5 Multivariate methodology and regression results

We tested our hypotheses with three models. The first one is a simple demographic model (model 1), which examines the impact of age, age-square and gender on sleep. The second one is an exchange-theoretical model, which in addition to the previous factors, also includes the impact of the working time and the level of education. In the third (full) model, we have combined the former demographic and exchange-theoretical effects with structural factors which are marital status, presence of a child under 7, occurrence of chronic diseases, and quality of housing. Thus our models were as follows:

1. Basic demographic model (Model 1)

(1) $$\text{Sleep time} = f\left(\text{age}, \text{age}^2, \text{gender}\right)$$

2. Exchange model (Model 2)

(2) $$\text{Sleep time} = f\left(\text{age}, \text{age}^2, \text{gender}, \text{working time}, \text{education}\right)$$

[2] According to the definition of HCSO, substandard dwellings are apartments without kitchen and of a full size of less than 50 sq. metres or if one of the following characteristics is true: lack of toilet; lack of bathroom; lack of waste-water drain channel; lack of groundwork and the walls were built of adobe.

3. Full model, that is the exchange with structural constraints (Model 3)

$$\text{Sleep time} = f\left(\begin{array}{l}\text{age, age}^2\text{, gender,working time, education, marital status,}\\ \text{presence of child under 7, occurrence of chronic diseases,}\\ \text{quality of housing}\end{array}\right) \quad (3)$$

The income variable has been excluded from the models because of the poor quality, whereas it is obvious that is has a great importance from both theoretical and empirical aspects. However there is a strong relationship between the level of education and income in Hungary (Kézdi 2005), so the level of education as a proxy variable could be used. Beside this the quality of housing was also used as an indicator of living conditions or risk of poverty.

Obviously, a multivariate analysis may exhibit a more accurate picture. As a starting point we applied OLS regression on the subpopulation aged 25-64 to examine the relationships between sleep time and (its) covariates. We excluded two individuals with no sleep time. The dependent variable was mean sleep time per day based on the time use diary, measured in minutes. Predictor variables were the following: age, age-square, gender, working time (mean working time per day, based on the diary, measured in minutes), education, marital status (married, not married), presence of a child under 7, occurrence of chronic diseases, quality of housing. Level of education was introduced as a categorical variable.

Linear regression makes strong assumptions, but often these requirements do not hold (Fox 2008). In our model, the variance of errors was not identically distributed, they are heteroskedastic, as it was revealed by the employed Breusch-Pagan test (Breusch-Pagan 1979) and White test, as well (White 1980). As a consequence, the OLS estimator is still unbiased and consistent, but it is no longer efficient (Baum 2006: 146). Depending on the nature of heteroscedasticity, standard errors of the estimates are biased, and they can be too high or too low. The "Huber-White Sandwich Estimator" providesrobust standard errors and hence accurate p-. Analyses were performed by using the respective Stata software.

It should be mentioned that the OLS standard errors were considerably smaller, thus biased downward, relative to the robust estimates. Here we show only the robust regression coefficients (Table 2). In the first model (basic demographic model), we could see the significant effect of age, age-square and gender. Besides these variables, the second (exchange theory) model confirms the effect of work on sleeping, and the impact of education is demonstrable. People with the highest educational level (tertiary education) sleep 19 minutes less than those with the lowest educational level (below lower secondary education). In the third (full) model, the effect of education is not significant, but the effect of marital status, the presence of children and chronic diseases shows up, the latter two with weak significance levels. We tested the model separately for females and males, as well, and we found significant differences between men and women in the mechanisms affecting sleep. The model for females reveals that married life and the presence of a child under 7 years decrease sleep duration, while in case of males the role of education is more decisive besides work.

Table 3
Sleep duration – Estimated coefficients and standard errors (in brackets) from robust regression models

				Model 3 separated for gender	
	Model 1	**Model 2**	**Model 3**	**Female**	**Male**
R^2	0.015	0.192	0.194	0.162	0.229
DF	5445	5441	5437	2965	2462
Age	-8.32***	-2.71*	-2.39*	-2.55†	-3.10*
	(1.13)	(1.04)	(1.05)	(1.37)	(1.61)
Age^2	0.10***	0.03*	0.02*	0.02	0.03†
	(0.01)	(0.01)	(0.01)	(0.02)	(0.02)
Female	7.37**	6.14*	6.66*	–	–
	(2.72)	(2.51)	(2.51)		
Work		-0.18***	-0.18***	-0.17***	-0.20***
		(0.01)	(0.01)	(0.01)	(0.01)
Lower secondary education[a]		-11.33	-10.27	0.81	-25.61
		(10.57)	(10.79)	(13.29)	(18.06)
Upper secondary education[a]		-15.10	-13.22	-1.32	-30.14†
		(10.24)	(10.62)	(13.12)	(17.69)
Tertiary education		-18.54†	-16.03	-5.97	-31.45†
		(10.43)	(10.83)	(13.39)	(18.03)
Married			-6.48*	-9.31**	-1.46
			(2.56)	(3.24)	(4.38)
Child under 7 years			-6.14†	-14.90***	4.30
			(3.36)	(4.35)	(5.19)
Chronic diseases			5.17†	5.33	4.83
			(2.75)	(3.49)	(4.38)
Substandard housing			-2.03	7.69	-3.23
			(5.62)	(7.51)	(8.40)

a: Below lower secondary education is the Reference category,
Significance codes: ***99.9%, **99%, *95%, †90%,
Source: Hungarian Time Use Survey 2009-2010, own calculations.

6 Conclusion

The tradeoff between sleep time and working time seems to be supported by the results. In addition, people with higher education appear to sleep significantly less than those with a lower one, which underpins even more the exchange theory's hypotheses.

According to all models, we can observe a U-shape association between sleep time and age. This association was also observed by Tune (1968) and by Basner et al. (2007), the latter study having been based on the data of the American Time Use Survey. However, this relationship

does not appear to be universal because Biddle and Hamermesh (1990) detected a different pattern for the two sexes: they found an inverse U-shaped (concave) relationship among men and a U-shaped (convex) one among women. These findings were based on data from the 1975-76 US Time Use Survey, which was conducted by the University of Michigan. In the full model separated for women, the U-shape relationship disappeared between age and sleeptime.

The impact of gender was only 8 minutes according to the descriptive data, and this gap between the two sexes was slightly smaller in the multivariate regression. At the same time, we observed different mechanisms for the two genders when we separated our model, which could be interpreted as a gendered trade-off. In the case of women, marriage and the presence of a child (under 7 years) are determining factors in sleep time beside work, while in case of men they are not. For men, the amount of sleep is primarily determined by the level of education and activity in the labour market. This difference can be explained by the well-known fact that in families, women typically reduce their paid work and do more unpaid work and child care, while men spend more time on paid work. This strong trade-off is the main finding of our study, which was verified by others earlier as well (Biddle and Hamermesh 1990, Szalontai 2006, Basner et al. 2007).

The results also exhibit an additional independent effect of chronic diseases on sleep-work transaction. Finally, substandard housing did not prove to be significant. Although it could be an appropriate indicator of deprivation, the level of education provides a much stronger prediction for the living conditions or even for the risk of poverty in the Hungarian social-economic environment (Kapitány – Spéder 2004, Kézdi 2005).

In the model separated for men, the role of education and the role of labour market participation seem to be priorities. Education decisively determines the chances of life. In the case of women, the increase in the level of education did not reduce significantly the time spent sleeping, but family life carries other determining factors in addition to age and work. The effect of family life can be interpreted as another trade-off between the sexes that is organically connected to the exchange between sleep and work. (Nevertheless, it could also be argued that family is a structural constraint, which basically determines the tradeoff between sleep and work.) This tradeoff between the sexes would require further investigation, but technically this could be tested properly on a time use dataset, which contains a household sample and both adult members of the household.

We have not examined the quality of sleep though it is likely that there is a stronger relationship between the sleep quality and the structural constraints (Burgard Ailshire 2009, Burgard 2011).

Our main result is that the duration of sleep is strongly linked to work. The contradiction between the two theories – methodological individualism vs. structuralism – appears to dissolve in the light of this empirical finding. Namely, the labour market participation has two side, a voluntaristic action side and a structuralistic one – regarding the fact that below a specific level of education the chance of integration in the labour market is very low. We can add to this

emipirical finding, that in Hungary the presence in the labour market – due to the low level of capital in the Hungarian population – has a great importance and the lifestyle of people who are integrated in this market is significantly different from those, who are unemployed. This can be seen well on sleep which is one of our basic physiological activity.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 57-72 ***dx.doi.org/10.13085/eIJTUR.11.1.57-72***

Unraveling the mystery of sleep duration dynamics – Sleep in the objective and subjective lives of employed men and women

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Abstract

This paper addresses the place of sleep duration - objectively and subjectively - in the lives of employed men and women in Canada, based on data in Statistics Canada's 2010 General Social Survey no. 24, with an emphasis on time use. It addresses the mystery of how public opinion reflects a view that night-time sleep has declined in duration during a decade when surveys show that it has increased. A further mystery is why women in particular feel sleep deprived when comparable surveys show greater durations for women over men. Analyses were carried out on 10,201 men and women between the ages of 25-64, to eliminate the special situations of youth and the elderly on free time and sleep in recent decades. Analyses of the 6,608 employed persons in this age range showed that employed women spend less mean time than employed men in paid employment, more time in domestic work, equal time with their partners in child care, and more time asleep than their partners. But their reference group is to non-employed women who sleep significantly longer, not to men's sleep durations, and multi-tasking plausibly accounts for stress generally imputed primarily to sleeplessness for this cohort. Data indicate that both the amount and content of multi-tasking impact directly on feelings of time crunch.

JEL-Codes: D11, D12, C21, C39, C51

Keywords: Household behavior, family economics, employed women, sleep duration, stress, time crunch, multi-tasking

An earlier version of this paper was presented to the 35th Conference of the International Association of Time Use Research, Rio de Janeiro, Brazil, August 7-9, 2013. I am grateful to the University of Toronto's Data Library for access to the data files analyzed and for its software and connectivity that facilitate research initiatives such as this. Critical review by eITUR readers stimulated many aspects of this draft.

1 Introduction

In his poem, "The Rime of the Ancient Mariner," Samuel Taylor Coleridge (1996; orig. 1858) described sleep as "… a gentle thing, Beloved from pole to pole." (p. 29) As a necessary activity to human survival which requires roughly a third of people's daily ration of 24 hours, sleep is an inherent aspect of everyday life and hence time-use analysis. The issue is not whether people sleep or even how much they sleep but how such a major phenomen in all people's lives fits into the larger daily life experience. We are concerned about apparent inequalities in who sleeps more and who sleeps less (not least by gender)? But to what extent, as illustrated by Coleridge and many other observers in his wake, is sleep a convenient and familiar mechanism at the surface of a more complex context of factors that help explain the personal impact of a daily round?

Sleep duration has been a focus of research attention in the past thirty years, in connection with societal developments having to do with increased paid employment by women, the personalization of electronic communications and entertainment devices, the expansion of hours in which stores and other facilities are open to the public, and the increasing privatization of means of transportation. These have all led to the conclusion in the eyes of observers that most people are sleeping less than before because they are taking time previously given to sleep to accommodate the accumulation of new roles and activities, as well as travel to get to them all during various times of the day. According to Melbin (1978, p. 100), "The last great frontier of human migration is occurring in time – a spreading of wakeful activity throughout the twenty-four hours of the day." Women, in particular, faced with the so-called "double day" accompanying more widespread paid employment while continuing the performance of gender roles during a "second shift" of unpaid domestic work and child care, are observed from a largely qualitative study of fifty families in California to have to take time from their allocation of sleep to make this possible, encountering as a result an increased number of time-pressures and strains (Hochschild, 1989).

Yet, the generally-assumed impact of these widespread societal changes on sleep diminution during this period is not supported by time-use research. In his analysis of international time-use trends in the latter half of the 20th Century, Jonathan Gershuny noted in 2000 that the amount of time people spend sleeping was relatively unchanging in the long run, despite changes in time devoted to other activities (2000). Robinson and Godbey (1997) had came up with similar conclusions after studying American time-use from 1965, 1975, and 1985. Tyler Frederick and I further confirmed sleep inelasticity in our analysis of Statistics Canada's time-use survey data from 1986, 1992, and 1998 (Michelson and Frederick, 2005).

My later analysis of Statistics Canada's time-use surveys, extended to 2005, in fact showed an *increase* in mean nightly sleep that was not found in the earlier surveys, as well as more sleep found among women than men (Michelson, 2010). An expansion of this analysis that included

data from the American Time Use Survey and data assembled by Kimberly Fisher and John Robinson of selected nations from the Multinational Time Use Study archive in Oxford supported both unexpected trends: towards an increase in sleep over time and greater sleep by women than men (Robinson and Michelson, 2010).

While these trends were not universal, they occurred in a clear majority of nations and studies, challenging a view in the academic public that projected multifaceted observations of a growing trend to employment by women onto the specific factor of sleep duration. The emerging findings about sleep have been supplemented by a more recent analysis of American Time Use Survey data showing that while employed mothers get no less sleep do men in the same situation, they do undertake more onerous unpaid work and encounter greater time pressures in this context (Milkie, Raley, and Bianchi, 2009). This American picture was duplicated in more recent research in Korea (Cha and Eun, 2014). Additional support for the trends shown in previous Canadian surveys appeared in the 2010 General Social Survey, showing a mean sleep duration of 495 minutes per night, comparable to the 2005 level of 497 minutes (Statistics Canada, 2010) and remain higher than in the time-use data in the earlier surveys up to 1998.

This paper utilizes data from 2010, in the most recent in the series of year-round time-use surveys conducted by Statistics Canada since 1986. The 2010 survey, like those preceding it, includes a yesterday time-budget along with an extensive set of socio-demographic and subjective questions having both overlaps and innovations compared to the previous surveys. Data were obtained from telephone interviews of a representative sample of the Canadian population. Many of the questions are similar to those in previous surveys, but others reflect strategic one-time decisions. The data files for these surveys are entirely separate, given their respective differences in size, substance, and, often, format. The 2010 sample yielded 15,390 respondents.

The objective of this paper is to shed light on the mysterious personal and statistical associations linking female employment to sleep deprivation. The analytic sections of this paper that follow focus, first, on why the population statistics on sleep duration trends might be irrelevant to the perceptions of employed women and, second, what *empirical grounds* for feelings of temporal inequality among employed women arise from the pressures of paid employment, apart from absolute duration of sleep, that give currency to perceptions now projected onto the singular phenomenon of sleep duration?

2 Employed women in an aging population

Table 1 shows that in 2010 Canadians from the age of 15 slept a mean of 8 hours and 15 minutes (i.e. 495 minutes) per day. By gender, this amounts to 488 mean minutes for men and 500, for women. A gender difference in favor of *more* sleep for women is found within each of the seven age brackets studied. Analysis of variance establishes that these gender differences are highly significant, occurring by chance less than once in 10,000 occurrences ($F = 44.646$,

d.f. = 1, 15,389, p = .0000). Mean sleep duration varies significantly as well for both men and women by their age bracket (F = 72.153, d.f. = 6, 15,389, p = .0000).

There is an easy, though partial solution to the part of the mystery arising from the literature having to do with *increasing* sleep over time. Sleep has been shown inversely correlated with time devoted to paid employment (Michelson & Frederick, 2005). The Canadian population has been gradually aging. The percentage of respondents aged 65 and over in the four Canadian time-use surveys between 1992 and 2010, has gradually increased from 16 per cent to 24 per cent of the population. Therefore, as employment levels are lower in both the pre-adult and senior age brackets, and the latter bracket has increased in percentage of the population it should be neither a surprise nor a mystery that mean sleep in the population has increased over time.

Table 1
Mean durations of night/essential sleep by sex and ten year age group

	Mean minutes of sleep			Number of cases		
Age groups	Male	Female	Both	Male	Female	Both
15 to 24	540	541	540	699	678	1,377
25 to 34	486	501	495	793	1,131	1942
35 to 44	470	486	479	1,087	1,366	2,453
45 to 54	471	481	476	1,314	1,654	2,968
55 to 64	477	495	487	1,329	1,700	3,029
65 to 74	492	507	500	934	1,127	2,061
75 years and over	516	522	520	566	1,012	1,578
All ages	488	500	495	6,701	8,689	15,390

Source: Statistics Canada General Social Survey 24 (2010), own calculations.

However, Hochchild's image of the impact on sleep of the double day focusses on the employed woman, not on teenagers, the elderly, and persons otherwise outside the labor force due to choice, ill health, or retirement. Table 2 therefore restricts the analysis of sleep duration by gender to only respondents between the ages of 25-64. And Table 2 breaks down this subsample by whether paid employment is the main activity of the past seven days compared to alternatives such as housekeeping, retirement, volunteer work, and education. Sleep duration can be seen in this table to be markedly lower among those with paid employment, compared to all of the other categories of main activity. This contrast between respondents having paid employment and those not is statistically significant at a very high level (F = 102.673, d.f. 1, 10,200, p. = .0000).

