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WELCOME ADDRESS OF THE IATUR PRESIDENT: EIJTUR AND TIME-USE: PAST, PRESENT AND FUTURE

Welcome to the inaugural edition of the electronic International Journal of Time-Use Research (***eIJTUR***). Developed under the auspices of the International Association for Time-Use Research (IATUR), eIJTUR is a refereed international journal for the publication of, in a timely manner, quality research that makes an original contribution to the advancement of time-use knowledge. Research papers and review articles will be selected through a peer review process, overseen by an international editorial board.

eIJTUR is the first journal dedicated to the measurement and analysis of time-use. It will present material of both a methodological and substantive nature.

eIJTUR is published by the Research Institute on Professions (FFB) at the University of Lueneburg German under the management of Joachim Merz. The board of editors, drawn from a wide geographical and disciplinary spectrum, is dedicated to the promotion of authors and literature in the field of time-use research.

Submissions are sought relating to survey and analysis methodology, substantive analysis, and policy applications of all time-use data. Brief reports on new studies will be included in an appendix.

Time-Use Research – Beginnings

The earliest known published accounts of Time-Use research appeared in 1913. Following a slow and sporadic beginning time-use research received a significant boost in the mid 1960's with the undertaking of the Multinational Comparative Time-Budget Research Project under the direction of Alexander Szalai. Gathering data from the fifteen different survey sites in twelve different countries, the multinational study, commonly referred to as the Szalai study, was a landmark endeavor in time-use and cross national research. It served as an impetus to, and a framework for, a large number of new Time-Use studies.

IATUR – Beginnings

Equally important, members of the Szalai project established a Research Group on Time-Budgets and Social Activities, following the official closer of the Szalai project in Vienna in 1970 to maintain the momentum created by the Szalai project. The first meeting of group took place at the International Sociological Conference in Varna in 1970. Aas (1986) provides an extensive account of the early years of the group listing all meetings up to 1984. The group has met ever

since as Ad Hoc or Thematic Group 1, with the International Sociological Association (ISA) Congresses. Additional meetings were typically held between congresses generating a meeting every two years. Occasional other meetings were held as possible.

The name of the group was changed to the International Association for Time-Use Research (IATUR) in 1988 at its meeting in Budapest. Also, at that time it was decided that IATUR would meet annually. The pace of data collection and analysis had reached a sufficiently high level that the bi-annual meetings did not provide an adequate venue for the growing output.

Following the Budapest meeting, meetings have been held in Varna (1989), Madrid (1990), Rome (1993), Amsterdam (1994), Jaranka, Poland (1995), Vienna (1996), Stockholm (1997), Montreal (1998), Essex (1999), Belo Horizonte, Brazil (2000), Norway (2001.

Starting in 2002 (Lisbon, 2002 and Brussels, 2003) IATUR conference attendance and paper submissions virtually doubled equivalent numbers for any pre-2002 meeting. In addition to the 2002 meeting in Lisbon which easily broke all attendance records IATUR met as Ad Hoc Group 1 with the ISA in Brisbane (2002).

The 2004 meeting is being held in Rome. The next two meetings are planned for Halifax (2005) and Denmark (2006). In addition to these regular conferences others have been co-sponsored by IATUR.

Time-use Research Growth

A number of significant advances have been made over the years in the collection of time-use data. These include expansion of diary keeping from a single respondent to two or more family members; the incorporation of geographic space information in the diary; development of light diaries (a matrix of a brief activity list and time-slots; longitudinal studies; panel studies; a broadening of objective dimensions; collection of multiple diary days per respondent, collection of diaries to encompass a full year; the inclusion of subjective dimensions in the diary; the linking of monetary and time expenditures; and forthcoming the linking of time-use with GPS data. While time-diaries are unquestionably the favored time-activity collection medium, question based recall approaches have gained some support for use in special circumstances. Continued work on the use and integration of diary and question based recall is needed.

Conference presentations and analytical approaches have advanced significantly since the middle of the 1980s. Increasingly papers and presentations are addressing theoretical issues and using more sophisticated statistical procedures. Statistical methods such as testing of means and proportions MCA analysis, ANOVA, OLS regression, logit and tobit regression focusing primarily on summary data dominated analysis up to the 1990's. While still playing a major role in analysis they are increasingly supplemented by techniques for dealing with episode data such as hazard analysis found in most statistical software, sequencing software such as Clustal G,

Time-Use Research – The Players

Prior to the Szalai study the main players in time-use studies were academics and local or national institutions, departments or agencies. The Szalai study was the first to be facilitated by an international agency, the European Centre for Coordination of Research and Documentation in

Social Sciences (Vienna Center). In 1975 the International Institute for Applied Systems Analysis (IIASA) hosted a workshop, *Application of time-budget research to policy questions in urban and regional settings*. Papers from that session were co-sponsored by IIASA and the Vienna Center. Following a hiatus in international involvement in 1985 the European Foundation on Living and Working Conditions based in Dublin underwrote the establishment of the Multi-National Longitudinal Time Budget Archive under the leadership of Jonathan Gershuny, at the time located at the University of Bath. This event was a major landmark in the expansion of data access for time use analysis. It enabled the beginning of an archival process which continues to create comparable time-use data sets over time and across countries. Gershuny, with the assistance of Sally Jones at Bath continued to expand the archive following a move to Oxford University. Subsequently the archive moved with Gershuny to the Institute for Social and Economic Research (ISER) at the University of Essex. Since cessation of European Foundation support, the archive has been primarily supported by participating institutions and various small research grants (however see linked article). The archive is undergoing extensive reorganization and upgrading with major inputs by Anne Gautier and her assistants at the University of Calgary and Kimberly Fisher at ISER. The MLTBA now known as the Multi-National Time-Use Study (MTUS) continues to be a major and expanding asset available to time-use researchers. Detail on the history, supporting researchers, documentation of archived studies and a listing of known studies as well as the archived data can be obtained at on the MTUS site.

In the early 1990's interest at the international level expanded with work undertaken by several UN agencies. Through the decade of the 1990's other UN Divisions including The Institute for Research and Training for the Advancement of Women (INSTRAW) undertook a program to examine the nature and measurement of non-market production, promoting the collection of time-use data as the major measurement tool. The UN Statistical Office assembled cross-national time-use data for inclusion in its *World's Women* publication. Efforts of the agencies and other NGO's culminated in the adoption of a resolution at The 1995 World Women's Conference in Beijing advocating non-market measurement based on time-use studies and calling on nations to implement them. Sine the Women's Conference the UN Statistical Office has been developing a classification of activities in an attempt to provide a bridge between developed and developing country studies. The UNDP incorporated time-use analysis in developing its Genderized Human Development Index. It has also promoted time-use workshops and studies in developing countries. The World Bank incorporated a chapter on time-use in its Living Standards Measurement Study guide.

Concurrently the European Community through EUROSTAT launched an effort to develop a model for Harmonized Time-Use Surveys. Numerous meetings were held, primarily at EUROSTAT, but also some in conjunction with IATUR meetings to address issues related to survey design, questionnaire and diary content and diary design. General agreement was reached on basic dimensions of a harmonized study and coding scheme. While the harmonized model was generally implemented as designed, various studies deviated from, often going beyond, the harmonized model. However, compatibility was maintained by collecting data in such a manner that the data expected for the harmonized model could be elicited. During the last decade many national studies have been undertaken. The EUROSTAT project generated 18 pilot/full studies in the late 1990's and numerous additional studies have been undertaken since. The most complete listing of studies is provided by MTUS and can be accessed at http://iserwww.essex.ac.uk/mtus/technical.php.

Several programs, in addition to MTUS exist to promote and facilitate time-use data collection and analysis. These include, in alphabetical order, the Multinational Household Expenditures Study MHES, University of Melbourne; International Research Network on Time-use RTNU, University of Lueneburg, Germany; Tempus Omnia Revelat, TOR, Free University of Brussles (VUB); Time Use Research Program, Saint Mary's University, Canada TURP. These organizations are working together to obtain time-use data and related information, organize and document it, make it available to the broader user community and to carry out analysis.

Time-Use Research – The Future

We now stand at the threshold of the emergence of time-use data as a major player in the world of social statistics. The expansion of data collection in both developed and developing countries and the expansion of MTUS are major contributors to this phenomenon. Another major contributor is the American Time-Use Study (ATUS) launched by the US Bureau of Labor Statistics (BLS) in January 2003. Since then the ATUS has collected approximately 2000 diaries per month with plans to continue to do so on an ongoing basis. The data, collected from a roll-out of the US Current Population Survey (CPS), will provide over time a rich body of time-use data. It will be rich both in the potential it will provide to focus in on small populations and in the potential to relate time use to various supplemental issues addressed by the CPS such as earnings, alternative work arrangements, union membership and much more.

eIJTUR will provide a major outlet for study results and a major forum for discussion of issues related to the theory and policy application of the use of time. I am extremely pleased with the establishment of eIJTUR under the auspices of the Research Institute on Professions (FFB) at the University of Lueneburg Germany and IATUR. It is a project which I have long envisaged. It became possible when Dr. Joachim Merz offered to Co-edit and serve as its Managing Editor in spite of the heavy burden a managing editor's job entails. On behalf of the members of IATUR I want to thank him for undertaking this task for us and pledge my support, and I trust the support of all IATUR members in helping him create and maintain a useful and quality journal dedicated to the rapidly expanding field of time-use research.

Dr. Andrew S. Harvey, President

International Association for Time-use Research.

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EDITORS' INTRODUCTION

The accurate measurement of the temporal characteristics of physical phenomena (durations, rates, accelerations, cycles, frequencies, simultaneity, sequences-of-occurrence) has been of the greatest importance for the development of the natural sciences. The motivation for this new journal is the view that the same will be true for the social sciences: time use ought to be a core concern in economics and sociology and for the analysis of public policy in general.

In the last five years the official statistical institutes of at least 20 OECD countries (including France, Germany, Italy, The Netherlands Belgium, US, Canada) have collected large national time-diary sample surveys. The reason for this substantial investment in time studies is not of course that researchers and policymakers are interested in time as such, but rather, in manner analogous to the natural sciences, in using time as a way of measuring the extent and distribution of social and economic activities.

Things that we do with our time, regularly and repeatedly, on a daily, weekly or monthly cycle, may add to our stock of personal capacities, and hence to the resources that determine our life-chances in the long-term. Time-use influences one's social and economic position (whether considered in terms of earning capacity or social class) through the accumulation of different sorts of embodied "capitals" or "capabilities". There is an interdependency between, on one hand, habits and short-term sequences of work and leisure activity, and on the other, processes of accumulation of production and consumption skills and social connections (i.e. human, cultural, social capital). Social position reflects those past activities that contribute to current capabilities. What we have done, determines who we become.

An understanding of a society's "time budget" also provides more macroscopic insights into issues of social and economic structure and social differentiation (poverty and well-being, life-chances in general) through the balancing of time spent in different sorts of consumption and production activities. Production and consumption activities must be balanced at the individual level, in the (Gary Becker) sense that the hours of work at a given wage must provide enough income to purchase the goods and services associated with the hours of leisure. Similarly at the societal level the total of work time (including that embodied in exports) must be sufficient to produce (or import) the goods and services required for the society's consumption time: the distribution of paid occupations in the economy must mirror the pattern of consumption (plus exported work, minus imported). Time-use indicators thus describe both labour supply and (through consumption) demand for labour, and have implications for national accounting practice, and for the understanding of the distribution, dynamics and transmission of social advantage or disadvantage, of class (since class structures reflect occupational patterns) and of gender differentiation.

Time allocation on its own is clearly not a sufficient basis for a full understanding of socio-economic structure. We also need to know about stocks of fixed and human capital, about collective norms, values and beliefs, and about patterns of public regulation and service provision. Time measurements however provide a basis for integrating the diverse phenomena of production and consumption into a general framework of explanation of processes of societal and economic structural change.

We as the editors of the new electronic International Journal of Time-Use Research (eIJTUR) are glad to welcome both readers and contributors to this new enterprise. This is a rapidly expanding and centrally important research field, and we hope that the journal will contribute substantially to it.

We thank all the contributors for giving us the opportunity to publish their articles and thank in particular Hanno Schlüter for web programming and Dipl.Vw. Paul Böhm for his publishing assistance. Special thanks to Kimberly Fisher for gathering the eIJTUR Time Pieces.

August 2004, Lüneburg

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Measuring work-life balance using time diary data

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Abstract

This paper examines how time diaries facilitate the study of work-life balance. We first compare aggregate time spent in paid work, unpaid work, attending to personal needs, and free time across seven countries using the Multinational Time Use Study. We then measure the overlap of work with other activities in two ways. First, we map the timing of episodes of work over the day, and overlay these maps onto maps of leisure time. A social group can be said to have a work-life balance if their peak periods of different activities do not overlap substantially. Second, we measure the total time spent performing multiple activities at the same time, and compare periods of multi-tasking where work is the main focus while other activities occur simultaneously with multi-tasking where work occurs alongside another activity that is the main focus of the diarist's attention. All analysis is broken down by sex and age. There are many qualifications on these results, and the results in this paper are exemplary of what can be done rather than definitive findings.

JEL-Codes: J17, J19

Keywords: work-life balance, cross-national analysis, simultaneous activities, quality of life

We would like to thank the European Foundation for the Improvement of Living and Working Conditions for funding this research.
Earlier versions of this paper were first presented at the International Association of Time Use Research (IATUR) Annual Conference 2002, 15-18 October 2002, Lisbon, Portugal; then as a 2003 working paper of the European Panel Analysis Group (EPAG WP 32), and sections of the paper appeared in two chapters of An Illustrative Report on Quality of Life Indicators; a report produced for the European Foundation for the Improvement of Living and Working Conditions, Dublin.

1 The problem of work-life balance

Popular discourse warns of dangers to quality of life when the responsibilities of people's paid employment dominate other aspects of daily life. In consequence, many governments have expressed interest in monitoring work-life balance. Measuring the degree to which populations lead balanced lives, however, can prove problematic. The dividing line between work and free time is not distinct. Some people draw more life satisfaction from their work than from free time activities. Other people devote such extensive time and financial resources to "free-time" activities that other dimensions of their lives suffer – creating an imbalance similar to the imbalance that can arise from working excessive hours. People increasingly answer work-related calls on mobile phones while in restaurants, out shopping, or even using the toilet. Checking e-mail often entails a combination of answering work-related and personal messages, even when e-mail is accessed at home or on holiday.

Official leisure statistics tend to focus on levels of consumption (such as number of DVD players or gym memberships sold), employment in leisure industries, and the proportion of populations that participate at some minimal level in varying activities (Gershuny and Fisher 2000). Merely possessing goods, having access to facilities, or periodically participating in various activities for short periods, however, does not guarantee that they draw satisfaction from their free time or that they have achieved balanced lives.

Social theorists have provided ample justification for measuring work hours as part of the measurement of work-life balance, but the other elements of the equation remain less clear. John Stuart Mill and John Maynard Keynes proposed that technology would speed the production of sufficient goods to satisfy people's wants, creating more free time. Karl Marx countered that the economic power of capitalist classes required the continued exploitation of workers through (in part) long working hours. Thorstein Veblen posited that new technology would increasingly provide workers with the means to emulate the leisure patterns of the superordinate classes, and that the desire to improve social standing would lead to a diffusion of patterns of leisure down through society. Betrand Russell and Joffre Dumazedier proposed that the evolution toward post-industrial society would lead to an inevitable expansion of time for leisure (these positions are summarised in Gershuny and Fisher 2000).

More recently, Juliet Schor (2001; 1998) suggests that businesses maximise profits by goading employees to work long hours. Thus, while workers more financial resources than previous generations, they also have less free time. Schor (2001; 1998) ontends that leisure has transformed towards rapid accumulation and unsustainable consumption of resources with little time for relaxation. The key measures suggested by each of these theories are the total hours devoted to work and total hours over which people have discretionary control. What remains is a need to measure both unpaid work and discretionary time alongside work time in a manner which allows the determination of the degree of balance. In this paper, we demonstrate that time diary data can fill this need. We first review existing research which shows that diary data can measure the balance of paid work, unpaid work, and free time. We then explore additional potential offered by diary data, the ability to measure the timing of work and leisure, and the ability to measure the overlapping of work and other activities. This paper serves as a guide to future substantive work.

2 Measuring hours of paid work, unpaid work, and free time

Policy makers and academics have a long-standing interest in collecting statistics on contracted hours of paid employment and usual hours of work. Recent changes in employment legislation at both the European level and the national level of many EU member states reflect a general concern among policy makers that long hours of work can have damaging social consequences (Lourie 1996). Conventional questionnaire surveys, such as labour force surveys, have asked people such questions about how many hours they generally work (in main and second jobs), how many hours they worked in the last week, how many hours of paid and unpaid overtime they usually work, how many paid and unpaid hours are worked at home, and average times spent commuting. Hours of work have a relation to quality of life to the extent that the greater proportion of the day and week that is devoted to work, the less time remains for the enjoyment of the fruits of that labour. Nevertheless, there are shortcomings to the conventional 'hours of work' approach.

First, the accuracy of estimates of time at work is in doubt. Jonathan Gershuny and John Robinson have compared the actual hours of paid work recorded in time diaries and estimated hours worked made by the employed people who completed the diaries, and found that the estimated time is often inaccurate, for some types of work underestimated, and for others overestimated – with overestimation being far more prevalent (1994). The reasons for the inaccuracy arises as people do not have an in-built stop watch keeping track of time spent in each activity. Except in cases where working hours are rigidly controlled, people do not keep exact track of hours. Unless they carefully reconstruct their actions for a day, people have difficulty estimating actual time spent in an activity - a phenomenon that also arises for housework, other unpaid work (such as chauffeuring children to school and activities, or helping an elderly parent with medical care), time in vehicles, and time with other people as well (Gershuny 2000). Further, time at the work place is not the same as time on the job, as people may attend to non-work-related matters while at work (Robinson and Godbey 1997). We return to the question of the overlap between work and other activities in the next section.

At the same time, considering the influence of work on the balance of needs in people's lives requires a broader definition than hours worked. Time which is not paid, but which is taken up by a focus on work (such as time spent waiting for a work activity to begin, commuting, or engaged in unpaid preparation for a work event) precludes the possibility of a focus on other areas of life. Nevertheless, time spent in these activities is relevant to measuring work-life balance. Further, the concept of a balanced life must also take account of unpaid activities necessary to maintain quality of life (from arranging for repairs around the home, to paying bills, to buying supplies and goods for the household, to child care) but which in themselves are not conducive to relaxation, quality time with family and friends or intellectual challenge. Conventional measures of contracted hours or hours worked last week miss out on these dimensions of work-life balance.

Time diaries, in which people record what they do during the day (and usually also note where they are, how they travel from place to place, and who else is with them during activities), offer the advantage of collecting information on the spectrum of issues relevant to measuring balance of needs in life. Diaries collect information on actual hours worked, time spent at the workplace or in other contexts that make work the focus of those periods of the day, time in unpaid work activities, time in personal care, and time in varying types of free time engagements.

The best source of future information on time use in Europe will be the Harmonised European Time Use Studies project (HETUS), co-ordinated by EUROSTAT, but including participants which are European Union Member States, EU candidate countries, and countries which are not presently candidate countries as well. This project has produced guidelines for time use data collection and coding, though these guidelines have been implemented to varying degrees across the participating countries. EUROSTAT published harmonised basic tables on its web site (2003), and the cross-national time use data file may become available in the future. Most HETUS participating countries hope to conduct future time use studies at five to ten year intervals, though funding for this aim is not guaranteed. Table 1 displays the current status of participation in the HETUS project.

In the mean time, the best source of harmonised cross-national time use data is the Multinational Time Use Study (MTUS). The MTUS project, funded in part by the European Foundation for the Improvement of Living and Working Conditions in its early phase, has harmonised data from 44 studies conducted in 21 countries[1] from the 1960s through the mid-1990s into a single dataset (Gershuny 2000).

Table 1 Participation in the harmonised European time use survey project

Conducted a Pilot Survey – 20 countries
Albania, Bulgaria, Estonia, Finland, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Macedonia, Poland, Portugal, Romania, Slovenia, Spain, Sweden, Turkey, United Kingdom
Participation in the Main Stage HETUS Survey – 19 countries confirmed
Completed Field Work – 15 countries Belgium, Bulgaria, Denmark, Estonia, Finland, France,* Germany, Hungary, the Netherlands,* Norway,* Portugal, Romania, Slovenia, Sweden, United Kingdom
In the Field – 3 countries Italy, Slovak Republic, Spain
Fieldwork to Transpire at a Future Date – 1 countries Poland

*did not generally follow the guidelines but cloned national data into HETUS format.

The data are weighted so that each study is treated as having 2000 diary days (so that larger studies do not overwhelm smaller samples in the results), so that the number of diaries produced by men and women reflect the sex balance in the national populations, and so that the distribution of diaries completed on each day of the week is balanced. Once weights are applied, the data set covers around 150,000 diaries from 80,000 diarists.[2] Given the nature of the data presently available, an overall sense of work life balance can be derived from comparing the total time in necessary activities (paid work + unpaid work + personal care time) with remaining free time. Figures 1 to 3 compare the grand mean (average time spent across all studies) in each of these four broadly-grouped activities with the data from a selection of countries, each time period, and basic demographic characteristics.

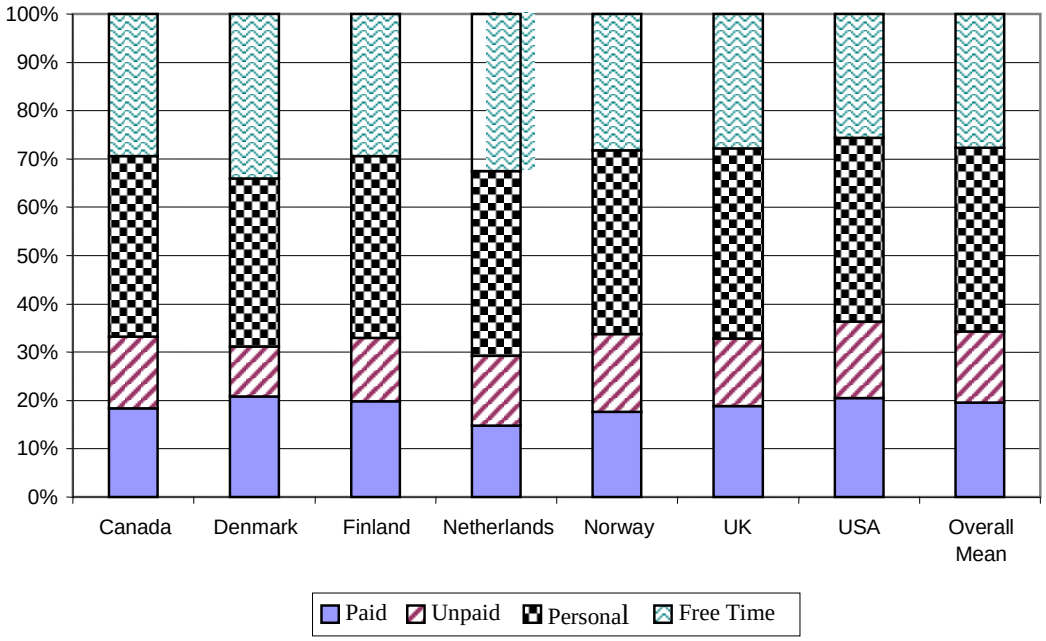
Figure 1 shows that Danes and the Dutch enjoyed relatively higher levels of free time than people in the other countries covered in the MTUS. These two countries also demonstrate that there are multiple means to the same end. Danes worked relatively long hours but performed less unpaid

[1] Details of all the studies are available in Fisher (2002b).

[2] At this time, the MTUS covers only aggregated main activity data (the sum of minutes spent in 40 activities), though in future releases, more detail will be included (Gershuny 2000).

work, while in the Netherlands people worked relatively shorter hours and performed more unpaid work.

Figure 1 Time use across countries



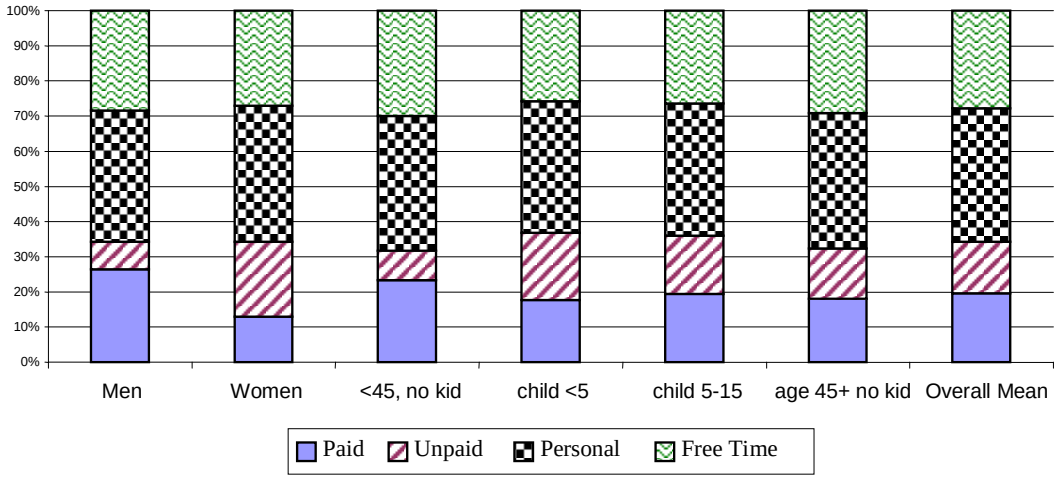
Source: The Multinational Time Use Study (MTUS) version 5.0.1.

Figure 2 considers the demographic details of diarists. Men and women enjoyed comparable levels of free time and performed similar levels of personal care. Men and women also performed similar levels of total work, though men primarily performed paid work and women primarily performed unpaid work. This distribution of activities creates unequal ability to makes choices during free time, as men, by virtue of receiving pay for a higher proportion of their total working hours, control more of the finances available for use during free time activities than women. Having children decreases free time and increases total work time (paid + unpaid work), though paid work is lower when the diarist has a child aged less than five, and increases once all children are aged 5 to 15.

Figure 3 shows that total work time declined across the countries between the 1960s and early 1980s, then began to rise again by the early 1990s. The proportion of free time expanded from the 1960s to the 1980s, then shrunk slightly by the 1990s, though in the 1990s, people still enjoyed more free time than they enjoyed in the 1960s.

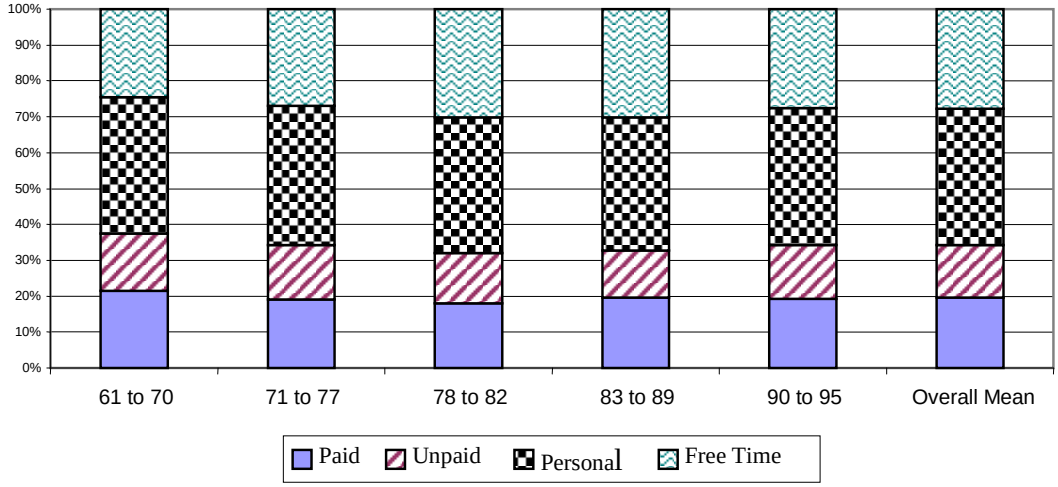
The reader should keep in mind that time use data do not, in and of themselves, reveal the full range of processes involved in the dynamics of change in time use. Geographic, economic, social policy, and social power factors impose varying constraints on people's daily schedules. Policies encouraging single mothers to spend more time improving their employment skills while their children are young will not be effective if affordable child care is not located near the homes or places of study of these mothers. Public policy must consider which groups will have the greatest and the least opportunity to change their behaviour in response to any given initiative. What time use data do provide is an indication of the effects the various key forces have on the way people allocate their time during the day.

Figure 2 Time use by sex and family status



Source: The Multinational Time Use Study (MTUS) version 5.0.1.

Figure 3 Time use by time period



Source: The Multinational Time Use Study (MTUS) version 5.0.1.

Time use data thus serve as one measure of the effectiveness of policy change; but time use data also best measure long-term, not short-term, change. People do not readily alter their habits, and consistent information and incentives must be applied over the long term to have significant effects on behaviour. For instance, in spite of pressure, first from feminist campaigners, and more recently from public agencies, to equalise the performance of both paid and unpaid work by men and women, women continue to perform the majority of unpaid domestic work (Gershuny 2000). Men have increased the time they spend doing housework and child care, but by a small amount. For example, by 2000, men in Finland performed an average of 12 more minutes per day of domestic work than they had performed in 1987 (Niemi and Pääkkönen 2002: 95). Between 1961 and 1995, British men increased their average time performing household cleaning and child care by 47 minutes a day (Gershuny and Fisher 2000).

3 The overlap of work and leisure

Aggregated time use information does not reveal the full story. People often perform more than one activity at the same time, and people who lead different lifestyles make different rates of transitions between activities. Relaxation and rest require time to let a person's mind and body shut down from other activities. Likewise, achieving a work-life balance can be defined by the ability to keep work in its place in the daily cycle and to prevent work from intruding into other activities. Time diaries are particularly suited to measuring both the timing of work and level of intrusion of work into other activities. As noted in the previous section, the study of work-life balance can include the analysis of both paid and unpaid work together. Nevertheless, as this area of research is relatively new, this section concentrates on the overlap of paid work and other activities, using data from the British National Time Use Study of 2000-01.[3]

One way of conceptualising the work life balance is to think of work, social activity and family life, and personal needs having their place in the day. Figures 4 and 5 show that men and women in Britain follow similar patterns in their scheduling of working hours during the day. As a higher percentage of men than women work full-time, men's average hours are longer than women's average hours and women's highest density of work hours peaks before men's highest density of work hours. An exception arises for people aged 65+ who work. Older men start and end work earlier than older women.

There are three ways that data such as these can be used to measure work-life balance. Similar to the examination in the previous section, one can consider the total proportion of the day in which work takes place. The higher the percentage of the population which works during a high proportion of the day, the less opportunity there is for a work life balance.[4] Over 32 % of men worked during 5 or more three-hour segments on an average week day work day. On Saturdays 22 % of men and on Sundays 20 % of men work during 5 or more three-hour segments of the day.

Roughly half the percentage of women as men work for pay during 5 or more three-hour segments of the day. People of both sexes work over a large proportion of week days than weekend days. Nevertheless, the percentage of women who work during most three-hour segments of the day increases on Sundays (11 %) compared to Saturdays (9 %).[5] Considering the proportion of the day touched by work, women in the UK have more potential opportunity to achieve a work-life balance than men, though this is primarily because women are more likely to work part-time than men (though as a consequence of continued wage differentials between women and men, women have fewer financial resources to spend in their free time than men) (Fisher 2002). A high percentage of both men and women devote a large proportion of their work days to work.

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[3] The study, which is the UK element of the HETUS project, collected diaries from June 2000 to August 2001 from all people aged 8 and older (11,700 people) in 6,500 households randomly selected for England, Wales, Scotland, and Northern Ireland. The data include 21,000 diaries, roughly half collected on week days and the other half collected on weekend days. The net diary response rate (completed diaries for sampled households) was 45 % (Fisher 2002b). The data used are weighted. Missing values were not imputed. Diaries containing fewer than 22 hours and 30 minutes of valid information (approximately 8 % of the collected diaries) were excluded.

[4] In this sample, 3 people worked during all 8 3-hour periods, and 40 people worked during 7 of the 8 3-hour periods.

[5] These differences are statistically significant, Pearson's Chi Squared 2-sided $p<.000$.

Not all people who worked over a large segment of the day necessarily failed to achieve a work-life balance. It is possible that some people live in households where work is concentrated in small numbers of days to allow for larger concentrations of other needs and pursuits to be accomplished on other days.

The greater the concentration of work on any particular work day, the more constraints (such as restoring energy after the drain of working long hours, or co-ordinating the timing of days off with friends and family members) a person must overcome to achieve a work-life balance. Consequently, in aggregate, lower numbers of people in a country working over most or all segments of the day would suggest a relatively higher possibility for people to achieve a work-life balance. An alternative way of measuring the same concept would be to determine if each dimension of life peaks for demographic groups at different times of the day. If people in a demographic group have similar general patterns of leisure, then they also have opportunities to socialise with other people in their peer group. Likewise, if periods of leisure peak at similar times for the different generations in families, then families are experiencing more opportunity to spend time together (whether family members actually meet together during leisure time when they have the opportunity or whether they engage in separate activities is the subject of the next section).

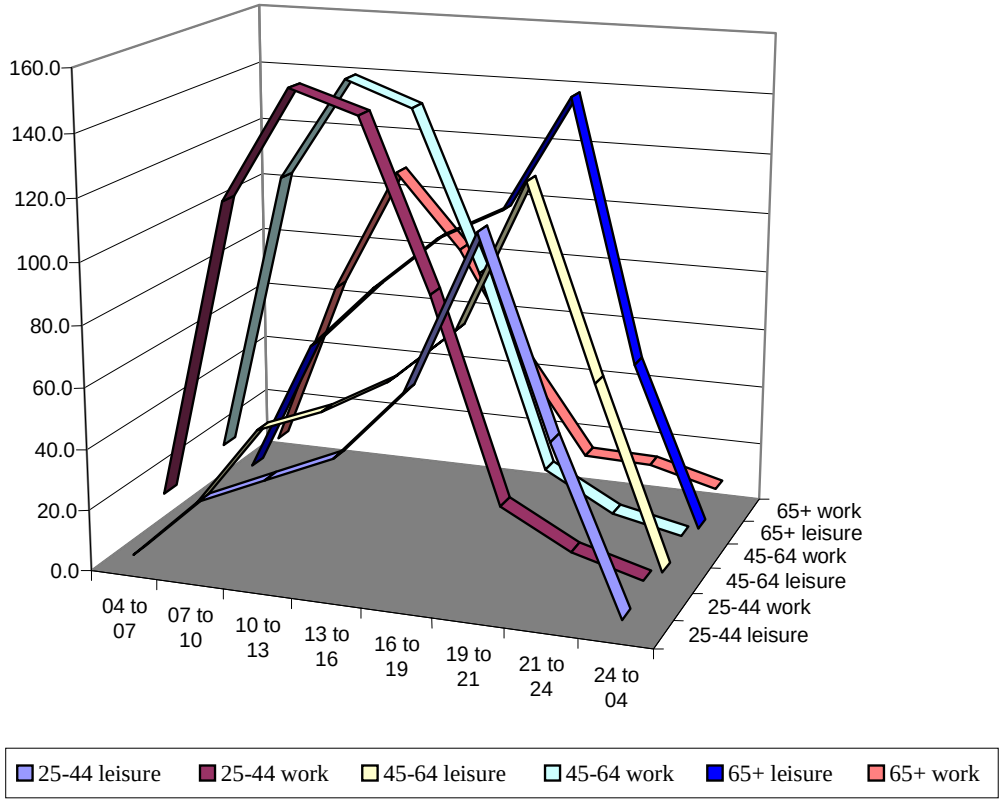
Figures 4 and 5 compare the timing of activities related to paid employment and leisure activities (social time, participation in sports and other leisure-based physical exercise, playing games or engaging in hobbies, reading, watching television, videos and DVDs, listening to the radio, tapes, records and CDs) for men and women of different age groups (after school age) in the UK. These figures show that leisure time peaks for women and men of all ages between 16:00 and 21:00, which indicates that most Britons enjoy opportunities to enjoy social time with both their families and their peer groups.[6]

As would be expected, men and women aged 65 plus engage in more leisure than employment activities, while men and women aged 25 to 64 engage in more work than leisure. Men's total time in employment is higher than women's time in employment (though women spend more time performing housework, child care and other unpaid domestic work than men, but the domestic work is not shown here).