Table 2 shows that sleep duration among women in the 25-64 year age range with paid work (481 minutes) is markedly lower than was shown in Table 1 for women in the population at large (500 minutes).

Table 2
Mean durations of night/essential sleep by sex and main activity in the past 7 days among Canadians aged 25-64

Main activity in past 7 days	Mean minutes of sleep			Number of cases		
	Male	Female	Both	Male	Female	Both
Paid work	467	481	474	3,253	3,350	6,603
Other	496	502	500	1,205	2,393	3,598
All Main activities	475	490	483	4,458	5,743	10,201

Source: Statistics Canada General Social Survey 24 (2010), own calculations.

This could be construed as evidence supporting the dysfunctions of a pattern of life grafting a second regular demand for everyday activity on the shoulders of employed women. From a psychological point of view, this could be an example of feelings of *relative deprivation* arising from comparing one's lot in life with that of particular reference groups of others (c.f. Stouffer, 1949; Merton, 1949); in this case, these are two: women in both older and younger age cohorts and women without regular employment commitments.

The reality of this situation must be more complex than what we learn from a sole focus on minutes of sleep. This becomes evident in Table 2 when the gender comparison is examined. This table shows that women with paid employment as their main activity and aged 25-64 sleep significantly more per night than do men in the same situation (481 minutes a night to 467 minutes a night ($F = 24.103$, d.f. 1, 20,200, $p = .0000$)). If we are to accept the feelings of dysfunction noted in the feminist literature as arising from women's combination of domestic and paid employment commitments, then evidence beyond sleep duration alone would be helpful. To delve into such matters, it is instructive to incorporate into consideration more contextual and subjective data about the experience of daily life - and not displace the symptoms onto sleep duration in the absolute.

3 Sleep duration dynamics and inequality – Contextual and subjective experiences

3.1 Activity tradeoffs

What is happening in the lives of *employed* men and women that may create feelings of exhaustion despite increasing durations of sleep?

Table 3, based on the most recent Canadian national time-use study in 2010, compares the extent that employed men and women aged 25-64 spend differential amounts of time on each of seven different categories of activity across the day, that account for nearly 1300 of the day's

1440 minutes. Six of the seven activities (child care excepted) show highly significant statistical differences by gender.

Table 3
Total duration of time spent in the day in selected major activities by employed persons aged 25-64

	Mean daily time in specific activities			Degrees of	
Activity	**Men (N=3253)**	**Women (N=3350)**	**F (sex)**	**freedom**	**P (sex)**
Sleep	467.01	481.06	27.449	1,6602	.0000
Paid work	411.90	353.50	64.584	1,6602	.0000
Domestic work	89.59	127.38	146.878	1,6602	.0000
Child care	28.01	28.32	1.132	1,6602	.2873
Entertainment	61.39	76.58	23.351	1,6602	.0000
Media	132.53	117.06	30.776	1,6602	.0000
Travel time	87.76	81.32	8.736	1,6602	.0031

Source: Statistics Canada General Social Survey 24 (2010), own calculations.

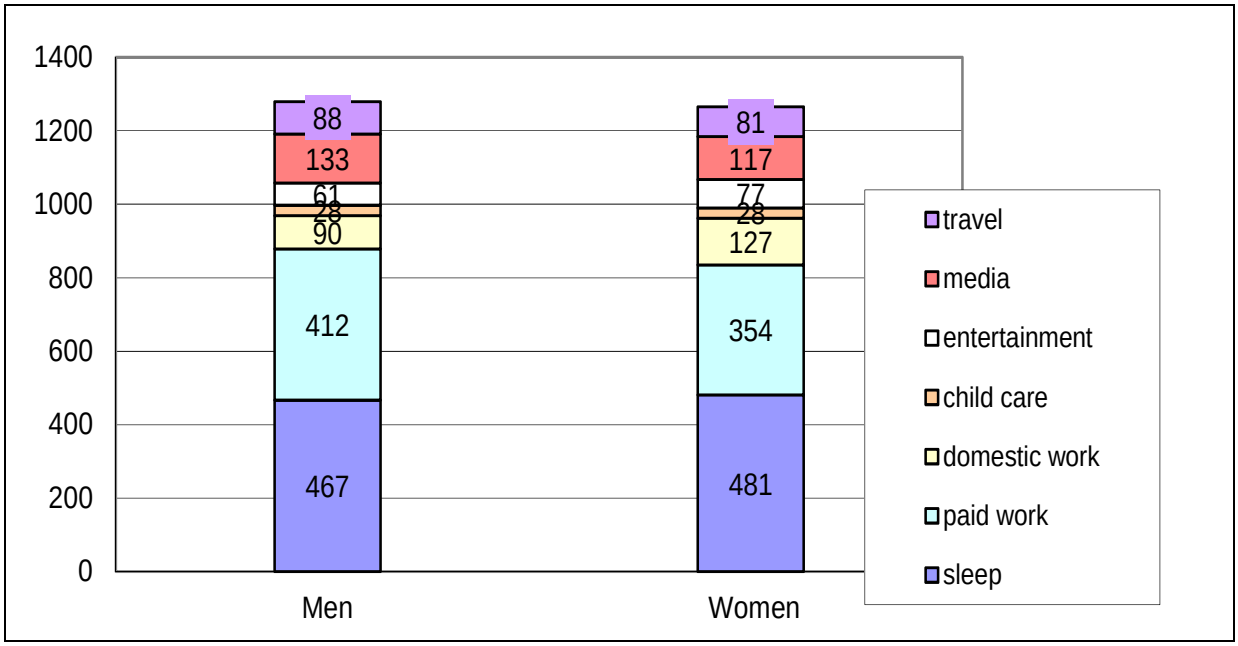
One way of examining this is to observe visually the *balance* of major activities in the day, not the duration of any one alone. Figure 1 continues with the subsample of employed Canadian men and women aged 25-64 in 2010. This is a stacked bar graph in which the respective times devoted to the seven prominent activities are portrayed for men and women.

The segments of the stacked bar at the bottom of each gender bar show the mean durations of sleep. Although of statistical significance on the basis of a large sample (see Table 3), these differences are not as compelling as in a pattern with respect to time in other activities.

While all respondents in this subsample are employed and in their traditional working years, what the chart shows very clearly is that the women spend much less time than men in their paid employment, along with visibly greater time in domestic work. Child care, however, is just the tip of the iceberg, as much of it is not reported as a primary activity; the likelihood is that it is being done as a secondary activity, almost certainly with domestic work.

While women are more likely to take responsibility for entertaining than men, the latter devote noticeably more of the day on the various passive media. Thus, while both men and women in this analysis are employed, the contents and proportions of their daily packages of activity are different. The contexts and demands of their everyday packages of activity while awake are not the same. Laurijssen and Glorieux (2012) suggest from their research that employed women can keep their days in balance only by cutting back on their hours of employment. Figure 3 shows what else has to be fit into place as a tradeoff for marginal hours of employment, as well as what else is sacrificed within the limits of twenty-four hours. Sleep is *not* one of them, but time in passive leisure (in the form of media) is. Working hours are exchanged for unpaid work, the extent of which is not yet fully obvious on Figure 1 (which does not consider simultaneous activities).

Figure 1
Gender comparison of time devoted to selected major activities in the day – Employed persons aged 26-64



Source: Statistics Canada General Social Survey 24 (2010), own illustration.

The experience of the daily package of commitments for which employed women are responsible is not the same as for men. The parts of women's package are more likely to interact with difficulty than men's. Women's double day is not a *doubled* day. But it is a *juggled* day. While women's daily package may not cut heavily into sleep, as commonly thought, that does not mean it is without *subjective* impact.

3.2 Time crunch

John Robinson's Time Crunch index is typically applied to the subjective side of everyday life (c.f. Robinson, 1988; Robinson & Godbey, 1997; Michelson, 2005, pp. 35, 86, 96, 104). The greater number of ten statements about subjective feelings concerning aspects of daily life with which respondents agree, the greater is the degree of imputed time crunch[1]. A comparison of

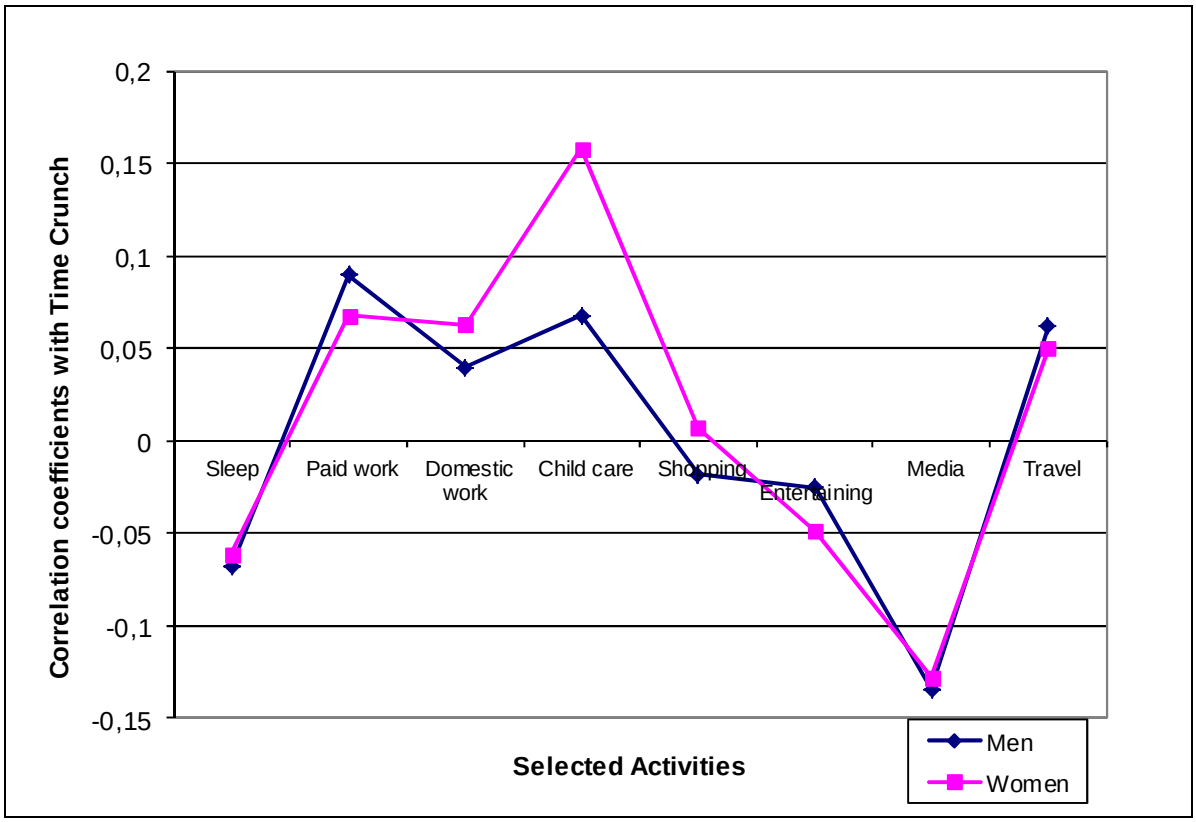
[1] The ten statements comprising the Time Crunch index, as displayed in the variable list for Statistics Canada's General Social Survey no. 24 (2010) by the University of Toronto Data Centre (http://sda.chass.utoronto.ca/cgi-bin/sda/hsda?harcsda3+gss24m) are as follows:

- Do you plan to slow down in the coming year?
- Do you consider yourself a workaholic?
- When you need more time, do you tend to cut back on your sleep?
- At the end of the day, do you often feel that you have not accomplished what you had set out to do?
- Do you worry that you don't spend enough time with your family or friends?
- Do you feel that you're constantly under stress trying to accomplish more than you can handle?
- Do you feel trapped in a daily routine?
- Do you feel that you just don't have time for fun any more?

time crunch scores for the same selection of employed men and women aged 25-64 shows that, even though women by and large get more sleep, their daily situations generate greater feelings of time crunch than is the case for men. On a scale of 0-10, women's mean time crunch score is 4.16, compared to 3.67 among men. Analysis of Variance shows that this degree of difference among 3,350 women and 3,253 men is not likely to occur by chance as frequently as once in a thousand times ($F = 58.704$, d.f. 1, 6602, $p < .0000$).

The relationship of male-female differences in time crunch to the daily package of activities that differentiates them is shown in Figure 2.

Figure 2
Correlation coefficients of time crunch with time devoted to selected activities among employed men and women aged 25-64



Source: Statistics Canada General Social Survey 24 (2010), own illustration.

This figure plots male-female differences in the Pearson correlation coefficient between their Time Crunch score and the time they put into each of the activities in the package portrayed in Table 3 and Figure 1. Where women exceed men in their positive correlations between time crunch and daily activity durations is with respect to domestic work, shopping, and child care. Women spend marginally more time than men on domestic work, and the varying daily durations of time devoted to domestic work are somewhat more highly correlated with feelings of

- Do you often feel under stress when you don't have enough time?
- Would you like to spend more time alone?

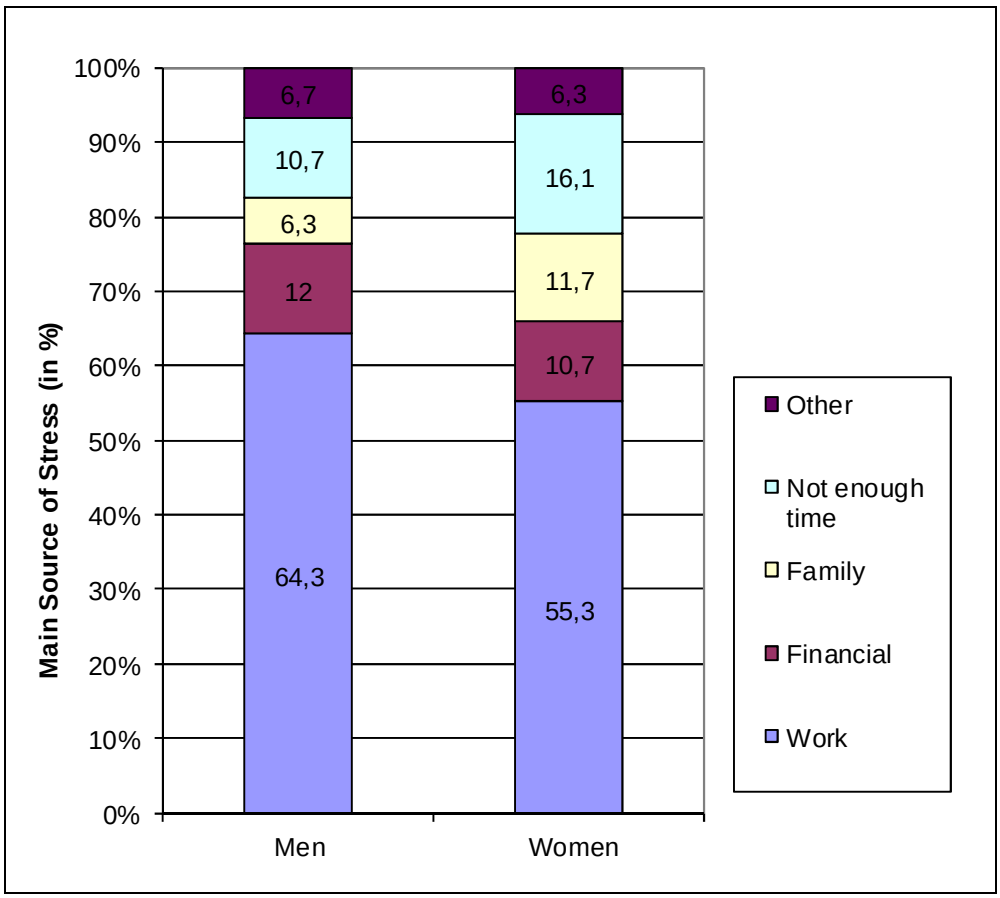
time crunch among the 3350 women than among the 3253 men but not of statistical significance (z = 1.018, p = 0.3086). However, while employed men and women are shown in Table 3 and Figure 1 to spend an equal amount of time on child care, Figure 2 shows that the correlation of total child care time with feelings of time crunch is much greater for women than for men, a statistically-significant difference (z = 3.4980, p = .0005).

More generally, the time crunch findings complement our interpretation of Figure 1, on the extent that women have to juggle household work and child care with work more fully than do men within the waking day, to the detriment of passive leisure rather than sleep. This is not just a neutral juggling of time, but a phenomenon with subjective implications.

3.3 Sources of stress

These findings on time crunch are substantiated by answers shown in Figure 3 to a stylized question, "What is your main source of stress?" Women are clearly more likely than men to attribute their feelings of stress to “family” (11.7%), and, more generally, to “not enough time”(16.1%), while the latter are more likely to cite traditionally male sources of stress having to do with work and financial circumstances.

Figure 3
Breakdown by gender of main sources of stress among employed persons aged 25-64



Source: Statistics Canada General Social Survey 24 (2010), own illustration.

While these gender leanings are statistically significant [chi square(6) = 84.40, p=0.00], they do no more than to complement the data in previous sections on activity tradeoffs and time crunch, as the majority of employed women also specify paid work as their main source of stress (though less so than men). Figure 3 also portrays graphically the degree that employed men and women share some of the same sources of stress while yet differ on others. Stress arising from family and insufficient time acts more as a supplement for employed women on top of the major concerns they share with men.

How much of the stress arising with regard to paid work, family, not enough time, and "other" is a function of insufficient amounts of sleep in the day, as compared to time used for other purposes in the course of the busy, varied day? The degree of impact by lack of sleep on women's feelings of personal stress in the context of other major demands on time can be observed in Table 4, from a multiple regression analysis with the Canadian 2010 data. In this analysis, the time crunch variable is the dependent variable.

Table 4
Regression coefficients on feelings of time crunch (Women: N = 3,350)

Independent Variables	Beta	Standard Error (Beta)	T-statistic	Probability
Sleep duration	-.017	.019	-.928	.354
Duration paid work	.096	.022	4.346	.000
Duration domestic work	.096	.019	4.920	.000
Duration child care	.153	.017	8.886	.000
Duration media	-.002	-.082	-4.538	.000

R-Squared = .048, F = 33.324, p(F) = .000,
Source: Statistics Canada General Social Survey 24 (2010), own calculations.

The independent variables, whose respective impacts on feelings of time crunch are measured, are the durations of time devoted to sleep, paid employment, domestic work, child care, and media. What the regression analysis shows is that, in this context of major daily activities, sleep duration fails to show that it has a significant impact of its own on time crunch. Sleep deprivation surely colors our feelings and health, but these data point with some confidence to perceptions of time crunch arising more directly from other parts of the daily package.

A simple correlation matrix of these variables shows the common finding that the daily duration of paid work among these respondents is inversely related at a very high level with sleep duration (r =-.39), duration of domestic work (-.46), and media duration (-.29). Nonetheless, in the context of these other related parts of the employed woman's day, it is these other variables, not sleep duration, that combine to explain feelings of time crunch. These conclusions are similar to those of Cha and Eun in Korea (2014).

3.4 Multitasking

An important link between differential packages of daily activities by gender and differential feelings of time pressure is the greater presence of *multitasking* among women (c.f. Michelson, 2005, ch. 7). Multitasking is the art of carrying out two or more activities at the same time. Although the admonition that 'you can't do two things at once' has been widely circulated, in actuality people do this frequently. People commonly listen to the radio while driving a car. You can have a conversation while walking the dog. People mind their children while cooking dinner. Some combinations are simple to carry out; others, less so. However, the underlying assumption in this discussion is that increased multitasking in the day of more difficult activities to reconcile contributes to the stress encountered in everyday life. To what extent are employed women more likely than their male counterparts to multitask? Is there truth in the adage that 'women invented multitasking'? Is multitasking a structure of time-use that goes beyond the properties of activities per se to help understand the onset of feelings like time crunch?

Not all time-use studies assess multitasking. But when they do, the time budget matrix of questions includes an additional part to the statement of activity at the episode level, to the effect of "and what else were you doing at the same time?" Multiple answers are often prompted as appropriate, to a maximum of three or even five secondary activities accompanying a single primary activity. Statistics Canada gathered multitasking information for the first time in its 2010 General Social Survey. However, it limited its use when the primary activity was such that asking about simultaneous activities might prove embarrassing to respondents. The lists of primary and secondary activities in this Canadian study are far from identical. Nonetheless, there is still some value in exploring what might be learned, even from less than logically ideal operationalization.

One approach in the present exploration focuses on the mean number of *episodes* in the day that are multitasked. In Statistics Canada's 2010 survey, employed women between ages 25-64 average 6.62 multitasked episodes of activity, while men average 5.58 such episodes. The literature (c.f. Michelson, 2005, ch. 7; Sullivan, 1997; Fisher, Egerton, and Gershuny, 2004) also suggests that women’s days are cut up into more episodes than are men’s, which itself adds more complexity to the day; in this regard, the gender differences were 18.89 to 17.07 in favor of women. In another approach to examining task complexity from multitasking, computed from the Canadian 2010 survey, women multitask 35.0 per cent of their episodes, compared to 32.6 per cent among men. This difference is amplified when the mean number of *minutes* in the day devoted to multitasked activities is displayed. Women average 256.19 minutes in multitasked activities (some of it certainly involving child care), compared to 226.42 minutes by men. The different means of measuring multitasking found in this one survey are consistent and mutually reinforcing in the pictures they paint about gender differences.

Our view, however, of multitasking would be incomplete without exploring *which* activities are being multitasked. All multitasked activities are not equivalent in substance or in potential for the generation of stress.

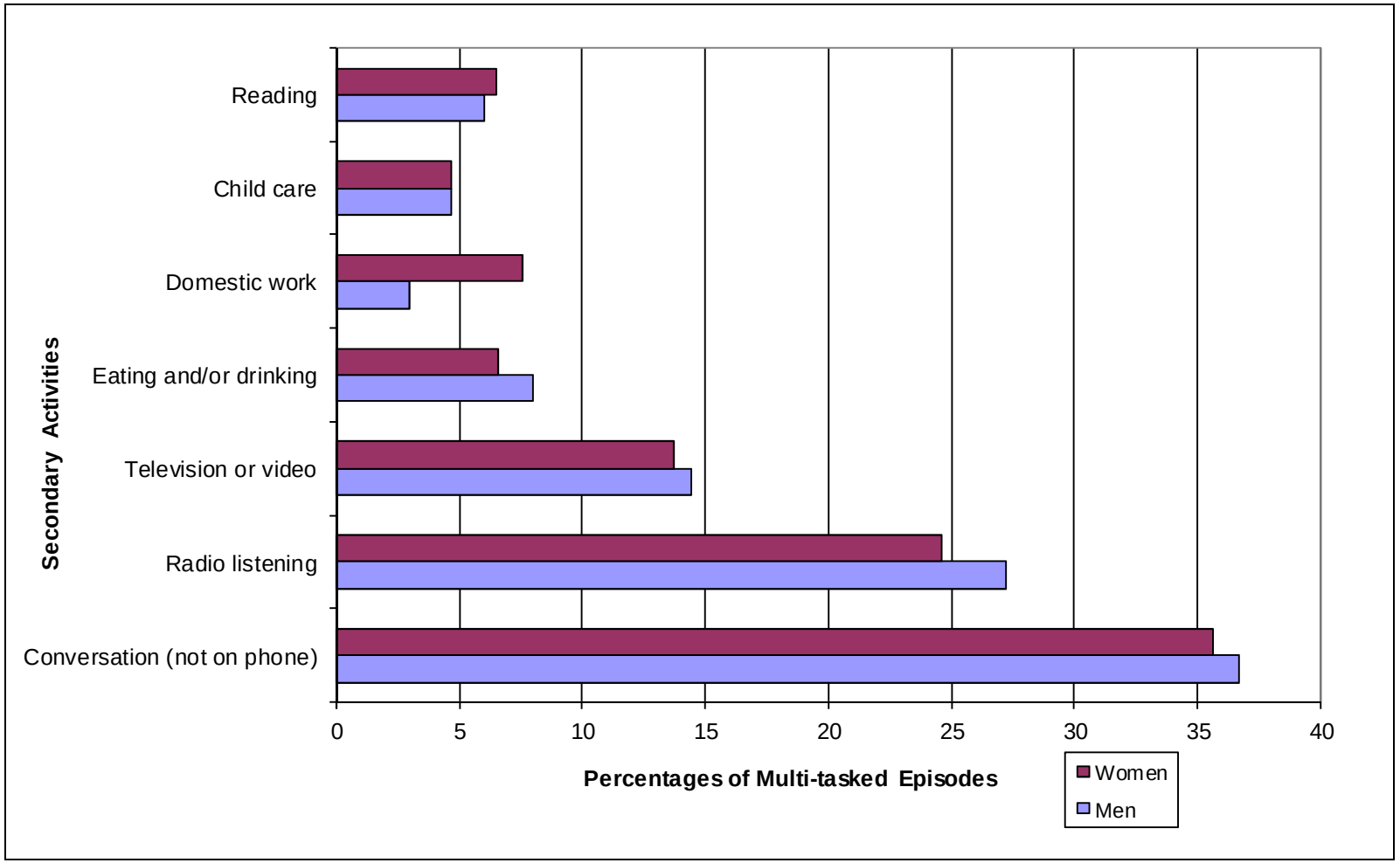
Five primary activities stand out for their accompaniment by secondary activities. Foremost as a primary activity accompanied by a secondary activity is eating at home – of meals and snacks. The most frequent secondary activities in this situation are watching television and conversation. More demanding domestic work is much less frequent while eating (once cooking is completed!). Commuting to and from work also generates much secondary activity, which almost entirely consists of listening to a car radio. Next as an independent variable in multitasking is food preparation, although its frequency as a multitasked activity is only about half that the eating and commuting. In this context, noteworthy secondary activities are television viewing, conversation, domestic work, child care, and radio. Only domestic work among these secondary activities to food preparation shows a noteworthy gender difference (13.1% for women and 8.2% for men). Travel for shopping and services elicits the relatively undemanding secondary activities of radio listening and conversations. Finally, when watching television, conversation is paramount as a secondary activity. Women are more likely than men to be doing domestic work and pet care simultaneous with TV viewing, while men are more likely to be carrying out child care while watching TV (likely while their partners are doing domestic activities as a primary activity). In sum, much simultaneous activity is not onerous. But in the few situations when this is more likely, it is more the experience for women than for men.

This suggests that many secondary activities are more relaxing than demanding, particularly in consideration of the primary activity with which they occur. Yet, gender differences potentially related to stress generation are visible. Figure 4 illustrates the percentage occurrence and gender distribution of seven frequent secondary activities.

Men exceed women in the frequency of four of the seven most common activities when undertaken as a secondary activity Women exceed men in only two, it is not a stretch from Figure 4 to understand the dynamics behind women's greater subjective feelings of stress. Even if much secondary activity is relatively benign, the gender distribution of domestic work and of child care as a secondary activity that adds to significant amounts of primary child care – may help account for greater feelings of stress among women, whether or not they lose sleep as a result (c.f. Offer & Schneider, 2011).

Figure 5 examines more directly the relationship between the number of episodes in which domestic work or child care is the first-named secondary activity and the Time Crunch Index value found among the men and women doing them. Once again, this graph is derived from the subsample of employed men and women aged 25-64 from the 2010 Canadian time-use file. The gender difference is large. For men, the count of episodes of secondary domestic work and child care is flat, by and large unrelated to perceived time crunch. The absolute number of such episodes by men is well below that of women, despite representing more persons in the subsample. In contrast, the slope of the horizontal line representing episodes of domestic work and child care as first secondary activity increases in a nearly linear pattern with the degree of time crunch up to the time crunch value of 7, out of 10. As there are relatively few respondents with crunch index values over 7, it is not surprising that the absolute numbers of these simultaneous activities decline for both men and women at the right side of the chart.

Figure 4
Most Frequent Secondary Activities by Employed Men and Women Aged 25-64 as Percentages of all Multitasked Episodes by Gender

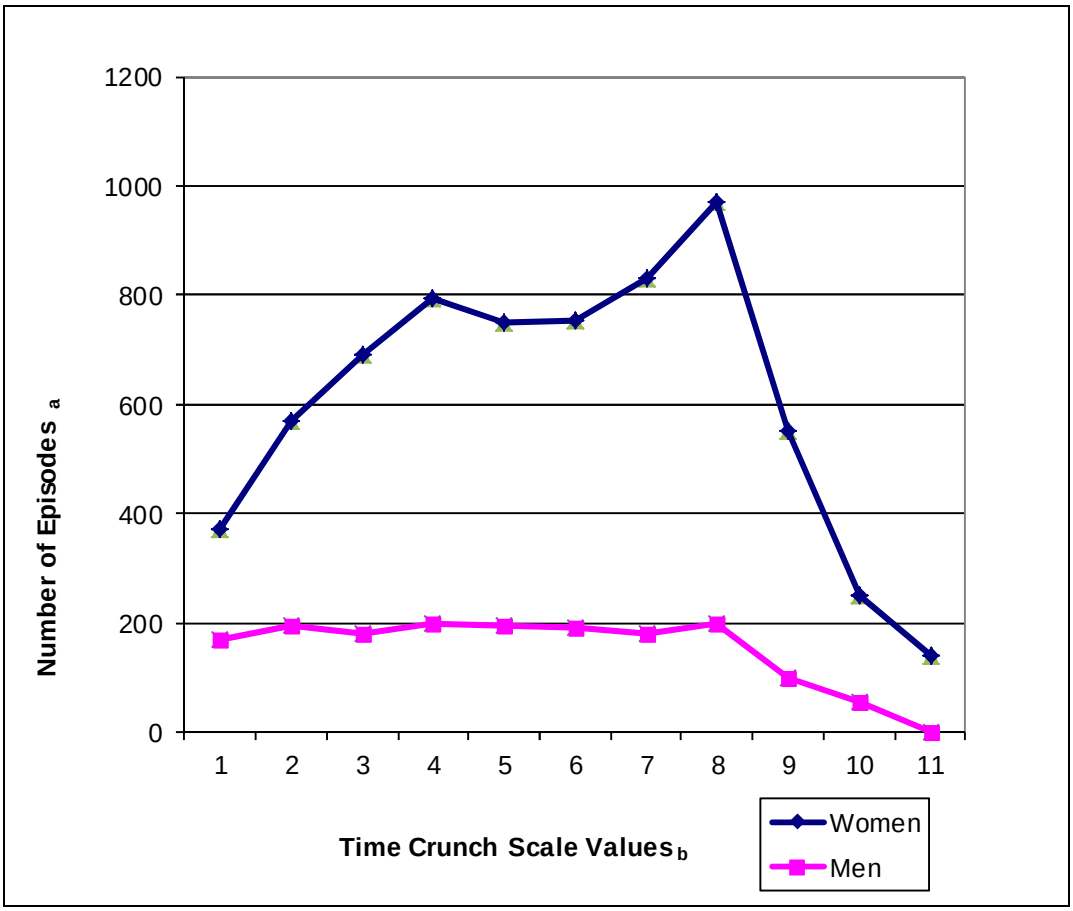


Source: Statistics Canada General Social Survey 24 (2010), own illustration.

Nonetheless, the extent of the gender difference in the occurrence of these secondary activities and their relation to feelings of time crunch is appreciable.

More evidence from this source supporting an understanding of the salience of under-reported, secondary childcare activities for feelings of time crunch and stress comes from an examination of with which primary activity the child care is coupled. Men are proportionately more likely than women to list taking care of children as a secondary activity when eating meals or snacks at home, watching television, socializing, and playing with them. For women, in contrast, their supplementary 38.6 per cent increase in episodes of child care observed from citing secondary activities comes disproportionately in tandem with a wide range of primary activities in the realm of unpaid domestic work. The multi-tasking of child care with other activities takes on a very different meaning and outcome for women than for men, with implications for perceived stress.

Figure 5
Number of episodes of domestic work and child care as first secondary activity by time crunch index value for employed men and women ages 26-64



a: Number of episodes in which domestic work and child care are first simultaneous activity, b: Time Crunch Scale Values (0-10), Coded as 1-11, for Respondents Doing Episodes, Source: Statistics Canada General Social Survey 24 (2010), own illustration.

4 Conclusion

The 2010 Canadian time-use survey substantiates previous time-use analyses that show an increase in the amount of nighttime sleep in recent decades after relative stability in the latter 20th Century. Contrary to a public myth, employed women continue to report greater duration of nighttime sleep than men. A reference point for feelings of disadvantage for employed women should be with respect to greater sleep duration on the part of women who are not in the labor force, not to employed men.

But just because concerns arising from societal change have taken the form of questionable assumptions about sleep duration does not mean that the dynamics of gender differences accompanying societal changes are illusory. They arise in a more subtle, subjective ways than the count of minutes of sleep per night. Differential stress, reflecting the interaction of gender roles with the need to balance the distribution of activities within the 24-hour day, which also includes the substantive and subjective dynamics of multitasking, is a reality that creates particular difficulties for employed women. These difficulties appear to have been projected erroneously to sleep duration, but they are important difficulties nonetheless.