Overall, these figure suggest that most people in the United Kingdom have a reasonable opportunity to enjoy a work life balance. Nevertheless, as this is a short illustrative exercise, these images are necessarily simplistic. Sleep and personal care time and necessary unpaid activity are not included to keep the images clear, and more pronounced differences emerge when the figures are broken down by such factors as region, employment status, and industry of work. More significantly, there are qualifications on the quality of work and leisure time that do not emerge in figures displaying total time in activities.

[6] Similar figures for all women and all men, and for women and men aged 8 to 15 and 16 to 24 are in the EPAG working paper.

Figure 4 Timing of British men's work and leisure



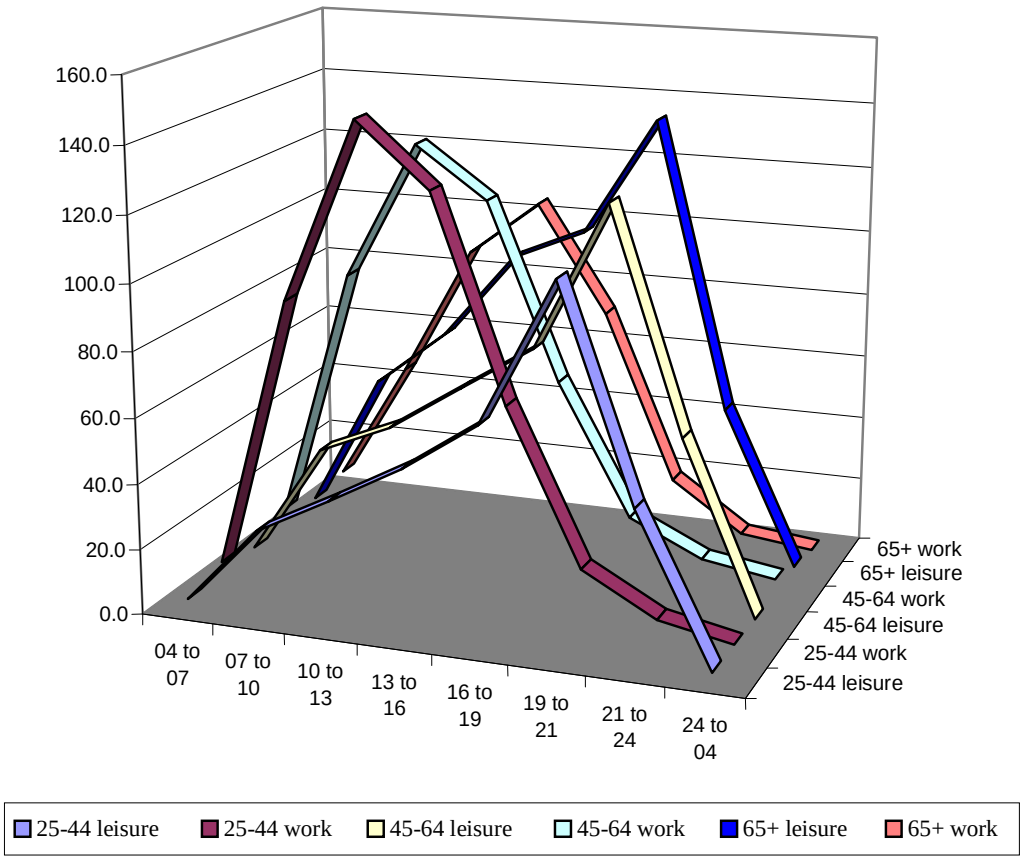
Source: Office for National Statistics (London), National Time Use Study, 2000-01.

The second way to measure work-life balance using time diary data is to consider the degree to which work overlaps with other aspects of the day.[7] People periodically perform more than one activity at the same time. For instance, people may listen to the radio while driving, or they may supervise the children who are doing their homework while cooking dinner. Most time diaries collect information about the main focus of people's attention as well as activities they are doing at the same time. In this study, men who worked on their diary day spent an average of 8 hours and 54 minutes in work related activities as their main activity.[8] For an average of 14 minutes of this time, men did another activity at the same time as paid work, and for an additional 15 minutes, men performed a non-work activity as their primary focus while also doing something related to paid work. Women spent an average of 7 hours and 20 minutes in work related activities, and in 11 of these minutes, women did something else in addition to work. For a further 14 minutes, women worked simultaneously while doing something else as the main focus of their activity. Figures 6 and 7 show the average time that these joint activities take for those people who performed each joint activity.

[7] A third and more tenuous measure, examining split shift working, that is working over multiple periods in the day with long gaps for other activities in between the working spells, is also examined in the original paper.

[8] Work related activities are defined as working for pay, waiting for a work event (meeting to start, building to be opened, etc.), commuting, applying for a new job, interviewing for a new job.

Figure 5 Timing of British women's work and leisure



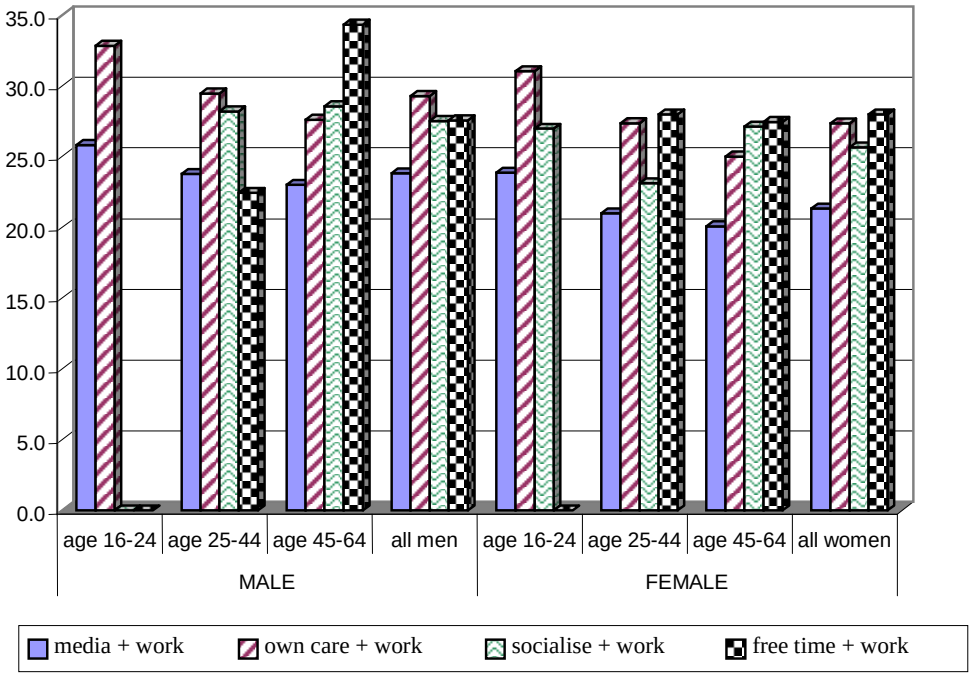
Source: Office for National Statistics (London), National Time Use Study, 2000-01.

There are four main categories of activity into which work intrudes, as shown in Figure 6. Media with work covers watching TV, reading, and listening to the radio or music while working (such as editing memos or arranging invoices while watching TV). Own care with work primarily consists of taking a business call on a mobile phone while using the toilet or eating lunch while continuing to work at one's desk. Socialising plus work covers discussing business with others at a party or public event, or taking business calls on a mobile phone while eating out or visiting friends or family. Free time plus work covers the mixing of work with other free time activity (excluding media use and social activities). For all people, engagement with work while using the media or performing personal care decreases with age. For men, the intrusion of work into other free time increases with age.

The degree to which work overlaps other activities has implications for quality of life and work-life balance. Some people find it hard to express something they consider to be of pressing importance if they know that they likely have only a few minutes before the person to whom they are talking will take a business call. Some children can feel less valued if they never attract the undivided attention of their parents. Conversations can lose their dynamic when interrupted. Further, there are qualitative differences between leisure experiences which are purely leisure (sitting back on a sofa with a glass of wine to listen to a new CD) and activities where work

overlaps leisure (listening to a few minutes of the new CD on the train until the mobile phone rings).

Figure 6 Work time intruding on other activities for people who mixed work with other activities

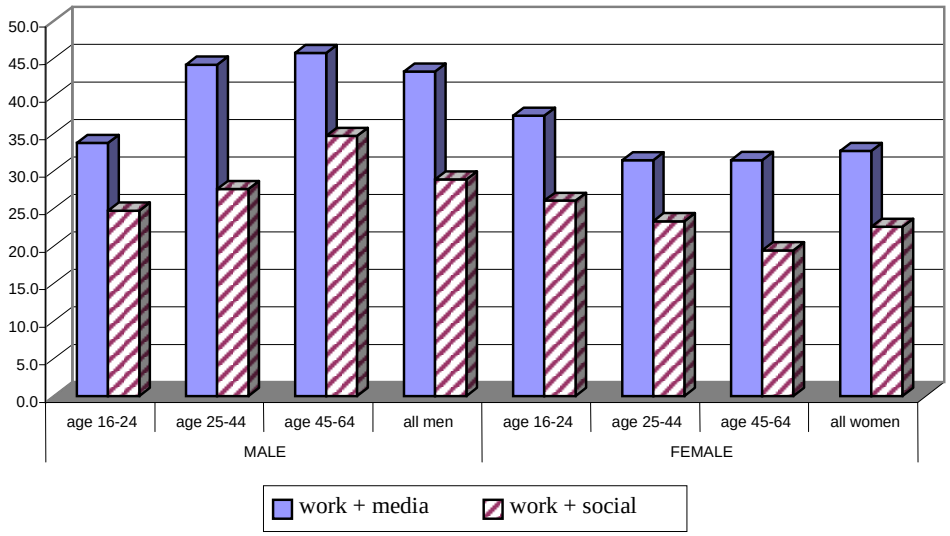


Source: Office for National Statistics (London), National Time Use Study, 2000-01.

One cannot simply define the intrusion of work into private life as always undesirable. The key issue is whether people experience work intrusions by choice or against their wishes. Nevertheless, even though some people choose to allow their work and private life to routinely overlap, a general increase in work intrusion into private life across broad population groups would represent cause for concern.

Intrusion works the other way as well, as many Britons also do some non-work activity while working as shown in Figure 7. Two groups of activity principally occur during work: media use (listing to music or the radio while working) and socialising (such as joking or making social plans with colleagues at the office). For men, media use and socialising while working increases with age, while for women, secondary activity while working decreases with age. Half of people who worked on their diary day combined work with another activity for at least part of their work day. The time of overlapped work reaches an average of 49 minutes for British workers. When work intrusion and overlapped work are taken together, working and non-working life overlap significantly for a large proportion of the British population.

Figure 7 Other activities intruding on work for people who mixed work with other activities



Source: Office for National Statistics (London), National Time Use Study, 2000-01.

4 Conclusions

Time diaries produce a picture of how people apportion activities over the day. From a policy perspective, diaries can track the degree to which long-term policy initiatives influence changes in behaviour. Diaries inform the work-life balance debate, not just by demonstrating the total volume of work more reliably than other existing measures, but also by revealing the timing of work in relation to the timing of other activities, the proportion of the day influenced by work, and the degree to which work intrudes into other dimensions of life. One key issue to bare in mind is that certain patterns of time use may not be damaging to quality of life if they result from the voluntary choice of individuals, but can be devastating if they are imposed on individuals by institutions, social structures or social attitudes. Nevertheless, while diaries provide informative measures of activities on a daily or weekly basis, they do not cover longer-term cycles of activity. Consequently, though diaries do not produce a complete picture of work-life balance, the nonetheless reveal an important part of that picture.

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Intra-family time allocation to housework - French evidence

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Abstract

We analyse new time diary data from France to explore the relationship between economic variables and husbands' share of housework time. Consistent with both bargaining and specialization models of the family, we find that the greater the husband's share of labor income, the lower his share of housework time; the greater the wife's market hours, the lower his housework time, but the larger his share of housework time. Treating market work as endogenous substantially lowers the size of these estimates, but they remain statistically significant. A parsimonious specification based on the specialization model generates estimates for housework share wage elasticities. The own wage elasticity of wives' housework is -0.3 and the elasticity of husbands' housework share with respect to wives' wages is +0.25.

JEL-Codes: D13, J12, J13, J16

Keywords: Time allocation, intra-family, time use, home production, bargaining, elasticities

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1 Introduction

Hersch (1991a, 1991b) shows that time spent on housework has a negative impact on wages for women but not necessarily for men. Hersch and Stratton (1994) examine the division of time among employed spouses in the U.S., finding an inverse relationship between husband's share of housework time and own earnings and workplace hours. Beblo (1999) reports similar findings for Germany. In both of these latter two studies, however, market hours or share of market hours worked is used as an exogenous determinant of housework time. This paper examines the housework allocation of French couples and verifies the robustness of results to the endogeneity of market work.

If Becker's (1991) model of household specialization is correct, there may be a vicious cycle where women's relatively low wages lead to more specialization in home production that, in turn, keeps their earnings power low. This suggests that a shock to the system leading to higher wages, for example, can also be self-reinforcing in a virtuous cycle that leads to less specialization in home production, and future increases in earning power. Alternatively, one might think of that model as depicting a system with two equilibriums for married women, a low-wage, high home production equilibrium, and a high-wage, low home production equilibrium.

Cooperative bargaining models of the family are also consistent with such a vicious or virtuous cycle. Higher wages for women imply a better outside alternative should a marriage dissolve (Manser and Brown 1981, McElroy and Horney 1981) or a better inside alternative in a separate spheres bargaining outcome (Lundberg and Pollack 1995, 1996); in either model, higher wages raise the woman's threat point, improving her bargained utility in the marriage; she is more likely to reduce home production, increase home consumption time (leisure), and/or invest in market-related human capital (Carlin 1991).

This paper examines the same topic for France and compares findings with studies examining such issues in Germany and the U.S. As we point out in the next section of the paper, the specialization and bargaining models have the same sign predictions for our main variables of interest. Hence we do not test the specialization model against the bargaining models. Such a test would require information from another data source that could be matched with these data. In future work, we hope to identify critical variables which could have different implications across these models, as in Carlin (1991).

We have three main contributions. The first is to add to the cross-country evidence on the relationships between labor income, market work hours, and education, by spouse, on husband's and wife's share of housework-relationships that are consistent with both specialization and bargaining models of the family, but are differently interpreted by them. The second is to provide evidence from time diaries, a rich and more accurate, resource for time use analysis, but which requires care in estimation and interpretation. The third is to test the robustness of our results to the potential endogeneity of market work in the housework time equations.

This is the first study on this issue we know of that takes advantage of time diary information rather than relying on survey responses based upon recall. Hersch and Stratton were forced to rely on a survey question in the Panel Study of Income Dynamics (PSID) about the amount of time spent cooking, cleaning and doing other work around the house in an average week. This measure may, of course, be subject to recall error, and it is difficult to assign a direction to the

bias; it may be overestimated or underestimated. Only in one of the years was the wife asked directly about her hours of housework time, so the recall problem is compounded, at times, by lack of direct knowledge. As any measurement error is in the dependent variable, it inflates the variances of OLS estimates. There is some risk that the measurement error in home production time might be correlated with one or more of the independent variables like wages or number and age of children. If so, then OLS estimators would be biased. In this study, we have the advantage of recent time diary data on time use; such data reduces measurement error.

2 Models for intra-family time allocation to housework

What model of family decision-making should guide our empirical analysis? The collective model of labor supply with home production, introduced by Chiappori (1997), assumes that both spouses maximize their own utility functions facing fixed prices and market wages. If home-produced and market-produced goods and services are perfect substitutes, the optimal allocation of time between spouses can be recovered from observed behavior. But if home-produced and market-produced goods are not perfect substitutes, in home-cooked and consumed meals, or with child care, for example, then severe identification problems arise. This is especially due to the endogeneity of the price of home-produced commodities. (Chiappori 1997, Apps and Rees 1997). More importantly, our ability to estimate a model of collective labor supply with these data would be limited by the relative scarcity of accurate information on household expenditures and home-produced goods.

We rely, instead, on insights from specialization and cooperative bargaining models of the family to explain the intra-family allocation of time. Along the line developed by Hersch and Stratton (1994) and Beblo (1999), we analyze the determinants of the gender division of housework by estimating three equations. The three dependent variables are, respectively, the husband's share of housework, the husband's and the wife's time spent on housework. The regression based on the husband's share of housework time relates most closely to the household's time allocation decision, but the other equations are necessary to identify whether an increase in the husband's share of housework, for example, is due to an increase in his time or a decrease in his wife's time devoted to housework.

We consider four specifications. The first model is in the spirit of the earlier studies. We enter wives' and husbands' market hours as exogenous variables determining husband's share of housework, along with other socio-economic control variables. Little justification for this approach is given in the studies by Hersh and Stratton or Beblo. But hierarchical models of time allocation have been suggested (Brown and Lankford 1992) where the market work allocation is a first order decision with other decisions made conditional on that allocation.[9] One might justify this approach by viewing the household as optimizing within a life-cycle context where the lifetime path of hours of work and fertility is chosen based on the expected path of lifetime wages, human capital and wealth accumulation. This optimization results in a preferred combination of work hours for both spouses and number of children at any point in time. This

[9] See Brown and Lankford (1992) and Carlin (2001) for empirical evidence interpreted as favoring a sequential rather than a simultaneous time allocation model for hours devoted to volunteer work. Both studies analyze time diary data and interpret their findings as being consistent with a hierarchical decision model where time devoted to market work is determined initially, and hours devoted to volunteer work are conditioned on the market work decision.

implies that, when working with cross-section data as in our study, one is confronted with an optimally selected set of work hours and number of children that are not necessarily closely related to current wage rates. Remaining time allocation choices, including ones about volunteer time or how many hours of housework each spouse should perform, would then be made conditional on this allocation of work hours and the number and age of children present in the household. In this view, decisions about housework time allocation are second order decisions and work hours and children might be considered exogenous determinants of such allocations.

Nevertheless, even if this hierarchical view is correct, one might argue that the market work time allocations are correlated with the error term in the home production equation, perhaps through an omitted variable such as relative preference for market over home-produced goods or ability at home production tasks. So, in our second model, we predict market work for both spouses with a Tobit model, and use predicted market work as explanatory variables in the home production time equations.[10]

Both of these models, however, may seem puzzling to those familiar with the home production/specialization models of Becker (1991) and Gronau (1986), where the wage as the shadow-price of time, plays such an important role. If one accepts the home production model of Becker/Gronau, then market work and home production time are jointly determined, based on the relative shadow price of time of both spouses. Market work cannot be an exogenous determinant of housework time or share of housework time. In the first two models, the wage rate itself is absent. So our third model is comparatively sparse, in the spirit of the Gronau (1986) and Becker (1991) models of home production, and returns the focus to the wage rates of husband and wife. Here we only include, as explanatory variables, socio-economic control variables, household non-labor income, and the predicted wages for husband and wife. In all of these specifications, we control for number and age of children, cohort effects, dwelling in a home rather than an apartment, and urban residence.

Our final model, with results reported in Appendix 2, incorporates a double hurdle model (Cragg 1971) to predict hours of market work for both husbands and wives. This is advisable when using time diary data because we get two kinds of zeros in the data for market work. The normal kind of zero is a behavioral zero; the household has decided that the wife should not work, for example. But we also may get zeros which are due to transitory effects; the wife works, but she is ill on the day in question and does not work. The double-hurdle approach is meant to control for both types of censoring. (See Anxo et al (2002) or Carlin and Flood (1997) for further explanation.) In Appendix 1 we report on the robustness of the results from model 2 to the omission of education and child variables.

Other control variables. Which explanatory variables are suggested by the three models of the family we are considering? Becker's (1991) model of the family predicts that benefits from specialization lead to a pattern of time allocation where one member of the household will specialize in home production and the other in market work. Even a small difference in wages makes this choice efficient. Furthermore, even if each spouse is facing the same market wage, childbearing and the complementarity between the bearing and rearing of children may lead to

[10] In the first stage, reduced form equations for market work, housework, and child care were each estimated with a Tobit model. In the second stage, the structural models were estimated as Tobit models, using the endogenous predicted values of market work as right-hand side variables. For example, female housework had, as explanatory variables, the predicted values for female and male market work.

the acquisition of different skills that would make it optimal for women to specialize in home production and men in the labor market.

Cooperative bargaining models of the family include those introduced by Manser and Brown (1981) and McElroy and Horney (1981), and the more recent separate spheres bargaining model of Lundberg and Pollak (1995, 1996). These cooperative bargaining models analyze the implications of decisions in a long-term relationship, such as marriage, in which transaction costs are significant. In the Nash Bargaining Solution utilized by McElroy and Horney, the bargaining position of each spouse is related to the disagreement outcome. If the couple cannot agree to a mutually acceptable division of the gains to marriage, the marriage dissolves and both spouses are left with their single state utility. This alternative comprises the "threat point" for each spouse. Anything that changes the likely single state (post-divorce) utility of husbands and wives alters the division of the gains to marriage even if divorce is not being currently contemplated. As men, on average, have higher earnings, their post-divorce state is likely to be relatively better, at least as far as pecuniary matters are concerned.[11] Hersch and Stratton (1994) emphasize that the higher earning male will be better able to afford the purchase of market substitutes for home production. If so, they will have systematically higher threat points and will tend to acquire more of the gains from marriage; that would be consistent with a lower share of housework, for example. Anything that systematically changes the post-divorce utility of men and women changes the threat point and affects the division of the gains to marriage.

The innovation of Lundberg and Pollak's separate spheres bargaining model is to identify the threat point with a non-cooperative allocation of time and goods where the husband determines the direction of his resources to obtaining home produced and market produced goods and services in traditional male spheres; the wife does the same for her sphere of influence. Such an allocation, with separate spheres of home production and consumption is considered to be less productive than a fully bargained one, so that the threat point is, again, in the interior of the household's production/consumption set. They argue that, for most couples, divorce is not a realistic threat point but some kind of non-cooperative continuing marriage is. In this framework, a higher wage provides higher income for the traditionally male household pursuits, moving the separate spheres threat point in the direction favoring the husband so that the cooperative allocation benefits him more. Again this would be consistent with a lower share of housework for the male.

These bargaining models give a possible explanation for an observed lower share of housework being performed by the higher wage husband. In the remainder of the paper, we will refer to these models collectively as bargaining models when it is unnecessary to distinguish between them. When distinguishing between them, we will refer to the McElroy and Horney model as the cooperative bargaining model and to the Lundberg and Pollak model as the separate spheres bargaining model.

Both Becker's specialization model and the cooperative bargaining models suggest certain explanatory variables for the spousal allocation of time, but the interpretation of their impact will vary. The individual with relatively high earnings may be expected to devote less time to housework, either because he or she has a comparative advantage in market work (specialization)

[11] See Peters (1986) for U.S. evidence from the 1970s supporting this view. See Carlin (1991) for direct evidence on the effect of divorce settlement generosity on time allocation within households. Carlin provides evidence that women in states with more generous divorce settlements tended to invest more in market human capital, allocating more time to work and education.

or because she or he has a higher threat point (bargaining). Both approaches suggest including the wage rates of both spouses as explanatory variables. The survey, however, collected data on labor income, not wage rates. Wage rates are derived by dividing labor income by hours. Wage rates for all, whether they work in the market or not, can then be predicted using techniques introduced by Heckman (1979). Hence, in these data, there is likely to be less measurement error in labor income than in wage rates. So, in the first two models, we use the *husband's share of labor income*, as a proxy for the relative spousal wage rate. As the relative spousal wage is a potential wage ratio, this proxy is imperfect. For example if one of the spouses does not work then the share of labor income will overstate the other spouse's relative wage. In other regressions not reported here, we used a different variable to measure the relative spousal wage rate, and substituted that for *husband's share of labor income* in the first two models. We constructed the variable by dividing predicted male wage rate by the sum of the predicted male wage and the predicted female wage. The results reported below for the first two models are robust to this change. By the same arguments as above, *husband's share of labor income* should be inversely related to his share of housework. In these models, we control for husband's and wife's hours of market work; changes in the husband's share of labor income more directly reflect changes in his wage relative to his wife's. In the third model, we use predicted wage rates.

We control also for *total household income* in the first two models. We assume there is an inverse relationship between household income and the time spent by each spouse in housework because the household with higher income may more readily substitute market-purchased goods for home-produced commodities. This implication is orthogonal to the specialization and bargaining models. The higher the level of household income, the lower the time devoted to housework by both spouses. If one views the changes in total household income as a proxy for changes in non-labor income, the division of housework could be altered as well, but even then, the direction would be ambiguous. The specialization model predicts that higher non-labor income would lead to an increase in leisure, a normal good, for both spouses. But the increase in leisure could be through a reduction in market work or a reduction in home production, or in both. In the bargaining models, an increase in non-labor income expands the household's utility possibilities frontier but, in the absence of information about the division of the non-labor income in the event of disagreement, has no necessary effect on the relative threat points of husband and wife. For the third model, we compute a non-labor income measure, essentially total household income minus labor income of the husband and wife. The results for the first two models, which are reported below, are robust to the substitution of non-labor income for total household income.

The implications of including market hours of the spouse are ambiguous. If husband and wife are substitutes in home production, then an increase in one spouse's market work hours will increase the other spouse's home production time. If husband and wife are complements in home production, then the reverse effect occurs. An increase in a spouse's market time decreases the other spouse's home production time. Hence the impact on the gender division of housework labor is also ambiguous.

Inclusion of own market work hours in the housework hours model is a straightforward quantity constraint. It reduces total hours available for all other activities. Analogous to the income effect in consumption analysis, if time devoted to housework is a normal good, we would expect the allocation to housework to go down when time to market work goes up.

Educational attainment potentially affects the spouses' allocation of time between market and home production through two channels. Education directly affects earning opportunities. In the

specialization framework, this influences the individual spouse's comparative advantage; in both bargaining models, the wage influences the spousal threat point. For this channel, both the specialization model and the bargaining models imply that the higher the differential in education between husband and wife, the greater the degree of specialization and/or the greater the disparity in the division of housework by gender. The second channel suggests that educational attainment can proxy for attitude. Beblo (1999) and Hersh and Stratton (1994) suggest that education may be positively related to egalitarian household values. If so, then highly educated households would tend to have a more equal distribution of housework time by gender. Because we separately control for relative wage or husband's share of labor income, the empirical effect of the first channel should be dominated by the second channel.

The educational variables utilized in the estimation measure three levels of attainment. The lowest educational level consists of compulsory elementary school, or less, and brief vocational training; the intermediate level requires the completion of either higher vocational training or upper secondary school (Lycée, high school, etc.). The high attainment level includes individuals with college or university degrees. The intermediate level is the omitted reference category in the estimation.

Children affect the time spent on housework and the gender division of household labor directly (more home production is needed) and indirectly through any gender-differentiated impact on earnings and on the bargaining process. In the specialization view, the woman's childbearing role generates a comparative advantage in child rearing, so the wife will spend more time in home production, will invest less in certain kinds of human capital, and be more likely to experience periods of low market work attachment. In the McElroy and Horney bargaining model, the presence of additional children will affect the disagreement outcome if the presence of children alters the single state utility of the spouses. For example, in the event of divorce, custody is more likely to be awarded to the mother. If there is some probability that financial support for the children from the father would either be inadequate or irregularly received, then the wife's bargained utility outcome in the intact household is harmed. (See Beller and Graham (1993) for U.S. evidence from the 1980s.) With the separate spheres bargaining model, the presence of additional children makes it more difficult for the woman to support herself and her children in the separate spheres equilibrium. Hence the threat point moves in favor of the husband in both cases, and he takes on a smaller share of housework. The presence of additional young children is expected to increase total time devoted to home production and reduce the male's share.

For all of these models, the impact of children on housework and its allocation by gender will depend both on the number and age of children. Furthermore, the direct impact of children on housework might be inversely related to their age if the child's share of housework performed increases with age. There are four dummy variables for children: the number of children less than three years old, aged between four and six years, aged seven to twelve years, and thirteen to seventeen years. The omitted reference category is having no children.

Again we must face the question of endogeneity. Parallel to our earlier argument, we view family planning as one of the big negotiations between couples that results in expected time paths for children and careers. The actual allocation that shows up at a particular point in time, however, depends on the stage of this planned path that the couple finds themselves on. The negotiated agreement for what to do when the child is 18 months old is likely to be very different from the negotiated time allocation when the child is 18 years of age. Hence, even though family planning decisions are bound up with decisions about career paths, the *realization* of the expected family

planning decision at the time of the survey/interview should have an exogenous impact on time allocations. Mroz's (1987) finding that endogeneity of children was a second order concern in married women's labor supply, provides some support for our maintained hypothesis that children are exogenous in the home production time equations. Furthermore, the data offer no good instruments for fertility. There is no information about family background, for example. As it turns out, the main findings are robust to the elimination of the number and age of children from the estimation. (See appendix 1) This is the same approach as that taken by Hersh and Stratton (1994); maintain the assumption of exogeneity of children but test the robustness of the results to inclusion and exclusion.

We follow Beblo (1999) by including the age difference between husband and wife (*Ageh – Agew*) in the first two models of the housework equations. Beblo argues, from a non-cooperative bargaining model introduced by Bolin (1997), that a dominant spouse can obtain a first-mover advantage by determining his allocation to market work and housework first, essentially restricting the choices of the subordinate partner. If the husband is older than the wife, he has decided first about his human capital investment and the extent of his participation in the labor market. Alternatively, the first-mover advantage could be independent of relative age if cultural values suggest the priority of the husband's career as "breadwinner." Since husbands in our sample are, on average, 2.5 years older than their wives, the non-cooperative bargaining model implies a negative impact of this age difference on his housework and a positive one on his wife's housework. The larger the age differential, the more unequal is the gender division of work.[12] Including this variable provides a test of the relevance of such non-cooperative bargaining models for time allocation in continuing marriages.

In order to capture the notion of changing social norms, we introduce a cohort variable, the average age of the couple. Older couples are expected to have a more traditional gender division of labor so the cohort variable is expected to have a negative effect on the husband's share of housework. We also control for home residence; couples living in a house are expected to devote more total hours to housework than those living in an apartment. A control variable, living in a large city, is also included to reflect the greater availability of substitutable market goods and services in urban areas.

3 Estimation method

As indicated earlier, we estimate separate equations for husband's share of housework, husband's hours and wife's hours of housework. To control for the fact that some individuals do not report housework, a Tobit model is used for the estimation.

(1) Structural equation: $y_i^* = x_i \beta_1 + \varepsilon_i$

(2) Threshold equation: $y_i = y_i^*$ if $y_i^* > 0$, and

[12] Ideally we would like to include information reflecting age when married. If a 37-year old man marries a 29-year old woman, there would be a bigger age difference than for a couple where a 26-year old man married a 20-year old woman. Yet it is more likely that the 29-year old woman has already made important career decisions, which might tend to offset the *first mover advantage* of the older male. Unfortunately, these data do not provide this information.

$$y_i = 0 \text{ otherwise.}$$

The estimated parameters have no natural interpretation. To get interpretable results, we use marginal effects. These marginal effects are based on

(3) $$E(Y) = \Phi(h)[X\beta + \sigma\{\phi(h)/\Phi(h)\}]$$

The marginal effect is then defined as the derivative of *E(Y)* with respect to the variables in *X*, with all effects evaluated at the sample means of *X*.

When we allow for the potential endogeneity of both own and spouse's market work as jointly determined with housework time, we first estimate a reduced form labor supply model with a Tobit model. Age and its square, predicted wage, number and age of children, and residence in a large city are the independent variables in the estimation. We use the predicted values of own and spouse's market work from this regression as right-hand side variables in the structural model of housework time. Because we are using daily time diary data, there are instances where someone who usually works is absent from work on the day of the diary. Hence there are more zeros than normal. We estimate a double-hurdle model to check the robustness of the estimates.

The double-hurdle model is described as:

(4) $$y_i^* = x_{1i}\beta_1 + u_i, \quad u_i \sim N(0,\sigma^2);$$

(5) $$d_i^* = x_{2i}\beta_2 + v_i, \quad v_i \sim N(0,1), \text{ i=1,2,...,n;}$$

(6) $d_i = 1$ if $d_i^* > 0$, otherwise $d_i = 0$;

(7) $$y_i = d_i \max(y_i^*, 0).$$

The unobserved latent variable is y_i^*, desired hours of market work, and y_i is the recorded variable, actual hours of market work. The model also has an unobserved latent variable, d_i^*, representing binary censoring due to faulty reporting or other random events, with d_i its corresponding recorded variable, whether the individual works or not.[13]

4 The data

The data for this study come from a 1999 time diary survey for France. This data set is a representative sample of the French population and the levels of the variables are comparable with other national statistics for French families. The interviews took place from February 1998 to February 1999. The diary days are randomly distributed across days of the week for both men and women. In the main body of the text, we refer to the results obtained when we aggregate the time diary information into a synthetic week. However, the main results are robust to an alternative procedure. Instead of aggregating to a week, we simply used the 24-hour diary and included a dummy taking the value one if the day falls on the weekend and zero otherwise.

[13] The model corresponds to equations (5) and (6) in Cragg (1971). Other recent applications of this model include Blundell and Meghir (1987), Carlin and Flood (1997), and Anxo et al. (2002).

To construct a time diary, participants are interviewed extensively, on randomly selected days throughout the year, about their time use during the previous 24-hour day. Thomas Juster and Frank Stafford (1991) report on a number of validity tests carried out in 1975-76 on an early time use study for the U.S. Those tests suggest that the time diary method is much more accurate than survey questions asking for typical time use, and a little more accurate than using an electronic paging device to randomly activate the recording of a time use activity when the signal is received. (Presumably there would also be more worry about a subject altering their planned routine when they know, in advance, that their paging device may record their activity at any time.) It is about as accurate, and much cheaper, than asking respondents to provide a detailed account of a randomly selected one-hour period. Klevmarken (1999a, 1999b) provides more recent discussions concerning the comparative accuracy of time diary studies. Hence this time diary data should reduce the possibility of bias due to measurement error in the dependent variable. Carlin and Flood (1997) report on the significant difference found in Swedish data concerning the effect of young children on male labor supply when they use time diary rather than survey data.

The measure of housework we have is also more precisely defined. Housework includes cooking; dishwashing and cleanup; laundry washing, drying and cleaning; cleanup and maintenance within the house; cleanup, repair and other maintenance outside the house including yard work; purchasing; and bookkeeping and household management. This broader definition means the results in our study are not susceptible to the criticism that the full range of household chores may not be represented in the definition of housework. Furthermore, it is relatively easy to alter the definition of housework to include or exclude various categories as a robustness check. The main results reported below are robust to the exclusion of categories like gardening and shopping, for example.

We have chosen to focus this paper on housework time and have excluded childcare time from our measure of housework; we view childcare time as a human capital investment activity that is different in nature from housework and is deserving of separate study. We note, however, that the main results reported below for the effects of income, wages, hours of work and education are fully robust to the inclusion of childcare time in the housework variable. (Results are available from authors.)

There is a potential difficulty with the time diary data. It is more expensive to gather this information than ordinary survey data so one must trade sample size off against the number of interviews of a given respondent. In the French data used here, the sample size is about 3,033 married or cohabiting couples between the ages of 18 and 64, but there is only one interview. The single interview can be a very serious problem for labor supply studies, requiring special attention. (Carlin and Flood 1997) The problem is less severe for housework where the problem of a random, zero observation on the day in question is less likely. We allow for this censoring by using a Tobit specification. For some couples we will get an inaccurate picture; perhaps a housewife would, typically, do 6 hours of housework but on the particular day involved, she was away visiting relatives, and only did one hour of housework. Conversely, her husband, who ordinarily just does one half hour, winds up doing two hours of housework. But, over a large enough sample, this random variation should even out, and we get a good picture of the actual division of housework between husbands and wives, on average.

Table 1 Sample characteristics (means and percentages), couples aged 18 to 64 years.

Variables	Means or Percentage
Age, male	43.6
Age, female	41.0
Number of individuals in the household	3.4
Number of children	1.32
Educational attainment, male	
- Low (%)	68
- Medium (%)	12
- High (%)	21
Educational attainment, female	
- Low (%)	64
- Medium (%)	14
- High (%)	22
Big cities (%)	41
House owners (%)	63
Labor force participation rate, male (%)	82
Labor force participation rate, female (%)	63
Paid work, weekly hours, male	35.4
Housework, weekly hours, male	14.1
Paid work, weekly hours, female	21.2
Housework, weekly hours, female	28.8
Husband's share of market work (%)	65
Husband's share of housework (%)	30
Number of observations	3033

Source: Time use data 1999 (daily average values scaled up to weekly totals).

The 3,033 observations constitute a relatively large sample by the standards of time diary studies, but it is smaller than many household surveys. The sample may not be large enough to offset some of the multi-collinearity between husband and wife education or between average age of the couple and the age and number of children, resulting in fewer significant estimates for these control variables. (The correlation matrix is available from the authors.)

Table 1 presents the sample characteristics for these French households. The majority of couples fall between the ages of 30 and 49 years, and there are 1.32 children per household. Slightly more than 20 percent of the husbands and wives have a college or university education; about two-thirds of the samples have a low education, compulsory elementary school or less, possibly with some brief vocational training. Forty percent live in big cities and about three-fifths own their own home.

Labor force participation rates for husbands are higher than those for their wives, 82 percent compared to 63 percent. French husbands allocate about 35 hours per week to work for pay and 14 hours to housework. French wives allocate about 21 hours per week to work for pay, and 29 hours to housework. Part-time labor force participation is more common for married women. The total weekly hours spent on paid work and housework for French men is 49.5, while for French

women, the total is 50.0 hours. The figures for husband's share of market work, housework, and labor income tell a similar story. The French husbands account for almost two-thirds of the household's market work hours and about 56 percent of the household's total income, including non-wage income. They also account for about 30 percent of the couple's housework time.

5 Results

We first report the results where we have treated market work allocations as exogenous variables in the housework regressions. But market work hours are likely to be endogenous; the results taking endogeneity into account are considered in the discussion of Table 3 below. The marginal effects evaluated at the sample means are reported in Table 2. The results are largely as predicted, except that husband's share of labor income is neutralized by the market hour variables, with no statistically significant effects. Increases in the wife's market hours would decrease her housework and increase the housework hours of her husband, resulting in a higher share for her husband. A 50 percent increase in her market hours from an average of 21 hours per week to about 32 hours per week would reduce her housework hours from about 29 to about 24.5 hours per week; husbands increase their housework hours from an average of 14 to about 15 hours per week. As a result, husband's share of housework climbs by about 4 and a half percent, a statistically significant increase from about 30 percent to almost 35 percent.

Increases in the husbands' market work hours have the opposite effect. A 20 percent increase in his work hours, from an average of 35.4 to 42.5 hours per week, would increase his wife's housework by about a half-hour per week, but his contribution to housework would fall by about two hours per week. Overall, his share of housework would drop by about 3.5 percentage points, on average, from 30 percent to 26.5 percent.

With this specification, education of the wife matters, as wives with low education work more hours in the home, and the husbands of wives with high education work more hours in the home. Overall, husbands of wives with high education perform a higher share of housework. Number and age of children has little effect except that having a very young child (0 to 3 years old) in the house significantly reduces the wife's share of housework as more time is devoted to child care. The small associated increase in husband's hours of housework is sufficient to result in a significant increase in his share. Older couples devote more time to housework, with wives raising their hours more for each extra year so that husband's share drops by a very small amount which is, nonetheless, statistically significant.

House dwellers do more housework, as expected, with the husband's share rising. Residence in a big city allows wives to drop their housework hours by about an hour per week; neither the husbands' hours nor their share changes significantly because of this.

As indicated earlier, these results are based on a synthetic week; we also compared the results from the first column of Table 2 with a set of results using the 24 hour diary (unaggregated) with a dummy for the weekend. The results are fully robust with respect to sign, significance and size. The gender division of labor does seem to be slightly more unequal during the weekend. These results are available from the authors. It could be argued that childcare time should be included in the category, housework. To check robustness, we re-estimated this equation with childcare time added to the housework time as the dependent variable. The parameter estimates were identical to the first decimal place and, in all cases but one, to the second decimal place. These results are available from the authors. Next we turn to the question of whether the parameter estimates are

robust to the use of an instrumental variables technique that controls for the possible endogeneity of market hours of work.

Table 2 Determinants of housework shares for French couples, treating own and spouse's market work as exogenously determined. (Marginal effects)

		Dependent variables		
Independent variables	**Mean**	**Husband's share**	**Husband's housework hours**	**Wife's housework hours**
Household total income	16.8[a]	-0.00[b]	-0.02	-0.05***
Husband's share of labor income	0.56	0.02	0.59	0.64
Wife's market work hours (predicted)	21.2	0.004*	0.08*	-0.40*
Husband's market work hours (predicted)	35.4	-0.005*	-0.30*	0.07*
Education				
- Low, husband	0.68	-0.00	0.33	0.84
- High, husband	0.21	0.00	-0.55	-0.56
- Low, wife	0.64	-0.01	-0.15	3.04*
- High, wife	0.22	0.03**	1.80**	0.71
Number of children				
- Aged 0-3	0.18	0.03***	0.86	-2.90*
- Aged 4-6	0.16	-0.02	-0.40	0.02
- Aged 7-12	0.28	-0.01	0.30	0.67
- Aged 13-17	0.24	-0.01	0.38	2.66***
Couple's average age	42.3	-0.001*	0.05***	0.28*
Age difference	2.5	0.00	-0.03	-0.02
House dwellers	0.63	0.05*	3.99*	1.83**
Big city	0.41	0.01	0.11	-0.84*

* Statistically significant at the 0.01 level; ** at the 0.05 level and *** at the 0.10 level.

Source: Time use data 1999.

Table 3 contains the estimated marginal impact of the explanatory variables on housework hours and husband's share when we treat market hours of work as endogenous. The results are largely robust, but there are some differences. When household income is high, controlling for labor income, French couples devote less time to housework, but only the wife's reduction is statistically significant, and it is not a large effect in practical terms. A 100% increase in monthly income from 16,800 FF per month to 33,600 FF per month would result in a decrease in the wife's hours from about 29 to about 28. As the husband's hours also drop, by a smaller and

[a] Monthly income in thousands of French francs, before taxes in this and all subsequent tables.

[b] All insignificant marginal effects are rounded to two decimal places. When the effect is 0.0049 or smaller, in absolute value, it is entered as 0.00, either with no sign (to indicate a positive value) or with a negative sign (to indicate a negative value).

statistically insignificant amount, there is essentially no change in the husband's share of housework.

The estimated coefficients for predicted market work hours are much smaller than those for actual market hours, but they are still statistically significant. Apparently the endogeneity of market work was biasing the coefficient estimates upward in ordinary least squares. A 50 percent increase in wives' market hours from an average of 21 to an average of 32 would reduce wives housework by about two-thirds of an hour, and would have no partial effect on husbands' housework share. A 20 percent increase in husbands' work hours from 35.4 to about 42.5 would reduce husbands' housework by a little less than two-thirds of an hour, and would lower his predicted share of housework by about an hour and a half. The effects are as predicted, and are statistically significant, but they are small in practical terms. So, these key estimates are robust to the endogeneity correction we have employed only in terms of significance, not in absolute value.

The education results observed earlier prove robust, although they are slightly stronger in this specification. A change in the wife's education from medium to low education increases wives' housework hours by about 3 and a third hours per week, on average, with no significant effect on husbands' housework or husbands' share of housework. A change in the wife's education from medium to high raise husbands' hours of housework by 2 and a quarter hours, on average, raising their share by 4 percentage points. These results tend to support the channel where education raises the wage, affecting either comparative advantage or the threat point. There is no need to bring in the idea that better educated households have more egalitarian values. Symmetric effects for husband's education are smaller and not statistically significant. Any increased sharing of housework in more highly educated French households is apparently not due to egalitarian values, *per se*, but to economic incentives connected to specialization and/or bargaining. There are now no significant effects of the number and age of children apart from the increase in wives' housework when older children and teenagers are present in the household. The cohort effect is still significant and is larger now. Among couples whose average age is ten years above the mean, the wives spend 4 and a half hours per week more on housework while husbands spend an hour more, with their share falling by 2 percentage points. There is still no support for age difference as an indicator of first-mover advantage. Dwelling in a house still increases housework more for the husband than the wife, with husbands' housework increasing by more than 3 hours compared to a less than 2 hour per week increase for wives; husbands' share increases by 4 percentage points on average. Residing in a big city reduces wives' housework by a little over an hour, but the husbands' housework is essentially unaffected, so husbands' housework share does not change by a significant amount.

These results are largely robust to the exclusion of education and child variables as explanatory variables and to the use of a double-hurdle model to predict market work hours. Appendix 1 consists of a table with results for this model (market work hours endogenous), but with education and child variables omitted. Child variables may be jointly determined with market hours, and education, through its correlation with the wage rate, is used to predict market work hours. The results are generally robust to these deletions. Husbands' share of labor income is still negatively related to their share of housework, and wives' predicted market hours still have a negative effect on their own housework, and a positive effect on husbands' share of housework, significant now. On the other hand, the husband's predicted hours of market work no longer are found to have a significant negative effect on his own housework hours and share of housework.

Table 3 Determinants of housework shares for French couples, treating own and spouse's market work as endogenously determined, Tobit system. (Marginal effects)

		Dependent variables		
Independent variables	**Mean**	**Husband's share**	**Husband's housework hours**	**Wife's housework hours**
Household total income	16.8	-0.001**	-0.13*	-0.19*
Husband's share of labor income	0.56	-0.09*	-3.20*	8.31*
Wife's market work hours (predicted)	21.2	0.00	0.00	-0.06*
Husband's market work hours (predicted)	35.4	-0.002*	-0.09*	0.04
Education				
- Low, husband	0.68	-0.00	-0.42	-0.61
- High, husband	0.21	-0.00	-0.96	-0.86
- Low, wife	0.64	-0.02	-0.43	3.36**
- High, wife	0.22	0.04*	2.28*	0.10
Number of children				
- Aged 0-3	0.18	0.01	0.76	-0.37
- Aged 4-6	0.16	-0.02	-0.57	0.59
- Aged 7-12	0.28	-0.01	-0.05	1.13***
- Aged 13-17	0.24	-0.02	0.15	2.86*
Couple's average age	42.3	-0.002**	0.10*	0.44*
Age difference	2.5	0.00	0.01	0.03
House dwellers	0.63	0.04*	3.28*	1.84*
Big city	0.41	0.01	0.06	-1.27*

* Statistically significant at the 0.01 level; ** at the 0.05 level and *** at the 0.10 level.

Source: Time use data 1999.

Appendix 2 reports on the results for model two when a double hurdle model is used to predict market work in a first stage regression rather than Tobit. The results are also broadly robust to this variation. Household income is negatively related to housework and to the husband's share while husband's share of labor income is negatively related to own housework and his share of housework and positively related to the wife's housework hours. Fewer of the direct (predicted) market work hours effects are still significant; an increase in the husband's predicted market hours raises his wife's housework hours substantially.

Before comparing these endogeneity-corrected findings to the earlier ones for the U.S. and Germany, consider the results, in Table 4, when we use the empirical model guided primarily by the Becker/Gronau home production model. As indicated earlier, the implications of the bargaining models are similar for the variables we are considering here.

Husband's predicted wage has no significant effect, but increases in the wives' predicted wage reduce their housework hours and raise husbands' share. The own (predicted) wage elasticity of wives' housework is –0.3, and the elasticity of husbands' share of housework with respect to the

wife's (predicted) wage is 0.25. A ten percent increase in wives' predicted wage lowers their housework hours by about 3 percent, and raises the husband's housework share by about 2 and a half percent. The household nonlabor income has a marginally significant effect in the expected direction, but the practical effect is small. The wives' housework hour elasticity with respect to nonlabor income is –0.01, while that for husbands' housework hours and husbands' share is –0.02. A ten percent increase in non-labor income would reduce wives' housework by about one percent, while husbands' housework and husbands' share of housework would both fall by about 2 percent.

Table 4 Determinants of housework shares for French couples (Becker/Gronau models).

	Dependent variables		
Independent variables	**Husband's share**	**Husband's housework hours**	**Wife's housework hours**
Household nonlabor	-0.002(-0.02)**	-0.09(-0.02)**	-0.07(-0.01)*
Male wage (predicted)	-0.00	-0.01	-0.01
Female wage (predicted)	0.001(0.25)*	0.01	-0.09(-0.3)*
Number of children			
- Aged 0-3	0.00	1.03	1.37*
- Aged 4-6	-0.03*	-0.73	1.80**
- Aged 7-12	-0.03*	-0.45	2.16*
- Aged 13-17	-0.04*	-1.23**	3.60*
Couple's average age	0.00	0.22*	0.51*
House dwellers	0.03*	2.60*	1.68*
Big city	-0.00[a]	-0.77	-1.44*

Education and market work hours excluded as endogenous, but number and age of children included as exogenous. (Main entries are marginal effects; items in brackets are estimated elasticities.)
* Statistically significant at the 0.01 level; ** at the 0.05 level and *** at the 0,10 level.

Source: Time use data 1999.

Among the control variables, number and age of children is now more important, with husbands' housework hours steady when older children are in the household, or even diminishing for each teen in the household. Wives' hours of home production increase steadily with the number of children in each category, but the increase is largest for the older categories. Cohorts that are ten years older have the wife doing about 5 hours more housework per week, and husbands doing about 2 hours extra, with the result that husbands' share is essentially steady. The results for house dwellers and big city are robust, with the house dweller effects slightly dampened and the big city effect slightly larger.

There are no significant effects for the age difference variable in any of the specifications. Beblo's hypothesized age difference link, as a measure of first mover advantage, finds little support here. For now, it appears that there is more likely to be an age-invariant first mover advantage to French males in career commitment, or no first-mover advantage.

[a] All insignificant marginal effects are rounded to two decimal places. When the effect is 0.0049 or smaller, in absolute value, it is entered as 0.00, either with no sign (to indicate a positive value) or with a negative sign (to indicate a negative value).

6 Comparisons

In Tables 5 and 6, we compare our main findings, with similar specifications, with those for Germany (Beblo 1999) and the United States (Hersch and Stratton 1994). Table 5 uses the Tobit specifications we emphasize in the discussion and Table 6 provides an even closer comparison by using an ordinary least squares (OLS) specification that we argue is not correct. However, it has the advantage of providing a comparison across the three countries using essentially the same econometric specification. The variables listed are those that are common, or roughly in common, across the studies. Before proceeding with this comparison note that the first two columns of Table 5 allow us to compare our results between the model where labor market hours is treated as exogenous (column 1) and endogenous (column 2).

The main differences are in the effects of household total income and husband's share of labor income, which change from insignificant in column 1 to negative significant findings in column 2, consistent with other studies. On the other hand, wife's market work hours no longer has a significant positive impact on husband's share of housework once the endogeneity is allowed for. Still, the pattern of results is broadly consistent with the expected findings, as suggested by the household specialization and bargaining models. In the discussion below, statements about the French results refer to the endogeneity corrected results in column two, unless there is a specific reference to *OLS* results.

There is broad agreement in the findings across the three countries. Increases in household income and in the husband's share in producing labor income tend to reduce his hours of housework. Increases in the wife's market work hours tend to increase or have no significant effect on her husband's share of housework, and increases in a husband's market work or his share of market work hours tends to reduce his share of housework time. With an ordinary least squares specification for France, the income effects are not significant, but the work hour effects of husband and wife are identical to the German effects.

If better-educated families have more egalitarian values, then, controlling for the husband's share of labor income, husbands with high education should perform a greater share of housework. The U.S. and German evidence supports this but the French evidence does not. This is true for the OLS specification as well. The effect of wife's education is also consistent across studies when significant; increases in wife's education, as a proxy for wage rate, tend to be associated with an increased share of housework for the husband, either a bargained response to the increased self-sufficiency of the wife within or after the marriage, or an efficient redistribution of housework consistent with lower potential gains to specialization.

The demographic variables had somewhat less consistent effects across countries. The presence of children either had no significant effect or tended to reduce the male's share of housework, although the husband's share increased in the U.S. for the category, children aged 7 to 12 years. The couple's average age has a negative impact on husband's share of housework in France, as in Germany and the U.S. The difference in spouse's ages, a proxy for "first-mover" advantage in non-cooperative bargaining was not tested with the U.S. data, while it reduced husbands' housework share in Germany, and had no effect in France.

Table 5 Determinants of husband's share of housework time in France, Germany and the United States.

Explanatory Variables	France Time Diary Tobit	France Time Diary Tobit IV	Germany Survey OLS	USA Survey OLS
Household combined income	o	-	-	-
Husband's share of labor income	o	-	-	-
Wife's market work hours	+	o	+	
Husband's market work hours	-	-	-	
Husband's share of market hours				-
Education:				
Husband, less than high school	o	o		-
Husband, more than high school	o	o		+
Wife, less than high school	o	o		o
Wife, more than high school	+	+		+
Husband's years of education			+	
Wife's years of education			+	
Children:				
- Age 0-3	+	o		o
- Age 4-6	o	o		o
- Age 7-12	o	o		+
- Age 13-17	o	o		-
Child dummy			-	
Couple's average age	-	-	-	-
Husband's age minus wife's age	o	o	-	

\+ positive - negative o not significant

Source: Time use data 1999.

The estimated parameters in Table 6 with the common, if less preferred, ordinary least squares estimates for the determinants of husbands' share of housework shows that fewer of the hours and labor income variables have significant effects in France.

Among those that are significant at conventional levels, the effects are smaller in size, often by a dramatic factor. The market work hour effects, for example, are about one-third as large in these French results as they are in the German results. The significant estimated parameter for couple's average age is about one-third the size of the same parameter for Germany which is, in turn, much smaller than that estimated for the U.S. The one exception to this general impression is that the negative effect of the wife having a low education appears larger, in absolute value, in France than in the U.S. It would appear that, in general, these economic factors play a somewhat smaller role in French intra-household time allocation.

The cross-country effects of income, work hours and education are largely consistent with the bargaining and specialization models of the family; the precise explanation of the reason behind those effects differs across the models.

Table 6 Determinants of husband's share of housework time in France, Germany and the United States with an OLS specification.

Explanatory Variables	France Time Diary OLS	Germany Survey OLS	USA Survey OLS
Household combined income	-0.000(0.17)	-0.00003(3.0)	-0.0000(2.03)
Husband's share of labor income	0.014(1.24)	-0.11(5.5)	-0.2(8.60)
Wife's market work hours	0.004(28.73)	0.011(11.0)	---
Husband's market work hours	-0.005(40.46)	-0.017(17.0)	---
Husband's share of market hours	---	---	-0.11(4.14)
Education			
Husband, less than high school	0.003(0.29)	---	-0.029(3.82)
Husband, more than high	0.004(0.36)	---	0.38(7.45)
Wife, less than high school	-0.018(1.78)	---	-0.005(0.67)
Wife, more than high school	0.017(1.45)	---	0.02(4.04)
Husband's years of education	---	0.004(4.0)	---
Wife's years of education	---	0.008(8.0)	---
Children			
- Age 0-3	0.007(0.70)	---	0.004(1.02)
- Age 4-6	-0.006(0.62)	---	0.004(1.02)
- Age 7-12	-0.008(1.03)	---	0.007(2.65)
- Age 13-17	-0.012(1.52)	---	-0.02(5.38)
Child dummy	---	-0.023(3.8)	---
Couple's average age	-0.001(1.88)	-0.0027(9.0)	-0.03(5.77)
Husband's age minus wife's age	-0.000(0.36)	-0.023(3.8)	---

absolute value of t-statistics in parentheses; bold entries are significant at 0.10 level or better

Source: Time use data 1999.

7 Conclusions

We find that, in France, as in the U.S. and Germany, husband's housework time allocation and, especially, his share of housework, responds to changes in economic variables. The greater his share of labor income (and hence, the higher his relative wage), the lower his share of housework; the greater the wife's market hours, the lower his housework time, but the larger his share of housework; and the greater the wife's education, the greater her husband's share of housework.

When we employ a model that provides a closer test of the Becker/Gronau home specialization model, we find solid support. The cross-wage elasticity on husband's share of housework is positive. For every 10 percent increase in the wife's wage, the husband's share of housework increases by 2.5 percent. There is also a negative own wage elasticity of housework for married women. For every 10 percent increase in the wife's wage, her own housework hours tend to fall by 3 percent. These are inelastic but sizeable effects.

These effects are consistent with both economic models. In the bargaining model, the changes in earning power, market hours and education all generate changes in the threat point, either

external or internal to a continuing marriage, and move the bargained allocation of time in the direction found in the empirical results. In the specialization model, increases in the wife's labor income, market hours, and education would all tend to reduce the gains to the wife specializing in home production, and move the time allocation in the direction found in the empirical results.

We find no support for Beblo's *first-mover advantage* argument in the housework time allocation results. Future work with other data sets and particular institutional rules governing within-marriage or post-marriage welfare of husbands and wives may provide further evidence for distinguishing between the specialization and bargaining models. This is important, as the interpretation of the empirical results for policy recommendations sometimes changes significantly, depending on which model one adopts. In the meantime, both these models provide a useful framework for investigating many empirical questions about the influence of economic variables on the intra-family allocation of time. Focusing on one model or the other may make particular insights easier to see. Carlin (1991) gains insights from bargaining models to investigate the impact of changing no fault divorce laws in the U.S. on time allocation to work, study and child care. Here we have used insights from the specialization model to refocus attention on (1) the potential endogeneity of market work in housework equations; and (2) the relative wage rates of husband and wife as important empirical determinants of time allocation to home production tasks in France.

Appendix 1 Determinants of housework shares for French couples, treating own and spouse's market work as endogenously determined; education and child variables deleted. (Marginal effects)

		Dependent variables		
Independent variables	**Mean**	**Husband's share**	**Husband's housework hours**	**Wife's housework hours**
Husband's share of labor income	0.56	-0.002**	-0.09**	-0.07***
Wife's market work hours (predicted)	21.2	0.001*	0.01	-0.09*
Husband's market work hours	35.4	-0.00	-0.01	-0.01
Couple's average age	42.3	0.00	0.22*	0.44*
Own house	0.63	0.02**	2.45*	2.21*
Big city	0.41	0.00	-0.73	-1.51**

* Statistically significant at the 0.01 level; ** at the 0.05 level and *** at the 0.10 level.

Source: Time use data 1999.

Appendix 2: Determinants of housework shares for French couples, treating own and spouse's market work as endogenously determined; market work time predicted with double-hurdle model. (Marginal effects)

		Dependent variables		
Independent variables	**Mean**	**Husband's share**	**Husband's housework hours**	**Wife's housework hours**
Household total income	16.8	-0.002*	-0.18**	-0.20*
Husband's share of labor income	0.56	-0.09*	-3.34*	8.60*
Wife's market work hours (predicted)	21.2	0.00	0.04	-0.02
Husband's market work hours (predicted)	35.4	-0.00	-0.00	0.06*
Education				
- Low, husband	0.68	-0.00	-0.47	-0.70
- High, husband	0.21	-0.01	-0.99	-0.38
- Low, wife	0.64	-0.03**	-0.52	3.64*
- High, wife	0.22	0.04*	2.06**	-0.63
Number of children				
- Aged 0-3	0.18	0.01	1.09	0.95
- Aged 4-6	0.16	-0.03**	-0.72	1.37**
- Aged 7-12	0.28	-0.02**	-0.28	1.71*
- Aged 13-17	0.24	-0.03*	-0.76	2.95*
Couple's average age	42.3	0.00	0.22**	0.45*
Age difference	2.5	0.00	0.07	-0.05
Own house	0.63	0.04*	2.92*	1.61*
Big city	0.41	0.01	-0.34	-1.53*

Statistically significant at the 0.01 level; ** at the 0.05 level and *** at the 0.10 level.

Source: Time use data 1999.

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Complexity in daily life – a 3D-visualization showing activity patterns in their contexts

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Abstract

This article attacks the difficulties to make well informed empirically grounded descriptions and analyses of everyday life activity patterns. At a first glance, everyday life seems to be very simple and everybody has experiences from it, but when we try to investigate it from a scientific perspective, its complexity is overwhelming. There are enormous variations in interests and activity patterns among individuals, between households and socio-economic groups in the population. Therefore, and in spite of good intentions, traditional methods and means to visualize and analyze often lead to over-simplifications. The aim of this article is to present a visualization method that might inspire social scientists to tackle the complexity of everyday life from a new angle, starting with a visual overview of the individual's time use in her daily life, subsequently aggregating to time use in her household, further at group and population levels without leaving the individual out of sight. Thereby variations and complexity might be treated as assets in the interpretation rather than obstacles. To exemplify the method we show how activities in a daily life project are distributed among household members and between men and women in a population.

JEL-Codes: C88, D13, P46, R29

Keywords: household division of labour, time-geography, 3D method, visualization, diaries, everyday life, activity patterns. Complexity in daily life – a 3D-visualization showing activity patterns in their contexts

Approaching the fabric of daily life

While we all experience daily life as time goes by, many social scientists find that daily life turns out to be quite a complex task when put under study. Since all activities take time to perform, studying time use may serve as a starting point for approaches to everyday life studies. Traditional ways of describing time use, by accounting for the average number of minutes for certain activities per individual in a population, are suitable for example when introducing discussions on time use topics. Averages also serve as measures and indicators when the purpose is to give a brief overview over daily life in a population.[14] But the average time use gives limited guidance when questions arise on more complex relations in everyday life. For example, how do various activities interrelate with each other in purposeful projects, what is the distribution of activities among the individuals in households and what are people's opportunities to realize projects that engage them?

People shape their daily life by continuously performing activities to satisfy their wants and needs. But their opportunities to act according to their wants and needs are restricted, first, by the natural and manmade material environment, second, by the individual's own capacity and capabilities, and third, by social institutions and structures like agreements, regulations and laws on social and economic couplings between individuals (Hägerstrand & Lenntorp 1974, Hägerstrand 1982, Mårtensson 1979, Giddens 1990). Individuals' various goals and strivings, their different resources and the specific restrictions they experience, result in each individual living her life in a different manner form everybody else. There are, however, some basic similarities in people's daily performance. The necessity for humans to allocate time for physiological needs, like sleeping and eating, do not differ according to culture and location on the earth, while the specific activity patterns and rhythms (when, for how long, where, and with whom people eat and sleep) may give rise to culturally constructed patterns that differ between regions on the globe (Szalai 1972). Hence, the study of everyday life is ambiguous and therefore investigations claim for methods that may reveal both variations and similarities according to how people organize their activities.

The aim of this paper is to present a new 3D method, dealing with the complexity of everyday life by regarding daily activities from a time-geographical perspective. A 3D visualization system is worked out for developing the method. In this article the method is used to show aspects of division of labor (gender and generation) related to the basic human need for food, in the context of a household and a population.

Theoretical and conceptual framework for analysing the complex everyday life

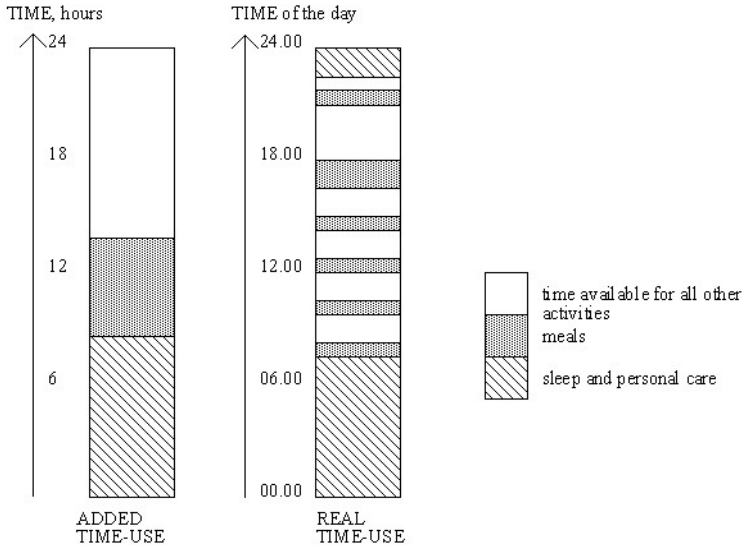
Approaches to study time-use data

Time use data collected in time diaries reveal what people write that they actually have done. To get a hold on the contexts in which activities are performed by individuals (alone, as household members or in other social groupings) we must rethink the traditional approach to present time use figures collected from diaries. The added time use (figure 1, left) is the way we usually are

[14] See for example Multinational Time Use Study, MTUS at http://www.iser.essex.ac.uk/MTUS/.

presented time-use figures, showing the sum of hours and minutes spent for activities by one individual during a day (24 hours). The added time use neglects important aspects: first that some activities are performed several times during a day and second what contexts the activities are parts of.[15] The real time use (figure 1, right) is an alternative way to present the same data, picturing the sequence of activities over the 24 hours of the day. The real time use shows how activities are intertwined in the course of the day[16] and it may also serve as a base for analysing, opportunities to co-ordinate activities in a household. The impressions from the two illustrations are different even though exactly the same individual, the same day and the same diary data is the starting point for both of them.

Figure 1 Differences in time-use of an individual during a day



The figure shows the differences in principle between added (left) and real (right) time-use of an individual during a day. The total number of hours used for "meals", "sleep and personal care" and "other activities" is exactly the same in the diagrams.

Source: Ellegård (1999 b), 170.

When looking for activity patterns, division of labour and habits embedded in the daily life of people in their households (section 5) the real time use approach is suitable. We claim that our method in addition may show how the principle of real time use may reveal interesting information on the population level (section 5.2).

About time-geography

With what do people fill their days to survive, enjoy, educate and develop themselves? How do they organize socially and make efforts to achieve personal and collective goals? How do they utilize resources available at the various places where they spend their time? Questions like these

[15] At an aggregate level the added time use equals average time use. Average time use for populations was first presented by Szalai (1972) and it is used in most national time use studies.

[16] Real time use might be transformed into added time use, while the reverse transformation is impossible.

are fundamental to most social sciences and several theoretical approaches and methods are developed to deal with them (welfare studies, time use studies, social interaction).[17]

The roots of time-geography[18] are found in geography, wherein the physical world and the human utilization of it are in focus. Time-geography is deeply rooted in the material world where human individuals live side by side with (and utilize) individuals from different kinds of populations (animals, plants, artefacts etc)[19] (Hägerstrand 1993). Human individuals exert strong power over individuals in other populations due to technologies developed to master the environment. Relations between individuals from different populations that co-exist in time and space are important in time-geography (Hägerstrand 1991).

Our time-geographic method focuses individuals in the human population. Each individual is a member of a household and many individuals live in households with more than one member. The individuals in a household are coupled to and dependent on each other[20], because they have many projects in common. Therefore, it is important to be able to move from the individual level to the household level without losing important information about the individual when the household is put in focus (Hägerstrand 1974). Hence, in our method one may concentrate on "the individual as a whole" at one level, but it is obvious that the "individual as a whole" constitutes just one part of "the household as a whole" on the next upper level.

Two basic assumptions in time-geographical thought are that everything takes place somewhere on the earth's surface, and that it takes time for everything to happen. Processes might be depicted in time and space – the time-space (Hägerstrand 1974, Lenntorp 1976). The process approach underlines the importance of not only the events going on, but also of relics of past events and of the seeds for future events immanent in present events (Hägerstrand 1961).

Individuals' struggle to overcome restrictions when they pave their way through life is a question of process and continuity. Now is continuously transformed into a past situation in the individual's biography and it constitutes her stepping stone when she takes her next step into the future. The plans and intentions of individuals are of importance for this transformation, and the power and resources controlled by each individual are decisive for what will turn out. However, routines and habits are developed and they help the individual to make her choice of activities and to live her life without deeper reflections over everything she chooses to do (Åquist 1992, Lindén 2001).

Indivisibility of the individual at one and the same level is another important assumption in time-geography.[21] This implies that an individual only can exist at one place at the same time, and therefore the time and space dimensions may be taken as basic descriptors of daily life.

Time-geography utilizes individuals' indivisibility in its specific notation system: an individual's existence in the time-space is illustrated by a continuous line - labelled individual path - that

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17 See also Allardt (1975), Thompson (1999), http://www.iser.essex.ac.uk/MTUS/

18 The time geographical approach was developed by Hägerstrand and his research group in Lund, Sweden from the late 1960's and on. The activity oriented time-geography is developed in Ellegård (1993, 1994, 1996, 1999a, 1999b) and in Nordell (2000, 2002).

19 Different populations consist of individuals of different kinds and there are, consequently, not only human populations.

20 Family is the concept for biological relationships while household is the concept used here for individuals living in the same home.

21 Looking at the human body at another level of analysis, however, it may be divided into organs, into cells and so on.

constantly moves in time and space[22], from birth to death of the individual[23] (Hägerstrand in Carlestam 1991). From the individual path we can read when the individual is located where, and how fast she moves between the different places she visits. Hence, the focus of this original individual path is where people are located (geography) in the course of the day (time) (Lenntorp 1976).

The original time-space based individual path is modified in our method, where focus is put on when and for how long people perform what activities. The result is an activity oriented individual path, see figure 2. The individual's activity oriented individual path shows her activity sequence and other phenomena important to the individual might be related to it. For example, factors like together with whom activities are performed, what places are visited, what means of transportation are used, and what feelings may be related to the activities performed (Ellegård & Nordell 1997).

An illustration showing the activity oriented individual path in the course of the day is a good base for analysing passing everyday phenomena like activities that usually are taken for granted. In the diagram, activities are clustered according to a general categorization scheme with seven activity spheres (Care for oneself, Care for others, Household care, "Recreation/reflection", Transportation, Procure & prepare food, Gainful employment & schoolwork). The activity oriented individual path does not reveal the motives behind why the activity pattern came out as it did. To answer to the why-question interviews are important complements in analysing the individual paths derived from diaries. When an individual looks at the activity path illustrating her day, based on her own diary notes, she easily recognises her unique daily life. Discussions between researchers and diary-writers might in this way deepen, compared to ordinary interview situations (Forsell 2002, Nordell 2000, 2002, Westermark 2003).

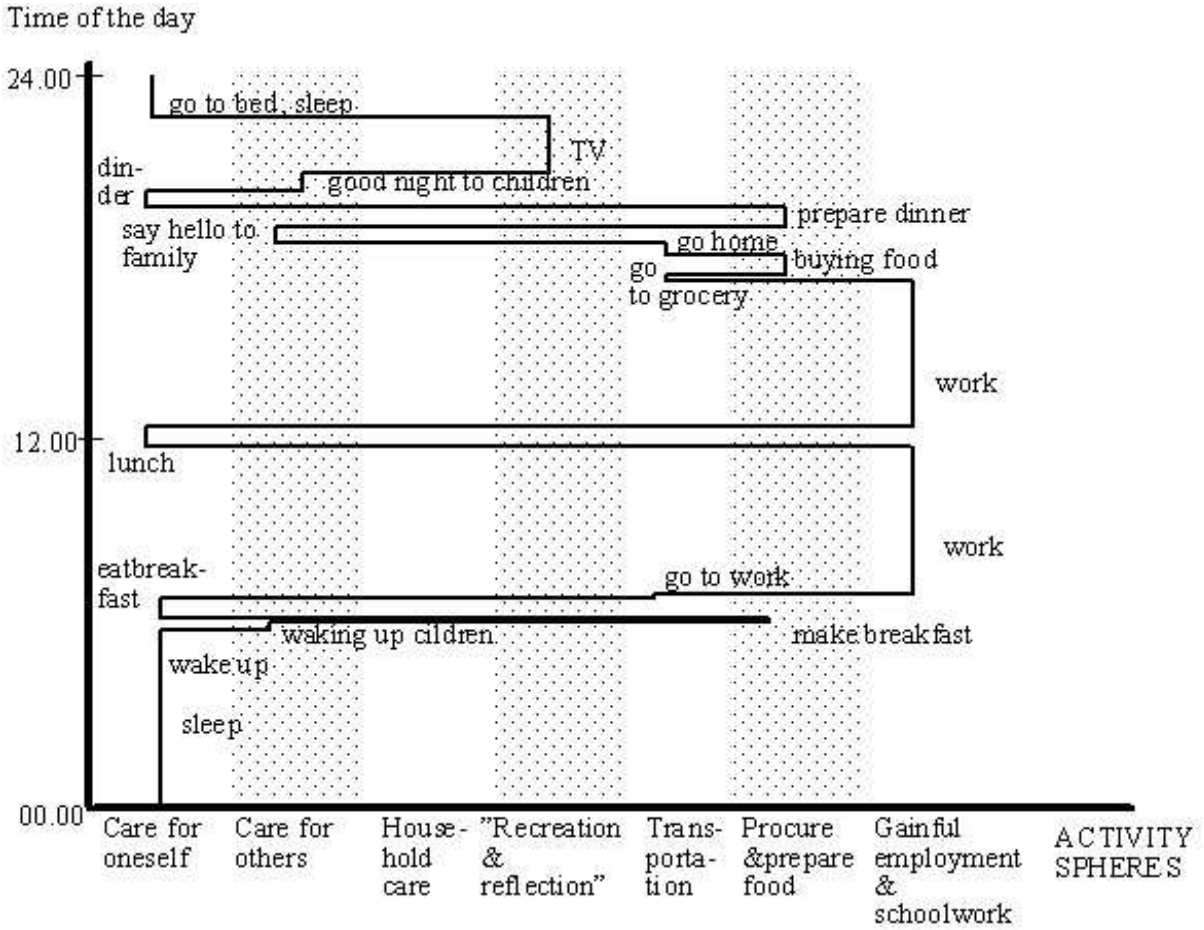
Concepts for analyzing everyday life activity patterns

Our 3D method utilizes the following concepts as tools to systematically investigate the complexity of everyday life: activity, project, activity contexts (everyday context and project context), social context and geographical context. *Activity and project.* An *activity* is defined as a handling, tied to the individual performing it and her location in time and space. Activities are regarded as processes since they take time and have duration. From the perspective of the individual activities are meaningful since they are means for her to reach goals. Activities aiming at fulfilling the same goal constitute a *project* (Hägerstrand 1985). A project is an analytical concept, containing activities that have passed, activities that are ongoing and that are planned. Thereby we may link activities of now to their history and to their future. The overall project, common to all individuals, is assumed to be "to live one's life". Within this all embracing project other, more specific projects are contained and exactly how they are performed varies from individual to individual and from time to time (Ellegård 1994, 1999b). There are, however, similar patterns and routines common to several individuals of the same culture. A project, hence, consists of a variety of activities that taken together aim at achieving the goal of the project, and they are performed in accordance with the specific circumstances of every individual (Hägerstrand 1982, 1985).