Staikov's conception of daily time budgets as a zero sum game (1973) remains as a crucial analytic paradigm, but it is joined by the need to consider explicitly the substantive, subjective, and dynamic underpinnings of time-use when trying to unravel mysteries surrounding social change and gender dynamics. In this case, the myth of linear impacts from sleep duration is clarified by sensitive attention to the gender-related contextual and subjective aspects of the situation, which include the need to trade off activities during the 24 hour day, the multiple sources and characteristics of stress (which are helpfully addressed by the concept of time crunch), and the existence and varying manifestations of multitasking. Sleep duration is important, but its independent impact on feelings of time crunch wanes in a context in which the day includes substantial time and emotional demands from such other activities as paid employment, domestic work, and child care - simultaneous with less time available for activities that many people find relaxing, such as media viewing. In this and in many other situations, the complexity of everyday life needs to be recognized in its larger array of interacting objective and subjective manifestations, not as a simple, linear phenomenon.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 73-93 dx.doi.org/10.13085/eIJTUR.11.1.73-93

Modular Online Time Use Survey (MOTUS) – Translating an existing method in the 21st century

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Abstract

Time-use surveys are internationally highly valued methods for capturing daily behaviour. Their combination of questionnaires and paper-and-pencil time-diaries (among others in Europe) or telephone interview yesterday-method (in USA) through which respondents (re)construct their daily activities (i.e. what and when) together with contextual information (i.e. with whom and where) is both its strength as well as its weakness. This weakness stems from the high (personnel) costs involved in conducting time-use surveys, costs that can largely be reduced by switching to an online method. However, recent experimenting with online time-use surveys a) jeopardizes the hard work of harmonizing international time-use surveys and b) never truly copied or implemented the methodology of the paper-and-pencil time diaries let alone added additional features that improve the 'old' method. After having received a substantial grant we took the challenge to translate this existing method to an online method a) without loosing its strengths, b) with adding additional features that enrich the data even more, and c) with automated processes that reduce personnel and processing costs. In this contribution we a) reveal our method and its modular design and automated processes, b) provide preliminary results of the quality and response of the population pilot study ($n_{invited} \approx 40{,}000$), c) evaluate our effort, d) challenge others to comment and collaborate on our methodology in order to end up with a (new) standardized methodology for online diary studies that allows cross-national comparisons, and e) reflect on future possibilities and initiatives that serve the imminent online diary methodology.

JEL-Codes: C42, C81, J22

Keywords: Time-use survey, online methodology, time-diary standardization, modular design

1 Introduction

What is time-use research? Answering this question means being aware of the concept of time and its meaning for social life as quoted for example by Szalai in 1972 (p.1): "Many interesting patterns of social life are associated with the temporal distribution of human activities, with the regularities in their timing, duration, frequency, and sequential order". These elements, i.e., timing, duration, tempo and sequence are often referred to as the parameters of time (Zerubavel 1982) and all data collection techniques that gather information about at least one of these four parameters are referred to as time-use studies.

In general there are three methodological methods to capture daily human behaviour: direct observation, survey research and diary research. The former has been acknowledged to be most accurate method to register 'real-time' human activities, albeit not the most functional and reliable one since the registered and observed behaviour is most likely to be influenced by the observer(s). The most frequently used methodology to study human behaviour is the survey method, either by self-report or through an interview. In surveys measuring human practices respondents are retrospectively asked what they have done during a certain period of time (i.e. participation), how often their activities took place (i.e. frequency) and/or how long there activities lasted (i.e. duration). The advantages are a reasonable response in addition to a fairly low field-cost, even for population studies, and the absence of a diary component, which leaves more space for inquiring in depth background questions, albeit the probability of having biased results is higher due to, for example, memory recall-effects and social desirability. In terms of the four parameters of time, survey methodology can only grasp the tempo and/or duration of activities.

Apart from direct observations and survey methodology, time-diary methodology (often referred to as time-use surveys) is capable of capturing all four parameters of time at once and, is therefore, believed to be one of the most profound and valuable ways to capture human behaviour. Time-use surveys draw a picture of how individuals use their time by utilizing a log or a time-diary during at least twenty-four consecutive hours (Pronovost 1989, pp. 76). Through self-observation respondents chronologically report their activities and specify for each new activity the beginning and ending time as well as some contextual information like the place of occurrence and the possible presence of others. The temporal and the behavioural embeddedness of each specific activity makes that the design of the diary is a useful tool for the respondent to report the natural flow of consecutive acts, so that "the time-diary, then, is a microbehavioral technique for collecting self-reports of an individual's daily behaviour in an open-ended fashion on a activity-to-activity basis" (Robinson 1999, pp. 83). This self-reporting is done either through telephone interview, the so-called *yesterday-method* as applied in the American Time Use Surveys (ATUS) with between 9,000 and 10,000 interviews/diary days per year since 2003, or by completing a paper time diary, the so-called *paper-and-pencil method* as

applied in the Harmonised European Time Use Surveys (HETUS). In either way, it is this activity-to-activity structure that empowers both the quality and the usefulness of the data. Time-diary methodology largely overcomes the (un)intended biases of survey methodology because respondents reconstruct their daily behaviour by denoting activities that are always embedded in other activities and are restricted to the maximum length of the day, which will benefit the quality. Besides, time-diary methodology serves multiple research topics because it is not a priori focussed on a specific topic of interest (in contrast to, for example, the European Social Survey - ESS).

Nevertheless, besides these benefits time-diary methodology has also its pitfalls. Firstly, it is bookmarked as a technique with a high demand of cooperation resulting in generally low response rates but which do not have necessarily a selective impact on results (Gershuny 2004). Secondly, it is highly expensive because of the wide fieldwork period (mostly the survey takes an entire year), the labour intensive execution, and the time intensive data-preparation (punching and cleaning) in order to start valorising the data. However, a large range of comparative studies show the superiority of time-budget surveys over survey research when it comes to analysing daily human behaviour, especially because the time-diary methodology is capable of taking into account all four parameters of time at once (see for example Michelson 2005).

2 Background of time-use surveys

2.1 The Odyssey of the Harmonised European Time Use Surveys (HETUS)

From the outset of time-use surveys[1] the focus laid on socio-economic issues. The earliest (small scaled) time-use surveys were motivated by the concern that the legal restriction of working hours would result in a working class with much free time to spend but without any ideas what to do (Bevans 1913) and by the occurrence of poverty and child mortality in the poorest families in London (Pember-Reeves 1914). Subsequent (large scaled) surveys kept the same focus, for example, economic and social planning in the communist Soviet-Union (Strumulin 1921-1923) and mapping female agricultural work in America between 1925 and 1931 (Zuzanek 1980; Stinson 1999, pp. 12-14). The international breakthrough of time-use surveys, however, came with the UNESCO-funded 'Multinational Comparative Time-Budget Research Project', coordinated by Alexander Szalai (Szalai 1972). Between 1964 and 1966 respondents in twelve countries reported their activities using the same time-diary methodology. The conventions of this methodology are still of crucial importance for today's time-use surveys (Minnen and Glorieux 2011).

[1] Note that from this point on by 'time-use survey' we explicitly mean surveys using the time-diary methodology as briefly outlined in section 1 in combination with questionnaires before and after completing the time-diary.

From that point on, time-use surveys were never to loose their socio-economic angle of incidence and under impulse of the United Nations the application of time-use surveys for quantifying socio-economic development expanded even more during the 80s, for example, by making visible (the timing of) unpaid work (Juster and Stafford 1991, pp. 472; United Nations 2004). This growing use of time-use data preluded two important global developments in the 90s. Firstly, more and more academics started taking up time-diary methodology to analyse a wide variety of social and economical issues and, secondly, more and more national statistical offices started conducting time-use surveys. The former led to the congregation of scholars in the International Association for Time Use Research (IATUR), the latter to a plea for more international comparative data (Harvey 1993) either by *post*-harmonising existing databases or by *pre*-harmonising the time-diary methodology. The *post*-harmonisation has largely been realized by the Oxford Centre for Time Use Research (CTUR) and resulted in an open-access database of Multinational Time Use Survey (MTUS), containing both EU- and American data. The process of *pre*-harmonisation, which logically was not at issue for the American Time Use Surveys but of major importance for the European Time Use Surveys, was not taken lightly and under the leadership of EUROSTAT resulted in a decade of debates and decision making that ultimately culminated in the guidelines on Harmonized European Time-Use Surveys (HETUS) (European Commission 2008). At the same time EUROSTAT promoted time-use surveys in its member states and associated countries, which resulted in comparable datasets of 20 countries.

2.2 The future of the Harmonised European Time Use Surveys (HETUS)

The HETUS-guidelines have resulted in highly comparable and highly valuable international data employed for a wide range of study domains (paid work, unpaid work, gender equality, leisure, …). Nonetheless, these benefits come at a high cost that directly relate to conducting time-use surveys, including an intensive preparation phase (comprising the different elements like instructions for respondents, questionnaire and the diary, the construction of the sample selection, and the training of interviewers), a yearlong fieldwork period (face-to-face interviews, explanation of the diary procedure, collecting completed diaries), and extensive punching and cleaning of the paper-and-pencil diaries to a digital database. As mentioned, one of the pitfalls of time-use surveys is their relatively low response rate, which means that there often is over-sampling, which increases the costs even more. To give an example, the average cost per respondent of the Flemish 2004 7-day time-use survey was about 265 Euros (about 360 US Dollars). Note that mainly for this reasons the American Bureau of Labor Statistics (BLS) opted for the telephone-aided *yesterday-method* for the American Time Use Survey (ATUS). Although this makes ATUS more cost-efficient, it does have its downside because respondents could only be asked to recall their previous day. Re-assembling a longer period significantly effects the quality of the reports (Juster, Ono and Stafford 2003), because of recall-effects. Nonetheless, the length of the observation window is an important element when studying activities not bounded by the daily cycle (f.e. paid work).

The combination of high processing costs and on-going cuts in research funding endangers (at least) the EUROSTAT-minded time-use surveys, and this (for the minimum) in two ways. Firstly, it hinders the continuity of conducting time-use surveys and of studying the changes of human behaviour for the wide range of study domains mentioned above. Secondly, and related to the former, it forces researchers to come up with cheaper methods that produce more or less equivalent estimates or to experiment with cheaper alternatives like online time-diaries. The former jeopardizes the comparability, validity and reliability of the socio-economic estimates, though the latter is undoubtedly welcomed because of its low costs. We estimated the marginal costs for a respondent based for an online 7-day time-use survey to be only 60 to 80 Euros and with the continuous growth of Internet access in the European population (Seybert 2011) online time-diary methodology offers a very good prospect. Several countries (Denmark, Belgium, The Netherlands, United Kingdom, Sweden, Australia, …) have already been experimenting with time-dairy registration through a website (see in Bonke and Fallessen 2010) or a native app (Fernee and Sonck 2013; Sonck and Fernee 2013). Nonetheless, we should not rejoice too quickly, because there is a tremendous downside of all this experimenting: if not done so already, it will put the time-diary methodology right back in the pre-harmonization era!

Assuming that an online time-diary methodology holds the future, the challenge, thus, is to come up with a system that on the one hand can be ultimately agreed on as the new standardized system of time-use surveys and on the other hand produces data that are as comparable as possible to the paper-and-pencil data to continue studying trends. This is the goal we have set ourselves when we received funding for the project called Modular Online Time Use Survey or abbreviated as MOTUS.

In this contribution we outline how we have translated all these features of the paper-and-pencil into a digital time-diary, the insuperabilities we have faced, how we have dealt with them, and the additional features we have included to make this new way of online time-use collecting more practical and easy to use (section 3). Next we provide some preliminary results on the status, quality and response of our pilot study (section 4) and discuss the additional experiments we have planned for the near future, the analyses we will perform to evaluate the online time-diary methodology, and what we expect from MOTUS in the near and distant future (section 5). An English demonstration version of MOTUS can be found at http://www.motusdemo.com.

3 Modular Online Time Use Survey

The classical procedure of paper-and-pencil time-use surveys is costly, time-consuming, and involves many personnel for conducting the fieldwork and cleaning and inputting the data. The online procedure of MOTUS has low marginal costs, is less time consuming, and involves many automated systems that replace much of the personnel. This does not, however, mean that the one methodology is a perfect substitute for the other. Reasoning from the latter, there are many elements that the online methodology can do better or more compared to the paper-and-

pencil surveys, but there are also aspects that this new methodology cannot. In this paragraph we will elucidate how we translated all crucial elements of paper-and-pencil time-use surveys into the online methodology of MOTUS, what additional features MOTUS comprises that eases conducting time-use surveys, and what 'features' or advantages the paper-and-pencil methodology holds over an online system.

3.1 Translating paper-and-pencil to MOTUS

The standard process of a paper-and-pencil time-diary survey starts with sending out invitation letters (spread over the survey period) to potential respondents (preferably a random sample) notifying them that an interviewer will pass by. This interviewer has the important task of convincing the respondent to participate and, if so, to take the first (*pre*-)questionnaire in a face-to-face manner (using CAPI), explain the procedure of the time-diary, and leave behind a drop-off (*post*)-questionnaire. After the ending date of the time-diary, the same interviewer returns to the respondent and makes a quick check of the time-diary and *post*-questionnaire to adjust possible major flaws in the registration. Hereafter, all paperwork is converted into digital data, often through a double punching procedure, and those responsible for this punching procedure try to undo most of the respondent errors (e.g. unspecified time slots, ambiguous activities, …) by interpreting the context of activities. This is often seen as a weak link in processing time-use data (see Chenu and Lesnard 2006).

Generally, the mode of paper-and-pencil time-dairies varies along two elements: the registration of time, that is *open-ended* or *fixed intervals*, and the registration of activities, that is *pre-coded* or *verbatim*. In the *open-ended* registration respondents denote the exact beginning and ending time of the activities, whereas in the *fixed interval* registration respondents denote their activities with a 10-minute grain precision. Bluntly stated, the advantage of the *open-ended* mode is a more exact registration compared to the *fixed interval* mode wherein respondents are asked to retain the 'most important' activity that occurred in that interval[2]. On the contrary, the advantage of the *fixed interval* mode is that it is less likely to result in unspecified time periods. With regard to the other element, the *pre-coded* mode of denoting activities (i.e., respondents look up the activity in a list of activities and write down the accompanying code) eases the punching procedure and lets the respondents decide how to interpret the activity. However, this might also be seen as a disadvantage, because such an activity list will never be exhaustive and thus might frustrate the respondent when not being able to 'code' the activity, hence the existence of a *verbatim* mode.

A final word of importance has to be said concerning the length of observation window. The EUROSTAT-guided (and less burdensome) length is one randomised weekday and one ran-

[2] Suppose for a certain 10-minute interval that a respondent sleeps 9 minutes and starts breakfast on the 10_{th} minute of this interval. If the respondent decides to register 'breakfast' as the most important activity of this 10-minute interval, we would, in essence, mistakenly conclude this respondent to have had breakfast for 10 minutes.

domised weekend day though many scholars prefer a length of seven consecutive days. The *two-day* length builds on the idea that the 'daily round' is comparable on all weekdays (and the same for weekend days), whereas the *seven-day* length builds on the idea that a week is made up of seven different 'daily rounds' (Weigert 1981; Zerubavel 1985).

The procedure of the 2013 Modular Online Time Use Survey (MOTUS) also starts with sending out invitation letters[3] (spread over the survey year) but now include a username and password with which respondents are invited to register themselves on the website. Once logged on, they are invited to change their password and voluntarily provide an e-mail address and/or a cell phone number in order to contact them. Hereafter they are invited to start the online pre-questionnaire that contains all features as any other online survey (different types of questions, routing based on previous answers, …). After completion of the *pre*-questionnaire the respondents are guided through a communication page that tells them when to start logging their time-diary and provides several explanatory links (instruction page, instruction video, activity list, note page for mnemonic, …). When finished the time-dairy for the given period, a new communication page asks the respondent to fill in the *post*-questionnaire to finally complete the survey. Hereafter a final communication page passes on the respondents 'lottery number' to win a money price and a web link that gives them an overview of their own time-use in comparison to the population sample results, which both are the incentives of the 2013 online time-use survey.

With regard to time registration we have taken a middle course: the default time slot that is suggested on the diary page is set at 10 minutes, albeit respondents are free to adjust the beginning time and ending time to the very precise minute. Concerning the activity registration we offer respondents two pre-coded ways of registering an activity. The first is a *selection* method that let respondents stepwise choose from a 3-level tree structure their main category, the subcategory, and finally their detailed activity. The second is a *search* method that let respondents to type in a keyword (including the activity code) that generates a list to which this term is tagged and from which the most detailed activity can be selected. These activities are also sorted based on their occurrence in the registration procedure[4]. Additionally, at the level of the subcategories we provided an 'empty' category allowing respondents to write down their activity verbally if none of the pre-coded activities sufficed. Finally, the length of the time-dairy is set at 7 consecutive days.