[22] The individual path moves along the time dimension when the individual is stationary at a place, and it moves simultaneously along the time and space dimensions when the individual moves over the earth's surface.

[23] In most studies the time perspective is shorter than the whole life, and it comprises a day, a week or a year.

Figure 2 Activity oriented individual path of one individual during one day



The activity path illustrates the sequence of activities performed by the individual from 00.00 to 24.00. Time is depicted on the y-axis and there are seven activity spheres on the x-axis. The individual path should be read from the bottom of the figure and upwards. The vertical sections of the individual path show the time use for activities and the location on the x-axis shows within which of the seven activity spheres the activity performed is classified. Horizontal sections of the individual path indicate that the individual stops one activity and starts another. This individual path illustrates a unique daily life starting with sleep and waking up (in the sphere Care for oneself), waking up children (sphere: Care for others), make breakfast (sphere: Procure and prepare food), have breakfast (sphere Care for oneself), go to work (sphere: Transportation), work (sphere: Gainful employment), have lunch (sphere Care for oneself), work (sphere: Gainful employment), go to a shop (sphere: Transportation), buy food (sphere: Procure and prepare food), go home (sphere: Transportation), say hello to the family (Sphere: Care for others), prepare dinner (sphere: Procure and prepare food), have dinner (sphere Care for oneself), say goodnight (Sphere: Care for others), watch TV (sphere "Recreation/reflection") and finally go to bed and sleep (sphere Care for oneself).

Source: own calculation from a one day diary.

Activities in daily life, and, to a considerable extent, also projects, may be studied from people's time diaries. To analyse them we need a robust category structure and a categorization scheme is developed for clustering the activities in diaries (Ellegård 1993, 1994, Ellegård & Nordell 1997, Westermark 2003). The categorization scheme is also a base for coding activities to prepare them for computerised illustrations. The categorization scheme takes as its points of departure the perspective of the individual as a handling subject and that the most general project, involving all

individuals is "to live one's life". As mentioned before this overall project is classified into seven activity spheres.

In individuals' time diaries, where notes are written on activities occupying the day, the level of detail varies a lot.[24] One individual may write "household chores" while another writes "scrub the floor" when doing exactly the same thing. As a researcher one must be able to compare the diaries despite their different levels of specification. The categorization scheme handles variations by including five levels of detail (Ellegård 1993, 1994, 1999a, 1999b). Therefore, it is possible to use the level that fits a not very detailed diary when comparing it to a very detailed one. The principle is illustrated in figure 3. There are about 600 different activities in the categorization scheme.

Specific projects may consist of activities found within one or more of the spheres. For example, the project "serve meals for the family" involves activities from the sphere "procure and prepare food", and, if transportation is needed to buy ingredients, it also involves activities from the sphere "movements, transportation".

So far the discussion has focussed on projects as *individual projects,* but there are *organizational projects* too (Ellegård 1975). There are formal organizations like companies and public organizations, and informal ones, like households and other voluntary organizations. Influential individuals in an organization decide upon the goals of organizational projects and the other individuals involved in the organization are expected to perform the activities that are necessary for realising the organization project. In this paper informal organizations (households) are put in focus.

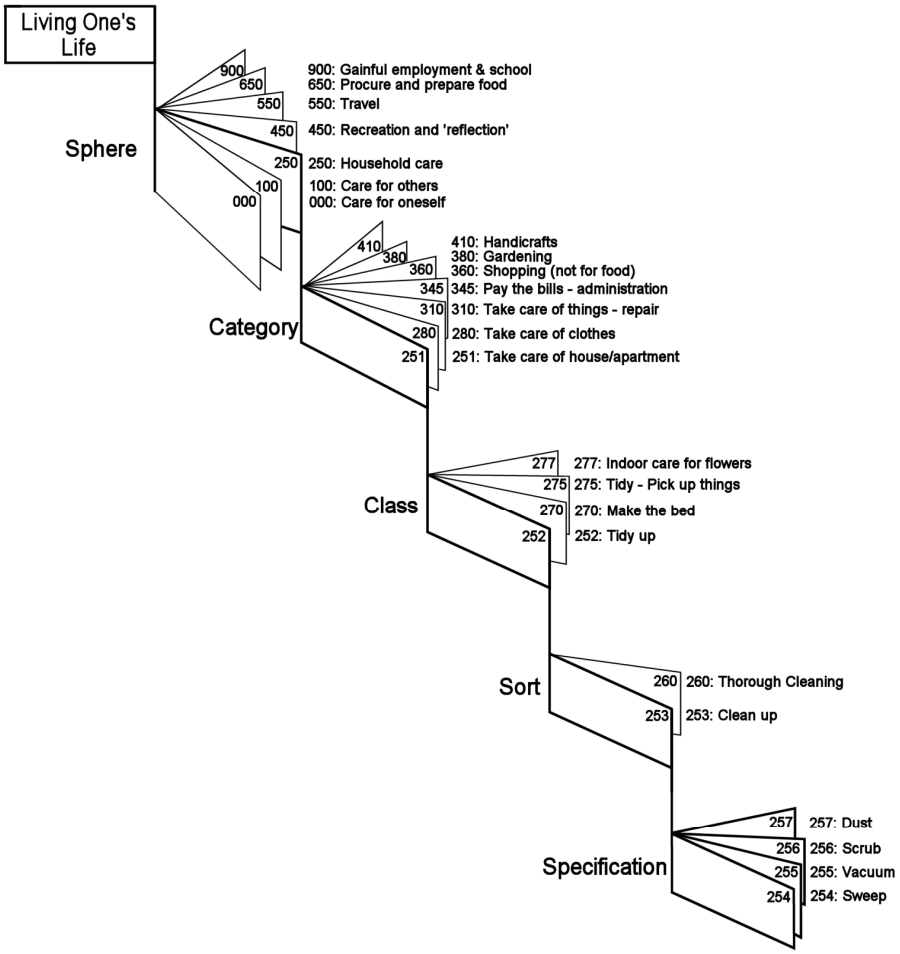
Contexts in daily life. There are two types of *activity contexts* used in the method, the *everyday context* and the *project context* serving different analytical purposes. The continuous sequence of activities performed by an individual during a day constitutes her everyday activity context. The *everyday context* pictures how activities sequentially follow upon each other, and we can see when an activity is interrupted by another activity and how the former activity is resumed. The everyday context is based on activities that already have passed and is visualized by an activity oriented individual path (figure 2), based on the principle of real time use (figure 1).

To a considerable extent, it is possible to derive from the everyday context what *projects* the individual is involved in, since activities appearing in the everyday context constitute realised parts of projects that the individual aims at fulfilling. The concept project is used when talking in general terms about activities oriented at one and the same goal, but then it lacks reference to the everyday context in which its activities it appear. Therefore, we need a concept for talking about the activities that in fact have been performed to realise the project, and we use the concept *project context* for this purpose. Consequently, the project context is always related to activities that have passed. Activities in one specific project context, hence, appear now and then in the everyday context of the individual who tries to reach the goal of the project. Activities related to one specific project do therefore appear intertwined among the activities of other projects. An example of a project context located in the everyday context of figure 2 is revealed by the activities performed for the project "serve meals for the family". Four types of activities appear as parts of this project context, namely "make breakfast", "buy food", "transportation (to and

[24] The diaries contain notes on time, activity, and place, and together with whom each activity is performed.

from the shop)" and "prepare dinner".[25]

Figure 3 Five levels of detail in the activity categorization scheme



Within the activity sphere 250 Household care examples of activities on more and more detailed levels are given.

Source: Ellegård (1994), 53, authors translation.

[25] Since there are some activities lacking to bring the project to full meals, someone else in the household obviously performs these activities, i.e. "lay the table" and "wash the dishes", and lunch is probably eaten in the workplace restaurant – and then it is prepared by someone else.

Our 3D method enables us to describe and analyse activity patterns in terms of everyday contexts and project contexts and it will help us to a deeper understanding of circumstances that affect people in performing their projects of daily life. The method may reveal *rhythms, habits* and *routines* that are at hand. The distribution of activities *among the household members* reveals the outcome of power relations in the household: Who buys the food, cooks, and washes the dishes? When and in what contexts are these activities performed? From such analyses the household members are enabled to articulate and discuss their division of labour, as revealed by their activity paths. However, this approach does not say anything about meanings behind the projects performed (Nordell 2000, 2002, Westermark 2003). To get deeper information on intentions and meanings, interviews are necessary. Interviews are facilitated when the discussion can start from a time-geographic illustration of the everyday context of the family members. Then all participants get a common reference point for their discussion (Nordell 2002).

The *geographical context* tells us about where (in what place) the individual was located and at what time the various activities were performed. The *social context* informs about togetherness: are there other individuals present when an individual performs her activities and, if so, who are they? These contexts (activity, geographical and social) may easily be related to each other since they all have the time dimension in common. However, in this paper we will limit our focus to the activity contexts at individual, household, group and population levels.

What about the distribution of activities *among groups* in the population (for example according to age, sex, income, urban- or rural location)? The 3D method may be utilized to reveal if there are specific activity patterns tied to specific groups by defining criteria for sampling groups of individuals from the whole population in the database. The distribution of activities *within the population as a whole* shows a cultural everyday activity pattern. Hence, we might shed light on questions about how everyday life is organized and lived in a society from inter-relating the time, activity, place and other dimensions, starting on the individual level and subsequently aggregating to group and population levels.

The database

The database consists of 926 diaries collected during the autumn months in 1996 by Statistics Sweden for a pilot study.[26] A total number of 464 individuals in 179 households have written diaries. Most of the individuals have written one diary on a weekday and one on a weekend day. The age span of the individuals writing diaries ranges from 10 to 97 years. The individuals live in households with different characteristics (couples, singles, with and without children at home etc), living in different types of regions (rural and urban). The households and diaries are briefly presented in table 1.[27] The database has close to 30000 activity entries, equalling the 1333440 minutes of the 926 days.

[26] The pilot aimed at testing a diary form to be filled in by all household members of 10 years of age and above. The test was successfully performed. The data has not been utilized by Statistics Sweden.

[27] In total there are 38 households with one adult, and 28 of them live alone while 10 of them have 27 children altogether. The number of children living with one adult varies between one and five. Evidently, there are not as many diaries as there are household members. The main reason is that children under 10 years old were not asked to write diaries. Another reason is that in some households all individuals approached did not fill in the diaries.

Table 1 Household types in the Swedish pilot study

Household size	No of households	Sum of household members	No of individuals writing diaries
1	28	28	28
2	45	90	87
3	15	45	39
4	24	96	74
5	41	205	128
6	17	102	65
7	6	42	24
8	1	8	6
9	1	9	6
10	1	10	7
Total:	179	635	464

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996).

The 3D Visualization System

We have developed a powerful, flexible and extensible visualization system for visual data analysis from the diary data gathered (Cooper et al. 2002). The system has been developed using AVS/Express, a popular modular visualization environment, which can be used to facilitate rapid application development using both standard methods, provided by the Express system itself, and additional algorithms and methods provided by the developer. AVS/Express includes functionality to interact directly with an SQL database allowing the user to drive the analysis from within the application, interactively selecting data and controlling the visualization of the selected data in real-time as they work.

Goals of the 3D Visualization System

The overall purpose of developing the system was to construct a flexible tool to improve ease of access to powerful analyses of diary data from a time-geographic perspective and, hence, illustrate the complexity of everyday life. Consequently, it includes several dimensions that are of importance for analysing an individual's performance of daily activities in the contexts (section 2.3) within which they are performed.

Through the use of multidimensional display techniques, the visualization system shows when, how often and in what contexts individuals perform activities in the course of the day. Most traditional visualization methods (circle, bar and other types of charts and diagrams) of time use are limited in this respect. Our method is flexible: *First*, it permits the user to select a range of individuals from a single person up to the entire population of the data with many intermediate levels based upon any combination of selectable search criteria. This allows the user to focus upon the single individual, the individual together with other household members (if any), and the individual together with other individuals with similar properties (such as sex, age, home region and various socio-economic factors) and the individual in the population as a whole. *Second*, it is possible to illustrate activities on different levels of detail. *Third*, it is possible to relate the activities performed to what places individuals visit during the day (geographical

context), *fourth*, to what other people the individual was together with when activities were performed (social context) and, *fifth*, to what technologies the individual can use to perform those activities. The latter means that a new context is included in the analyses, the technical context.[28]

The dimensions of the 3D representation

In our 3D-representation *time* is always located on the y-axis, and the individuals are always mapped onto the x-axis. The z-axis is used to display other factors, one at a time, for example *activities*, *places*, *togetherness* and *technologies* used. When the third axis (z) is used for depicting activities, the result is an activity oriented individual path (as shown in figure 2). The program also offers the facility to use colour to simultaneously depict an extra dimension than can be contained in the three axes mentioned above. For example, the program shows (1) at what time (y-axis), (2) one or more individuals (x-axis), (3) perform what activities (z-axis) and (4) what specific place they are located at (using colour).

Technically, the data representation in the 3D visualization system can then be interacted with by the user in real-time. The user can rotate the displayed objects to examine the picture from different angles, either to align and compare specific data items or to avoid obscuring them, or might zoom into it or look at it from a distant point of view. These properties are of special importance when there are a large number of individuals and when the activities are illustrated with a high level of detail.

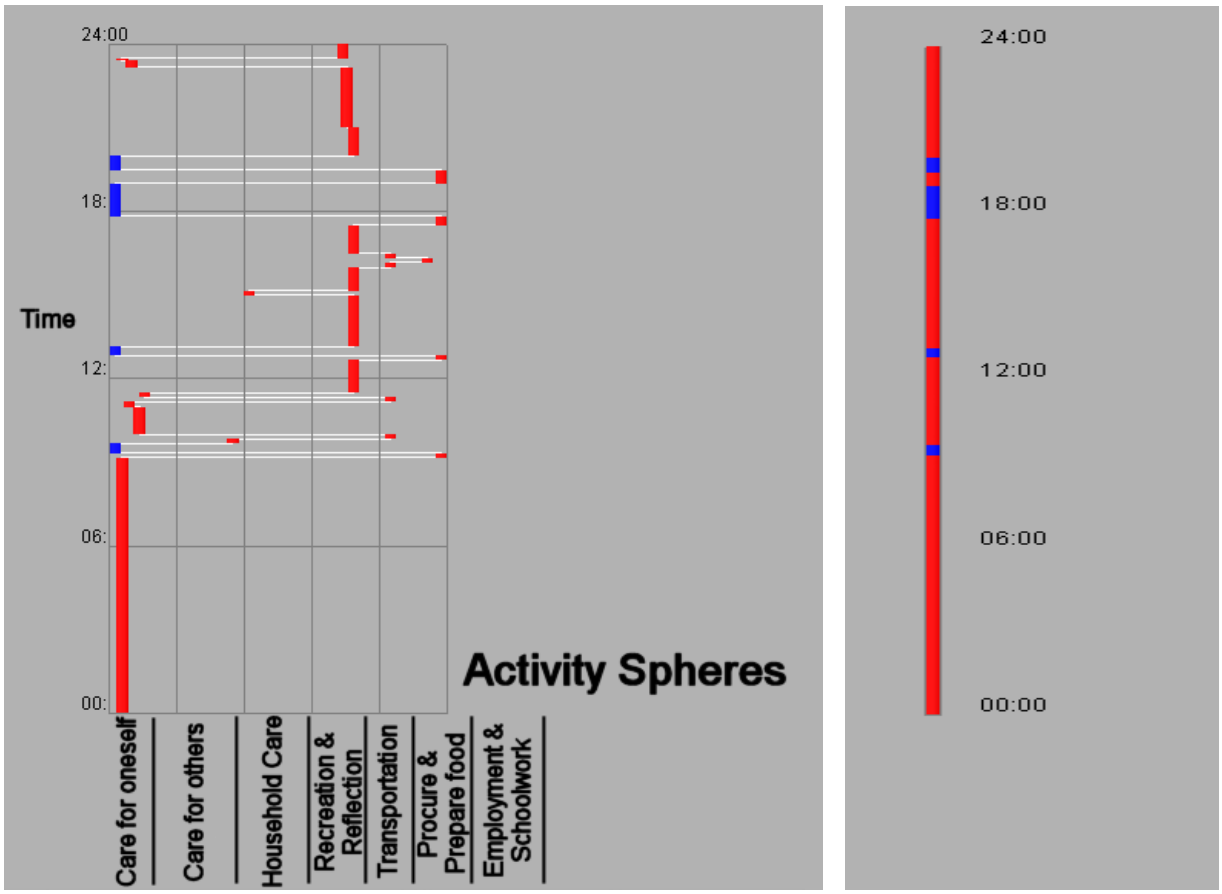
We intend to develop the 3D visualization system to include the facility to incorporate features for stereo display and three dimensional interaction tools to enable the use of the tool in VR environments which will further enhance its ability to enable complex visual interaction. We will also add the facility for the program to include more than one day.

Activity patterns illustrated by paths and logs in the 3D visualization system

An *activity oriented individual path* is exemplified by one individual in figure 4, where the dimensions chosen are time (y-axis), individual (x-axis) and activities (z-axis). The path is constructed according to the principle presented in figure 2. In figure 4, however, the principle is developed visually and the path consists of two types of elements: *activity logs*, symbolising activities and *connecting lines*, helping the eye to read the order of the activities (logs) performed. An activity oriented individual path moves constantly along the time axis (y) when an activity is performed (visualized by an activity log) and it turns horizontally from one activity to the next on the activity-axis (z) when the individual changes from doing one activity to another (visualized by a connecting line). Activity logs are coloured red or blue.

[28] Activities, places, togetherness and technology will in the next version of the programme be related to energy use and to emotional state.

Figure 4 Activity oriented individual path



Left: One individual's activity oriented individual path (the everyday context) during a weekend day. The diagram shall be read from the bottom and upwards, from 00.00 to 24.00 along the time axis. On the activity axis the activity spheres are ordered according to the principle shown in figure 2. This individual does not perform any activities in the sphere "Gainful employment/School" during this weekend day, and consequently the activity logs to the right in the diagram shows activities in the activity sphere "Procure and prepare food". Activity logs coloured blue indicate when and for how long the individual has performed the activity "eat meals" (it occurs four times during this day). In the everyday context as a whole, there are three clusters in time of activities within one and the same sphere using a lot of time. First to the left in the diagram (in the activity sphere "Care for oneself") where the "eating" activity belongs. Second, the activities in the activity sphere "Reflection/recreation" take considerable time to perform, firstly in the afternoon, secondly in the evening.
Right: Using the opportunities offered by the 3D visualization system, the activity oriented individual path shown in figure 4a is rotated 90° to a front perspective. The blue activity logs showing when and for how long the individual performed "eating" activities stand out from the background of all other activities (red).

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

In figure 4 we have coloured "eating" activities performed by the individual in blue. Hence, the blue logs indicate meals eaten and the red logs indicate all other activities. The order in which the activity spheres appear on the activity dimension (z-axis) is the same as on the x-axis in figure 2, and the activity "eating meals" (blue) belong to the sphere "care for oneself".

In the right part of figure 4 (front perspective) the connecting lines are not visible and the illustration resembles that of the real time use in figure 1. It reveals when and how often "eating"

activities (blue) appear in the course of the day. The front perspective is especially valuable when many individuals are to be compared to each other in the same illustration.

So far, the illustrations do not differ very much from what might be drawn by hand or by older computer programs. When there is more than one household member the picture of household activities often becomes fuzzy in most illustrations, because when adding individual paths for the rest of the household members, the different individuals ”shadow” each other. This is not necessarily the case when utilizing the 3D representation since it is possible to rotate the illustration and, hence to look at the illustration from many angles so that each and every household member’s path are clearly shown at least from some directions.

Representation of projects in the course of a day on different levels

Illustrating a project in the everyday context of individuals in a household

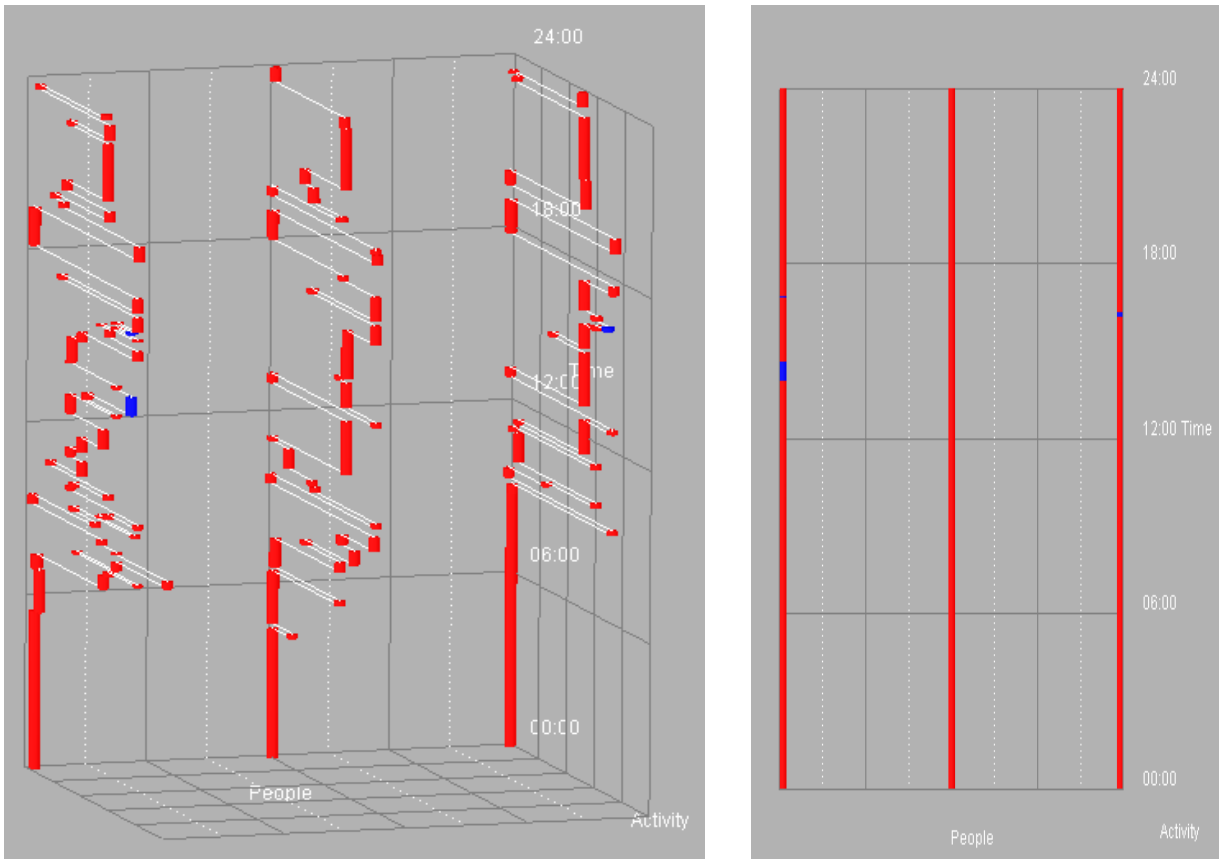
In everyday life most individuals depend on activities performed not only by themselves but also by other household members. In this section we will show how individuals in a household co-operate to fulfill the goal of an organizational project to “serve meals for the family”. We will discuss the household’s division of labor by a 3D representation of how the household organizes the project. We have chosen a household with three members: a mother aged 35, a father aged 45 and a son aged 14. We display their weekend day diaries.

Three specific activities within the project “serve meals for the family” are focussed: “buy food”, “prepare meals” and “wash the dishes”. Questions like who performs which activities in the project, when and for how long and do the household members perform their activities simultaneously or sequentially, may be discussed from the illustrations. The everyday context, revealed by the activity oriented individual paths of the three individuals respectively, is the descriptive starting point for the analysis. The path to the right in the figures 5-9 emanates from the diary presented in figure 4, written by the 14 year old son.

During this weekend day all the household members for some time are occupied by activities aiming at fulfilling the goal of the project "serve meals for the family". The pattern for “buying food” in the everyday contexts is illustrated in figure 5. The son performs the activity "buy food" once in the afternoon, the father “buys food” twice in the afternoon, while the mother not is occupied with this activity at all during this day.

The second activity in this project is "prepare meals". All three family members perform this activity, see figure 6. The mother and son make breakfast – to some extent simultaneously (figure 6 right), the son prepares lunch by himself, and all the household members participate in preparing the dinner. The father spends most time of them all for making dinner. Dinner preparation activities occur more than once in the mother's (twice) and the father's (three times) everyday contexts, while the son performs this activity only once. As a whole, the dinner making is time-consuming and occupies in total more than two hours for the father, close to two hours for the mother and about 20 minutes for the son. One dinner making activity of the father ends because of lacking ingredients. This is revealed by his everyday context: After a very short dinner making activity, his path turns into the sphere “transportation” (when he goes to the grocery), thereafter it appears in the sphere “procure and prepare food” (more specific when he perform the activity “buy food”, compare figure 5), then it moves back to “transportation” (as he goes home), and after that he continues to "prepare dinner".

Figure 5 Activity: "buying food"

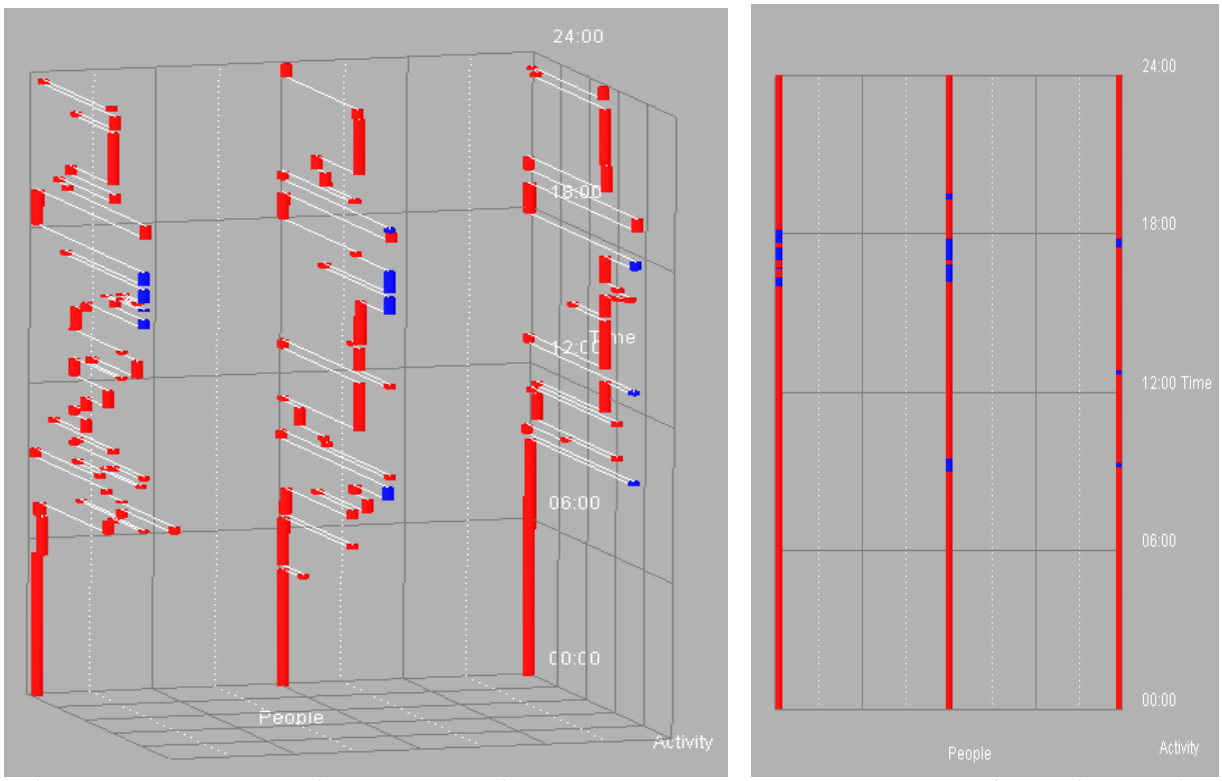


Left: The activity oriented individual paths (everyday contexts) of the three individuals in one household are shown during a weekend day. There is a father (left path), a mother (middle path) and a son (right path). The path of the son is the one already presented in figure 4. One activity, "buy food", is chosen from one organizational project of one household ("serve meals for the family"). The activity "buy food", shown by blue activity logs, occurs twice in the everyday context of the father (at about 14 and 17) and in the everyday context of the son it occurs once, at about 16. The late occurrence in the father's path is hard to see since it had a very short duration.
Right: The activity "buy food" (blue activity logs) in the household project "serve meals for the family" shown from a front perspective as performed by the three members of the household. Father (left), mother (middle) and son (right). The principle of the diagram is the same as in figure 4 (right). The dimensions are time (y-axis), individuals (x-axis) and the activities shown on the z-axis are seen from the front, here the activity "buy food" is blue.

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

The third activity in the project is "wash the dishes". The mother and the father "wash the dishes" three times each during this weekend day, while the son "washes the dishes" once, see figure 7. The son and the mother "wash the dishes" together after 19.00 and the father takes over from them at 19.30. The mother and father also "wash the dishes" after breakfast and lunch.

Figure 6 Activity: "prepare meals"



Left: One activity, "prepare food", is chosen from the organizational project "serve meals for the family" of the household. The activity oriented individual paths for father (left), mother (middle) and son (right). The activity "prepare food", shown by blue activity logs, occurs four times during the father's day, four times during the mother's day and three times in the course of the son's day.
Right: The activity "prepare food" (blue activity logs) in the household's project "serve meals for the family" from a front perspective. Father (left), mother (middle) and son (right).

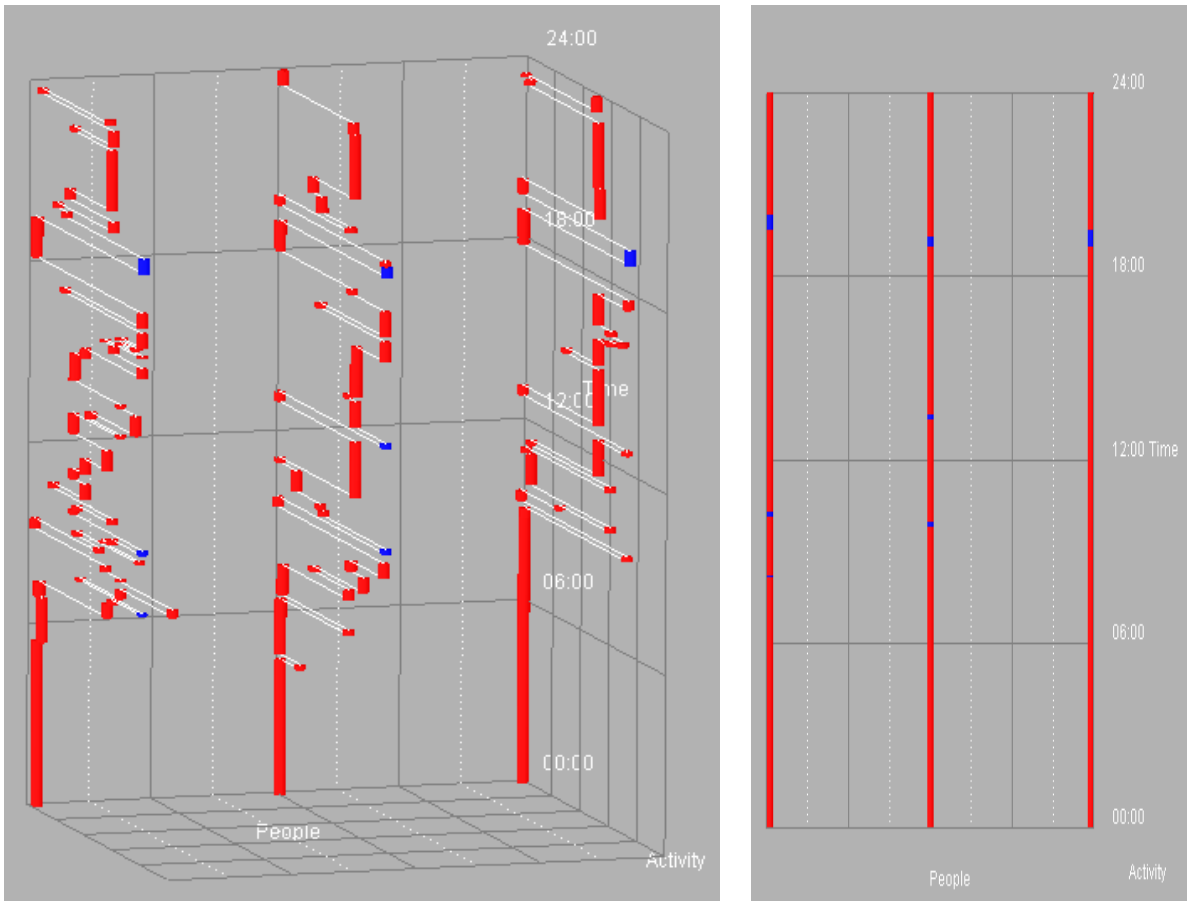
Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

From the everyday contexts of the members of this household, the complete project context is revealed by the appearance of all the different activities contained in the project "serve meals for the family": when do the activities in the project appear in the everyday contexts and for how long time does each individual perform the various activities in the project? The project context shows that in this family all members are involved in the project "serve meals for the family" and it also shows that this particular day "buying food" is the men's duty. Hence, the family arranges the project according to a co-operative strategy, revealed by the project context.[29]

To eat the meals served is at a higher level the goal of all the activities performed in the project "serve meals for the family". In figure 8 all "eating" activities performed by the family members are illustrated: breakfast (all three members), lunch (mother and son) and dinner (all the family). However, on this weekend day the individuals eat in a kind of overlapping sequence: the father starts eating breakfast and the son joins him after a while, but the mother starts eating just as the father is finished and the son finishes his eating before the mother.

[29] Another household strategy is based on specialisation, which means that one individual perform more or less all activities within a project herself which may be revealed by the project context.