3.2 Benefits of MOTUS over paper-and-pencil

Methodologically, most of the benefits of MOTUS relate to controlling the quality of the time-diary registration. Firstly, to reduce the unspecified time, the ending time of the previous activi-

[3] Respondents of the pilot project of MOTUS were randomly drawn from the population register. The sample contained information on the names and the contact addresses of the respondents (street, number, postal code and city/municipality).

[4] For example, if a respondent types in 'baby' the first activity suggested list is 'taking care of baby: washing, bringing to bed, soothing' and the last activity suggested is 'taking baby to general practitioner'.

ty is suggested as the beginning time of the next activity. If respondents do leave open a period of time, this time slot will appear in red in the respondents' timeline overview and allows the respondent with one single click to still edit this time slot.

Secondly, like any online registration method, several algorithms can be run to perform real-time verifications. We distinguish *hard warnings* from *soft warnings*. While the former cannot be ignored the latter can. Examples of *hard warnings* include the impossibility to register activities in the future and the impossibility to leave certain fields open (f.e. whether one was alone or someone else was present during the registered activity). Examples of *soft warnings* include a notification if an activity endures longer than 20 hours (which is often the result of wrong date setting) or a notification of not having registered a displacement if the location of two sequential activities has changed. Besides those warnings, the system also communicates encouragements, for example, by complimenting respondents for every day they completed and by counting down the days to be filled in.

Administratively, MOTUS has some major beneficial features like Direct Data Storage (DDS), Respondent Management System (RMS), Respondent Tracking System (RTS), and Customized Survey System (CSS). The DDS facilitates the storage of all respondents' input to a direct available database, which makes the (time- and cost expensive) procedure of (double) punching unnecessary. The RMS on the one hand automates the mail handling, for example, with respect to randomly assigning respondents to different research modules (see section 3.4) and equally (and randomly) spreading respondents over the survey period, and on the other hand randomly assigns starting days for the time-diary[5]. The RTS allows sending out notifications or reminders via e-mail or text messages if respondents pass pre-defined 'states' of the survey. Such states might be 'not having registered any activity for the past 24 hours', or 'having completed the time-diary but not the *post*-questionnaire'. Additionally, the RTS stores the respondents' *para data* like logging times, browser type, time lapse of completing certain aspects of the time-use survey, and so on. The RTS thus allows real-time monitoring of respondents and intervention (through notifications) when needed and in a sense largely replaces the interviewer. Finally, the CSS allows creating several surveys at the same time or altering existing surveys period by deciding on all elements mentioned above: whether or not to include *pre-* or *post*-questionnaire, *open-ended* or *fixed interval* mode, *pre-coded* or *verbatim* mode, number of (levels of) activities, number of days, and so on. This adds a high degree of flexibility to (time-use) surveys compared to the paper-and-pencil method for which every alteration means reprinting and re-distributing questionnaires and time-diaries.

[5] In case of a seven-day registration length, the RMS randomly assigns the starting day and in case of a two-day length the RMS randomly assigns a starting weekday and, when completed, a starting weekend day (or vice versa) with a maximum of a 6-day difference (Monday-Sunday or Saturday-Friday).

3.3 Benefits of paper-and-pencil over MOTUS

Like any online survey one element is untranslatable and that is the human factor involved. When it comes to persuading people to participate in surveys, especially in the somewhat more burdensome time-use surveys, personal contact cannot be underestimated. Someone explaining the need/aim of the survey, guaranteeing anonymity, and immediately answering the most pressing questions might instil more confidence than a letter with an encrypted username and password. Especially in times where eavesdropping, NSA, and PRISM are daily news. Here the telephoned-aided American Time Use Surveys has an advantage over online time-use surveys because there is still human contact between interviewer and interviewee. We did try to overcome this feature by placing a special made short video on the importance of time-use surveys on the MOTUS homepage, by having a special phone number that invitees to the survey can call, by trying to respond to e-mails within one day, and by putting a privacy statement on the website. Though this will never replace face-to-face contact with an interviewer.

3.4 Modularity

The 'M' of MOTUS stands for modularity and part of this modularity has already been explained in the previous subsections: all elements of the survey itself and the administrative features are adjustable to one's wishes. There is, however, a modularity that has been underexposed so far and that has to do with registering the context of activities. In all time-diaries respondents are asked to provide the context in which the activity took place, that is, respondents denote who else was present, with whom they talked, where the activity took place, and (in some cases) what motivated them to perform that activity (Glorieux 1990). From the perspective of different research domains, different contextual information might be of interest, though this idea has never been taken up by any time-use survey for several reasons. Firstly, paper diary layout simply lacks space to include more contextual information. Secondly, assigning different contextual questions to different parts of the survey requires a lot of administrative planning and coordination. Thirdly, most of this type of contextual information is activity-specific and thus need not to be completed for every activity.

An online time-use survey methodology might easily overcome these problems and that is what we have tried in the pilot study. We developed three 'modules' that should test questioning additional context information. The first module, the *base* module, only questions the 'typical' context information (what activity was done, where it took place or what transport mode was used, and with whom the activity was undertaken). The second module, the *media* module, questions for every activity whether any media (smartphone, tablet, laptop, written media, …) has been used. The idea behind this module comes from the fact that the use of, for example, smartphones or tablets are so well established in daily life that their usage is hardly ever registered as an activity. This module is developed in consultation with the research group on Studies on Media, Information and Telecommunication (SMIT) of the Vrije Universiteit Brussel.

The third module, the *transport* module, questions contextual information only if the respondent registers a displacement and is developed in consultation with the research group on Business Technologies and Operation (BUTO) of the Vrije Universiteit Brussel who focusses amongst other things on logistics. This module demonstrates the feasibility to link a particular questionnaire to a particular activity. That is, if and only if respondents registers a displacement, the system generates a small questionnaire asking, for example, the mode of transport or scaling the ease of transport. It is obvious that running activity-specific questions is not an option in paper-and-pencil diaries; you either print all possible contextual questions or ask none. Additionally, both modules allowed testing if there is some sort of upper limit of the number of contextual questions that a respondent will answer. We did not, however, find any negative effects of these additional questions. Respondents in the transport module did not register less transportation activities compared to the base module in order to avoid these questions.

Both modules generate context questions based on answers that were given in the pre-questionnaire (what multimedia devices do you own?, how many cars do you own?, what type of car(s) do you have?, …). The ease of modulating questions gathering this activity specific contextual information truly does justice to the 'M' of MOTUS.

4 Preliminary results

It is important to know that the Research Group TOR (TOR being the acronym of Tempus Omnia Revelat which translates to Time Reveals Everything) of the Vrije Universiteit Brussel has developed the methodology MOTUS and that TOR has an extensive expertise in conducting and analysing time-use surveys. It has conducted a small sample time-use survey in 1984, a time-use survey with emphasis on additional contextual information in 1988, two Flemish population time-use surveys in 1999 and 2004, and had an advisory role in the Belgian population time-use surveys in 1999, 2005, and 2013. All this expertise has been of crucial importance in determining the strategy of the development of MOTUS, which we will call a top-down approach: we aimed for MOTUS to be capable of conducting the most extensive, though reasonable, time-use survey we could think of. This implied having an elaborate *pre*-questionnaire, a 7-day time-diary with *open-ended* time registration and a list of over 225 activities, an elaborate *pos*t-questionnaire, and the implementation of three different research modules with respect to contextual information. Moreover, we decided the pilot study to be a population study, for at least two important reasons: firstly, to get an insight in the (selective) non-response and secondly, because we planned the survey period of MOTUS to run parallel with the survey period of the paper-and-pencil population time-use survey of 2013 as conducted by the National Institute of Statistics Belgium (NIS) following the HETUS-guidelines. The latter allows us to compare both methodologies and if needed to benchmark MOTUS with these paper-and-pencil-data and to see if we need to weight the online data in case online effects come forward. Nonetheless, the choices for a top-down approach and a pilot population study off course have an important

impact on measuring participation. In the following section we provide some preliminary insights on the participation of our surveys and the quality of our data.

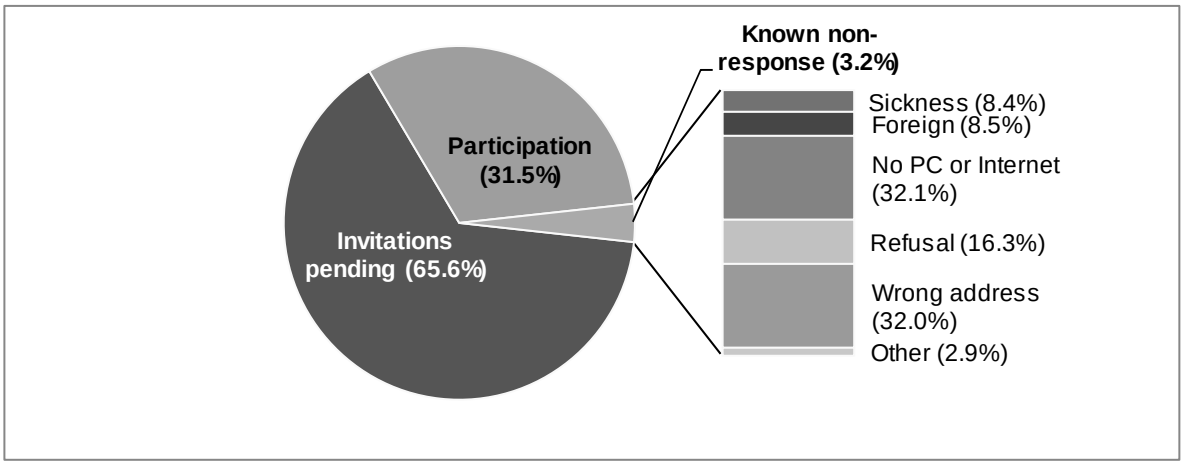
4.1 Participation

One of the main measures of participation used in any survey is the *response rate*. Nonetheless (and especially in time-use surveys), there (still) does not exist a clear consensus on how to define a response rate, even though Kviz started this discussion already in 1977 and the American Association for Public Opinion Research (2011) provides (and updates) standard definitions since 1998. For example, whether to calculate it using the raw sample size, or whether to first adjust the sample size for certain noise like inexistent addresses, deceased respondents, illiterate respondents, households with no Internet access, or even whether to count respondents that delivered unusable data because they simply do not fill in all days, not in a consecutive order, or do not meet certain standards (e.g. by registering only 2 activities per day). This implies that such measures are almost always incomparable and this is often worsened by not clearly specifying the conditions of the survey design, for example, whether the sample is drawn from an 'experienced' panel, whether the survey is linked to another survey, or whether the sample is randomly selected from the population register. In order to evaluate MOTUS in terms of (non-)participation, we, therefore, split up the whole procedure as outlined in the previous section in *stages*. Note that we do not distinguish between the different modules of MOTUS because, even though significant (χ^2=25.916, p=0.004), pairwise comparisons show that this is only the result of a slightly higher percentage of respondents in the media module finishing the *pre*-questionnaire and a slightly lower percentage of respondents in the media module finishing the whole survey. All other differences in percentage of stages over these modules are negligible.

All figures concern the 39,756 persons between 18 and 75 years old that have received an invitation letter and at most two reminders in the period January 2013 until half of March 2014 and the progress of this time-use survey is downloaded from the MOTUS server at 14 April 2014. Of all invitations, over 65% are still pending (see Figure 1), though this percentage definitely will include a large part of the non-response, if only because in Flanders almost a quarter to thirty per cent of the households still has no PC and/or internet connection at least not for 7 consecutive days and even 15% of the Belgian have said never to have used Internet before (Belga News Agency 2013; Statistics Belgium 2014). The latter is nicely reflected in the almost 3.2% of persons of which we are happy to know their non-response. Almost one third of the known non-response relates to this problem and another third relates to wrong or non-existent addresses. The other non-response relates to refusal of participation, sickness, non-natives, and a small miscellaneous category that includes amongst other things illiterate or deceased persons. In relation to the absence of a home computer or Internet connection the paper-and-pencil design has an advantage over online surveys. Additionally, having interviewers that can ask about the refusal to participate or can give their appreciation about the reason of non-

participation (e.g. address not found, respondent has moved out, …) will off course make the non response more transparent.

Figure 1
Participation and known non-response



Source: MOTUS 2013, Own illustration.

Almost a third of the invitations are answered and once logged to the system we make two important observations in relation to the participants. The first observation is rather ambiguous: over 90% of the respondents complete the *pre*-questionnaire, over 80% takes a preview of the time-diary, but only 52% of the respondents start using the time-diary (i.e. log at least 1 activity). At this point we thus somehow face a dropout of almost half of the respondents that logged on to our system. Probably, one main reason for this dropout is that although every respondent has immediately access to their time-diary, the randomly assigned starting day not necessarily follows the day on which they complete the *pre*-questionnaire. The reason for this is that in following the HETUS guidelines of EUROSTAT, we let the system randomly assign starting days to keep track of the quota of dispersion of starting days over the week. Other reasons might be respondent fatigue or (technical) difficulties with logging activities. From respondents that contacted us on the telephone helpline and from the *para data* on the used Internet browsers during the study we learned that some used old computers with slow processors that badly performed when loading the time-diary pages and from the logging data that are stored automatically to the server, we learned that several respondents had out-dated Internet browsers that were unable to visualise the online diary properly[6].

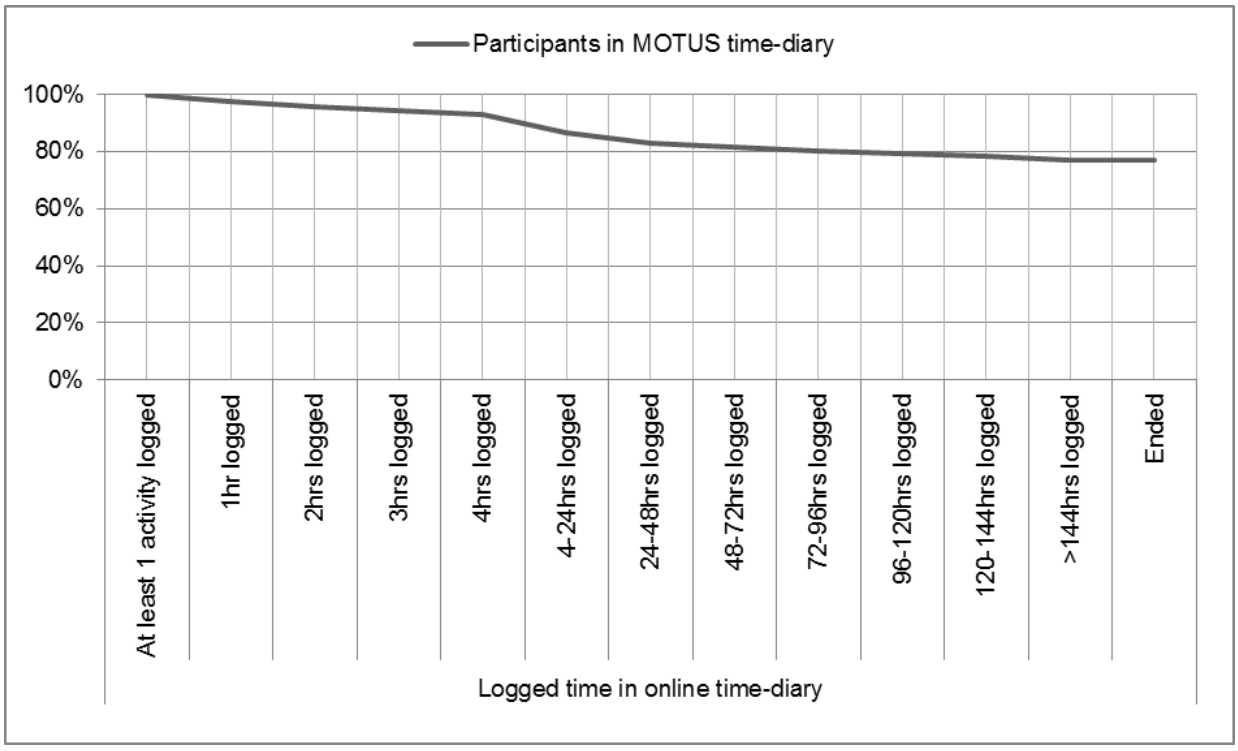
Paper-and-pencil time-use surveys are known for their low response because of the intensive survey procedure. Apparently, the online version does not immediately alter this, although obviously we did not expect this from the first population pilot study in which we tested the most

[6] Especially Internet Explorer 6 and lower caused some troubles with the visualization of the time diary.

demanding fieldwork setup that lasted in total at least 10 consecutive days[7]. However, online time-use surveys like MOTUS do have the advantage of knowing more about the drop-out non-response compared to paper-and-pencil time-use surveys, simply because all data are immediately stored on the server. For any respondent starting the survey and dropping out the answers given already are kept in the database. This allows answering questions like 'at what question did respondents quit?' or 'what are the characteristics of respondents not continuing with their time-diary?'.