Figure 7 Activity “wash the dishes”



Left. The activity "wash the dishes" in the organizational project "serve meals for the family" of the household. The activity oriented individual paths for father (left), mother (middle) and son (right). The activity "wash the dishes ", shown by blue activity logs, occurs three times during the father's day, three times during the mother's day and once during the course of the son's day.
Right. A front perspective of the activity "wash the dishes" (blue activity logs) in the household's project "serve meals for the family". The occurrences of the activities are indicated with blue activity logs. Father (left), mother (middle) and son (right).

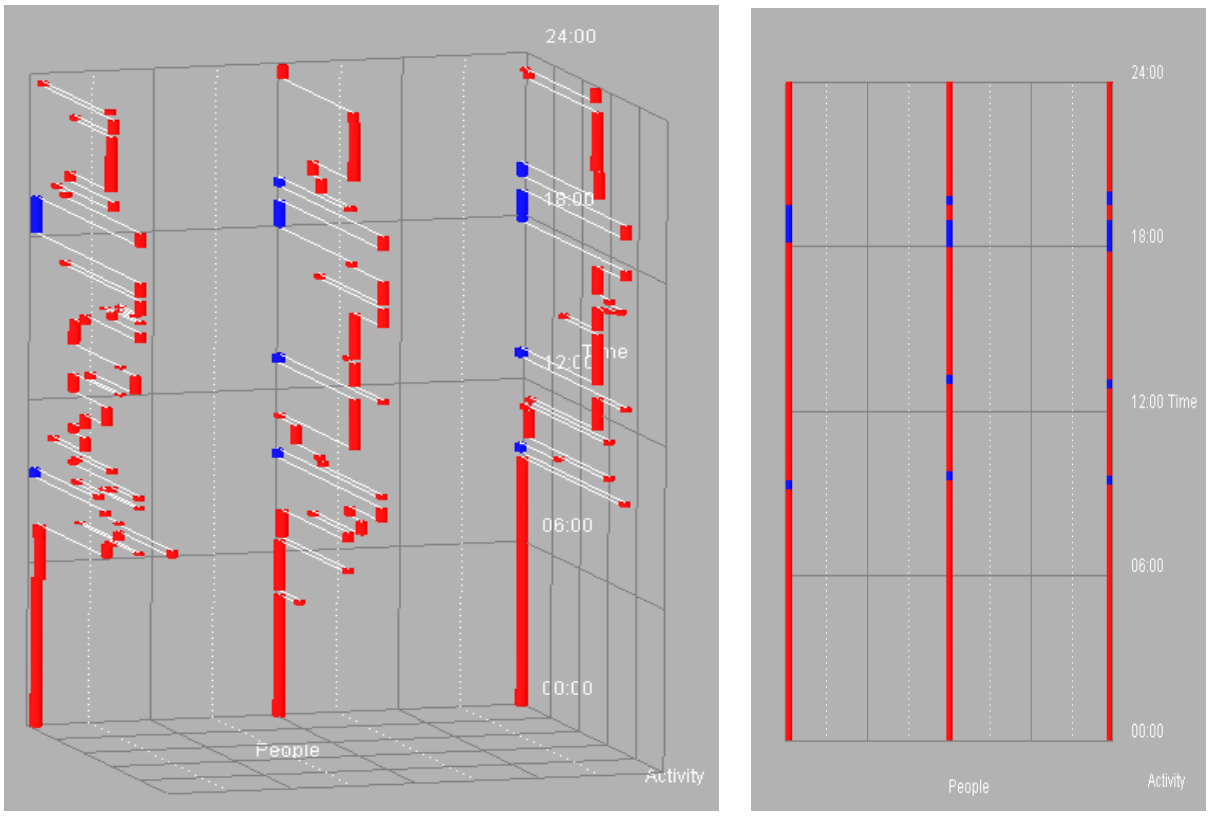
Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

From figure 6 we can see that the son prepared lunch and from figure 8 we can see that he starts eating lunch before his mother comes to the table. The family members start eating dinner at different times, and the activity “eating dinner” occurs twice in the diary of mother and son because they "wash the dishes" before finishing their meal. Probably they have the dessert after "washing the dishes", while the father "washes the dishes" when he has finished his dinner completely. To explain why this pattern is the case interviews are needed. Without the illustration, however, we would not have known that this is their eating pattern, and we would probably not have asked them questions about it.

The example shows how the 3D program can be utilized to illustrate how individuals in a household co-operate and participate in the activities of a basic household project. Now we will

show how these activities are distributed among the individuals in the population of the database during weekend days.

Figure 8 Activity: “eating the meals produced”



Left: The organizational project "serve meals for the family" aims at "eating" the meals produced. This illustration shows when and for how long "eating" activities occur in the everyday context of the three household members. "Eating" is indicated with blue activity logs. Father (left), mother (middle) and son (right). "Eating", shown by blue activity logs, occurs twice during the father's day, four times during the mother's day and four times in the course of the son's day.
Right: When and for how long the family members' "eating" (blue activity logs) activities are performed during the weekend day shown from a front perspective. Father (left), mother (middle) and son (right).

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

Activities in the project "serve meals" at population level

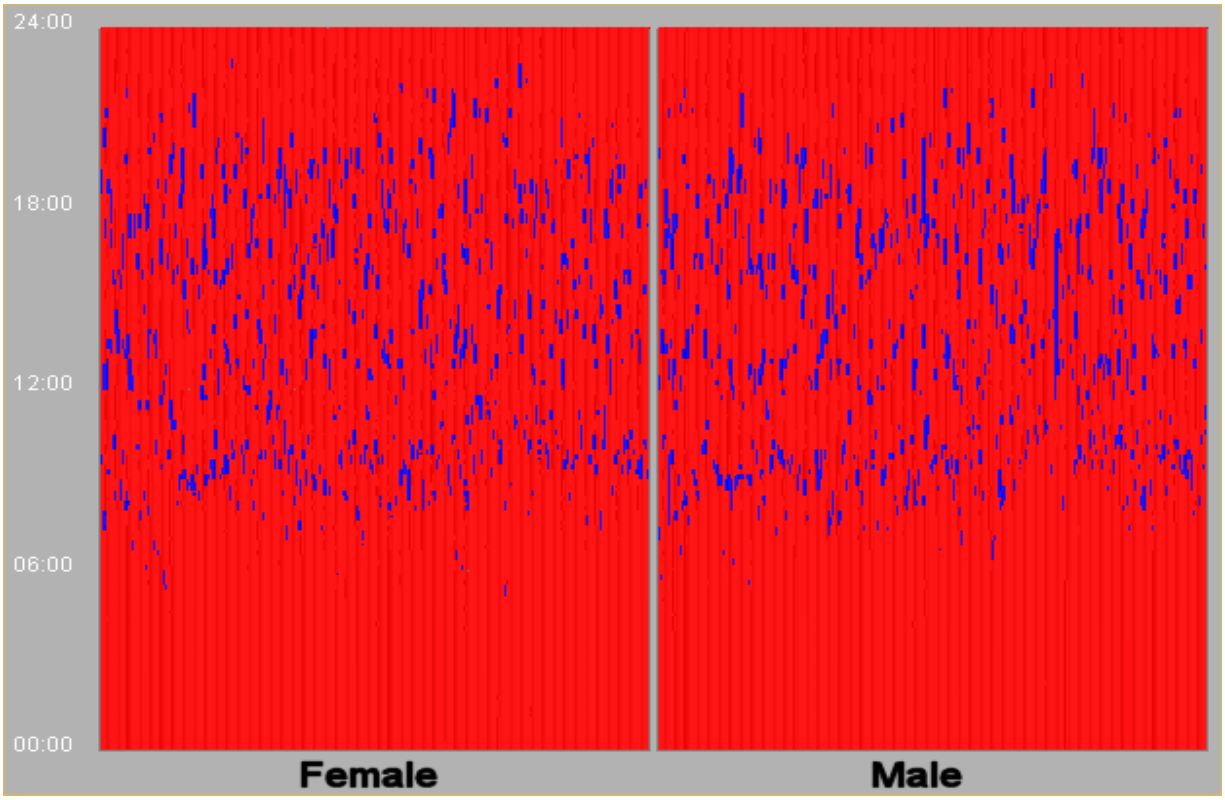
The diaries from weekend days written by individuals in the 179 households in the database are the point of departure in the following section. We will show how the 3D program can be used to visualize the pattern on population level of time use for the activity “eat meals” and for three activities in the project "serve meals" (“buy food”, “prepare meals” and “wash the dishes”). Since a visualization of population patterns in three dimensions is difficult to read in a two dimensional medium, we will use the front view perspective of the activity oriented individual paths of the members of the population. Then the blue activity logs for the activity in focus will stand out from the red background of all other activities (compare right part of figures 4-8). An individual’s time use may be traced on the y-axis in the diagrams by following a vertical line from the bottom at 00.00 up-wards to the top at 24.00, and the individuals in the population on

the x-axis are ordered by age. We have prepared separate diagrams for men and women to identify gender differences.

In the left part of figure 9 all "eating" activities performed by the women in the population are illustrated as they appear in the course of the day for each one of them. The blue logs show that women's eating activities have different duration and obviously breakfasts have shorter duration than dinners. Breakfast is eaten by most of the women some time between 08.00 and 11.00. Some women have breakfast very early. There is a tendency showing that girls (left) have breakfast later than older women (right) and that young women eat later in the evenings than girls and older women.

The right part of figure 9 represents the "eating" activities of the men in the population. The pattern resembles that of the women, and the same age related breakfast time pattern is apparent among boys as among girls.

Figure 9 Eating activities for women and men



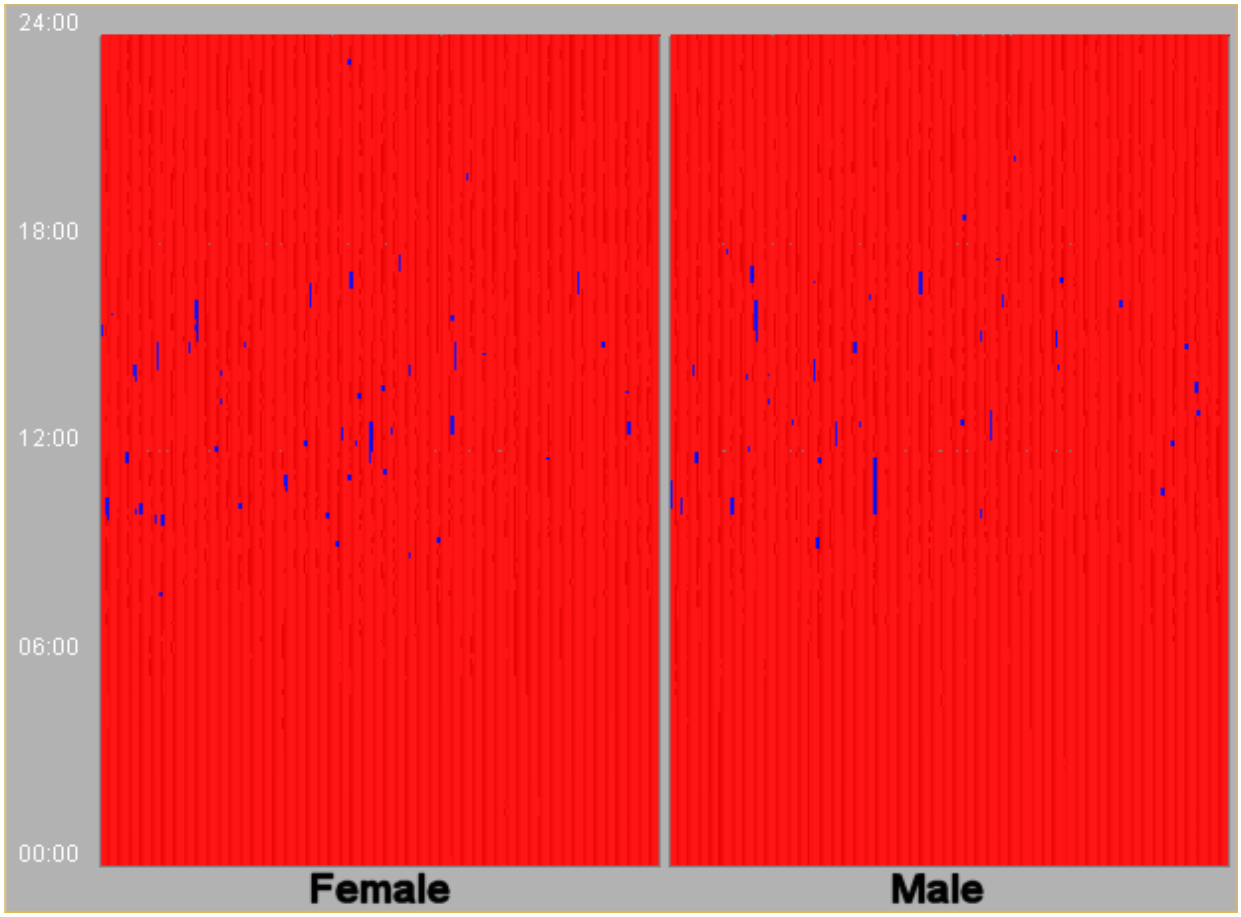
Left: A front perspective of when and for how long the women in the population in the database use time for "eating" activities during weekend days. "Eating" activities are indicated with blue activity logs. The individuals are ordered by age, girls to the right and oldest to the left. Each individual path is drawn from 00.00 to 24.00.
Right: A front perspective of when and for how long the men in the population in the database use time for "eating" activities during weekend days. "Eating" activities are indicated with blue activity logs. The individuals are ordered by age, boys to the right and oldest to the left. Each individual path is drawn from 00.00 to 24.00.

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

The basic activities of the project "serve meals" from a population perspective are the same as on the household level ("buy food", "prepare meals" and "wash the dishes"). A scattered pattern appears when the 3D program is asked to represent the activity "buy food" both for the female

part of the population (figure 10 left) for the male part (right). “Buy food” appears mostly in the afternoon, and most of the appearances are quite short in duration on weekend days. There are more occurrences of the activity "buy food" among the women than among the men. One obvious thing is that very few of the youngest individuals (to the right) perform this activity.

Figure 10 Buying activities for women and men

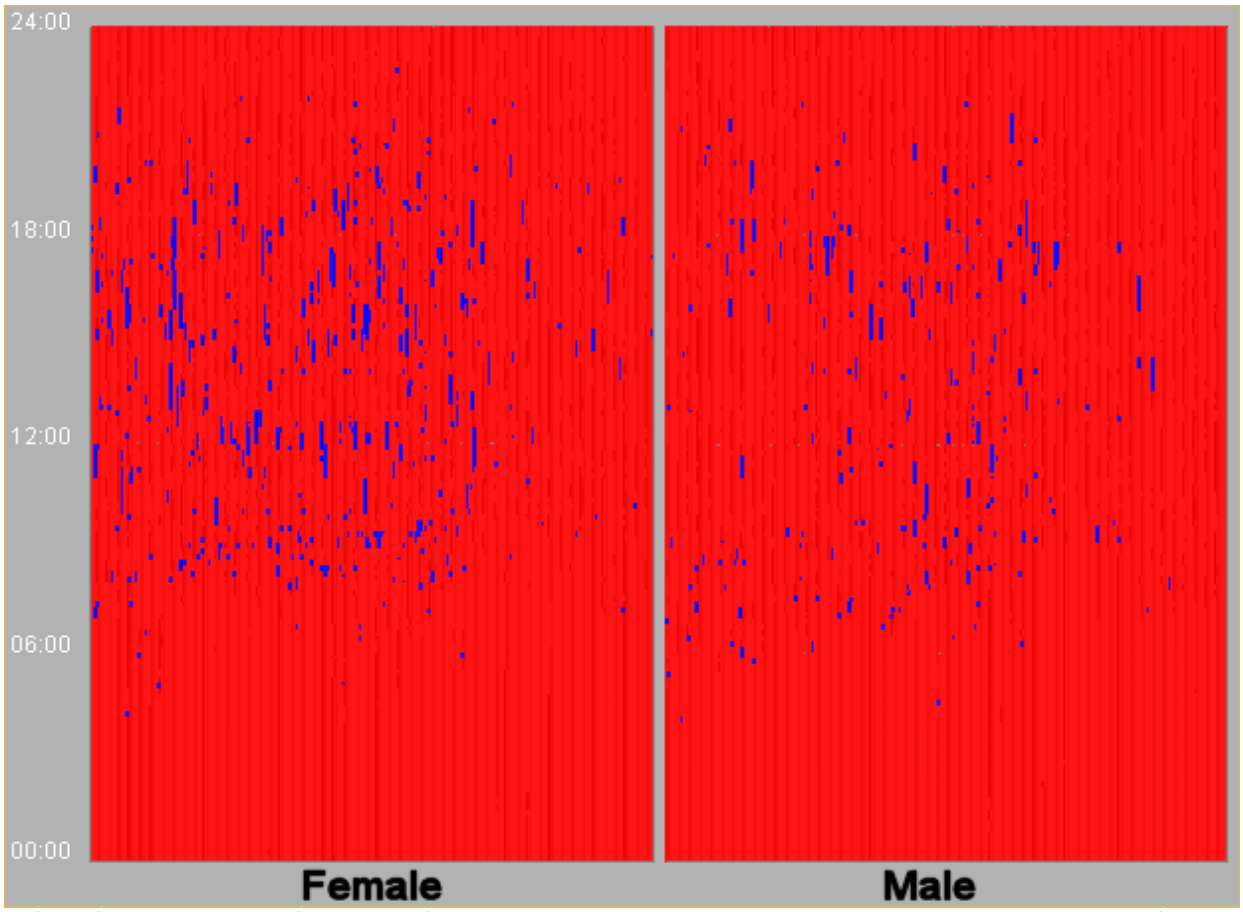


Left: A front perspective of when and for how long the women in the population in the database use time for the activity "buy food", in the project "serve meals", during weekend days. "Buy food" activities are indicated with blue activity logs. The individuals are ordered by age with the girls to the right and the oldest to the left.
Right: A front perspective of when and for how long the men in the population in the database use time for the activity "buy food", in the project "serve meals", during weekend days. "Buy food" activities are indicated with blue activity logs. The individuals are ordered by age with the boys to the right and the oldest to the left.

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

In figure 11 (women left, men right) the distribution of the activity “prepare food” in the population is illustrated and a clear gender difference appears. It is much more common that women “prepare food” than men doing it on weekend days. There is also an age effect shown in the diagrams. There are not many children (to the right in the diagrams) involved in “preparing food” and older men do “prepare food” more seldom than middle aged men.

Figure 11 Preparing activities for women and men



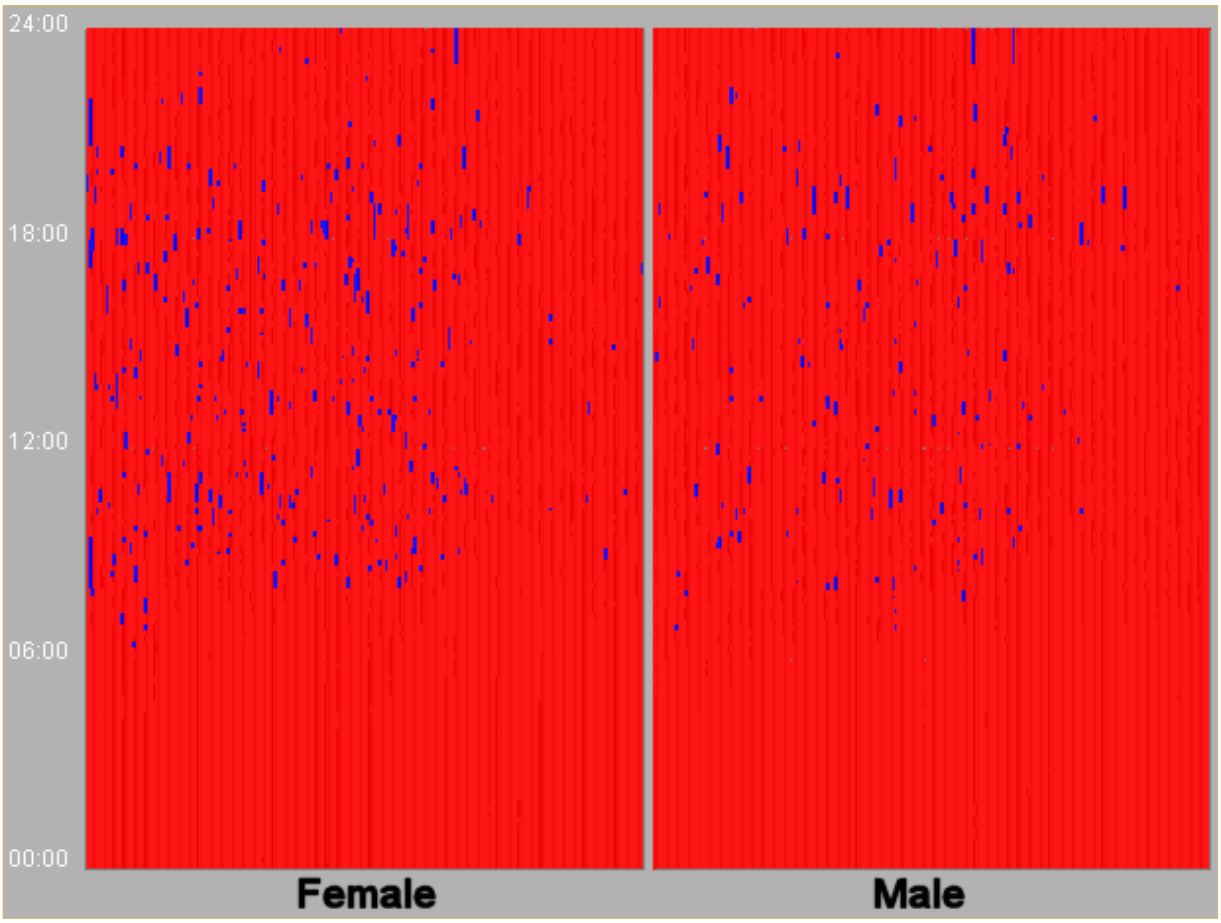
Left: A front perspective of when and for how long the women in the population in the database use time for the activity "prepare food", in the project "serve meals", during weekend days. "Prepare food" activities are indicated with blue activity logs. The individuals are ordered by age, with the girls to the right and the oldest to the left.
Right: A front perspective of when and for how long the men in the population in the database use time for the activity "prepare food", in the project "serve meals", during weekend days. "Prepare food" activities are indicated with blue activity logs. The individuals are ordered by age, with the boys to the right and the oldest to the left.

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation

Figure 12 shows the activity “wash the dishes” in the “serve meal” project as it is spread over the women (left) and men (right) in the populations during weekend days. This pattern resembles that of the activity “prepare meals” shown in figure 11. More women than men are involved, very few children “wash the dishes” and the older men perform this activity to a lesser extent than the middle aged men.

The illustrations of the distribution of activities in the project “serve meals” among the individuals in the population during weekend days show some gender differences. Women “prepare meals” and “wash the dishes” more than men. The youngest individuals of both sexes do not perform these activities very much, and nor do the older men. Middle aged men show a pattern resembling that of women. This generation effect may indicate that within 10 to 20 years the difference between men’s and women’s participation in this project might disappear.

Figure 12 Washing activities for women and men



Left: A front perspective of when and for how long the women in the population in the database use time for the activity "wash the dishes", in the project "serve meals", during weekend days. "Wash the dishes" activities are indicated with blue activity logs. The individuals are ordered by age, with the girls to the right and the oldest to the left.
Right: A front perspective of when and for how long the men in the population in the database use time for the activity "wash the dishes", in the project "serve meals", during weekend days. "Wash the dishes" activities are indicated with blue activity logs. The individuals are ordered by age, with the boys to the right and the oldest to the left.

Source: Statistics Sweden, Time Use Diaries Pilot Study (1996), own calculation.

Final remarks

This paper gives an overview of how a 3D visualization system based on the time-geographic approach and developed in an interdisciplinary research group, can be utilized to illustrate time-use data from individuals' diaries on individual, household, group and population level. It goes beyond the visualisations introduced by Szalai (1972) since each individual in the population is discernable. It will enable social scientists to come further in the analysis of the complex everyday life of individuals, households, socio-economic groups and populations. Different strategies of division of labour in households may be revealed, like gender inequalities. The distribution of activities among individuals in important everyday projects may be put under

detailed, contextual study. The development of the method is ongoing and many improvements are still to be done. The 3D representations used in this article are static, and do not show the full possibilities of the "live" version of the interactive 3D-program. This is of course unsatisfactory. We hope for comments and that some readers are interested in knowing more about the method and its 3D visualization system.

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Schedules as sequences: a new method to analyze the use of time based on collective rhythm with an application to the work arrangements of French dual-earner couples

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Abstract

This paper sets out a new method to analyze schedules with an application to the analysis of synchronization within dual-earner couples. The flaws of the traditional time-budget approach are brought to light: time is not a constant flux and disregarding the social dimension of time and the significance of scheduling dismantles a great part of the phenomenon analyzed. The method proposed is inspired by Optimal Matching techniques but also informed by sociological theory: it relies on information about the collective rhythm. This method is further applied to French dual-earner couples in 1985 and 1998 (enquêtes Emploi du Temps, Insee, France, N=2574): twelve work arrangements are uncovered. Six of them refer to double full time schedules days, and two to feminine partially worked days. A significant proportion (20%) of the spouses who both worked a full time schedule experiences a high degree of desynchronization (greater than 50%). A few of them are even found to be completely desynchronized. Women who worked partially the day observed are also concerned by off-scheduling: though the probability of being desynchronized is reduced, a significant number of women work while their spouses are not working. Desynchronization dramatically increased between 1985 and 1998: more spouses work more desynchronized days but desynchronization also expands in most of the days. The increase observed is particularly prominent for couples where women work partial schedules.

JEL-Codes: C61, J20, J22

Keywords: method, sequence, optimal matching analysis, collective rhythm, dual-earner couples, synchronization

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Introduction: the social nature of time and its consequences for the analysis of the use of time

The use of time has been mainly analyzed through time-budgets, *i.e.* in a way by identifying time with money[30]. The introduction of a recent document broaching methodological aspects of time-use analysis provides a fine example of this process (National Research Council 2000): "Although much is known about how American budget their financial resources, very little is known about how Americans budget their time resources". The implicit hypothesis of such a rationale is that time is money that time can be accounted for in the same manner than money: that we can add up time like we would do with any currency. But is this true? It would if time were the homogeneous flux used by physicists, mathematicians, or economists. But the flow of the day is not a succession of identical moments filled in by activities. This representation, conveyed by an analysis of the use of time focused on time-budgets, helped and is still helping to detect empirically macro social changes, like for instance those underlined by Jonathan Gershuny (2000). However, when individual behavior is at stake, the use of time cannot be restricted to the budget of time (Wilson, 1998).

Indeed, adding up hours is legitimate when a temporal accounting system is aimed at. An accounting system gives a very synthetic picture of the assets and liabilities of firms but does not explain how these firms managed to reach these particular balanced budgets. It is the same with time-budgets. Trying to get back to the individual decisions which have led to the observed budget is a most perilous task, much more than that performed by a financial analyst whose job is made easy by the availability of additional information such as the firm's biography, whereas for the time-budget analyst, this information is not only missing but would be in fact useless, given the size of the sample required by statistical procedures. Moreover, using time-budget data to grasp individual behavior is quite puzzling knowing that these data come from time-use surveys which provide a wealth of details. It amounts to simplify the data and try to recover this subsequent loss of detail by using complex statistical methods. It would be simpler and safer not to lose information in the first place. And in that case, the information is the decomposition of time-budgets into different parts of the day, the scheduling of activities, which is far from being random.

In this regard, sociologists have long evidenced the social nature of time. It does not only mean that time is socially structured but also that people do and when they do it depends on their expectations about what others do or are supposed to do. Durations amalgamate these crucial subtleties and are to be avoided if individual behavior is to be grasped. Instead of muddling incomparable moments, comparable moments should be gathered and separated from different moments, *i.e.* only a typology can address this issue with some relevance[31]. This article introduces a new method to measure the similarity of schedules, a method based on collective rhythm. This method is illustrated with an application to the analysis of the work arrangements of dual-earner couples. But first, in view of its prominence in the study of schedules, the collective dimension of time is briefly emphasized.

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[30] Money is used here because of the connotation of the word "budget", but the issue at stake is much more general: statistically speaking, how far can we legitimately compute and use averages of dissimilar objects?

[31] A typology also ensures that averages computed within each type have some consistency.

The social nature of time

As Émile Durkheim noticed (1925, p. 16), time is a social construction that reflects the rhythm of the collective life but also contributes in return to structure this collective rhythm by producing a stable environment. This quite simple statement conveys two essential ideas for the analysis of schedules. First and foremost, it means that scheduling is a crucial dimension of activities since time reflects the collective rhythm or in other words *time is socially differentiated* so that adding up hours may dismantle a great part of the social dimension of the phenomenon studied: time is not a constant flux, each hour, day, week, etc. is different from one another. But it also means that the collective rhythm is liable to influence the scheduling of activities: time's multiple embodiment into calendars and clocks helps individuals to orient and schedule their activities by fostering a stable environment propitious to anticipation and planning (every parent knows that by the end of the afternoon they should pick up kids from school).

First, the link between time and collective rhythm is to be demonstrated. Secondly, the most prominent institution in the collective rhythm, work, is reviewed.

Calendars and clocks: the social regulation of cosmic phenomenon

If calendars and most calendar divisions derive ultimately from cosmic recurrent events, their present regularity are the most tangible evidence of the long work to stabilize them. Indeed, if the day is determined by the Earth's rotation on its axis, if the month is approximately linked with the phases of the moon, and if the year is connected with the Earth's revolution around the sun, these correspondences are actually quite loose in comparison with the accuracy of our calendar system (Elias, 1992). It was not so easy to work out a solution to the problem of the varying number of days in a year and this solution, the leap year, is now used with no understanding either of its signification or of its origin despite the total predictability it promotes. But this regularization is not the only social regulation of cosmic phenomenon.

In this light, the week represents one of the most achieved parts of this social regulation (Sorokin and Merton 1943, Zerubavel 1985). Indeed, the week is not rooted in natural recurrent events like the other calendar elements but, on the contrary, is a pure social construction to improve the coordination and the synchronization of collective activities (Sorokin and Merton 1943). Indeed, there is no natural phenomenon between the month and the day to break the continuous flow of days. Hence the necessity of a repetitive short sequence of days to organize daily life, to make daily social coordination easier: the week makes the month discrete hence manageable.

Furthermore, the week is structured by the recurrence of two days, the weekend days, during which the majority of people do not engage in supervised professional activities. But the difference between weekdays and weekends is not limited to work: the week is a cycle completing the other natural cycles; this system creates a regularity which enables expectations and transfers of activities according to these expectations. Thus, the week strengthens the stability of daily life and as a result helps people to organize their life.

Consequently, clocks and calendars are direct evidence of the link between time and the collective rhythm. They are the historical product of the gradual efforts of individuals to coordinate their activities. But it also means that individual schedules observed on a particular day incorporate individuals' expectations about what was to happen that day and the days following. The expectations concerned are not only those of the individuals but also the expectations of those who interact with them.

Therefore, now that the connection between time and the collective rhythm has been highlighted, let us clarify what encompass the concept of collective rhythm. The collective rhythm is actually made up of various clocks, each reflecting a certain aspect of the collective life, embodied into institutions (Sorokin and Merton 1937): the opening hours of administrations, shops, restaurants, as well as labor legislation, familial policies, etc., foster continuously a societal temporal space. By enabling social synchronization, these societal clocks, in turn, constitute the foundations of social interactions. Work is the most important clock and, since it is linked with the issue of synchronicity within dual-earners couples, is now reviewed.

The work clock

If time have its origin in religion, through the alternation of the sacred and the profane (Durkheim 1925), the division of work progressively increased the complexity of the interdependences between individuals hence required still more accurate and homogeneous means of coordination. For instance, Eviatar Zerubavel (1982) showed how railroad development in the US introduced the necessity of a time-zone system in order to improve social coordination. This case evidences how economic growth is able to directly mold the time system. But the economy also effects temporality on more daily and local grounds through firms' business hours. In this regard, the traditional day/night alternation functioning as the consumption/work metronome is now even challenged by the 24-hour economy. Indeed, this phenomenon seems quite developed in the US since 20% of men and 12% of women who work and live in a couple have non-standard work schedules (Presser 1987). This phenomenon is much more limited in France on account of the more restrictive labor legislation. Night shifts are highly penalized and were still forbidden in certain industries to women only a few years ago.

Consequently, each type of industry, service or even each firm is liable to produce its own clock. Nonetheless, according to their occupation and their social position, work schedules are likely to vary to a large extent: work schedules space is likely to be connected with the position of workers in the social space.

In particular, Alain Chenu (2002) evidenced that the probability of working at each moment of the day depends on the position of the individuals on the social ladder. It means that the amount of cultural and economical capital owned determine to a certain extent the kind of daily life people have. Although the industry is also likely to introduce some distortion into this system, the occupation is nonetheless likely to be the main determinant of the possible sets of schedules. Indeed, if we consider a railroad company then a night shift is not uncommon among conductors but is pretty much inconceivable among secretaries, and to a lesser extent among executives, although employed in the same company. Pierre Bourdieu (1979, p. 535) underlined the temporal dimension inherent to the social space.

Each position in the social space corresponds to a certain set of work schedules probabilities. This issue has been recently addressed by Jonathan Gershuny (2000). His main idea can be summarized by the motto "leisure is work": extending Becker's famous theory of the allocation of time (1965), Gershuny points to an obvious fact rich in consequences, namely that consuming is time consuming. Even if Gershuny is drawing conclusions in terms of education policy and social stratification, a corollary of service consumption becoming more and more prominent in economic growth is that economic growth requires more and more desynchronization between certain social classes.

But the bottom line remains that individuals' daily schedules do not only give an account of individual lives but also of their lives as members of a particular family and society with a particular set of cultural and economical capitals. Consequently, the analysis of daily activities people engage in must be temporally grounded. For instance, two individuals can work the same amount of time, but one can work night shifts and the other daily fixed schedules. If these situations are mixed up then it is no wonder that it is so difficult to get good R^2 from regression analysis using time-use data. Adding-up hours dismantles the phenomenon studied: it amounts to neutralize all these differences to obtain a mean result that in fact means nothing (Halbwachs 1923, p 301). This is not to say that the analysis of daily schedules is vain but that new methods are required to extract all the relevant information contained in time-use diaries. But this is not the only issue at stake in studying the work arrangements of dual-earner couples given that the phenomenon studied is two-dimensional.

Synchronicity within dual-earner couples

Families are at the junction of the different component of the collective rhythm: each family member imposes on the family the various clocks he depends upon. This is not only valid for adults but also for children who bring into their family the temporality of schools and other extracurricular institutions.

But one of the most important change of the last fifty years is the transition from single to double breadwinners: the access of women to the labor market transforms drastically the nature of the daily family life since it complicates the temporal equation of families by doubling the economic and social classes clock constraints and engendering the issue of work synchronicity.

The issue of synchronicity

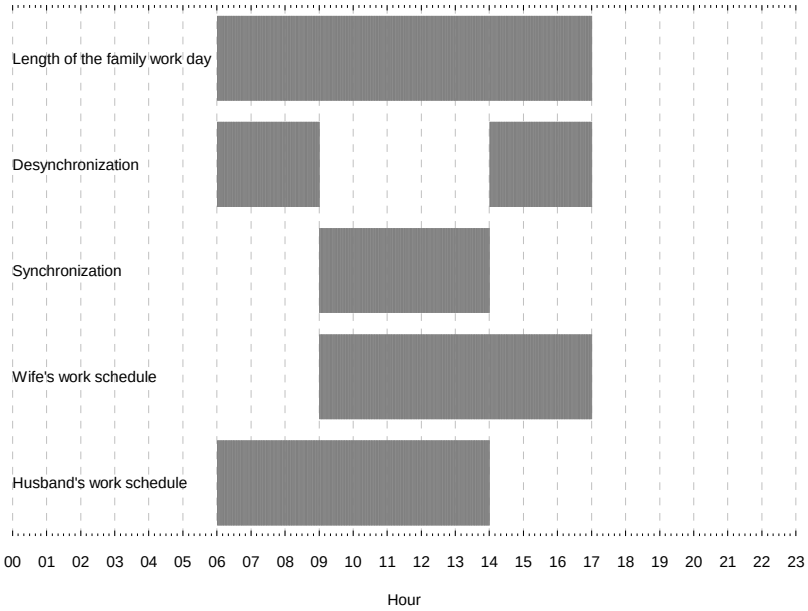
Indeed, when one spouse is engaged in paid work, family is facing only her economic and socio-professional constraints, the other spouse having the ability to adjust her schedule to her spouse's. Within dual-earner families, work constraints are doubled and work schedules might not match: desynchronization or off-scheduling, *i.e.* non-overlapped work schedules, is likely to appear.