The second observation, though, is certainly positive: once respondents logged their activities in the time-diary for up to 24 hours, they are very likely to complete the whole survey which underlines the easy and intuitive registration flow of the MOTUS time diary design (see Figure 2).

Figure 2
Participants by logged time in online MOTUS time-diary



Source: MOTUS 2013, Own illustration.

In other words, the crucial point of MOTUS apart from persuading more people to accept the invitation thus is to convince people to continue to the start phase of the time-diary and start experimenting with the log-procedure, because once familiar, it turns out not too difficult to

[7] After the respondents completed the pre-questionnaire (day 1) the starting date of the diary registration was communicated. This diary could start the earliest the following day (day 2) and existed of a learning period from 19h till 24h. At midnight (day 3) the actual period of 7 days started and lasted until all days were completed (day 9) and the ending time of the last activity ran over midnight (day 10). After the diary registration was ended respondents also had to fill in a short post-questionnaire.

complete the time-diary. Note that this applies to people that have the possibility to participate in an online survey. If we want to include more people in a time-use survey in general, we might, for example, opt for a mixed mode (online and paper-and-pencil). To further elaborate on the above results we can have a look at Table 1.

Table 1
Response by population characteristics (in %)

	Population sample	Respondents	Respondents starting time-diary	Respondents completed at least one diary day	Respondents completing MOTUS
Gender					
Male	50.1	52.8	48.8	44.1	43.9
Female	49.9	47.2	51.2	55.9	56.1
Age group					
18-24 years	10.9	13.2	13.9	13.7	13.3
25-39 years	25.2	26.1	26.7	26.2	24.7
40-54 years	30.2	31.3	30.3	31.6	32.0
55-64 years	18.3	18.8	18.1	19.5	20.1
65-75 years	15.3	10.7	11.0	9.0	9.8
Level of education[a]					
Low	29.5	22.3	25.5	15.3	14.7
Medium	39.3	35.7	36.9	34.6	34.0
High	31.2	42.0	37.5	50.1	51.3

a: Distribution of level of education in weighted population sample based on Belgian Labour Force Survey 2012 (Flanders only), Source: National Register 2012 (population sample gender and age), Belgian Labour Force Survey 2012 (population sample education), MOTUS 2013 (respondents), own calculations.

Based on the presented results we might conclude that we were somewhat too overanxious with respect to the selectivity of our response. As it turns out females are only slightly overrepresented in our response compared to the population sample and the oldest age group (65-75) are some mere percentage points underrepresented. For the level of education of our population sample we use the information of the Flemish subsample of the Belgian Labour Force Survey (LFS) conducted by the Belgian National Institute of Statistics. The LFS sample can be regarded as being representative for our studied population in 2013 and based on the results we might carefully conclude that the lower and medium educated are slightly underrepresented in our response and the higher educated somewhat overrepresented[8]. Even more striking is the finding that the distribution of these characteristics hardly changes after the dropout during the transition from *pre*-questionnaire to time-diary. Again this lets us provisionally conclude that our

[8] Levels of education: low=at most lower secondary education, medium=at most higher secondary education, and high=higher education or university degree.

concern about participation rates should not be with selective response, but with convincing respondents to make the step from finishing the *pre*-questionnaire to starting the time-diary.

Nonetheless, we do have to conclude from the last column of Table 1 that over the whole process of completing MOTUS, we do lose males, those 65 and over, and lower educated respondents.

4.2 Quality of time-diary data

From the previous subsection we derive that the time-diary is the most burdensome element of MOTUS to complete. Nonetheless, once started, respondents do go through the whole process of completing 7 consecutive days. A next question to address concerns the quality of the completed time-diaries. We can judge this quality by three indicators (Juster 1986): (1) the average number of activities registered per day, (2) the average number of minutes of unspecified time per day, and (3) the percentage of activities rounded to obvious time slots (e.g. to 1 hour or to 10 minutes). Table 2 gives an overview of these three indicators per registration day. We also contribute to the debate whether or not the registration quality declines as the number of diary days increases. Note that these days do not concur with the days of the week, since each respondent is randomly assigned a starting day. Further note that we again do not distinguish between the three different modules of MOTUS since none of scores on the indicators significantly differs between these modules[9]. This finding is an indication that counters the idea of 'negative respondent learning' resulting in respondents that avoid registering activities that generate extra questions (and thus require more time). For the former two indicators Table 2 also provides the figures by gender, age group, and level of education.

Firstly, the average number of activities registered per day is 18 and varies between 17.1 on day 1 and 18.3 on day 7. Although this figure is slightly lower than the median of 21 (primary) activities achieved by HETUS-based paper-and-pencil time-use surveys (Rydenstam and Wadeskog 1998), the difference is negligible when comparing to the average number of 18 registered activities per day in previous 7-day paper-and-pencil time diaries of the Flemish 1999 and 2004 time use surveys using an open time registration and pre-coded activity list . Apart from the average per day, it is more interesting to mention that regardless of the population characteristics, figures hardly vary over the day and variance is small, which all points in the direction of a 'learning curve': respondents provide more detail once familiar with the registration system (which is contrary to general belief). Note that difference between sexes, age groups, and levels of education do not say anything about the quality of the data. It is known that women, 25 to 54-year-olds, and the higher educated have a more fragmented time-use and thus register more activities (see for example Glorieux, Laurijssen, Minnen and Van Tienoven 2011).

[9] Combined difference between modules for average number of activities per day: F=0.554, p=0.574. Combined difference between modules for average number of minutes of unspecified time per day: F=0.118, p=0.889.

Table 2
Overview of three indicators of quality of time-diary data

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Overall
				Number of registered activities				
General mean	17.1	17.3	17.5	17.5	17.7	17.9	18.3	17.6
Differences between days: F=5.586, p<0.001, η^2=0.002								
By gender								
Male	15.6	15.7	16.2	16.1	16.3	16.6	16.9	16.2
Female	18.3	18.6	18.6	18.7	18.9	18.9	19.4	18.8
Differences between sexes: F=410.406, p<0.001, η^2=0.019								
By age group								
18-24y	15.9	16.4	16.2	16.1	16.4	16.4	16.9	16.3
25-39y	17.6	17.6	18.1	17.8	17.9	18.4	18.8	18.0
40-54y	17.6	18.0	18.2	18.3	18.4	18.4	18.5	18.2
55-64y	16.7	16.8	16.9	17.2	17.7	17.8	18.7	17.4
65-75y	16.6	16.3	16.7	16.8	16.7	17.0	17.6	16.8
Differences between age groups: F=27.401, p<0.001, η^2=0.005								
By level of education								
Low	14.9	15.1	15.3	15.4	15.5	15.9	16.3	15.5
Medium	16.6	16.8	16.9	16.7	17.0	17.0	17.5	16.9
High	18.1	18.3	18.6	18.7	18.9	19.1	19.5	18.8
Differences between levels of education: F=173.158, p<0.001, η^2=0.017								
				Minutes of unspecified time				
General mean	19	2	1	1	0	0	2	3
Differences between days: F=88.646, p<0.001, η^2=0.025								
By gender								
Male	19	3	0	1	0	0	2	3
Female	18	2	1	1	0	0	2	3
Differences between sexes: F=0.012, p=0.913, η^2<0.001								
By age group								
18-24y	12	1	2	1	0	0	1	2
25-39y	8	1	1	0	0	0	3	2
40-54y	20	2	1	1	0	0	1	3
55-64y	27	4	0	1	0	0	1	5
65-75y	44	7	1	1	0	0	2	8
By level of education								
Low	21	3	1	2	0	0	1	4
Medium	22	3	1	2	0	0	1	4
High	15	2	1	0	0	0	2	3
Differences between levels of education: F=3.547, p=0.029, η^2<0.001								

Table 2 (Cont.)

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Overall
	Percentage of activities by rounded time slots							
Rounded to								
1hr.	11.3	10.1	9.3	9.2	8.9	8.5	8.6	9.4
½ hr.	16.4	15.4	14.9	14.4	14.0	14.1	13.7	14.7
20 min.	13.9	14.2	14.7	14.9	14.8	15.3	15.3	14.7
10 min.	23.1	24.3	24.8	25.1	25.3	24.7	25.1	24.6
5 min.	33.0	33.8	34.0	34.2	34.7	35.0	35.0	34.2
< 5min.	2.4	2.2	2.3	2.3	2.3	2.3	2.4	2.3
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Percentage distribution differs between days: χ^2=586.738, p<0.001, η^2=0.002								

Source: MOTUS 2013 (respondents), own calculations.

Secondly, the average number of minutes of unspecified time also underlines this short learning curve. The first day contains an average of 19 minutes of unspecified time (on a total of 3,600 minutes per day), but this figure immediately drops to only 3 minutes on day two and gets negligible on the days thereafter. Again we conclude that once respondents start the time-diary and complete one day, there is no additional hurdle in completing the whole time-use survey. This holds for everyone, even for the oldest age groups and lowest levels of education. They only seem to have some more troubles with completing the first day but not with days thereafter.

Thirdly, the percentage of activities rounded to obvious time durations give an indication of whether respondents take the easy way out of the time-diary or not. Again these figures are optimistic. Over half of the activities are registered with duration of 10 to 5-minute time slots and this remains relatively stable over the days. Besides that, the percentage of activities rounded to 1 hour or half an hour slightly decreases over the days again indicating that respondents quickly adopt the entry procedure of the time-diary and register their activities in more detail.

5 Discussion

As we outlined above, the top-down approach of our pilot-study was rather ambitious. Conducting a large-scale population (18 to 75 years old) study without any help of an interviewer on a full time-use survey design that lasts at least 10 days since it includes extensive *pre*- and *post*-questionnaires, a 1-day time diary learning day, a 7-day time diary registration, and different modules to test the modularity of the contextual questions in the time-diary. With regard to the latter, we conclude that the different modules (read: different and additional contextual questions) do not result in different tendencies with regard to the participation in MOTUS. Apart from that, the pilot-study revealed some bottlenecks in the time-use survey design that require further investigation, modification, and evaluation. In this final section we briefly discuss current and future experiments that should increase the participation rate and even (more)

higher the quality of registration (*en surplus*), we outline how we will continue to evaluate MOTUS, and we elucidate on what we expect from MOTUS in the future.

5.1 Small-scale experiments

The absence of an interviewer is an often-named flaw of the digitalization of surveys and although the confidence building contact with a real and reliable person might convince more people to take part in social surveys (especially in times with the NSA and PRISM as on-going headline news), we rather see its absence as merely insurmountable. Therefore, we aim at making meaningful adjustments in the survey design and methodology to see whether they positively affect people's willingness to participate and perseverance to continue. Note that this adjustability is one of the main advantages of online social surveys since it does not require any reprinting and redistribution of questionnaires and/or time-diaries.

Currently we set up an experiment that changes three elements of MOTUS in order to benefit the participation and continuation rates. Firstly, we invited 1,000 people to complete their time-diaries only for one randomized weekday and one randomized weekend day instead of 7 consecutive days (which is basically what EUROSTAT-HETUS prescribes). Secondly, we invited another 1,000 people that are proposed a fixed incentive of 10 euros for completing MOTUS. Currently, people are awarded a lottery number that will give them a 1 out of 4 chance of winning a money-price (ranging from several prices of 10 euros to one price of 500 euros). Thirdly, for another 1,000 invitees we change the three-level structure of activities (see section 3.1) to a two-level structure, which reduces the number of activities from which to select from 225 to 49 activities. Based on the results of this round we will make combinations of these adjustments and test these again, but we already see that reducing the registration days from 7 to 2 (one weekday and one weekend day) significantly highers the number of respondents starting and finishing the diary registration. This also shows that the automated communication to assign respondents to different days and remind them to start the second day (which is not necessarily the next day since, like in the HETUS-format, we question a weekday and a weekend day) works properly. Also the two other tests have a merit towards the original setup.

Another experiment that is on the drawing table is conduct MOTUS in a *mixed mode* setting, that is, letting people choose whether they want to participate via the online modus or via the classic paper-and-pencil modus, or to (re)introduce the interviewer to convince respondents to participate and instruct people how to use the online diary registration. Both suggestions, undoubtedly, will increase the costs of conducting time-use surveys but this will still be less than a traditional paper-and-pencil design. Additionally, this gives the opportunity to include the 25 to 30% of households that do not have access to a PC with Internet connection.

Furthermore, we are redesigning the visible front-end of the time-diary. At this moment we use a sequence of input fields and display all entries in a time-line on the right-hand of the screen (Twitter view). However, we are interested in knowing whether an agenda-layout with the possibility to cut, copy, paste and drag activities might generate different results, since many peo-

ple are already familiar with such designs (f.e. like Google calendar), or if a Life History view would be beneficial, which make it possible to develop an e-Work Grid as one of the research tools of HETUS. Additionally, we are trying to have the activity registration resemble the HETUS way of registering by allowing respondents to type in what they have done and use artificial intelligence to have the MOTUS-software analyse the inputted description and show to the respondent a number of related pre-coded activities. If the respondent chooses one of this suggestions the verbatim activity is already coded at no extra costs at a later stage.

Finally, we are currently working on developing an application for smartphone/tablets for all main operating systems (e.g. Android, iOS and Windows) that complements the online time-diary registration. This allows people to complete their time-diary entirely on a smartphone/tablet, or to make brief entries in their time-diary using the App, synchronise it on their computer via the website of MOTUS, or the other way around. Of particular importance is that respondents carry the smartphone/tablet with them almost all the time as if it were the 'paper-and-pencil booklet'. Pilot panel studies in the Netherlands have shown that people tend to use their smartphone to log an activity about 11 to 12 times per day. This is obviously more than can be expected from an online diary via a desktop or laptop.

5.2 Using the MOTUS database

As far as we know, MOTUS is the first online time-use survey ever conducted on a population scale so there exists no evidence on the reliability of time-use estimates gathered through online time-use surveys. Therefore, we have deliberately chosen to conduct MOTUS parallel with the third wave of the 2-day Belgian time-use survey following the HETUS-guidelines (raw response rate of 19%). The latter, with a sample drawn from the same population, still uses the classical paper-and-pencil methodology, which enables us to analyse the reliability of the time-use estimates of MOTUS and compare both methodologies. Additionally, since we know that the response is selectively biased, this allows us to calibrate the MOTUS database with both the population and the Belgian time-use survey before using it for profound time-use analyses.

Furthermore, the MOTUS database contains a lot of data that are often referred to as *para data*. These data include type of browser used, times, dates and duration of respondents' logins, times, dates, and time-lapse of completing different fields of the questionnaires and time diary, loading times of submitting activities or retrieving questionnaires, and so on. Analysing these kinds of data will tell us a lot about the actual completion-behaviour of respondents, a view in term of quality measures that has never attempted by the traditional paper-and-pencil method.

Additionally, the 'stacked' design of MOTUS (*pre*-questionnaire, time-diary, *post*-questionnaire) in combination with the direct storage of any data inputted in the system, provides us with little up to a lot of information (based on their progress in the time-use survey) of the 'drop-out-response'. Compared to partially completed paper-and-pencil questionnaires or diaries that end up in the trash, we might use these interrupted data to touch upon the some of the sore points of our time-use methodology.