For instance, if a husband works from 6 AM to 2 PM and his wife from 9 AM to 5 PM, then the two spouses have an eleven hours long family workday among which five hours of work are in common (synchronised work), hence desynchronized work amount to six hours (see figure 1). Here desynchronization is equally shared by spouses, each one works three hours not worked by the other, a rare case occurring when both spouses have the same work time (8 hours in the example). Synchronization and desynchronization can be expressed in relative terms, using the length of family workday as the unit of reference: relative synchronization amounts to 45% (5 hours out of 11) and the relative desynchronization due to the husband (only the husband works, or man relative desynchronization) as well as the one due to the wife (only the wife works or woman relative desynchronization) both reach 27%.

If spouses have different work time, for instance if an husband works from 8 AM to 8 PM, a 12 hour work day, and his wife works from 10 AM to 6 PM, then the length of their family work day coincide with the work day of the husband and reaches 12 hours (see figure 2) and the synchronized work overlaps exactly the work day of the wife. Desynchronization, which amounts to 4 hours, is here purely structural: although desynchronization is real, it echoes differences in the work time of spouses but not differences in the scheduling. If we use the midpoint of a work schedule as an indicator of its center of gravity, then we see that the midpoint of both spouses'

work schedule coincide (2 PM). Translated in relative terms, synchronization reaches 67%, relative desynchronization due to the husband 32% and relative synchronization due to the wife 0%. Hence, when spouses have different work time and that this difference explains a part of the desynchronization then non-structural desynchronization can be measured by the desynchronization due to the spouse whose work time is the lowest.

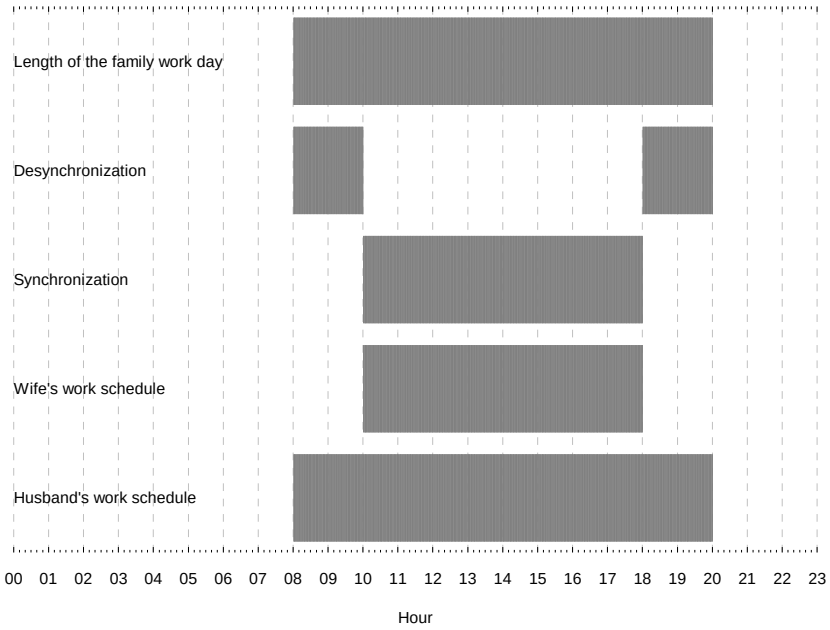
Figure 1 Example 1 of desynchronized work schedules



Both spouses have the same work time but different schedules: desynchronization is equally shared by spouses (each spouse works three hours not worked by the other).

Desynchronization is a quite recent issue, addressed so far only by a few analysts. Harriet B. Presser evidenced that desynchronization improved men's participation to childcare and household chores (1986, 1988, 1989, 1994). Steven L. Nock and Paul W. Kingston addressed this issue in an article dedicated to the problem of measuring dual-earners work day (Nock and Kingston 1984): using three measures (length of the family work day, total family work time and off-scheduling), they evidenced the variety of the dual-earner work day. In another paper (Kingston and Nock 1985), they illustrate the consequences of the family workday on the quality of family life and marital adjustment. They further evidenced that off-scheduling reduces significantly spouses' time together (Kingston and Nock 1987) but increases fathers' time with children (Nock and Kingston 1988). Daniel S. Hamermesh (2002) tested the significance of couples' synchronicity by comparing synchronicity resulting from independent work schedules with the actual synchronicity. The significance of the result is further interpreted as evidence supporting his hypothesis of spouses' search for being together. In the same vein, Alain Chenu and John P. Robinson (2002) proposed an index of desynchronization measuring the difference between an abstract situation of independent schedules and the actual schedules.

Figure 2 Example 2 of desynchronized work schedules



Spouses have different work time but otherwise quite synchronized schedules: desynchronization is structural.

Reintegrating synchronization into its daily substrate

Except Presser (1987) who did not measure off-scheduling but rather used an indicator of discordant work schedules[32], all these authors have used a single number to summarize desynchronization. At best, structural off-scheduling[33] is noticed, but on account of the reduction of this phenomenon to indexes, it remains quite impossible to disentangle it from pure off-scheduling. Chenu and Robinson (2002) tried to decompose their index into a gross and a net index using a measure of structural dissimilarity between work schedules. But this structural dissimilarity index only measures the duration of incompressible off-scheduling given that the rest of the spouses work schedules are perfectly synchronized. From the moment that this condition is not fulfilled, this measure becomes useless because it arbitrarily reduces the desynchronization observed for couples that are not perfectly synchronized anyway. For instance, for a couple where the husband worked a night shift of nine hours and the wife worked in an office during the day for seven hours the real structural desynchronization is nil but the Chenu and Robinson's (2002) structural desynchronization index adds up to two hours, the difference between the spouses work durations. Consequently, the off-scheduling issue needs to be put back in its daily context and in relation to spouses work commitment if it is to be understood.

Off-scheduling appears to be a major implication of a double work commitment and as a result is to be considered in this analysis. But a single index is unable to catch all the relevant dimensions of synchronization. The accounting approach of the use of time must be given up in favor of a

[32] She opposed day shifts to non-day fixed or non-fixed shifts.

[33] When the lack of synchronicity between two schedules is imputed to the difference of work time (when the two work sequences do not have the same length), the schedules being in other respects synchronized, then off-scheduling is purely structural, indicating a difference of work time not a difference of scheduling.

process one: *schedules must be apprehended as sequences, processes* and not as time-budgets. Consequently, the schematic description of the family work day must integrate in the most synthetic way and for each time slot what combination of work is observed. The most basic set of combinations is fourfold:

No spouse is working;

Only the husband is working;

Only the wife is working;

Both spouses are working.

It amounts to represent a dual-earner couple workday as a one-dimensional temporal process evolving in a four-state discrete space. Although this synthetic representation is focused on synchronicity it does not solve the issue of the temporal contextualization. Nonetheless, the necessity of taking into account the timing of activities is once more underlined and appears crucial both from a theoretical and a practical points of view and pleas for a tailor-made method.

Method and data

What we need is a method that respects both the order of the events and the particularity of every point in time they appear: schedules must be conceptualized as sequences. In addition, we know that every moment of daily life is liable to incorporate expectations about the future: the present does not only depend on the past but depends also on the future. This is a crucial point because this is a direct violation of a fundamental hypothesis of event-history models. Thus, the classical statistical methods to analyze stochastic processes cannot be used.

Andrew Abbott imported into sociology a new class of methods from biology called Optimal Matching Analysis (1986, 1990, 1995, 2000). This method can be used to compare sequences as a whole and, since it does not rely on statistical hypotheses, seems particularly interesting for the analysis of schedules as sequences. Actually, Optimal Matching algorithms are just a way to transform sequences into distances between individuals which can be clustered in order to uncover patterns: therefore, the end product of OMA is merely descriptive. OMA has been adopted by geography and transportation students and adapted in order to suit the dynamic and multidimensional requirements of urban and transport analyses (see for instance Joh et al. 2001a, 2001b). This burgeoning method is further briefly introduced and improved[34] upon to suit the theoretical requirements of this study.

Comparing schedules and preserving temporality

Optimal Matching Analysis comes from molecular biology and was aimed at the decryption of DNA (Sankoff and Kruskal 1983, Durbin et al. 1998). This technique was introduced into sociology by Andrew Abbott (1986). This method is basically an algorithm that produces a distance matrix out of a set of sequences. Thus, OMA is just a particular way to work out dissimilarities between individuals. This means that other procedures, like clustering or multidimensional scaling, are not only required to complementing the analysis, but also to access and assess the distances. Furthermore, it calls for attention to the relevance of the method to the

[34] This is not exactly an improvement since a new algorithm is introduced; however, it can be seen as an adaptation of OMA to the analysis of the use of time.

problem studied. Consequently, after a brief presentation, the meaning of OMA for the comparison of schedules is investigated and its specificities evidenced.

OMA in a nutshell

OMA is a way to measure the degree of dissimilarity between two sequences, i.e. two sets of ordered events. In OMA, the dissimilarity is the cost required to make identical the two sequences with the help of three basic operations: *in*sertion, *del*etion (*indel* operations) and substitution. Each operation is associated with a cost and the dissimilarity produced by OMA is the minimum total cost required to match the two sequences[35]. Consequently, choosing the cost parameters represents the crucial point of this technique.

For example, let us consider two sequences, X and Y, of a space with only two states, A and B (see Table 1).

Table 1 Two simple sequences

X:	A	A	A	A	B
Y:	A	B	B	B	

These sequences may have different lengths, even though in the case of the spouses' work schedules, all the sequences have equal length. To transform the sequence X into the sequence Y, it is possible to delete the first three As and to add two Bs, operations represented by the empty set operator (Ø). When an empty set is on the first line then it means that the element on the second line is inserted and when an empty set is on the second line, it means that the element in the first line is deleted (see Table 2).

Table 2 Transformation of the sequence X into Y with the help of three deletions and two insertions

X:	A	A	A	A	B	Ø	Ø
Y:	Ø	Ø	Ø	A	B	B	B

Obviously, this is not the only solution to match the two sequences. This can be done with three substitutions and one deletion (see Table 3).

Table 3 Transformation of the sequence Y into X with three substitutions and one insertion

X:	A	B	B	B	B
Y:	A	B	B	B	Ø

If a cost is associated with each operation then it is possible to determine the cost of each matching as the sum of the weighted costs. Eventually, the dissimilarity is the minimum cost to achieve sequence matching.

Traditionally, each indel operation costs one unit. The choice of the substitution cost depends on the interpretation of replacing a state by another one. If the transitions do not have a meaning, the substitution cost is usually set to two units (Abbott 2000). A data-based substitution cost system can also be derived from the frequencies of the transitions between all states which are used as measures of proximity between these states: thus, substitutions between two close states would cost less than between two states which are far away in terms of frequencies. This solution

[35] This distance is actually the Levenshtein distance cite, see Sankoff and Kruskal, *op. cit*.

amounts to use the diachronic closeness between states to build a synchronic proximity matrix between states and to use it to assess the diachronic proximity of individuals (Abbott 1990). In conclusion, the costs system is to be carefully chosen and adapted to the issue analyzed.

OMA and time-use analysis

To choose the best cost system, we must keep in mind that the dates of the events are of paramount importance in the study of schedules. The cost system must be able to discriminate between two sequences which are quite similar from the point of view of the ordering of states but moved forward or put back one hour, because this kind of shift is crucial in this analysis. The indel operations tend to separate events from their date of occurrence since each indel operation has all the earmarks of inserting or deleting time, thereby warping the temporal structure. Consequently, these operations should be rarely, if at all, used, especially when an accurate view of activity scheduling is aimed at. But if the substitution costs are too high then this kind of operation is never to be used, that is why Abbott (1990) suggests choosing an indel cost at least equal to the highest substitution cost increased by the difference between the two highest substitution costs. This is an indirect way to penalize the use of the insertion-deletion operations. For example, let us consider two sequences of identical length, X and Y, of a three-state space whose main differences lie in their temporal shift (see Table 4).

Table 4 Two shifted sequences

X:	A	A	A	A	B	B	B	B
Y:	C	C	A	A	A	A	B	B

With a traditional cost system, the optimal matching (two insertions of C and two deletions of B) is associated with a cost of four units. If only substitution operations are used then the total cost is $2 \times 4 = 8$. Therefore indel costs smaller than substitution costs leads to the vanishing of the temporal shifts between sequences.

Consequently, Andrew Abbott's recommendation is to minimize the use of indel operations in favor of substitutions. As a matter of fact, when the main goal is not to detect patterns of consecutive events then the indel operations are useless. But if only substitution operations are used[36] then this is no more an optimal matching method but simply a matching procedure or a sequence comparison.

Using collective rhythm to compare individual schedules

Therefore, the comparison of the daily activities requires a new algorithm to work out distances from sequences. The algorithm proposed here is informed both by OMA and theory. Sociological theory tells us that calendar and other time concepts both reveal the rhythm of collective activity and ensure its regularity (Durkheim 1925, p. 16): it means that the different moments of the day are different because of the social activity, because what people do varies with time owing to their expectations on what other people do. In the example of the French dual-earners couple work day, it is the economic or the couple work rhythm, which is at stake and which, is to be uncovered. A collective rhythm can be compared with an ocean with different streams: uncovering a collective rhythm means revealing all its streams. In the case of the family work

[36] It is actually equivalent to use systematically the upper bound of the Levenstein distance which corresponds to the case where the best transformation is only composed of substitution operations with sequences of identical length (increased by as many insertions when one sequence is longer).

day, streams link the four different states with one another. If, for every point in time, the relative strength of the different streams is gauged, then it becomes possible to determine whether two couples are drifting together or apart, are close or not. In statistical terms, we need to derive substitution costs from the observed transitions between states. But the usual solution, which relies on a single transition matrix, is not enough since these general transitions hide temporal variations that are the substance of time. Consequently, as many transition matrices as time slots[37] will be used to compute the proximity between states at every point in time.

This solution is not only appealing from a theoretical point of view; it also gives an endogenous answer to the problem of the distance between activities at certain points in time. Indeed, even if we know that night-shifts are quite uncommon in France it is rather impossible to determine the distance between working or not for each moment of the night, and it is definitely impossible to derive distance matrices from theory when it is the couple and not an individual work schedule that is at stake. Thus substitution costs vary with the time and the degree of scarcity of the transition between the states for the particular time considered.

In mathematical terms, the substitution cost between the states *i* and *j* at time *t*, $d_t(i, j)$[38], is thus defined as:

If $t \notin \{1, T\}$, then :

$$d_t(i, j) = \begin{cases} 4 - \left[p_{t,t+1}(i, j) + p_{t,t+1}(j, i) + p_{t-1,t}(i, j) + p_{t-1,t}(j, i)\right] & \text{if } i \neq j \\ 0 & \text{otherwise} \end{cases}$$

If $t = 1$, then :

$$d_1(i, j) = \begin{cases} 4 - 2\left[p_{1,2}(i, j) + p_{1,2}(j, i)\right] & \text{if } i \neq j \\ 0 & \text{otherwise} \end{cases}$$

If $t = T$, then :

$$d_T(i, j) = \begin{cases} 4 - 2\left[p_{T-1,T}(i, j) + p_{T-1,T}(j, i)\right] & \text{if } i \neq j \\ 0 & \text{otherwise} \end{cases}$$

With $p_{t,t+1}(i, j)$ as the empirical probability[39] to reach the state *j* at time *t+1* given that the previous state was *i*.

Therefore, the rarer the transition shifts between two states (the weaker the stream) in a single time slot, both before and after, the higher the distance between these states at that time. For instance, since the transition between the states "no spouse works" and "only the husband work" at 1 AM is uncommon, the distance between a couple with a night shift and a couple with a day shift will be high. But since such a transition is quite common around 9 AM, couples with standard work schedules will be quite close. To put it in a nutshell, if we want to estimate the

[37] If there are *n* time slots then only *n–1* transitions matrices between two adjacent dates exist.

[38] This measure of dissimilarity fulfills only one of the three axioms required to be a distance hence cannot be legitimately called distance.

[39] The empirical probabilities $p_{t,t+1}(i, j)$ and $p_{t,t+1}(j, i)$ are hence not equal in theory.

proximity between two individuals at a certain time, we look at the proportion of the sample which has transited between the two states considered between[40] *t–1* and *t* and between *t* and *t+1*: if this proportion is high then it means that a lot of people "hesitate" between the two states thus that those states are close. As a consequence, the distance at every moment between two individuals depends on what the entire population has done at the last stage and is about to do in the next one, which is a way to have both a dynamic and a relative definition of which behavior is common and uncommon.

Although the sequence comparison algorithm proposed here is inspired by Optimal Matching techniques, it avoids some of its pitfalls by removing the indel cost issue, and, since it is no longer an optimization procedure, the result is not anymore the product of hidden trade-offs. Nonetheless, for all that method is theoretically appealing, it should also be assessed on the ground of its results. After a brief presentation of the French time-use surveys, this comparison method is applied to the 1985-86 and 1998-99 investigations.

The French time-use surveys

France has a quite long tradition of investigating the use of time after its participation to the seminal international study by Alexander Szalai (1972). The two last French time-use surveys carried out in 1985-86 and 1998-99 by the French institute of statistics (Insee) are used to investigate the dual-earner couples work schedules.

The number of persons who responded to all the questions is 16,155 in 1985-86 and 15,441 in 1998-99. Both surveys used leave-behind diaries but with different time slots. The 1985-86 survey has 5 minutes slots while the 1998-99 investigation records activities every 10 minutes. People living in collective accommodations such as rest houses, hospitals, barracks, etc., are excluded from the sample since only personal housing is sampled. People on vacations are equally not interviewed. Since this study is about dual-earner couples, these biases are not serious.

Given the scarcity of homosexual couples[41], only heterosexual dual-earner couples who worked[42] at least 10 minutes the day they filled in the diary will be considered, whatever the actual work duration or the day of the week.

[40] Rather than choosing the (t–1,t) transition matrix more than the (t,t+1), it seemed more interesting to use both in order to lightly smooth the trends.

[41] There are no homosexual couples in the 1985-86 survey and approximately 20 in 1998-99.

[42] The definition of work used here encompasses having a meal with colleagues at work or work-related travels. The aim is not to measure accurately working time but the amount of time dedicated to work in general: when you have a meal with colleagues, you are not available to do something else.

Table 5 Subsamples size

Subsample	1985-86	1998-99
Childless dual-earner couples	425	330
Dual-earner parents	1,038	781
Total	1,463	1,111
Grand total	2,574	

Source: French time use surveys, Insee, 1985-86 and 1998-99.

Comparability issue

The difference of the sample sizes (see Table 5) is due to the sampling procedure. Once a sample of accommodations is constituted, some of their occupants are interviewed. In 1985, one occupants among those older than 15 was selected in random order using the Kish method; if this person was living maritally, her spouse was also interviewed. In 1998, every occupant older than 15 was systematically interviewed.

But the differences between the two surveys exceed the sample sizes since the time slot of the diary has doubled in 1998 to reach 10 minutes. The consequences of this methodological difference are quite hard to grasp but are likely to sway only small duration's activities. Given that work is generally unlikely to be classified in that category, this methodological difference seems harmless for this study.

Calculation details

The sequence comparison algorithm proposed in the previous section is applied to the pooled 1985 and 1998 French surveys. Given the relative small size of each sample, pooling is appealing: it is likely to distort slightly the distances between couples[43] but in return, it enables insightful temporal comparisons.

The graphical comparison of the difference of the distance between states at every point in time does not indicate drastic changes between 1985 and 1998 consequently the analysis will be performed on the two pooled samples.

The distance between couples produced by the sequence comparison algorithm[44] is then used as input for a clustering algorithm. The algorithm used is the flexible-beta method proposed by Lance and Williams (1967) and reviewed by Milligan (1989). This clustering algorithm is not only very flexible owing to its smoothing parameter but is also able to produce clusters of unequal size.

[43] Given that distances are directly related to the transition matrices, it is equivalent to ask if we can add the weighted transition matrices time slot by time slot and compare work schedules of couples as if they were coming from the same sample. If we omit the differences in the sampling techniques used, pooling seems acceptable if the transition matrices are roughly equivalent time slot by time slot. But if this is not the case, then pooling will distort the distances which are based on the degree of scarcity of transitions: distances will artificially increase for one sample and decrease for the other. For instance, if night shifts or non standard schedules are differently represented in the two samples then it will affect systematically the distances. In brief, such a comparison is legitimate only if the structure of the transitions between states is roughly the same at every point in time for both samples.

[44] The algorithm has been implemented in the SAS software as a macro using the IML module. The code is available upon request; see the address of the author.

Joel H. Levine (2000) recently criticized OMA applications in the social science field for the lack of evaluation of their validity. Levine is right, but the lack of evaluation seems a rather more general issue in the social sciences where statistical methods are too often used as black boxes. The difficulty to assess the quality of OMA-like methods stems from the nature of the output obtained: after all, OM methods are just a rule to compute distances between individual in terms of a particular set of variables. Since another method is required to access and assess the output, the question has no answer. But the quality of the clusters will be here investigated, mainly with the help of graphical tools.

Results

The relevance of the work days of the French dual-earner couples uncovered is part of the assessment of the quality of the method proposed to compare schedules. Of course, given the limited number of states considered in the analysis of the family work day, uncovered patterns are likely to be quite familiar. But this familiarity would be a guarantee of quality. Moreover, besides the issue of originality, this is the first time that desynchronization is really adequately measured among dual-earner couples, as well as its temporal evolution. Finally, the quality issue is addressed using box-plots on the underlying dimensions of the family work day.

The twelve work days of the French families

Twelve configurations of family work day are uncovered: it means that if we pick at random one work day of any French dual-earner couples, it should be one of these days. The visual inspection[45] of these days reveals their high degree of homogeneity (see figure 4 below).

Table 6 Taxonomy of the French families work days

Type of family work day	Days	Main characteristic	Main difference
Double full-time schedules	1-6	Both spouses worked a full-time schedule	From almost totally synchronized to almost totally desynchronized
Single full-time schedule	7-8	Only husbands worked a full-time schedule	Morning vs. afternoon feminine part-time schedule
Atypical workers schedules	9-12	Low work time with nonstandard schedules	Distributions of work

Source: French time use surveys, Insee, 1985-86 and 1998-99.

Three types of days can be brought to light (see Table 6). Days 1 to 6 are double full-time schedules days, days 7 and 8 are partially worked by the wife, and the other days gather low work duration for at least one spouse, sometimes combined with non-standard work schedules.

Days 1 to 6 are not systematically associated with double full-time couples as well as days 7 and 8 are not systematically combined with part-time wives. Of course, the chances to work a full-time shift are higher (4.7 in 1985 and 2.5 in 1998) when women hold a full-time job, but 71% of women who held a part-time job worked a full-time schedule in 1998, and 14% of the full-time employed women in 1998 worked a part-time schedule (see Table 7) the day observed.

[45] The best visual representation of this kind of cluster is a graphic representing for each time slot the percentage of couples belonging to the four different states.

Consequently, the expression "full-time schedule" seems more precise than "full-time", emphasizing that what is observed is a schedule of a particular day and not the work time specified in the labor contract.

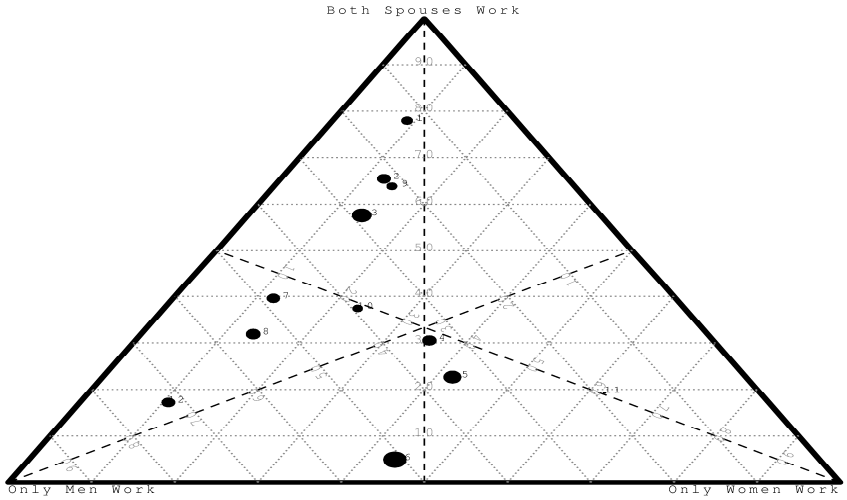
Table 7 Labor contract and schedule observed for women living in dual-earner couples

Women's labor contract		Full-time schedule (days 1-6)	Part-time schedule (days 7 and 8)	Total
1985	Full-time job	89%	11%	100%
	Part-time job	64%	36%	100%
1998	Full-time job	86%	14%	100%
	Part-time job	71%	29%	100%

Source: French time use surveys, Insee, 1985-86 and 1998-99.

The first main result is that 70% of the days worked by dual-earner couples are double full-time schedules, 13% are partially worked by the wife and 17% belong to another work pattern. Besides differences in the beginnings and endings of work, the dissimilarities of the days within those types lie in the degree of synchronicity of work schedules and the source of the desynchronization observed, *i.e.* whether the desynchronization is equally shared by spouses or also reflects asymmetrical work duration. These three main differences, related to the length of the family workday can be represented in a ternary plot (see Figure 3). The vertical line coming from the top of the triangle materializes the different degrees of synchronization (the higher the couples are located on this line, the more synchronized they are) as well as the equality of the contribution of spouses to the desynchronization observed (hence the difference of their work time).

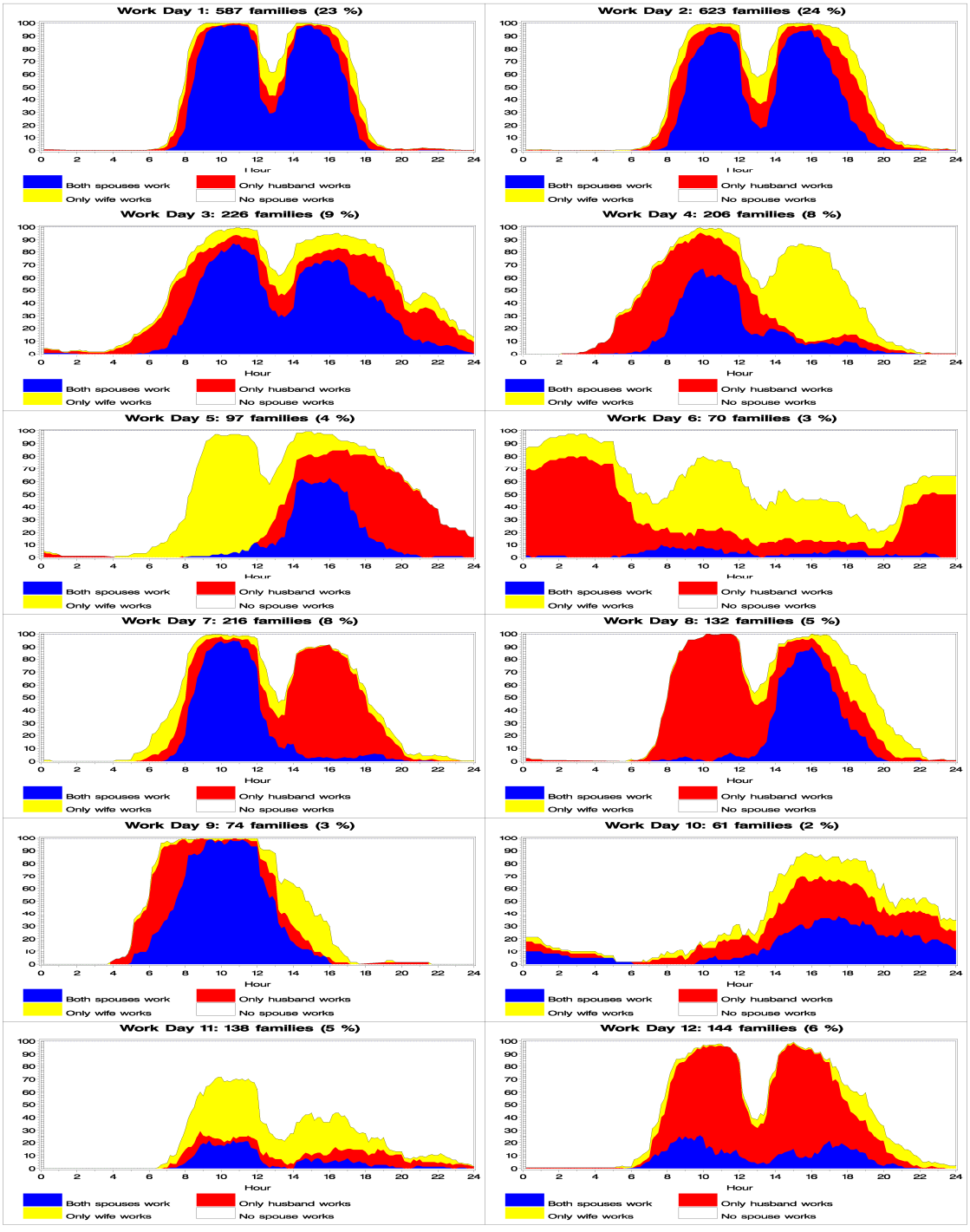
Figure 3 The French families work day



The French families work day according to their mean synchronization and desynchronization relative to the mean length of families work days (which length is proportional to the thickness of the dots). Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes.

Source: French Time Use surveys, Insee, 1985-86 and 1998-99

Figure 4 The twelve work days of the French families



Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes.

Source: French time use surveys, Insee, 1985-86 and 1998-99.

The first six days cluster around this axis: days one to three are characterized by a quite high degree of synchronicity, men contributing slightly more to desynchronization than women; days four to six exhibit more desynchronization than synchronization[46], men and women contributing quite equally to this phenomenon. Eventually, standard double full-time schedules days (i.e. days 1 to 3) account for 56% of the dual-earner work days and for 80% of the sole double full-time schedules. It means that almost half of the dual-earner couples experience a different work organization than a double standard work schedule and that even if only double full-time schedules couples are considered, the figure is still sizeable (20%). Consequently, disregarding the distribution of work over the day is likely to flaw the analysis of dual-earner couples' work. It is worth noting that the lower the relative synchronicity, the higher the length of the family work day, hence the higher the absolute desynchronization. This result is confirmed if we inspect the work days absolute desynchronization (see Table 8): one out of three double full-time schedules couples experience desynchronization greater than five hours, about 3% of them living completely desynchronized (mean desynchronization towers over 13 hours). Serious desynchronization is thus affecting a great part of the French dual-earner couples despite quite restrictive labor regulation.

Logically, work days with feminine part-time schedules clustered in the left part of the triangle, illustrating the difference between the work lengths of spouses. However, if we consider again the representation of these two days (see Figure 4 above), we can see that the desynchronization observed is not purely structural since a significant amount of those women work earlier (day 7) or later (day 8) than their spouses, which is expressed by not being stuck to the triangle's upper left side: a substantial amount of partial work involve non-standard schedules. Even when one spouse is not working a full-time schedule, a lack of synchronization is still perceptible: absolute desynchronization due to women adds up to more than one hour. The concept of structural desynchronization is definitely difficult to implement without a global perspective on the work schedules, even in the textbook case of part-time schedules.

Concerning the other types of family work day, the proximity between days 9 and 2 noteworthily evidences that even if the clusters obtained can be described using mean durations, they cannot be subsumed to these simple figures. If proximities had been based on these three dimensions, those days would have been merged despite their tremendous differences (see Figure 4): work starts between eight and nine AM and stops between six and eight PM in work day two characterized furthermore by a bimodality indicating a midday break; on the other hand, in work day 9, work starts between four and six AM and progressively ends from twelve to five PM with no midday break. But in any event, the crucial point remains that time is not the constant flux symbolized by the chronograph: the tool should not be confused with the process whose true nature is social (Elias, 1992). Days 10 and 11 exhibit both a low spousal work time and quite non-standard schedules with prominent night work: these groups are likely to capture the weekend work of executives or teachers for instance. Eventually, day twelve is largely characterized by the very low work time of women and could be labeled "false dual-earner workday".

[46] All the family work days located below the 50% horizontal line are characterized by relatively more desynchronization than synchronization. Subsequently, schedules which relative desynchronization lower than 50% will be called standard schedules.

Table 8 Work schedule overlapping of the twelve family work days[47]

Day	Size (%)	Only men work	Only women work	Total desynch.	Both spouses work
1	22.8	1:13	0:50	2:03	7:16
2	24.2	2:17	1:17	3:34	6:48
3	8.8	3:42	1:46	5:29	7:27
4	8.0	3:35	3:43	7:18	3:12
5	3.8	4:17	5:06	9:24	2:45
6	2.7	7:27	6:25	13:52	0:43
7	8.4	4:51	1:12	6:04	3:58
8	5.1	5:54	1:27	7:21	3:26
9	2.9	1:58	1:16	3:14	5:43
10	2.4	3:26	2:02	5:29	3:17
11	5.4	1:01	3:23	4:24	1:03
12	5.6	7:21	1:05	8:26	1:45
	100.0	3:07	1:49	4:58	5:14

Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes

Source: French time use surveys, Insee, 1985-86 and 1998-99.

Temporal evolution

The assessment of the evolution of desynchronization between 1985 and 1998 is not an easy task. Instead of working out a number for the entire set of days, it seems more interesting to gauge the evolution of the double full-time schedules couples and of the partially worked ones separately[48]: the homogeneity of these days is great and thus ensures that such indicators have a meaning. The mean desynchronization for the double full-time couples is based on the total desynchronization observed in days 1 to 6 and weighted with their relative size (the reference is the number of double *and* single full-time couples). The mean desynchronization of part-time couples (days 7 and 8) is obtained by weighting the desynchronization imputable to women. The results are shown in table 9: desynchronization increased dramatically between 1985 and 1998, especially for single full-time schedules.

Table 9 Global evolution of desynchronization[49]

	1985	1998	Evolution	Structural part
Double full-time schedules	3:38	3:52	6.4%	73.7%
Single full-time schedules[50]	0:09	0:16	77.8%	46.2%

Population: couples who worked either a double or a single full-time schedule (days 1 to 8).

Source: French time use surveys, Insee, 1985-86 and 1998-99.

But these two figures hide two kinds of change:

Structural or inter-day change: the relative sizes of the workdays can vary with time;

[47] The averages computed here are based on relatively homogeneous collections of objects, as a result of the clustering algorithm.

[48] The desynchronization observed for the rest of the days is not typical and quite hard to interpret.

[49] Absolute figures are the weighted means of the desynchronization observed in each work day: the part-time figures underestimate the actual desynchronization observed in days 7 and 8 (see table 10) because of the weighting system which is based on days 1 to 8.

[50] Desynchronization for single full-time schedules is measured by the desynchronization due to women.

Global or intra-day change: the underlying dimensions of each workday can evolve with time.

The first source of change corresponds to change in the distribution of days, possibly owing to change in the structure of work opportunities, since, as in most developed countries, the service sector is growing in France, leading to more non-standard work schedules. The second source of changes would result from a societal movement towards more individualized schedules, perhaps affecting differently the family workdays. It seems that both changes are at work (see Table 10).

Table 10 Inter- and intra-day temporal evolution between 1985 and 1998 of absolute desynchronization within the workdays of French dual-earner couples

	1985-1986				1998-1999			
Day	Size	Des. Men	Des. Women	Des. Total	Size	Des. Men	Des. Women	Des. Total
1	27%	1:09	0:45	1:55	18%	1:20	0:58	2:19
2	22%	2:18	1:13	3:32	26%	2:16	1:21	3:37
3	8%	3:47	1:34	5:22	10%	3:37	1:58	5:36
4	8%	3:24	3:38	7:03	8%	3:47	3:48	7:36
5	4%	4:38	4:56	9:34	4%	3:47	5:21	9:09
6	3%	7:27	6:28	13:56	3%	7:26	6:20	13:47
7	7%	4:52	1:03	5:56	10%	4:50	1:21	6:12
8	4%	5:48	1:15	7:04	6%	5:59	1:38	7:38
9	3%	1:51	1:15	3:06	3%	2:07	1:17	3:25
10	2%	3:18	1:48	5:07	3%	3:35	2:17	5:53
11	6%	0:47	3:23	4:11	4%	1:30	3:22	4:52
12	6%	7:40	1:03	8:43	5%	6:56	1:07	8:03
	100%	2:59	1:43	4:43	100%	3:18	1:57	5:15

Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes

Source: French time use surveys, Insee, 1985-86 and 1998-99.