5.3 The future of MOTUS

We are aware of the fact that MOTUS as a methodology for conducting online time-use surveys still has some important steps to take. Nonetheless the ambitious top-down approach for the development of MOTUS has one major advantage: almost every element of time diary research that one might think of is included in the software ready to be adjusted. Additionally, the MOTUS-software is future-proof in a sense that it allowed for optional plug-ins that might facilitate time-use registration (e.g. data gathered by GPS' or accelerometers on smartphones). Within MOTUS there is still a lot to explore, design, and test and through this flexibility and modularity we hope to avert the scenario of ending up with multiple, freestanding, non-harmonized online time diary software. Therefore, we aim at setting up a broad international network of statisticians of National Bureaus of Statistics and international university research departments to jointly develop and fine-tune the future of online time-use research to arrive at a standard for conducting online time-use surveys; a sort of HETUS 2.0. The time-use community came a long way to harmonize the paper-and-pencil time-use methodology and make cross-national comparisons possible, especially in Europe, and we cannot imagine anyone willing to abandon this harmonisation. Nonetheless, the quest for cheaper time-use methodology does endanger this achievement. We already anticipated this by thoroughly designing the basics for an online time-use methodology but maintaining European or internationally harmonised guidelines cannot be done by us alone.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 94-111 dx.doi.org/10.13085/eIJTUR.11.1.94-111

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New developments in time technology – projects, data, computing and services

MEASURING SMARTER – TIME-USE DATA COLLECTED BY SMARTPHONES

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Multifunctional time use registration

We live in a rapidly changing world in which people are using smartphones all the time, for sending text messages, being on Facebook, tweeting and retweeting, checking train tables, using GPS and as well for calling. Smartphone applications ("apps") allow us to set up survey research in a completely different way. Especially for registering time use, a mobile application may prove useful. This has many advantages because smartphone users have (almost) permanently access to this device, so respondents can report (more easily) their activities at multiple times per day, instead of using a paper diary in traditional time-use research. Additionally, smartphones enable to collect complementary information, such as exact location (by GPS), how people feel at random moments during the day (i.e. experience sampling), what short-term activities they do throughout the day (by pop-up questions such as about social media use), or collecting 'passive' data which can provide insight into how individuals use smartphones (e.g. for communicating with others). Even more interesting is that all these different types of information can be combined to give a full overview of the respondent's time use and well-being. In this way, smartphones are not simply a replacement for the traditional paper and pencil time use diaries, but a 'multifunctional tool' to combine the old method with new data sources which would not be possible without smartphones (Link et al. 2014).

In the most recent guidelines for global time use research of UNECE (2013) attention is drawn to the use of new technologies in time use studies. It is expected that in the coming years, data collection for time use studies will be done more frequently through the web and more specifically through the use of smartphones and their aforementioned additional applications that a smartphone offers. Although there has been recently some scholarly attention to the possible use of smartphones in time-use research, the number of studies which actually implement such a smartphone measurement to evaluate its benefits and drawbacks is still low.

Exploring smartphones as a future measurement instrument – A pilot study

Already in 2011 The Netherlands Institute for Social Research (SCP) and CentERdata at Tilburg University jointly started with experiments to collect time-use data by smartphones. An app was specifically designed for this purpose in which we followed as much as possible the Harmonised European Time Use Surveys (HETUS) guidelines (Eurostat, 2009). Meaning that respondents were asked to fill their activities in the app on a week- and weekend day, in fixed ten minutes slots for one main and one side-activity as well as who they were with during these activities. One main difference with the HETUS guidelines was the choice not to fill in the activities of the respondents in their own words, but to use a hierarchically ranked category list with a tree structure of overall and sub-categories based on the HETUS categories. In this case the respondents did not have to type every activity in the small screens on their phone; however it was always possible for the respondent to type the activity in their own words if the respondent could not find the appropriate category. Thus, this registration method can be considered a so-called 'light' diary which gives a broad overview of the time allocation, rather than detailed insight in specific activities which are lower in the tree structure.

This pilot study was evaluated positively regarding the technical software development and tests, as well as the willingness of respondents to participate, their response quality and the ease with which even inexperienced persons were able to use the smartphone app (for more information, see Sonck and Fernee 2013; Fernee and Sonck 2013). One of the disadvantages of this study was the small number of participants and that this group was not representative for the Dutch population.

Implementation of the app among a representative group

Because of the overall positive evaluation of the pilot, the smartphone app was implemented in a larger survey. Data were collected from a random selection of the LISS-panel, which is representative for the Dutch public aged 16 years and older. At the time of the study roughly about 61 percent of the Dutch population owned a smartphone[1]. To minimize a possible selection effect in the participation between those owning and those not owning a smartphone, people without a smartphone could borrow one. In order to be as similar as possible to the data collected by the traditional time use survey in the Netherlands (2011/12), data were collected for an

[1] http://statline.cbs.nl/StatWeb/publication/?DM=SLNL&PA=71098ned&D1=33,58&D2=0&D3=a&HDR=G1,T&STB=G2&VW=T

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entire year (2012/13). The data collection finished in September 2013 in which ultimately around 1200 respondents participated.

With this data it is possible to compare the smartphone data collection in more methodological detail with the traditional Dutch time use survey using a paper diary. Furthermore it provides a better understanding of differences between experienced and inexperienced smartphone users. Finally additional functionalities of the smartphone survey enable us to address additional research questions about various topics (well-being, feelings of time pressure, mobility, social media use, etc). In particular, the combination of the different types of data collected using the smartphones may give us a more complete picture of respondent's time-use and well-being. These issues are currently under study by the Netherlands Institute for Social Research.

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TIME IS RUNNING DIFFERENTLY ON THE INTERNET

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Despite the fact that time is an important psychosocial construct by which we organize our daily lives, we do not often think about it. Lack of this reflection is characteristic for the modern world, dominated by features such as speed, agility, flexibility and multitasking, reflecting the popular maxims "time is money" or "do not stop time by hands". Undoubtedly, modernity provides an acceleration which we can achieve by new technologies like GSM and the Internet, imposing "the tyranny of moment" on us (Eriksen, 2003). The increasing number of people owning smartphones, tablets, netbooks, as well as the accessibility of the internet makes the practices of sharing networks in public places (buses, cafes, universities) more common. In this context, we have a question - what kind of influence the new technologies have exerted?

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The authors of the article, based on review of literature and data, develop a thesis that Internet is changing the individual and social perception of time. In order to prove this thesis, we present a new temporal phenomenon, important from the sociological and psychological point of view. In our article, we want to show how the Internet changes people's general concept of time. In this contribution, we only want to signal what content will come in the middle.

Internet proved to be a truly revolutionary invention from the point of view of the social perception of time (Castells, 2007; Dolata, 2006; Eriksen, 2003). Firstly, geographic distances lose their importance. Thanks to the Internet, it is possible to communicate synchronously and exchange information between significant numbers of people separated by thousands of miles. Secondly, the Internet has led to the "colonization of time" (Dolata, 2006), abolishing the distinction for both leisure and work time and transparent division between family, friends and work. Therefore, today we live in eternal present (Tarkowska, 2010). Eriksen (2003) and Bertman (1998) highlight the dominance of the "now" and the culture of the present.

The spread of the Internet has led to the separation of time and space (Szpunar, 2008). Transmission of messages, words and information carries on regardless of geographical barriers at very low cost. Moreover, classical division on the sender and the recipient now is not so important, because the recipient can become the sender at the same time (and vice versa). Examples include social networks, forums etc. Virtual community is thus characterized by a lack of hierarchical structure (Doktorowicz, 2004). The fact that everyone can communicate at the same time is leading to disturbances in the sense of temporal-physical distance.

Another temporal phenomenon is time compression (Barney, 2008). Time compression refers to the ability to perform multiple tasks at the same time. The international study "World Internet Project Poland" (2012) showed that 68% of Internet users spend time in the network performing more than one activity. This multi-tasking is especially characteristic among the younger generation. Jung (2001) notes that the intensification of the time was made possible by miniaturization and the mobility of technical devices such as tablets, netbooks, smartphones etc. For example, while traveling by train, it is possible to connect to the Internet, make a commercial transaction, send an e-mail, eat a sandwich and talk on a cell phone. Paradoxically, on the one hand, new technologies lead to time saving. On the other hand, its increasing importance in our everyday life is time-consuming (Bedyńska, Sędek, 2010).

What is more, time compression concerns reducing the amount of time for each activity. For example, today we can contact with another person or fill out job duties much faster. There are also new forms of activities, carried out by the Internet, such as e-shopping and e-elarning, which are possible to do without leaving home. In the "culture of speed" (Virilio, 1993) the division of past, present and future disappears, because ideas can be immediately put into practice with a single e-mail or Skype conversation.

With reference to the research of virtual gamers, "flow phenomenon" is defined as a specific state of time on the Internet (Csikszentmihalyi, 1990). Holbrook (1994; Chou & Ting, 2003) describes the three qualities that provide the game with the power of "possession" of our time.

Firstly, a game is an activity that we initiate voluntarily, usually in the safe comfort of your home, cutting off from the hustle and bustle of everyday problems (Chou & Ting, 2003). In this way, the game enters our private lives. This activity is performed only for pleasure, without consequences, without the participation of others and care for them. Secondly, the game requires an active approach from the player (not passive, like watching TV) and maximizing his focus on attention, almost becoming an "entry in its center". Thirdly, the game has a real value in itself, because the satisfaction and joy felt by the player are a direct consequence of contact with game. Virtual world is so fascinating that it devours more and more time. Importantly, the most common video games are multi-level. Gamers have a lot of "bonuses" and "extra lives". They can exist forever. Eternity and infinity are not possible in the real world where time flows linearly and seems to be finished.

Is the distortion of time still persisting after the game session? Luthman et al. (2009) evaluated PC gamer's passage for defined lengths of time (e.g. 10 seconds, 60 seconds) before the game starts and after its completion. It turned out that after the game session participants' stretches of time were judged less accurately (e.g. 10 seconds were signaled after about 12 seconds). Before, the game estimates were much closer to the objective over time. For some players, the game can be a cause permanent distortion of time and have adverse effects on the safety in the real world (Wood et al., 2007; Luthman et al., 2009). Many activities of daily living, such as driving and using machines, require reflexes. Delayed reaction of the driver or mechanic can be dramatic.

Esser and Witting (1997; Luthman et al., 2009) have proven that the participants of their experiments lose a sense of time during the game. Many of them use certain strategies to avoid loss of control over the game, for example by setting an alarm clock. Online survey showed that most associated with the loss of sense of time are high complexity of the plot, "multi-level" game character, getting high scores and a large number of logged-in users. Many players have a problem with controlling the time spent playing, as demonstrated Rau et al. (2006; Luthman et al., 2009). Most respondents could not tear themselves away from their favorite games without intervention from the outside. Chen et al. (2000; Chou and Ting, 2003) proved that players often do not know how to refrain from spending long hours on the network because they do not want to give up the pleasure of being in cyberspace. Researchers argue that computer games are one of activities which are able to induce the "flow" state which may cause pathology in the form of addiction.

Chou and Ting (2003) conducted a study which explored how the experience of "flow" contributes to the dependence of playing in computer games. The researchers asked participants numerous questions about addictions (e.g. "When I'm not playing on the computer, I'm unhappy" or "Playing computer games is the most important thing in my life") and about experience of "flow" state in the game (items relating to the distortion of perception of time: "During the game, time passes very quickly to me", "During the game I'm losing a lot of time", "During the game I was unaware of the passage of time"). Results of this study show that the main reason

for repeating the game session is the state of experiencing the maximum concentration on the experience and change the perception of time.

Young (2003) believes that the most characteristic symptom of "flow" while playing computer games is the change in the perception of time. According to the researchers, the player who spent many hours in front of a screen may correspond to only few minutes in his subjective perception. Moreover, limiting any external influences on the game time usually result in conflict with the environment and closing in on itself.

Previous studies have shown that computer game session causes deformities in the perception of time. However, types of computer games (verbal vs. skill) have not been tested so far, as well as the cognitive-motivational states that could explain this effect. The study can be considered a game of solitaire adventure game or reading text on your computer. Then it can be a subjective assessment of the passage of 60 seconds after the game session. In addition, respondents can complete the questionnaire involvement in the currently performed activity (e.g. Csíkszentmihály, 1990).

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eIJTUR

electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 94-111 dx.doi.org/10.13085/eIJTUR.11.1.94-111

A 'QUEER' OMISSION – WHAT TIME USE SURVEYS MIGHT GAIN FROM ASKING DIARISTS ABOUT SEXUALITY

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Yiu-Tung Suen
University of Hong Kong

The field of time use research historically has had an undercurrent of promoting social justice. This dimension dates back to early explorations in the field, from Maud Pember-Reeves use of diaries kept by working class women and George Bevans and use of diaries kept by working class men to debunk myths suggesting the poor lead idle lives without long hours of paid work. Pember Reeves (1913), Leeds (1917), Kneeland (1929), Reid (1934), and others demonstrated that women make significant contributions to the economic output of nations while undertaking unpaid domestic work which official national statistics and economic policies ignored. While it has taken decades for these early observations to gain widespread recognition, recent United Nations reports highlight the importance of collecting surveys of people's daily routines to promote gender equality, both by making women's full economic contributions visible and to formulate other gender equality promotion policies (United Nations 2005; UNECE 2013; Calderón Magaña 2013).

While gender equality for women has featured prominently in the time use research literature, the field offers potential to support a range of social justice agendas, as a basic principal of time use surveys is that the all behaviours of all peoples matter. As time use surveys collect data on activities that have received little research or policy attention, and as these surveys collect diaries from of groups with limited social status, some activities which - and people who - have been invisible in policy debates become visible. This principal is not complete. Time use survey sampling methodology tends to leave out institutionalised people and populations whose transient accommodation makes them difficult to sample (homeless people and refugees, among others). Some minority populations, including people with minority sexual orientations and gender identities whom we consider here, have been sampled, but not specifically identified, making analysis of their time use challenging.

Why presence in surveys and statistics matters

Lesbian, Gay, Bisexual, Transgender and Intersex (LGBTI) people recently have made significant legal breakthroughs in some countries, though in others, anti-homosexuality laws and attitudes have become more severe. In those countries where the legal status of LGBTI people has improved, change remains contested and controversial. Few social surveys and official statistics identify LGBTI people as a separate community of research and policy interest. Such large-scale social surveys that are available for LGBTI research mostly concentrate on same-sex couples, and more of these surveys have been collected in the USA than elsewhere (Fisher and Suen 2014).

Visibility in official statistics matters. Public policies cannot cater for unknown needs. Evaluation of the success or failure of programmes requires reliable data on changes in those communities that policies aim to assist. Appearing in routine population statistics confirms regularisation of the legal and social standing of minority groups. Just as recognising the value of the unpaid domestic work of women has played a role in improving the status of women, presence in official population figures will have a role in improving the quality of life of LGBTI people. Carpenter and Gates (2008) reflect a growing number of voices who "strongly urge researchers to more routinely include direct measures of sexual orientation identification on surveys", not only by collecting whole household age/sex matrixes from large samples, but also asking more specific details about partners and partnership history.

Tracking changes in daily behaviour over time for cohorts of LGBTI people and their majority sexuality contemporaries can reveal the extent to which each of these groups uses the same social spaces at the same (or different) times, the range of regular activities different groups undertake, and whether some groups make compromises (taking longer routes to reach the same destinations or more complicated sequences of behaviours to achieve the same outcomes) to manage the same range of daily experiences. Degrees of different use of spaces, performance of activities and arrangements of days can reflect the degree of social integration (or lack of integration) of any minority population.

Time diary surveys in particular offer the additional possibility of informing the way minority communities which have been ostracised alter their daily routines as they gain social acceptance. As even in their most quantitative and reduced form, time diaries collect narratives, the narrative component of time use surveys offers elements of resonance with the qualitative sexuality studies. On-going experiments with GPS and related devices tracking the location of diarists will enable future time use research to consider the more precise location of activities (in height and well as longitude and latitude), which may prove more useful if measuring differences in uses of social spaces.

Same-sex couples in time use surveys

Some time use surveys offer the potential to explore the daily activities of same-sex couples. The United States Census and Current Population Surveys collect data on couples in households, including collecting the age and sex of people who identify themselves as being married or living together as a couple. The American Time Use Survey samples a subset of the CPS. Similar possibilities arise in surveys following the Harmonised European Time Use Surveys guidelines, and collect detailed matrixes of household members mapping relationships between members.

As yet, the capacity to identify same-sex couples is incomplete. No currently released national sample time use survey explicitly asks participants about their sexuality (though this will change in 2015). As this research is in the early phase, we adopt a basic definition - people reported to be of the same sex and in a couple on household grid information. We find 415 such people completed diaries (Fisher and Suen 2014) included in the Multinational Time Use Study

archive (Fisher and Gershuny 2013 summarise this dataset). We accept that this crude approach may capture some data errors where the sex of one person is recorded in error. Only eight of the over 60 surveys in the MTUS appear to include any same-sex couples, and of these, only three have sufficient numbers of couples for independent analysis – but prospects for analysis do exist for Spain (HETUS surveys and the USA (ATUS). We explore the Spanish surveys in separate research (where we compare the time use of both partners for the same days). In this paper, we concentrate on people living same-sex couples in the USA, where only one of the people in these couples completed one 24-hour diary.

Table 1 displays basic descriptive statistics comparing same-sex and mixed-sex couples in the American Time Use Survey (MTUS version for 2003-2010). People in same-sex couples are slightly younger, a lower proportion of them live in rural areas, and generally they have greater social and monetary capital resources. This most basic comparison suggests sampling bias which we cannot wholly eliminate in modelling. As we have no reliable statistics for the total same-sex couple population, precisely disentangling this potential bias is difficult.