The structural component of this increase can be assessed by simulating a situation where intra-day synchronization would have not changed between 1985 and 1998.[51] We see in table 9 that structural changes account for most of the increase observed for double full-time schedules days but only for half in the case of single full-time schedule days. We now review these two sources of change.

More spouses work desynchronized days

The relative size of the work day 1 decreased dramatically between 1985 and 1998; days 2 and 3 benefit from this decrease: in the end, day 1 lost its title of most sizeable day between 1985 and 1998 to day 2, *i.e. desynchronization increases* (see Table 10). However, if the most extreme forms of desynchronized work schedules (days 6, 7 and 8) remained stable, the number of feminine partial workdays increased significantly as if partial work were chosen to avoid a degree of non-structural desynchronization too high[52]. Among the other type of family workdays, only the size of day 11 changed downward.

Hence, the increase of desynchronization observed for double full-time schedules couples stems from a decrease in the number of couples working the most synchronized and standard day.

[51] The desynchronization of 1998 is calculated using desynchronization of 1985 but with 1998 distribution of days.

[52] The percentage of feminine part-time jobs increased significantly between the 1980's and the 1990's in France, starting from 10% to reach 16%.

However, the relative size of the most desynchronized days remained unchanged: the number of double full-time schedules with desynchronization increased, but the desynchronized work days concerned by this increase are not the most desynchronized ones. Therefore, if the number of desynchronized workdays increased in France between 1985 and 1998, this increase remained however limited.

The increase of the number of feminine part-time schedules perhaps contributed to the relative stability of the relative size of the most desynchronized days, but accounts for less than half of the increase of the desynchronization observed for those couples. Therefore, the shape of the family workdays has also evolved, leading to more desynchronization.

Desynchronization expands in most of workdays

Besides the distribution of workdays between the different types, their essential dimensions have evolved between 1985 and 1998 towards more desynchronization. If the dimensions of the work days 2 and 3 remained approximately unchanged, desynchronization increased by half an hour in work day 1: the most synchronized work day is losing ground in terms of relative size (less couples are concerned by this type of work day), but also in terms of synchronization (desynchronization increases).

The desynchronization of workdays 5 and 6 remained stable. The exception is the workday 4, which desynchronization increases by half an hour: desynchronization increased only in one of the three highly desynchronized full-time schedule workdays.

With regard to single full-time schedules, desynchronization, measured by the contribution of women to desynchronization, expanded significantly between 1985 and 1998 (around 20 minutes for work days 7 and 8): the increase of part-time labor contract in the 1980's and 1990's among French women mechanically increased the number of single full-time family work days but also came with an increase in non standard work schedules translated at the level of the couple into desynchronization.

In the end, more couples with double full-time schedules experience desynchronized work days which are themselves more desynchronized; desynchronization also rose for couples where the wife partially worked: the individualization of work schedules gained ground between 1985 and 1998.

Quality

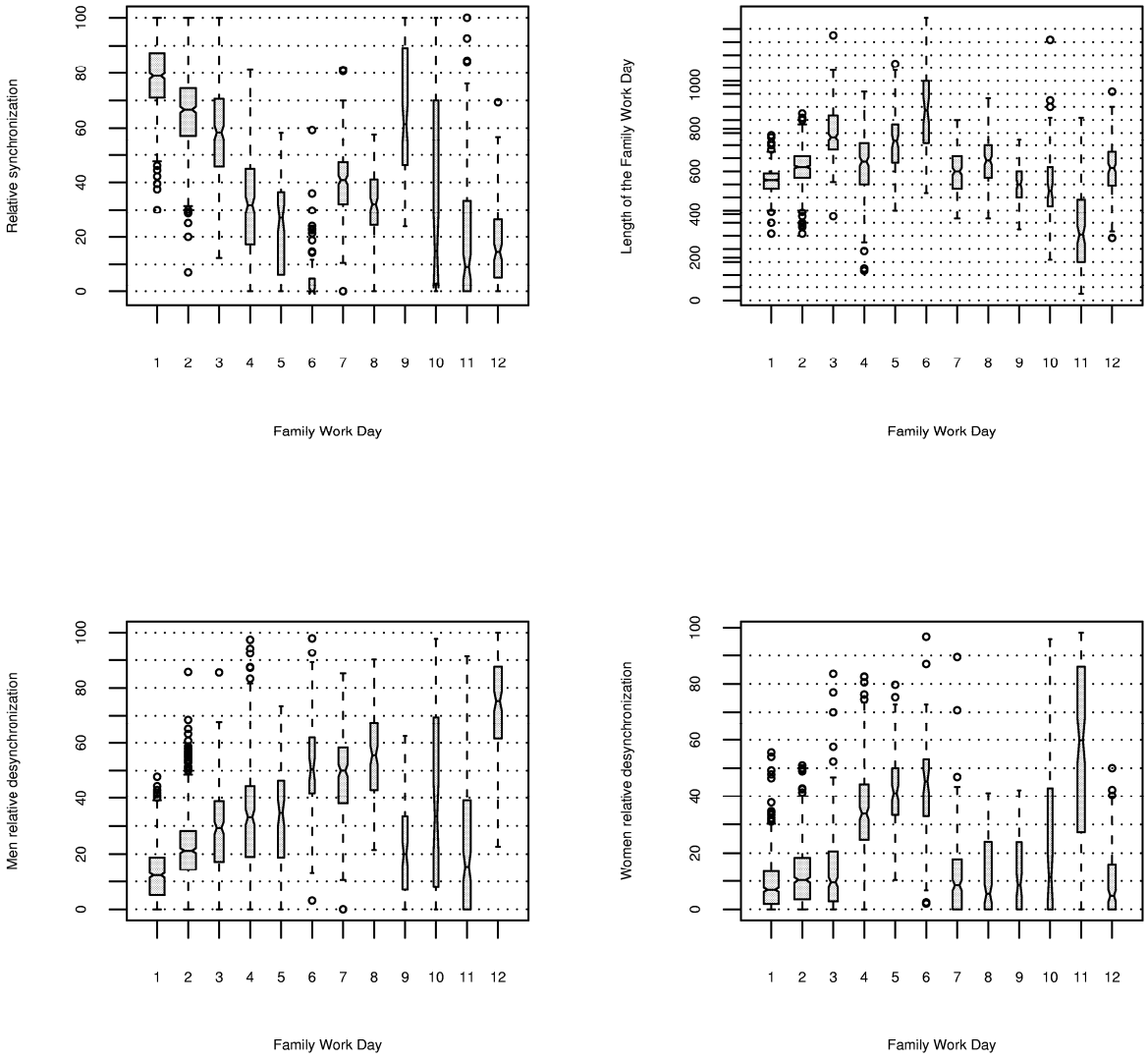
Given the lack of explicit variables used to cluster couples' work schedules, it is only possible to assess the quality of the classification by using a series of variables related to family work day: synchronization, men's and women's desynchronization, spouses work time, length of the family work day. A good classification is discriminatory, *i.e.* is characterized by a homogeneous population within each cluster and heterogeneous populations between clusters, in statistical words with low intra-class variance and high inter-class variance.

To gauge the quality of this classification, box-plots of these variables are used (see Figures 3 and 5). The most striking result lies in the thickness of the boxes and the clear-cut median values, indicating a low intra-class variance and an excellent discrimination. In short, each workday uncovered is homogeneous and distinct from the others[53]. Of course, the higher intra-class

[53] The combination of the information of those box-plots leads to the previous interpretation.

variance observed for workdays 9 to 12 was expected given their visible heterogeneity (see figure 4).

Figure 5: Box-plots of the French families work days according to the underlying variables of the analysis (I)



Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes

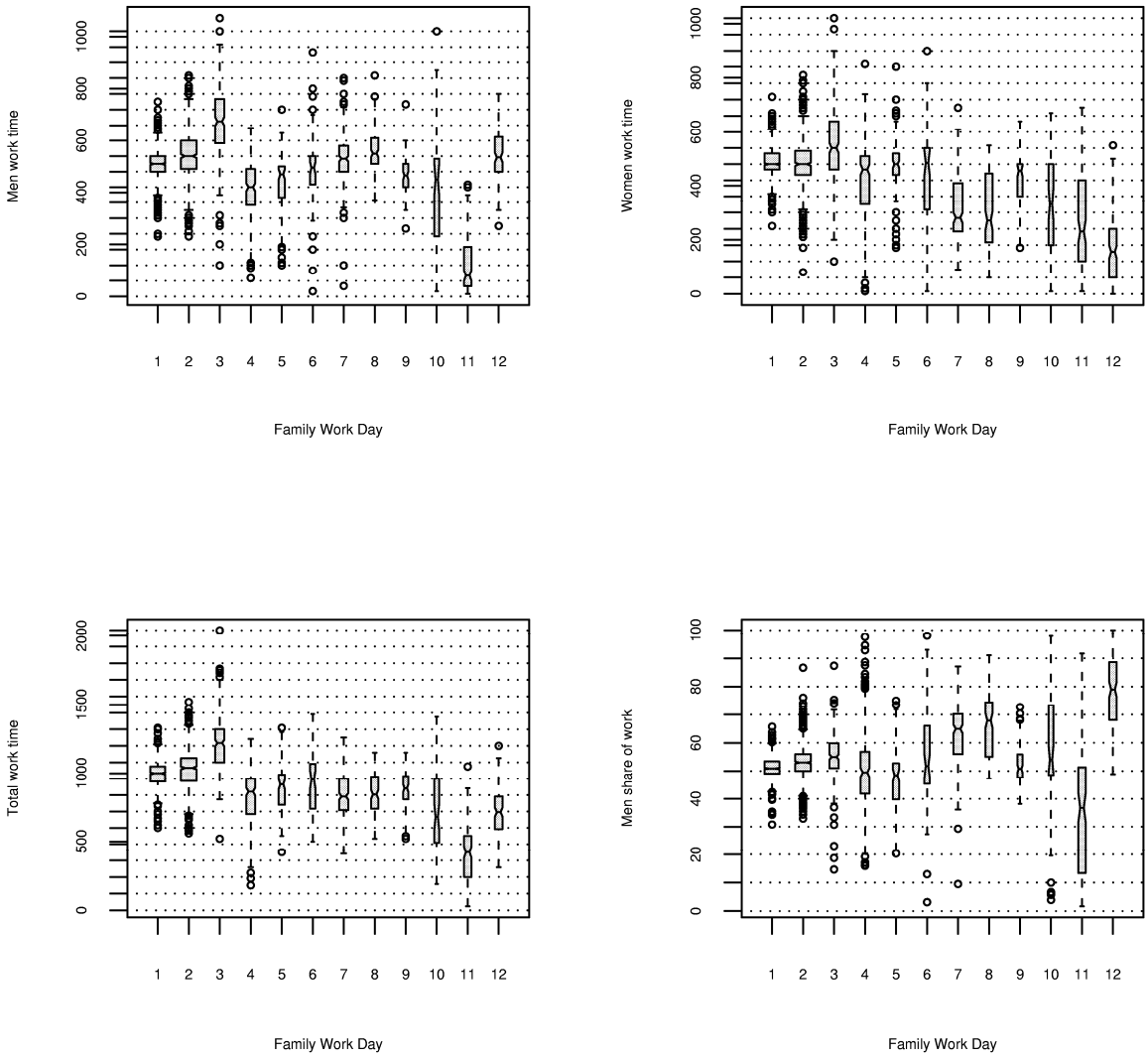
Source: French time use surveys, Insee, 1985-86 and 1998-99.

A substructed typology[54] can be drawn from the different family workdays (see table 6) based on obvious dimensions such as the time spouses worked, the scheduling of this work, and the shift between their schedules. Indeed, the days uncovered seem trivial so that the reader can wonder if the result is worth the effort. Why develop a new method if the empirical identification of clusters can be easily derived from a typology, *i.e.* a conceptual classification. However, it seems that the familiarity of the work days uncovered, far from being a problem, rather emphasizes the quality of the algorithm and furthermore enables us to identify theoretical cases which were by the way

[54] Creating a full typology out of a single type is a substruction operation (Lazarsfeld, 1937).

impossible to form given the continuous processes at stake. Eventually, this identification of theoretical cases of the substructed typology makes possible the uncovering of the explaining factors of the twelve family workdays.

Figure 6 Box-plots of the French families work days according to the underlying variables of the analysis (II)



Population: 1985-86 and 1998-99 dual-earner couples who worked at least 10 minutes

Source: French time use surveys, Insee, 1985-86 and 1998-99.

Conclusion and discussion

This study brought to the fore the absolute necessity to temporally ground the analysis of the use of time. Indeed, time is not a uniform process, a constant flux, but on the contrary a true social phenomenon. Time reveals the collective activity, the need for people to being synchronized, a need obviously linked to the social division of work. Calendars and clocks remind permanently individuals of their binds with society, with other people. Because clocks and calendars also help

individuals to orient and plan their activities, the scheduling of activities partakes of the use of time. Adding up hours dismantles a great part of the social phenomenon studied. But taking into consideration this dimension is not an easy task. It requires considering schedules as sequences, sequences of a particular kind since the present is liable to depend on anticipations, *i.e.* on the future. Consequently, usual statistical methods to analyze processes cannot be used. The only solution is to consider sequences, schedules as a whole, an issue addressed by Optimal Matching methods. But, as demonstrated, standard OM methods warp the temporal structure of schedules.

When taking into account the exact timing of activities is of paramount importance, OMA-like methods lead to inconsistent results because of this warping. Of course, when one tries to classify numerous activities combined with additional information for instance about with whom and where the activities were performed, then OMA methods have proved their efficiency, especially in geography and transportation studies. The warping of time, i.e. the extension or contraction of time, is even an advantage when the goal of the analysis is to identify different string of events. But when only a few states are studied and when the exact scheduling of activities is crucial then OMA is defective. To tackle this problem, a new method is proposed, based on what the entire population do at each moment of the period of time considered. Substitution costs are derived from those transition matrices and enable to work out distances between schedules. The keystone of this method lies in its sensitivity to small time differences, consequently, only a few states/activities can be handled adequately. Otherwise, this method is likely to rapidly lead to an unmanageable situation with too many clusters for instance. However, it is possible to adapt the method to such situations, for example by increasing the number of dates encompassed by the transition matrices, which is a way to reduce its time sensitivity.

This method is applied to the work arrangements of French Dual-earner couples in 1985 and 1998. Applying this method to this issue enabled us to visualize and measure accurately synchronicity. A substantial part (20%) of the French dual-earner who worked a double full-time schedule experiences a high degree of desynchronization (greater than 50%). Couples where women worked part-time schedule are also concerned by non-structural desynchronization. Desynchronization significantly increased between 1985 and 1998, for structural and more substantial reasons: the most synchronized day yielded ground to more desynchronized work arrangements, but also to more partially worked days; desynchronization also increases within the different family work days uncovered, especially within the part-time schedule ones. On the whole, work desynchronization expanded considerably: the non-overlapping of double full-time schedules increased by 6.4% between 1985 and 1998. Although the first application of the method proposed seems satisfactory from both interpretation and quality standpoints, more applications are required to validate definitely its relevance in the field of time-use studies.

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Examining large-scale time-use files through graphic representation

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Abstract

The objective of this paper is to demonstrate the utility of graphic means to add to the comprehension of time-use analysis. The paper traces the development of several graphic approaches, from the logic of plotting a single case in multidimensional space to several ways of examining time-use dynamics graphically without limitations on sample size. It draws on pilot studies from the FAMITEL research project on telecommuting and extends to Statistics Canada's General Social Survey in 1998 with time-use data (GSS12). The examples of graphic development focus on aspects of the daily lives of teleworkers, to illustrate in this context how graphic representation can illuminate much-discussed differences between the complex pattern of daily life characterizing of these workers in comparison to conventional workers, regardless of the size of samples and subsamples. The graphic techniques discussed advance understanding of these phenomena by presenting visual evidence of differential patterns reflecting the interrelations between the several components of time-use as well as reflecting the different times in the day in which phenomena occur, within and between analytic subgroups. As in many other analyses, gender can be literally seen in the graphics as an important differentiating factor, even within occupational situations.

JELCodes: C10, D10, D30, J20

Keywords: telework; home-based work; graphic analysis; tempogram; composite tempogram.

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Background and objectives

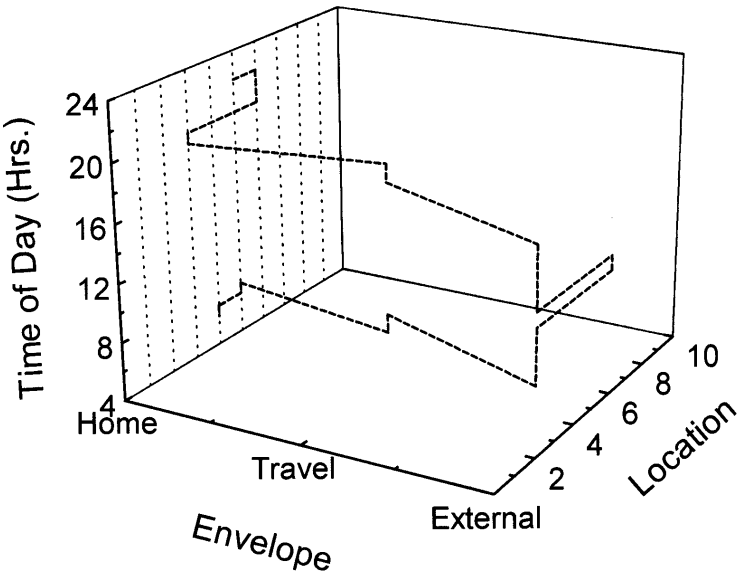
Time-use is inherently composed of multiple dimensions (time, duration, activity, places, persons, and sometimes perceived subjective outcomes), with numerous categories and values associated with each. Tabulation and statistical examination of this complex matrix may lead to diverse and interesting results, but these are not always easily discerned. Graphic presentation of results adds to the comprehension of these results (Michelson, Crouse & Stalker 2001; Michelson & Crouse 2002). It offers a unique ability to make the *pattern* of a person's daily use of time explicit. It also offers a means of pointing out the interaction between the several dimensions of time-use throughout a person's day. And it can plot the differences between subgroups in these patterns, such that they can be readily compared; these subgroups can represent aggregates whose comparisons are of theoretical and/or analytic interest or indeed changes over time with respect to the same aggregate. In the subfield of Geography called Time-Geography, the literature has shown over many years a necessity to use graphic means to explicate the dynamics of time and space pursued (e.g. Hägerstrand 1970; Parkes and Thrift 1980; Friberg 1993). This legacy has been largely conceptual until 2001, with simultaneous empirical operationalization by the present authors and by Kajsa Ellegård (2001).

Ellegård's approach captures elegantly for individuals and families the three dimensional components of daily activity developed in the time-geography tradition. But, to this point, her graphic approach to the daily activities of *larger* groups lacks parsimony and clarity. Progress in graphic representation is coming surely, but in bits and pieces from many sources (c.f. Research Centre on Portuguese Economy 2002).

The initial Canadian approach detailed here commenced in connection with a pilot study of teleworkers and their partners in Canada, coordinated with similar efforts in Europe within the umbrella of a research group called FAMITEL (families and telework). That first pilot involved only six families, chosen to fulfill certain requirements and variations but not particularly representative of any universe. Part of pilot work is intended to observe whether the implementation of the research design and methods is feasible. Beyond that, it is important to assess the extent that the data are sufficiently pertinent to justify extending data gathering to a larger scale. A sample of six teleworkers and six partners provides a time-use data matrix entirely too small and diffuse for tabulation and statistical analysis. Therefore, the assessment of data proceeded through the creation and analysis of graphic patterns. Even with only six respondent pairs, it was thereby possible to examine logical differences between teleworkers and their non-teleworking spouses in the pattern of the weekday time-use patterns.

It is possible to draw simultaneously from different dimensions of time-use at the level of the individual episode (i.e. an activity at one point in time) from a spreadsheet type of matrix, so as to create graphs with a continuous line through a three-dimensional box denoting in serial order through the day whether people are at home, in transit, or are in a generalized category of external location (called an *envelope),* as well as the precise nature of location in an envelope (room in the home, mode if in travel, and type of land-use if external). Figure 1 is a hypothetical and hugely simplified

Figure 1 Hypothetical day of one person



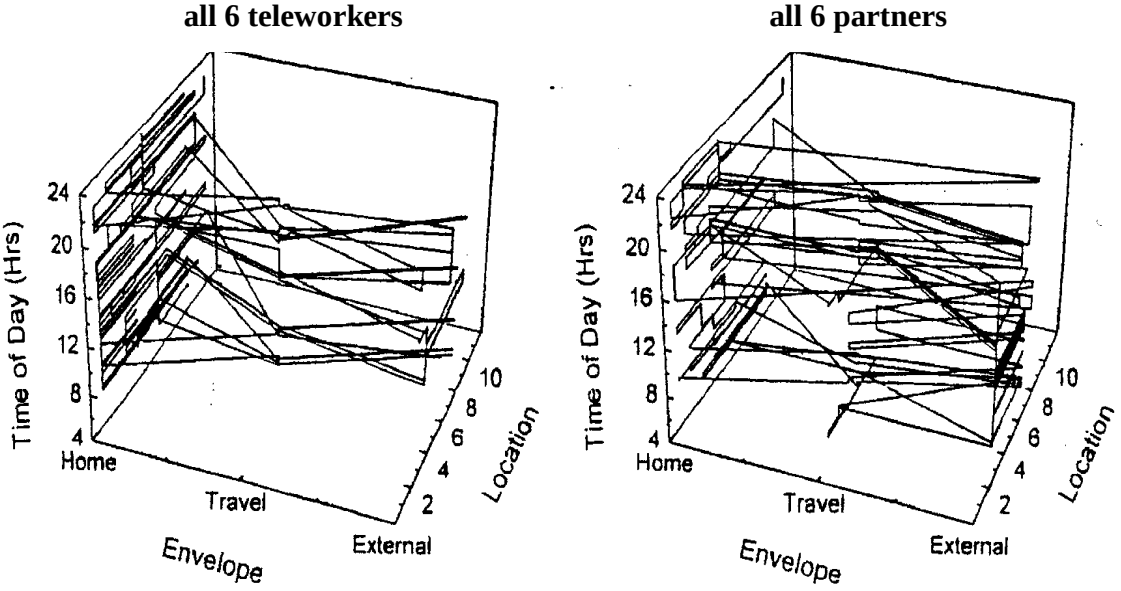
Source: not applicable (illustrative example).

representation of one person's day, starting from two rooms at home, going to work and staying there a while, stepping next door for lunch and then back to work, and returning home, in which several rooms are then used before retiring. This kind of figure is not restricted to just these dimensions of time-use. Type of activity, persons present, and self-reports of stress may be plotted alternatively.

Six teleworkers are compared to their partners in Figure 2a & b. This is done by plotting a line for each respondent on the graph and observing what the totality of lines says about the day for each of the two subgroups. The graph makes it easy to spot a pattern of life that goes well beyond the obvious facts that teleworkers are at home more and take fewer trips than their non-teleworking partners. The teleworkers are visibly seen to divide the day into a greater number of shorter episodes and to use a great number of different rooms in their homes through the day, not simply a room set up as an office.

Nonetheless, although this graphic technique relying on lines for all respondents is relatively clear for six cases, it becomes confusing and muddy when the sample increases – such as when including the results from additional research partners in the multinational project.

Figures 2a and b Envelope and location by time of day



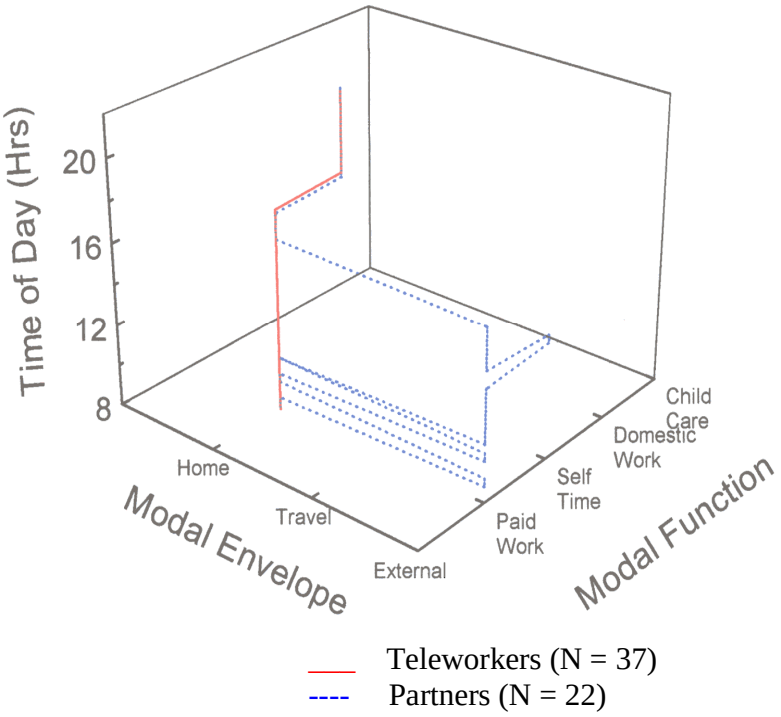
Source: Computed from Canadian pilot data for FAMITEL project, 2001.

Addressing larger samples

A modification is therefore necessary that can be applied with clarity to samples of large size, such as the national samples increasingly producing such valuable information. The key here is the creation of a single line through the day for each analytically pertinent subgroup, made possible through data reduction and simplification. This requires several fundamental changes in the organization and presentation of time-use data. Plotting of time must be away from sequences of episodic activity throughout the day representing individuals and to what was typical for the subgroup during fixed periods of the day. The logical extension on this is to plot typical activity components for each of the 1440 minutes of the day. Expressing what is typical of the group each minute (or other grouping) requires considerable reduction of the values of time-use variables and simplification of the data. Depending on the dimension of time use involved, this becomes the modal activity, place, or person present Hence, Figure 3 compares the 37 teleworkers and 22 partners from the multinational Famitel pilot data, regarding the interactions between place envelopes and main activities (called functions, as reduced to paid work, self time (a combination of personal care and free time), domestic work, and child care).

Figure 3 shows clearly[55] the modal pattern of teleworkers to be at home working until after 4 p.m., with the rest of the day predominantly devoted to self time. This contrasts to the pattern of their partners, the bulk of whose days center on their workplaces, other than going out around noon for personal purposes (which the teleworkers in this sample do not do). At no time during the day is travel a modal envelope for either subgroup, nor are domestic work or child care ever modal activities within these aggregations.

Figure 3 Modal envelope and function



Source: Computed from multinational data from the FAMITEL project, 2001.

The major purpose of this paper is to examine the feasibility, usefulness, limitations, adaptations, and results that occur when making the major leap to an application of graphic techniques on the 1998 General Social Survey #12 by Statistics Canada (referred to as *GSS12*), with a total sample of 10,749 respondents, pursuing in more detail the substantive themes developed in the work just described.

[55] In the development of more multidimensional plots from larger samples, the plotting of matrix lines varied marginally in successive stages in an attempt to increase an ability to see these plots in three dimensions. But then the three dimensional perspective becomes important to locate the position of a given line. The software (KyPlot) makes it possible to rotate the graphs to observe the dimensions from different viewpoints. But such rotation is not included here on behalf of parsimony.

Feasibility and usefulness

Figure 4, for example, parallels Figure 3, but it is based on 395 home-based and 3469 conventional workers (all of whom were shown to perform principal employment activities on a weekday for which time-use data were collected). The results are quite similar, even though the Statistics Canada GSS12 time-use matrix extends from 4 a.m. to the same time the next day, compared to the graphing in Figure 3 of data from 8 a.m. to 8 p.m. The home-based workers show a modal day which is the same except for a short period in the early afternoon, when the modal home-based worker goes for a short time to an external location for purposes of work. The modal conventional worker, does some work at home (for 4 minutes) before going to an external location for work. He or she takes the aforementioned noon break, which remains at an external location and is not related to work. When returning home, the modal conventional worker does not take up work upon arrival, but spends the rest of the day in self-time activities.

Figure 4 Modal envelope and function by time of day from a large sample

N = 3864; conventional workers = 3469; home-based workers = 395.

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Figure 5 compares the same two subgroups from the Statistics Canada 1998 data (GSS12), but substitutes persons present in the three-dimensional graph for functions. In this case, the graph shows quite clearly that the modal home-based worker spends the day until shortly after 4 p.m. alone; even when he or she goes out in the early afternoon, this does not change. In contrast, the modal conventional worker is shown explicitly and certainly not surprisingly in the company of

work colleagues through all the workday except at the very beginning and end, and for during a very short time during the lunch break. However, once home, the modal conventional worker is shown to spend a greater and continuous period with kin than does the modal home-based worker. The latter goes back and forth between being alone and in the company of kin, before turning to a solitary situation at an earlier hour than the conventional worker does.

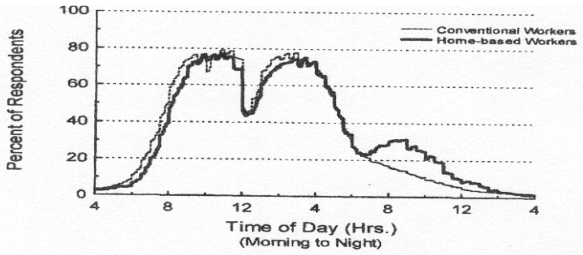
Figure 5 Modal envelope and persons present by time of day in a large sample

N = 3864; conventional workers = 3469; home-based workers = 395.

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

The analytic utility of this approach needs to be examined more completely. Figures 4 and 5 do show that plotting the patterns of *typical* aspects of behavior made possible by time-use protocols produces patterns that are logical and consistent with other analyses, without any detriment from greatly increased sample size. A comparison of Figures 3 and 4 shows nearly identical results, despite the sampling deficiencies underlying Figure 3 and the greater hours in the day covered by Figure 4. In an earlier paper, with the smaller FAMITEL international sample, this approach, with a modified selection of variables, enabled insights into the precipitants of perceived stress in the context of the daily pattern. Stress among home-based workers visibly rises just before other family members return in the afternoon (Michelson & Crouse 2002).

Figure 6 Paid work by time of day: home-based vs. conventional workers



N=3864: conventional workers = 3469; home-based workers = 395

Source: Computed from General Social Survey 12, Statistics Canada, 1998

Limitations and adaptations: tempograms

Nonetheless, there are limitations that accompany the simplification of time-use data within analytic subgroups to typical values, whether modes, means, or medians. It excludes examination of alternative values, the distributions of which through the day can be of considerable interest. For example, domestic work and childcare are never modes within our two analytic subgroups, but this does not mean that they are non-existent or their distributions, uninteresting. Paid work is not modal in the evening, but it is important to examine the extent that it takes place and by whom.

Therefore, although Figures 4 and 5 show that graphing typical patterns with large-scale data sets is both feasible and, to some extent, profitable, graphic presentation of typical patterns by no means pre-empts other forms of data analysis and presentation. Creating graphic patterns on the basis of a continuous scan of the day, rather than by individual-based episodes, can include a greater range of values of time-use. The analyst may show the percentage of respondents (in their respective subgroups) evincing a given value of time-use each minute of the day in successive graphs. The percentage distributions through the day for the reduced four values of activity (or functions) are displayed in Figures 6 and 8 - 10. Given the resemblance of these figures to cardiograms, these graphs are called *tempograms* in this discussion.[56]

The tempogram in Figure 6 shows the percentage of home-based workers and conventional workers engaged in paid work by the minute throughout the day. The over all shape of the pattern is the same for both work situations. Nonetheless, there are some visible differences. With only momentary exceptions, the conventional workers are marginally more likely to be involved in their work until after 3 p.m. From 3 until a shade after 6 p.m., the percentages are indistinguishable. However, after 6 p.m. and until about 2 a.m. the home-based workers are much more likely to be involved in paid work. For example, at about 8:30 p.m., about 35 per cent of home-based workers are so engaged, twice the percentage of conventional workers. And the ratio remains at about 2:1 throughout the evening.

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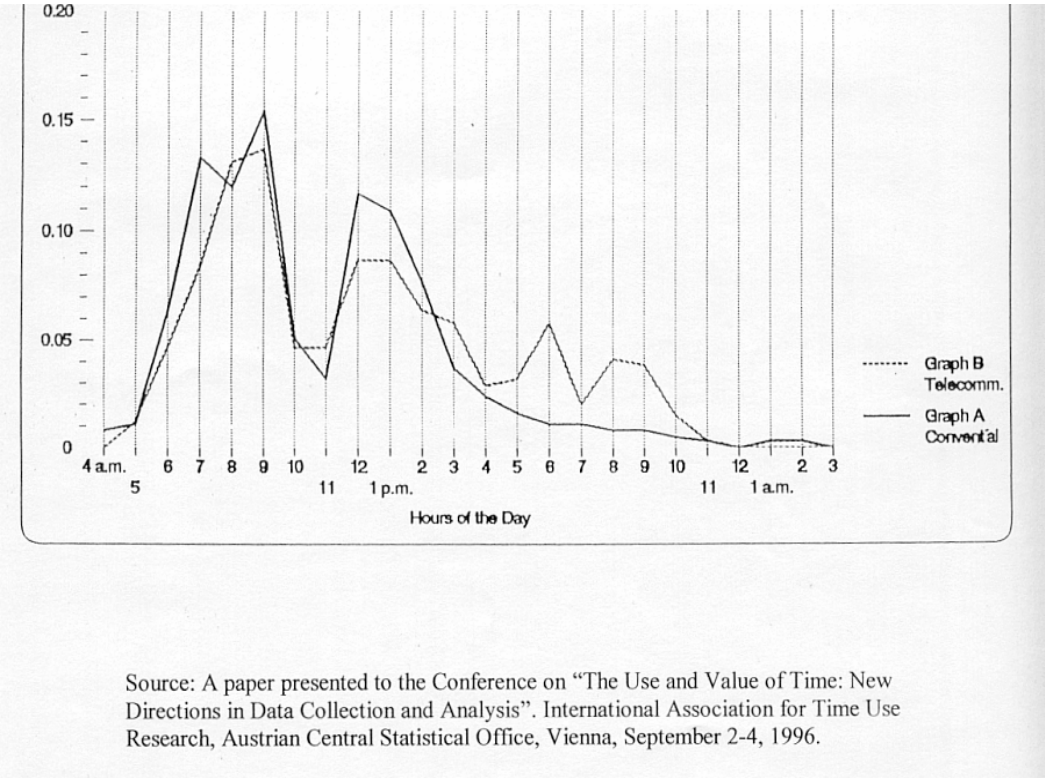
[56] The Multinational Time-Use Study (Szalai 1972) applied this technique to 15 minute periods during the day on such aspects as travel, time with children, and location. This approach appeared in their work to be most informative when the simple percentage of persons in an aspect of time use was used, in contrast to absolute numbers of people or the cumulative percentages of numerous activities. As might be expected, graphs based on 15 minute periods are less smooth and exact than tempograms reflecting each minute.

This general pattern and the differences between home-based and conventional workers parallels closely findings in a study of Swedish national time-use in 1991, gathered by the Swedish Central Statistical Bureau (Michelson 1996).See Figure 7. In that analysis, the graph represented the hourly percentage distribution of the starting time of episodes of paid work. Comparing the two graphs, it is evident that our current method, shown in Figure 6, shows more accurately the duration of times of the day during which paid work occurs. Plotting starting times leads to sharper peaks but not as good an indication of how long typical devotion to work lasts. This is particularly evident in the graphs' depiction of evening time-use, in which Figure 6 suggests a greater continuity of paid work through the evening than does Figure 7. The tempogram for home-based workers follows also the same pattern of 104 American home-based workers studied by Ahrentzen (1990), who plotted the percentage engaged in paid work at half-hour intervals.

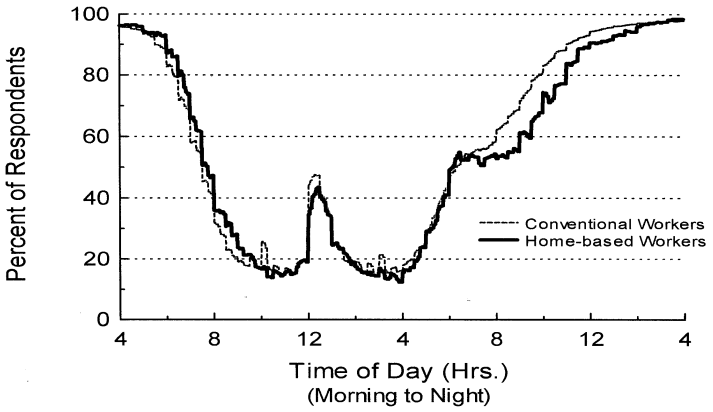
Figure 7 Hourly distribution of starts to regular work episodes: telecommuters vs. conventional workers (in percentage of daily trips by hour)



Source: A paper presented to the Conference on "The Use and Value of Time: New Directions in Data Collection and Analysis". International Association for Time Use Research, Austrian Central Statistical Office, Vienna, September 2-4, 1996.

Figure 8 shows the distribution of time through the day spent on what *self time*, a reduction and combination of activities frequently grouped as personal time and free time. The former includes sleep, personal hygiene, and eating, while the latter includes various active and passive pastimes. In general, this pattern varies inversely with the distribution of time for paid work. Differences between conventional and home-based workers in self time in the evenings are particularly noticeable, just as was the case for paid work in the evenings. Nonetheless, the tradeoffs are not completely identical.

Figure 8 Self time by time of day: home-based vs. conventional workers



N=3864: conventional workers =3469; home-based workers= 395

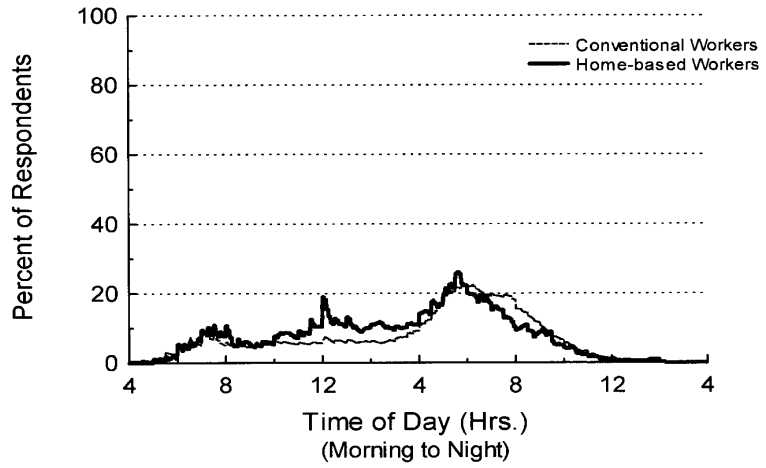
Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Some greater understanding of the lack of a full tradeoff between paid work and self time among the home-based and conventional workers is gained by bringing in consideration of a minor function, at least in terms of participation percentage at any single time. Figure 9 shows that home-based workers exceed conventional workers in domestic work participation nearly every minute during the traditional work day. It is only after about 5 p.m., when the conventional workers arrive home and the home-based workers are more likely to hunker into paid work again (see Figure 6), that the conventional workers start to exceed home-based workers in percentage performance of domestic work.

As might be expected from the literature (c.f. Michelson 1998), Figure 10 shows both the absolute rate of participation and the differences between home-based and conventional workers are greater when analyzing female workers only. Home-based workers do mix paid and domestic work episodes during the workday (as in Figure 2), particularly among the women, even if this does not show up in patterns of modal behavior.

In aggregate, without considering the situation of parents alone, an even smaller percentage of working people is found to participate in child care at any given minute, always less than 10 per cent. The patterns of home-based and conventional workers are essentially similar except within about 7-9 a.m., when it is the home-based workers who are much more likely to be caring for whatever children are on hand. Once again, it is women who are much more likely to be performing child care. When women alone are observed, the home-based workers are much more likely to be participating in child care activities not only between 7 and 9 a.m., but until about 8 p.m. The tempograms clearly show not only the existence of gender role differences in behavior but also when in the day they occur. These graphic representations are shown in Figures 11 and 12.

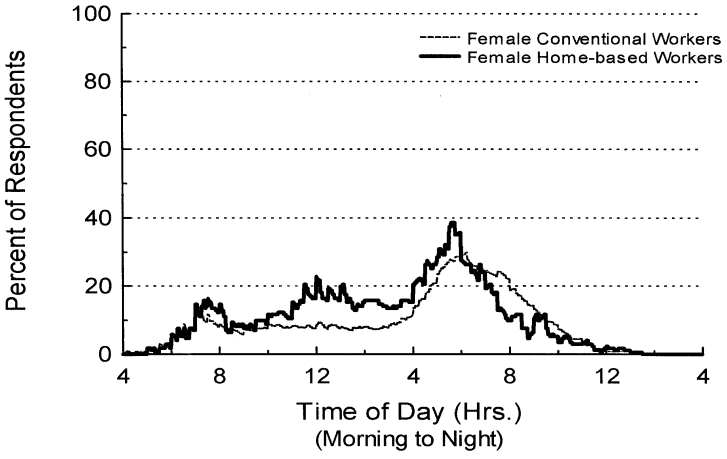
Figure 9 Domestic work by time of day: home-based vs. conventional workers



N=3864: conventional workers = 3469; home-based workers = 395

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

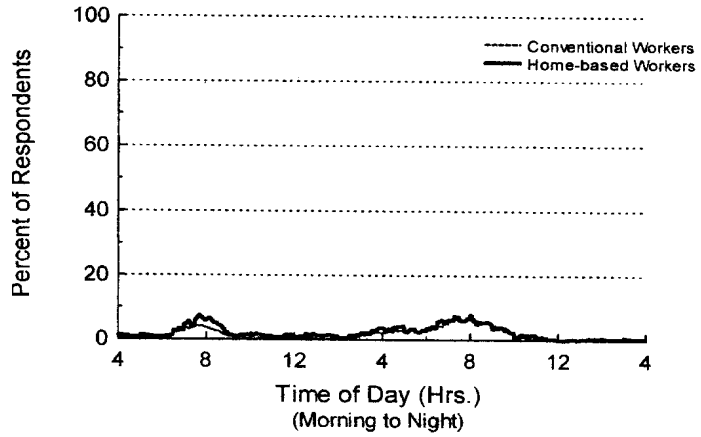
Figure 10 Domestic work by time of day: female home-based vs. conventional workers



N=1806: female conventional workers = 1635; female home-based workers = 171

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

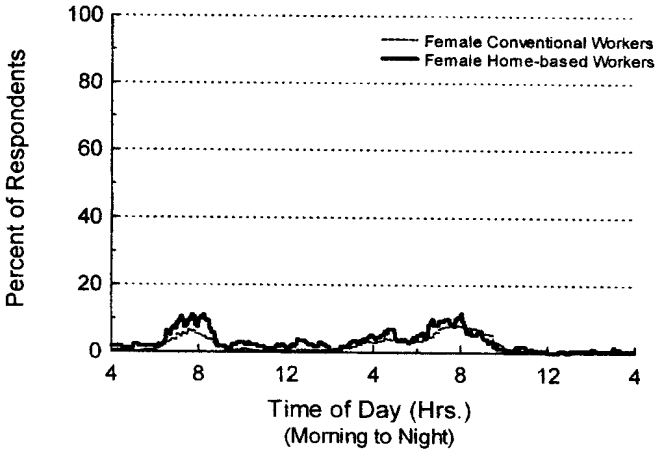
Figure 11 Child care by time of day: home-based vs. conventional workers



N=3864: conventional workers =3469; home-based workers =395

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Figure 12 Child care by time of day: female home-based vs. conventional workers



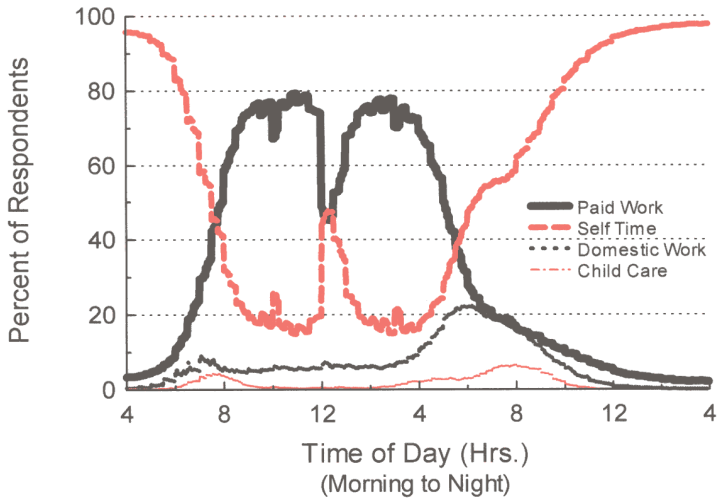
N=1808: female conventional workers =1635; female home-based workers =171

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

In Figures 13 and 14 composite tempograms are presented for conventional and home-based workers, respectively. These composite tempograms enable more of a view of the dynamic relationships of behavioral functions throughout the day in the two analytic subgroups of workers – and more clearly than has been the case in graphs showing composite strata adding up to 100 per cent (c.f. Szalai 1972). The general reciprocity between paid work time and self time is clearly evident for both subgroups. However, the place of domestic work compared to paid work and self time is highly visible in this comparison. Among the conventional workers, the line reflecting participation in domestic work stays distinctly below that of free time throughout the day, but rises to meet the line representing paid work in the early evening. In contrast, among

home-based workers, domestic work encroaches on self-time at several points in the day, particularly in the late afternoon. And domestic time declines to a level well below that which the home-based workers devote in the evening to their paid work.

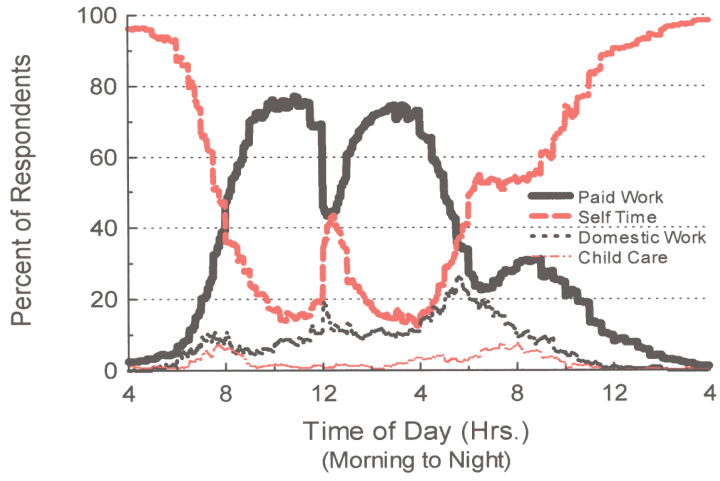
Figure 13 Four functions by time of day: conventional workers



N= 3469

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Figure 14 Four functions by time of day: home-based workers



N=395

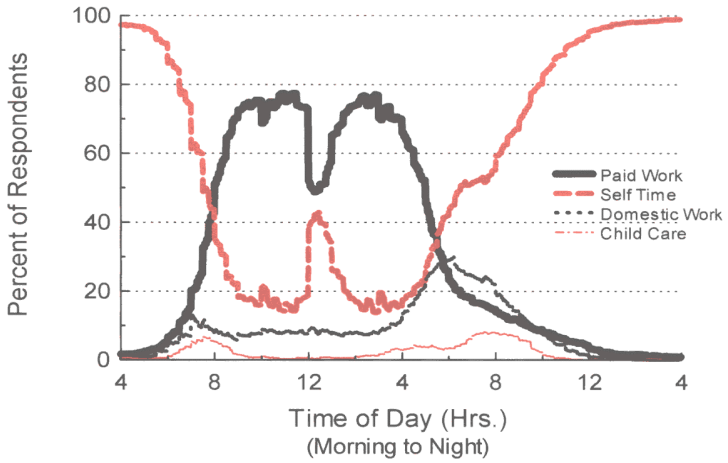
Source : Computed from General Social Survey 12, Statistics Canada, 1998.

The composite tempograms also bring out the special place of gender in explanation. Compare, for example, Figures 13 and 14 with Figures 15 and 16, which depict these phenomena for

women alone. Among female conventional workers, the line showing percentage of participation in domestic work lies closer to that for self-time than is the case for conventional workers as a whole, and it considerably exceeds participation in paid work from about 5 p.m. to 9:30 p.m., unlike the pattern in Figure 13. Among the female home-based workers, participation in domestic work approximates or exceeds self-time during most of the afternoon, as shown in Figure 16. Indeed, domestic work among the female home-based workers exceeds paid work from about 5 p.m. to 7:30 p.m., a pattern which is decidedly not the case in Figure 14, when men are factored in.

These composite tempograms help us understand the temporal meaning of the purely statistical results from a previous study showing that, among home-based workers spending great amounts of time doing their work at home, women, despite enjoying their work as much or more than men, spend less time at it and report more stress in their days (Michelson 1998). Particular parts of the day are cut out for domestic work and child care, regardless of the salience of work in their lives.

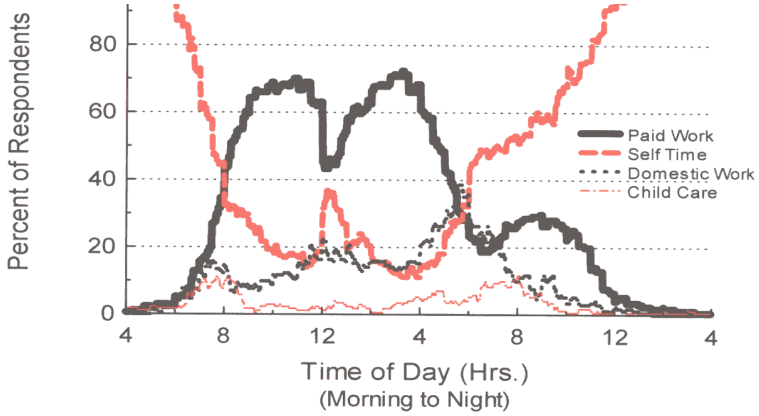
Figure 15 Four functions by time of day: female conventional workers



N= 1635

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Figure 16 Four functions by time of day: female home-based workers



N=171

Source: Computed from General Social Survey 12, Statistics Canada, 1998.

Concluding observations

The analyses and graphic representations in this paper confirm that adaptations to traditional episode-based approaches to analysis and data presentation, intended to display and communicate more easily patterns of time-use (and analytic comparisons), can be extended to large samples in ways that are concise and legible. Furthermore, the plotting of reduced and simplified data by minutes of the day can provide comparisons with enhanced analytic value, because they provide *visual* evidence of potentially differential *patterns* reflecting the interrelations between different components of time-use. However, the contribution to understanding may be brought to a greater degree of specificity if a focus on typical behavior (modes, means, medians) is extended into tempograms and composite tempograms dealing with percentage of participation in a limited number of activity functions minute by minute throughout the day. The tempograms enable a visible understanding not only of how much time is devoted to the dimensions of time but also differential patterns of time distribution throughout the day, within and between analytically pertinent groups. When calculated in terms of percentage participation by the minute, a more exact, complete, and useful picture of human activity is portrayed.

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time-pieces

news on time use research in the
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New developments in time technology – projects, data, computing and services

A BRIEF PROFILE OF THE IATUR COMMUNITY

Kimberly Fisher
IATUR Secretary-Treasurer

The visibility of time use research has grown considerably in recent years. Since 2000, attendance at the annual meetings of the International Association for Time Use Research as well as the number of articles and books using time-related data have greatly expanded compared with previous decades. This research note draws on IATUR records and a survey of the IATUR community in 2003 to profile the people who have registered an interest in the work of IATUR.

Time use studies attract researchers from around the world. Over 300 people from 44 countries (shown in Table 1) are currently registered members of ITUR or have requested to be on the IATUR mailing list. Slightly more than half of these people (52.5%) are women; 47.5% are men.

In March 2003, all people who registered for the 2002 IATUR conference in Lisbon as well as people on the IATUR e-mail list as of 1 March 2003 who did not attend the Portugal conference – 266 people in all - were e-mailed a questionnaire. Half (133 people – 50%) responded. This survey revealed that academics and students account for the largest proportion of time use researchers, though Figure 1 shows that people working at national statistical offices also constitute a significant proportion of the time use community. Time use research also attracts people from international organisations, private research agencies, journalists, and some people who simply have an interest in the subject. Nearly 80% of people who attended the Lisbon conference ranked time use as the key or a main focus of their research (see Figure 2).

For 16.1% of participants, time use was a minor research focus, while 4.5% came out of general interest.

The opportunity to hear other people's time use work attracted more people to the 2002 IATUR conference than other motivations, followed closely by the opportunity for researchers to present their own work to the international time use community. A number of people commented that they found the possibility of learning about the successes and challenges faced by people doing similar work offered inspiration for their own work. Others also reflected on the value of enabling people new to the field to mingle with more established and leading time use researchers. More than forty people commented on the importance of social interactions at IATUR meetings, regularly expressing appreciation of the "open", "friendly", and "low-key" atmosphere where people could find value both in the formal discussions in sessions and also in the informal conversations between sessions and at social events. Possibilities for networking with other time use researchers attracted over 60% of the participants to the 2002 conference, with nearly half also attending to learn more about time use data collection and analysis techniques.

Table 1: Distribution of Time Use Researchers by Country as of February 2004

Number of people with interest in IATUR	Countries where IATUR members and people on the IATUR e-mail list work		
1 to 4	Albania	Israel	**Poland**
	Austria	Korea	**Romania**
	Bulgaria	Latvia	Slovak Republic
	Estonia	Lithuania	**Slovenia**
	Greece	Luxembourg	South Africa
	Hungary	Macedonia	Taiwan
	India	Nigeria	Thailand
	Ireland	**Palestine**	**Turkey**
5 to 9	**Brazil**	Japan	Russia
	Denmark	New Zealand	Sweden
	Italy	Norway	Switzerland
10 to 19	Belgium	Germany	**Portugal**
	Finland	Netherlands	Spain
	France		
20 or more	**Australia**	**United Kingdom**	United States
	Canada		

Figure 1: Time use employment sectors

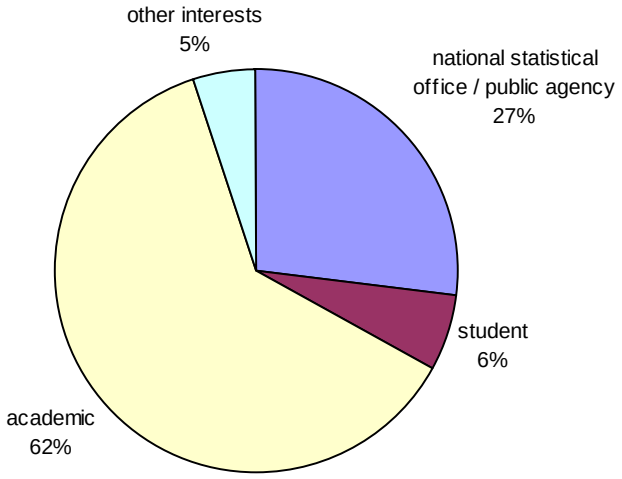
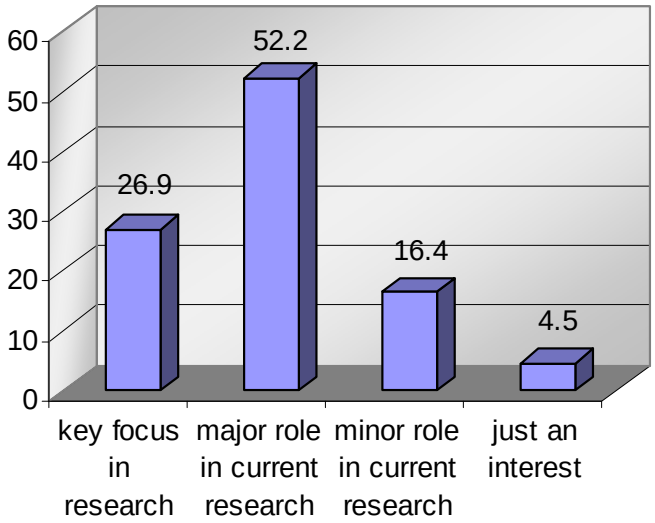


Figure 2: Significance of time use in people's research careers



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MTUS PROGRESS REPORT: THE MULTINATIONAL TIME USE STUDY

Jonathan Gershuny,
Institute for Social and Economic Research (ISER), University of Essex

The UK Economic and Social Research Council (ESRC) has agreed to provide four year funding for a programme of work on time diary materials, "Time-use Studies, Daily Life and Social Change" based at ISER in Essex, and starting in October 2004. The programme includes a range of substantive projects bringing together micro time-use perspectives (studying sequences and aggregates of time-use at the individual level) with macro-perspectives such as time-based social accounting systems, into an integrated account of social change. It will also support work on time diary data resources, enabling among other activities a significant programme of extension and improvement to the Multinational Time Use Study (MTUS).

Highest priority is work on the Harmonised European Time Use Study (HETUS), materials which, despite their name, are at present in need of considerable development before they are suitable for comparative research. Eurostat, which has sponsored HETUS from its inception in the early 1990s, is unable to make the micro-data available to researchers. The MTUS team has made a number of bilateral agreements with national authorities willing to contribute HETUS materials; so far we have consents to add data from Finland, Sweden, Norway, Netherlands, France, UK and Slovenia. We are in negotiation with Denmark, Germany and Italy, and other HETUS contributing countries are cordially invited to join in. Heritage materials from the US are also being revised (under a separate project, funded from a Yale University-based research foundation), so as to provide an appropriate historical comparator for the new American Time Use Study (ATUS) collected by the US Bureau of Labour Statistics and due for release in Summer 2004.

The future MTUS work goes beyond the mere addition of recent datasets. We are also developing a new generation of comparative data files. A new release of WORLD5 data including a number of HETUS studies is expected by late summer, and further studies will be added as they become available. In addition we are developing a new WORLD6 format, that will include, for the first time, the original diary data in an activity sequence form, rather than as totals of time devoted to various sorts of activity, so as to enable use of the full range of time diary evidence (including multiple simultaneous activities, location and co-presence data) for analytic purposes.

The MTUS is currently used by more than 100 researchers and research groups across the world. The new releases will be added to the downloadable materials which can be found on http://iserwww.essex.ac.uk/mtus/, together with full documentation and information on sources and procedures.

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THE 2001/02 GERMAN TIME USE SURVEY - SCIENTIFIC AND PUBLIC USE FILES

Erlend Holz
Federal Statistical Office of Germany

One decade after the first survey in 1991/92, the Federal Statistical Office of Germany conducted a new Time Use Survey in 2001/2002. Again the survey was based on the financial support by the Federal Ministry for Family Affairs, Senior Citizens, Women and Youth (Bundesministerium fuer Familie, Senioren, Frauen und Jugend, BMFSFJ) and was carried out together with the statistical offices of the German ‚Laender'. As it was already the case for the 1991/92 survey the Federal Statistical Office will provide two different sets of 2001/02 German time use microdata. On the one hand a "Scientific Use File" (ScF/SUF) will be made available to scientific institutions in Germany. On the other hand a "Public Use File" (PcF/PUF) will be offered to everyone in Germany and abroad. The Public Use File is a solution how foreign researchers can be given access to the data. The advantage and specific attraction of microdata consist in the diversity of the ways in which they can be analysed. Some examples of research topics are:

- poverty and time use (poverty and wealth reporting, see Kettschau, Hufnagel, Holz 2004),
- household production/valuation of unpaid work, exchange between paid and unpaid work, between household production and market,
- inequality between men and women in daily life (gender statistics / gender analysis),
- volunteer, community work and networks, exchange of informal help between households (social capital analysis),
- working time patterns, new arrangements of working time (incl. telework, working at home),
- social life, physiological recreation and leisure activities including the use of new communication technologies (cultural analysis),
- time use and commitments of families, family life, child care, arrangements to reconcile family and job, intrahousehold division of work,
- time use of special populations like young people, senior citizens etc,
- education / learning in life / lifelong learning,
- mobility,
- time stress and time crunch.

Because of this bulk of topics the Federal Statistical Office was assisted in its analyses by a Scientific Evaluation Council ('Wissenschaftlicher Auswertungsbeirat') whose members worked in most different areas. Their contributions will be published soon (see Statistisches Bundesamt (Ed.), forthcoming 2004). The 2001/02 German Time Use Survey consists of about 5400 households, about 37700 diary days and about 270 activity codes. Its design follows EUROSTAT's Guidelines on Harmonized European Time Use Surveys, HETUS (for European analysis and results see e.g. EUROSTAT 2004). All household members aged 10 years and older were asked to fill out diaries based on 10-minute intervals on three days – two days during the week from Monday to Friday, one day on the weekend. Data were collected on primary and secondary activities, persons involved or present, the location and mode of transport. A wide

range of household and personal data (socio-demographic/economic variables and other background variables) were collected in special questionnaires, too. For more information about the German Time Use Surveys, ordering, prices, schedules etc please contact:

Mr. Erlend Holz, Statistisches Bundesamt, Zweigstelle Bonn (Federal Statistical Office of Germany, Bonn Branch Office), Graurheindorfer Str. 198, 53117 Bonn, Germany,: erlend.holz@destatis.de

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THE GERMAN SOCIO-ECONOMIC PANEL STUDY (SOEP)

The SOEP is a wide-ranging representative longitudinal study of private households. It provides time use data information on all household members, consisting of Germans living in the Old and New German States, Foreigners, and recent Immigrants to Germany. The Panel was started in 1984. In 2002, there were more than 12,000 households, and nearly 24,000 persons sampled.
The time use data include for example normal day time (hours per day), leisure time activity frequencies, and many detailed indicators on working time. Time allocation is one topic. Others include household composition, occupational biographies, employment, earnings, health and satisfaction indicators.
The data are available to researchers in Germany and abroad in SPSS, SAS, Stata, and ASCII format for immediate use. Extensive documentation in English and German (including questionnaires and frequencies) is available online.

Contact: SOEP, DIW Berlin, D-14191 Berlin, Phone: +49 30 89789-292, Fax: +49 30 89789-109, Email: soepmail@diw-berlin.de, Internet: http://www.diw.de/gsoep

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RESEARCH NETWORK ON TIME USE (RNTU)

The objective of the International Research Network on Time Use (RNTU) is to support researchers who are interested in time use with questions and answers considering survey statistics, methods and results of analyses and explanations micro-behavior and macro-impacts as well as policy matters.

We offer an internet information system and network about time use research at our website:
http:/ffb.uni-lueneburg.de/timeuse or http://ffb.uni-lueneburg.de/rntu.

Besides Resources with information about time related institutions, journals, events and data bases, the RNTU Research Safe is the heart of the time use network. The interested user may search for any desired information on his/her topic via an internet query in a relational data base system of who is doing what and more. Our information system offers data concerning the researchers, their subjects and projects, methods, results, references, available literature, suggestions etc.
We kindly ask for your support: Please fill in the RNTU-questionnaire in the internet or connect with us by mailing and help us with further suggestions. Your help is greatly appreciated.

RNTU is a project of the University of Lüneburg and its Research Institute on Professions (FFB) (http://ffb.uni-lueneburg.de) headed by Prof. Dr. Joachim Merz and supported by the German Federal Statistical Office (www.destatis.de). RNTU works together with IATUR, the International Association on Time Use Research (www.iatur.org) and the Time Use Research Program (TURP) at Saint Mary's University in Halifax, Nova Scotia, Canada (Prof. Andrew S. Harvey, Director), in particular, as well as with further organizations and persons.

Co-ordination: Prof. Dr. Joachim Merz, University of Lüneburg, Department of Economics and Social Sciences, Research Institute on Professions (FFB), 21332 Lüneburg, Germany.
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http://ffb.uni-lueneburg.de/timeuse

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Book reviews

by Kimberly Fisher

Baigorri, A. and Fernández, R.,
Botellón: Un Conflicto Postmoderno
(2004)

Publisher: Barcelona: Icaria Editorial
Languages Available: Spanish

This book examines the phenomenon of the botellón, a contemporary custom of youths in Spain to meet in open spaces to drink alcohol, listen to music, and socialise. Not all people living around the locations that young people chose to practice the botellón approve of the behaviour of these young people. This book explores the dimensions of social conflict between the young people and their detractors.

Michael Bittman and Nancy Folbre (Eds.)
Family Time: The Social Organization of Care (2004)

Contributing Authors: Michael Bittman, Michelle Budig, Lyn Craig, Janet Fast, Kimberly Fisher, Nancy Folbre, Anne Gauthier, Duncan Ironmonger, Joe Marchand, Shelly Pacholok, Timothy Smeeding, Cathy Thomson, Judy Wacjman, Douglas Wolf
Publisher: New York/London: Routledge
Languages Available: English

This book presents a collection of essays examining the problems of defining, measuring, and valuing the unpaid informal provision of care to children, working age adults with impairments, and the elderly in private households. Though the authors primarily engage with time use data collected in Australia, Canada, Finland, and the USA, the book also presents analysis of a variety of data sources. Chapters cover both theoretical issues and implications for public policy.

Breedveld, K. and van den Broek, A.
De Meerkeuzemaatschappij
(Multiple Choice Society) (2003)

Publisher: Den Haag: Sociaal en Cultureel Planbureau
Website: http://www.scp.nl/boeken/titels/2003-8/nl/metainfo.htm
Languages Available: Dutch, with an English summary

This book investigates how people in the Netherlands have responded to increasing options for organising their activities during the day arising from changes in economic, political, demographic and cultural conditions through an examination of four topics: opening hours of public services; the location of paid work; the scheduling of child care in daily routines; how time use patterns change as service hours change. The book primarily draws on time use data collected in the Netherlands for four decades, and gives special attention to women's increasing labour market participation and the rising prevalence of information communication technologies.

The book finds that the increasing range of choices open to people in the Netherlands has led to people undertaking more activities and spending more money on activities, but this increase in activity has accompanied a decrease in leisure time. Increasing flexibility in the scheduling of paid an unpaid work has produced some benefits but also entails significant downsides for people in the Netherlands.

Daniel S. Hamermesh and Gerard A. Pfann (Eds.)
How People Use Their Time: Economic Approaches (2004)

Contributing Authors: Namkee Ahn, Patricia Apps, T Bauer, Jens Bonke, René Fahr, Anna Galdeano, Nabanita D. Gupta, Daniel S. Hamermesh, Mike Horrigan, Andrea Ichino, Joyce Jacobsen, Stephen Jenkins, Juan F. Jimeno, Anders Klevmarken, Peter Kooreman, Gerard A, Pfann, Nina Smith, Frank Stafford, Jean Yeung.
Publisher: Amsterdam: Elsevier
Languages Available: English

This book presents selected papers from a conference organised to examine the significance of time use data for economic analysis. The book covers such topics as child care, informal education, gender gaps in wages and use of time, time patterns over the lifecycle, activities of the unemployed, shopping hours, leisure time, the continuous national time use study in the USA, and general methodological issues. The book has an international focus.

Mary Fraire (Ed.)
I Bilanci del Tempo e le Indagini sull'Uso del Tempo: Metodologie di Rilevazione e Analisi Statistica dei Dati Sull'uso del Tempo Umano Giornaliero (2003)

Contributing Authors: C.Facioni, Mary Fraire, S.Gazzelloni, Maria Clelia Romano
Publisher: Roma: CISU Ed.
Languages Available: Italian

This book serves as a handbook for the collection and analysis of time use data for users from academic, public policy, and national statistical agency backgrounds, as well as for those with a general interest in time use. Though the book includes a focus on time use data collected in Italy, it also tracks the development of international time use projects, including IATUR and the Multinational Time Use Study. The book also includes tables of time use results and example programs in SPSS, SPAD, and SAS.

John de Graaf (Ed.)
Take Back Your Time Day: Fighting Overwork and Time Poverty in America (2003)

Contributing Authors: Cecile Andrews, Robert Bernstein, Stephen Bezruchka, Barbara Brandt, Eric Brown, Kirk W. Brown, Barbara Carlson, William Doherty, Carol Eickert, Lori Erickson, Camilla H. Fox, Larry Gaffin, Beverly Goldberg, Lonnie Golden, Anders Hayden, Benjamin Hunnicutt, Tim Kasser, David Korten, Anna Lappé, Sharon Lobel, Paul Loeb, Irene Myers, Karen Nussbaum, Carol Ostrom, Christine Owens, Linda Breen Pierce, Charles Reasons, Vicki Robin, Joe Robinson, Jonathan Rowe, Juliet Schor, Barbara Schramm, Suzanne Schweikert, Jerome Segal, Bob Sessions, Sean Sheehan, Betsy Taylor, David Wann, Rabbi A. Waskow

Publisher: San Francisco: Berrett-Koehler Publishers, Inc.
Website: http://www.timeday.org
Languages Available: English

This collection of essays serves as an organising text for a movement in the United States that seeks to increase the proportion of free time and to decrease the time spent in paid work and consumption. The book includes sections about the dominance of work in the lives of people in the USA and the over-scheduling of family life. The essays then explore the potential health, social, and environmental consequences of these patterns of life. The book concludes with possible solutions that people in the USA might adopt to change their lifestyles.

Jos de Haan, Andries van den Broek, Frank Huysmans, and Koen Breedveld
Tijdverschijnselen. Impressies van de Vrije Tijd (2003)

Publisher: Den Haag, Sociaal en Cultureel Planbureau
Website: http://www.scp.nl/boeken/speciaal/spec21/nl/metainfo.htm
Languages Available: Dutch

This book draws on the extensive regular collection of time use data in the Netherlands over the last four decades to examine changing patterns of cultural consumption and use of information technology in that country.

Eurostat
Time Use at Different Stages of Life - Results from 13 European Countries (2003)

Publisher: Luxembourg: Eurostat
Website: http://europa.eu.int/comm/eurostat/Public/datashop/print-catalogue/EN?catalogue=Eurostat&collection=12-Working%20papers%20and%20studies&product=KS-CC-03-001-__-N-EN
Languages Available: English, French, German

This on-line publication uses the basic tables produced from the Harmonised European Time Use Surveys (HETUS) project to examine differences in daily time use patterns in European countries. These basic tables cover aggregated time spent on an average day in 12 broad categories of activities broken down by sex, employment status, and lifecycle groups. The tables cover both average minutes spent per day and the participation rate for each demographic group in each activity.

Åsa Westermark
Informal Livelihoods: Women´s Biographies and Reflections About Everyday Life: A Time-Geographic Analysis in Urban Colombia (2003)

Publisher: Göteborg, Sweden: Department of Human Economic Geography, Serie B, No 102, Göteborg University
Languages Available: English

The book reports on qualitative work with two female informal-sector workers in Bogata Colombia. The author asked the women to keep time and geographic movement diaries over an extended period. The study reveals the importance of understanding women's daily life circumstances when planning strategies for improving their living conditions.

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Merz, J. and M. Ehling (Eds.), Time Use – Research, Data and Policy (1999)

Contributing Authors: Artemov, V., Artemova, O., Beblo, M., Bediako, G., Chadeau, A., Dellaert, B., Dietrich, H., Dobbelsteen, S., Ehling, M.,Flood, L., Garhammer, M., Gershuny, J., Grasjö, U., Grieco, M., Harvey, A., Hofmann, E., Holz, E., Huq, M., Hynes, T., Juster, Th., Kirsten, D., Klevmarken, A., Kooreman, P., Küster, Chr., Lang, R., Mata, A., Merz, J., Meyer, I., Occelli, S., Pinyopusarek, M., Rydenstam, K., Seel, B., Turner, J., van Soest, A., Vanek, J., Wagenhals, G., Wenke, M., Wilson, C., Wolf, E., Yan, H.
Publisher: Baden-Baden: Nomos
Languages Available: English

This book presents papers from an international conference to provide an actual survey time use on research, their data and their implications for a targeted economic and social policy. Topics from an economic and social sciences perspective included are: formal and informal economy, new working hour arrangements, labour supply, working hour tension, freelance and contract working, paid and unpaid labour supply, women and the family, shadow economy, valueing household production, welfare analysis of extended income, temporal obligations, time poverty, commuting and travel, panelanalyses, microsimulation of tax and benefit changes, international time use data, national accounts and time budgets, leisure, internet-based marketing, sustainable consumption and environmental protection, volunteers and the welfare state …