Table 1
Basic demographic characteristics of diarists in same-sex and mixed-sex couples in the American time use survey (multinational time use survey version)

Basic demographic characteristics of diarists	Same-sex couples	Mixed-sex couples
Diarists who are women (%)	49.2	48.2
Mean age of diarists	42	46
Diarists who live in a rural area (%)	7.9	19.3
Couple lives with a child aged <5 years (%)	13.2	27.1
Diarist is a citizen of the USA (%)	94.7	91.3
Diarists working full-time (%)	77.1	58.9
Diarist holds managerial or professional job (%)	39.3	26.5
Household in top 25% of income distribution (%)	46.4	33.4
Diarist has post-secondary education (%)	78.9	62.4
Household rents accommodation (%)	24.1	16.3

Source: ATUS (MTUS version for 2003-2010), own calculations.

Given the long history of limiting access to adoption and fertility treatment and the very recent legal recognition of same-sex couples in many US states, the lower percentage of couples living with young children is not surprising. Qualitative research comparing same-sex and mixed-sex couples suggests that the absence of established cultural narratives defining roles for domestic arrangements means same-sex couples enjoy more freedom to experiment and invent roles their roles (Shipman and Smart 2006; Smart 2008). The possibility that more people in LGBTI couples work full time may reflect a more widespread interest in domestic equality (some literature on this topic summarised in Fisher and Suen 2014). Other stark differences in the basic distributions are more difficult to explain, though higher levels of education in same-sex compared to mixed-sex couples has been observed before (Shipman and Smart 2006; Smart 2008). It may

well be that Lesbians and Gay men with more social standing (reflected by the employment status, income and education) may feel more able to openly acknowledge their sexuality and to choose to form partnerships in keeping with their identities.

The way LGBTI people structure daily routines is a new area in the time use research field. In a small-scale survey of parents, Chan et. al. (1998) observed no difference in the time investments Lesbian and straight parents devote to raising children. While conducting in-depth interviews with ageing gay men in the UK, Suen (2012) recorded many instances where these men recalled needing to use caution with the timing certain activities as well as taking care in choosing the place of some common-place activities, like eating out, in order to avoid trouble.

The MTUS harmonises time use surveys post-collection. This process involves translating original activity codes into a set of 69 harmonised time use activities (Fisher and Gershuny 2013). As a point of initial exploration, we selected those ATUS (MTUS version) diarists who completed good quality diaries and who live in a couple, and ran simple 1-way Anova tests of time in all 69 of these activities comparing the mean daily minutes spent in each activity by same-sex and mixed-sex couples; then by same-sex couples with and without children, and mixed-sex couples with and without children (full tables in Fisher and Suen 2014). Of these 69 activities, only 21 showed significant to marginally insignificant variation in total minutes spent in each activity per day across the two then the four couple groups (Fisher and Suen 2014), though as we have very small samples across pooled years of the American Time Use Survey of same-sex couples, these numbers are not necessarily meaningful. We collapsed these 21 activities into 15 categories for further analysis.

The MTUS offers blunt location information as such detail is not readily harmonised. We tested three additional basic concepts regarding location and timing in the same way as we initially examined the 69 activity categories – total minutes of leisure time in the day spent with the spouse or partner; total minutes per day away from home, and total minutes per day away from home after 18:00. In simple one-way Anova tests, the four groups of couples appear to vary, but again as the numbers of same-sex couples are small, these variations are not necessarily meaningful.

We then followed up the total minutes per day spent in these 18 groups of activities which appeared to show some differences using a simple OLS model[2]. We opt for this basic model, in part as this paper offers an initial overview of what might be possible in this area, and in part as the numbers of same-sex couples is too small to permit many more sophisticated approaches. While there are some diarists in couples who have no time recorded in one or more of these activities, as people do not undertake every potential activity every day, these 0 observations

[2] controlling for sex, age, age2, citizenship, whether the diarist undertook post-secondary education; living in a household in the highest 25% income band, holding employment in a managerial or professional job, working full-time or not, living with a child aged <13 in the household, renting accommodation, living in rural area or not, and (appears to) live in a same-sex couple.

reflect real behaviours over the 24-hour diary observation windows. More details and results appear in Fisher and Suen 2014.

Once some consideration is made for basic person and household demographics, same-sex couples appear to undertake only four of these activities differently from mixed-sex couples. Same-sex couples spent roughly four extra minutes per day walking dogs; 10 more minutes per day using the internet as well as going out to cinemas, theatres or concerts; and half an hour additional time visiting and in conversation with others. The extra internet and cultural performance time may reflect what appears to be a sample bias, as those same-sex couples with more income, education and higher status jobs may well be over-represented. We suspect that the higher social time same-sex couples enjoy, both with pets and with other people, may prove noteworthy in follow-up research.

The non-significant results, however, also have meaning. We replicate the finding of Chan et. al. (1998) that same-sex couples make the same time investments in their children. As time with children, time contributing to wider social good through organisational and voluntary activities, and time in religious activities reflect some of the contested ground in policy debates over the legal rights and social status of people with minority sexualities, finding no difference between same-sex and mixed-sex couples behaviour in such activities reinforces arguments that protecting the civil rights of minorities poses no threat to the majority population.

Wider considerations and future research potential

Such contemporary concerns as work-life balance or the impact of behaviour on the environment matter for people of minority as well as majority sexualities. Minority groups can face particular circumstances requiring policy attention, and while this is not always the case, policy research should consider the prospects for such differences. As visibility in social statistics affects the representation of minority social groups in policies promoting fairness of opportunities and access to services, time use surveys have particular relevance for collecting some of this baseline social data.

The huge gap in knowledge relates to minority sexuality people who are not in couples. This case has a parallel in the wider time use research literature, as comparatively few articles consider the time use of single people separately, and many which do are relatively recent.

The 2015 Canadian General Social Survey, which will include a 24-hour mixed-method interview time diary, also will ask all participants a basic question about their sexuality (Fisher and Suen 2014). This question will add clarity (or perhaps open new research investigations) into the number of same-sex couples and the suitability of using household matrices to find such couples. More intriguingly, this question will identify some LBTBI people who are not in couples, albeit using categories covering a limited range or orientations. Though not all people will feel empowered or inclined to answer this question, leaving some concern with sampling bias, this question nevertheless represents an advance.

Having a larger sample of non-straight diarists holds out the prospect for more detailed consideration of the timing of activities and structuring of days. The daily routines of LGBTI people merit further research. We hope more future surveys may build on the 2015 Canadian example.

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electronic ***International Journal of Time Use Research***
2014, Vol. 11, No. 1, 94-111 dx.doi.org/10.13085/eIJTUR.11.1.94-111

Book notes

by Kimberly Fisher

Beauguitte, L. (ed.)
Networks in time and space (2013)

Publisher: Actes de la Deuxième Journée D'études du Groupe Fmr
Website: https://halshs.archives-ouvertes.fr/halshs-00869371
Languages Available: French

This book draws on expertise from researchers in history, town planning, sociology, geography, physics and computing to map changing social and economic network structures in time and space in France. This book draws on ideas developed by PhD and younger researchers mixed with the experience of those more established in their fields.

Calderón, C. M. (ed.)
Redistributing care – The policy challenge (2013)

Contributing Authors: Castillo, A. F., Galván, E., Jain, D., Lamaute-Brisson, N., Navarro, F. M., Ponce, L. O., Fernández, P. P., Enríquez, C. R., Salvador,S., Sauma,P. and A. V. Rodríguez
Publisher: CEPAL
ISBN: 978-92-1-021070-6
English Website: http://www.cepal.org/cgi-bin/getProd.asp?xml=/publicaciones/xml/7/51137/P51137.xml&xsl=/publicaciones/ficha-i.xsl&base=/publicaciones/top_publicaciones-i.xsl
Spanish Website:
http://www.cepal.org/publicaciones/xml/6/50976/cue101Redistribuirelcuidado.pdf
Languages Available: English, Spanish

In 2007, the United Nations Economic Commission for Latin America (CEPAL) sponsored a regional conference on Women in Latin America and the Caribbean to plan how to improve the visibility of women's contributions to national output. This conference stressed the importance of measuring care labour. This report assesses progress since that meeting, and highlights the latest debates on the definition and measurement of care. The report also discusses how time use information has influenced public policies in the region (though some of the time use surveys discussed here collected extended stylised estimate reports rather than time diaries or other continuous measures).

datapieces

Cloïn, M.
An overview of time use – Results from the Netherlands time use survey (2013)

Publisher: Sociaal en Cultureel Planbureau
ISBN: 978-9-037-70670-3
Website:
http://www.scp.nl/Publicaties/Alle_publicaties/Publicaties_2013/Met_het_oog_op_de_tijd
Languages Available: Dutch

This report offers an overview of daily life in the Netherlands in 2012. The report also maps changes in activity patterns in the Netherlands, primarily contrasting the 2006 survey with the 2011-12 survey, as both these surveys followed the HETUS guidelines, and collected diaries during a 12 month period from all members of sampled households aged 10 and older for one week day and one weekend day. The report also reflects trends since 1975, though the every 5 years early surveys conducted prior tp the HETUS surveys collected a one-week diary from one person aged 12 and older per household during October only.

Corti, L., Van den Eynden, V., Bishop, L. and M. Woollard
Managing and sharing research data – A guide to good practice (2014)

Publisher: Sage Publications
ISBN: 978-1-446-26725-7
Website:
http://www.uk.sagepub.com/books/9781446267264
Languages Available: English

Practitioners advance the cause of time use research by making data available for continued analysis and reuse. This book gives excellent step by step advice on how to prepare data for archiving. The book covers the range of processes involved, from how to plan for archiving from the initial design of data collection through the deposit of data. The book also offers guidance on publishing and citing data resources, promoting collaborative research, and ethical issues associated with data reuse.

Csikszentmihalyi, M.
Applications of Flow in Human Development and Education (2014)

Publisher: Springer eBooks
ISBN: 978-9-401-79094-9
Website:
http://www.springer.com/psychology/book/978-94-017-9093-2?wt_mc=Alerts.NBA.Sep-14_WEST_16829205
Languages Available: English

Mihaly Csikszentmihalyi, one of the pioneers of the Experience Sampling Method alternative measurement of time use, primarily examines education systems in this book. Nevertheless, he also addresses a number of topics relevant to time use research, including the influence of daily routines, family life, leisure patterns, and the organisation of learning activities. The volume mixes more theoretical sections with more policy-focussed sections that suggest how education can inspire people to reduce their environmental footprint and adopt

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lifestyles associated with higher well-being and enjoyment.

Dolan, P.
Happiness by design – Finding pleasure and purpose in everyday life (2014)

Publisher: Allen Lane
ISBN: 978-0-241-00310-7
Website:
http://www.amazon.co.uk/Happiness-Design-Finding-Pleasure-Everyday/dp/0241003105/
Languages Available: English

This book proposes that the structure of daily life contributes to the overall happiness (or unhappiness). The book reviews a range of social science and medical research, and makes suggestions for behaviour patterns that are more likely to enhance happiness. The book make some review of time use literature, but also offers analysis based on related behaviour research.

Duff, K.
The secret life of sleep (2014)

Publisher: Atria Books/Beyond Words
ISBN: 978-1-582-70468-5
Languages Available: English

This popular science book explores the concept of sleep. Duff explains the biological functions of sleep, and a range of ways in which people address sleep challenges caused by stress, illness, biological changes associated with the life cycle, and work environments (from more extreme cases, such as astronauts, through more frequent cases, like shift workers). The book also examines cultural expectations and practices associated with sleep.

Eydal, B. E. and T. Rostgaard (eds.)
Fatherhood in the nordic welfare states – Comparing care policies and practice (2014)

Contributing Authors: Andersen, A. F., Bloksgaard, L., Brandht, B., Duvander, A. Z., Eydal, G. E., Friðriksdóttir, H., Gíslason, I. G., Gornick, J., Haataja, A., Hakovirta, M., Johansson, M., Kvande, E., Lammi-Taskula, J., Lausten, M., Nielsen, S. B., Nordenmark, M., O'Brien, M., Ottosen, M. H., Pääkkönen, H., Reincke, K., Rostgaard, T., Salmi, M., Westerling, A. and M. Ylikännö
Publisher: *Sarah Crichton Books*
ISBN: 978-03-742-2844-6
Website:
http://www.scp.nl/english/Publications/Publications_by_year/Publications_2013/Using_smartphones_in_survey_research_a_multifunctional_tool
Languages Available: English

The volume explores changes in the ways fathers participate in supporting and caring for their children in Denmark, Finland, Iceland, Norway and Sweden. While some chapters do not address time use topics directly, the whole book contributes to understanding how the combination of the Nordic style of welfare provision and social policies promoting gender equality shape fathers' daily activities. A number of the au-

thors are regular contributors to the collection and analysis of time use surveys.

Meers, S. and J. Strober
Getting to 50/50 – How working parents can have it all (2014)

Publisher: Piatkus
ISBN: 978-0-349-40236-9
Languages Available: English

This is one of two major popular literature books exploring the work-life balance of working parents written by working mothers released in 2014. Meers and Strober argue that the key to achieving this balance and a happy family life is for women and men to share the paid-work, child care and housework tasks equitably. They propose a number of steps, including strategies for negotiating with employers to "baby boot camp" for first-time fathers, to foster the attitude shifts required to encourage their vision of happy families meeting the challenges of the contemporary world.

Palestinian Central Bureau of Statistics
Main findings of time use survey, 2012/2013 (2014)

Publisher: Palestinian Central Bureau of Statistics
Website:
http://www.pcbs.gov.ps/pcbs_2012/Publications.aspx
Languages Available: Arabic, English

This report details basic time use patterns and summarises the methodology of the second national time use survey conducted in the Palestinian authority. The survey sampled nearly 6,000 households and collected diaries from household members aged 10 and older between October 2012 and September 2013. The report covers the challenges for collecting official statistics in the circumstances faced by this community.

Schulte, B. and T. Gilbert
Overwhelmed – Work, love and play – When no one has the time (2014)

Publisher: Brilliance Audio
Languages Available: English

This narrated version of Washington Post journalist and mother Brigid Schulte exploration of the work-life balance struggle which working parents in the USA face is the first time use book released in an audio format, and the narration offers an engaging experience. As part of her research, Schulte attended the 2010 IATUR conference in Paris, where she interviewed a number of prominent authors in the field. She offers a hilarious account of dining out with John Robinson and Jonathan Gershuny. Though aimed at a general rather than an academic audience, this book does address the current debates in the time use literature relating to gendered divisions of work and the structure of contemporary work and family life patterns in the USA and European countries.

time use sciences

Todesco, L.
What men don't do – Unpaid family work in contemporary societies (2014)

Publisher Carocci
ISBN: 978-8-843-07044-2
Website:
http://www.pcbs.gov.ps/pcbs_2012/Publications.aspx
Languages Available: Italian

This book explores the roles the balance of paid and unpaid labour within households plays in wider social power structures. The book considers how public policies and welfare systems have potential to reshape the behaviour of men and women in households, and how changes in the gender balance within households in turn could reshape societies.

United Nations Economic Commission for Europe
Guidelines for harmonizing time-use surveys (2014)

Publisher: United Nations Economic Commission for Europe
Website:
http://www.unece.org/publications/time_use_surveys.html
Languages Available: English

The United Nations Economic Commission for Europe (Geneva, Switzerland) released this major contribution to the time use survey literature shortly after the publication of the last issue of the eIJTUR. These guidelines focus on official reporting of survey results and policy applications using using time use data, the most significant of which include monitoring progress towards gender equality, calculating the full system of national accounts (including unpaid domestic work as well as monetised economic activity), and measuring well-being. The report highlights other policy applications for time use data, and details challenges and opportunities arising for the future collection of such surveys.

Varjonen, J., Hamunen, E. and K. Soinne
Satellite accounts on household production – Eurostat methodology and experiences to apply it (2014)

Publisher: Statistics Finland
ISBN: 978–9-522-44487–5
Website:
http://tilastokeskus.fi/ajk/julkistamiskalenteri/kuvailusivu_fi.html?ID=12368
Languages Available: English

Historically, women's contribution to total goods and services produced in each country has been under-represented as systems of national accounts have failed to include the unpaid work households undertake to produce goods and services consumed by the same households or by households with which people have informal, non-institutionally organised arrangements. Early efforts to expand the production boundary to account for unpaid domestic work concentrated on valuing the labour inputs. This report applies a method refined by a recent Eurostat task force that calculates non-financial accounts using time use survey data, in this case for Finland, which values both the labour inputs and the

service outputs. In addition to revealing the full scale of economic activity in Finland, this report also outlines methodological issues arising from applying the Eurostat methodology.

time-pieces