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Time use and the life course: a study of key events in the lives of men and women using panel data

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Links between gender, activity/travel patterns and the life course have become a significant subject of inquiry in recent years. This paper draws upon a previous study that found that key events in the life course had significant effects on the complexity of trip and activity patterns. Some of these effects differed significantly between men and women. The panel data analysis presented here uses descriptive statistics to illustrate more clearly the patterns of time use before and after key events such as the birth of a child, entry into the labour market, or retirement. Further, regression models of time use changes for employed work, out-of-home leisure, escort, and time spent at home are presented. The data used is the German Mobility Panel (GMP) 1994 to 2014 in which households and their members are asked three times in three successive years to report the trips they made over a week. The results show the gendered effects of various key events on change in time use. Key events in partnership and the family affect women's time use more than men's, while for labour market events it is mostly the other way round.

Keywords: activity pattern, gender, key event, behaviour change, life course, change in time use.

1. Introduction

A new field of inquiry has developed in travel studies over the past decade. This field investigates the effects of key events, transitions, and critical incidents in the life course on activity and travel patterns. A workshop at the IATBR conference in Lucerne in 2003 was an important event in this respect (Lanzendorf, 2003; van der Waerden et al., 2003, and others), but similar ideas were proposed elsewhere around the same time (Klöckner, 2003; Stanbridge et al., 2004), with a focus on residential relocation as one major key event (Krizek, 2003; Scheiner, 2003). The main focus in this research is on changes in mode choice (Bonham and Wilson, 2012; Chatterjee et al., 2013; Scheiner and Holz-Rau, 2013; Clark et al., 2014; Scheiner, 2014b) and/or car ownership (Oakil et al., 2014; Zhang et al., 2014; Clark et al., 2016), while travel distances have received some attention as well (Krizek, 2003; Prillwitz et al., 2007). However, one may well argue that many key events have more obvious effects on activity patterns, and that changes in travel are secondary to activity pattern changes. The effects of key events on time use are, however, rarely studied (for exceptions see Kan and Gershuny, 2009; Sharmeen et al. 2013, 2014; Scheiner, 2014a).

The effects of key events on activity patterns are likely to be gendered in many respects. This is well-known with respect to the birth of a child (Baxter et al., 2008; Kan and Gershuny, 2009; Grunow et al., 2012). Partnership formation and dissolution, and the family cycle in general, have also gained attention (Cunningham, 2007; Baxter et al., 2008; Kan and Gershuny, 2009; Grunow et

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al., 2012; Schober, 2013). There is, however, relatively little direct evidence (e.g., from panel studies) on other key events.

It has also been suggested that women's life courses are more complex than men's as they are often characterised by multiple and changing roles which imply more transitions and diversity in life paths (also called trajectories) (Jackson and Berkowitz, 2005; Elzinga and Liefbroer, 2007; Kan and Gershuny, 2009; Widmer and Ritschard, 2009). On the other hand there has been overwhelming international evidence of convergence between the genders over time in terms of activity patterns (Bianchi et al., 2000; Hook, 2006, 2010; Dex, 2010; Sayer, 2010; Kan et al., 2011; Neilson and Stanfors, 2014).

This paper studies the effects of life course events and mobility changes on time use for employment, leisure, escort, and time spent at home, while various state variables, period effects (year of survey) and path dependencies (baseline behaviour) are taken into account. Throughout, the analysis systematically distinguishes these effects by gender. It thus contributes to the rare literature that links gender, time use and the life course. The paper builds upon a previous paper that studied the effects of key events on complexity in activity patterns and trip chaining, but without clarifying which activities are actually 'responsible' for the changes in complexity (Scheiner, 2014a). The German Mobility Panel (GMP) 1994-2014 is used for the empirical study. The GMP is a nationwide sample in which every household is surveyed three times over a period of three consecutive years.

Germany is commonly considered a conservative (or social capitalist/corporatist) regime in terms of gender relations, similar to France, Belgium, and The Netherlands (Kan et al., 2011; van der Lippe et al., 2011). Germany has some notable incentives for couples to conduct a male-breadwinner-and-female-housewife type of worksharing, including a joint income tax system for couples and a relatively poor provision of public childcare, compared to other countries (Cooke, 2006; Kan et al., 2011). Parental leave regulations are generous (36 months since 1992), but included little financial benefit until 2006 (Geisler and Kreyenfeld, 2012). Female labour force participation rates have increased steadily over time, but with high proportions of part-time work. The gender housework gap is larger in Germany than in many other developed Western countries (Sayer, 2010). In the past few years, Germany has undertaken considerable efforts to expand childcare facilities, and to encourage women into employment and fathers to take paternal leave (Geisler and Kreyenfeld, 2012). Hence Germany has recently experienced a process of rapid change in gender relations. On the other hand, the latest change is a new tax benefit for relatively high-earning lone parents, rather than providing incentives for separated parents to share childcare and family work more equally.

The next section introduces the state of the research. This is followed by a description of the data, the modelling approach and the variables used. Subsequently the results are presented, starting with an overview of cross-sectional figures of time use and associated changes, and followed by regression models of time use changes. The paper closes with some conclusions for further research and policy.

2. State of the research – gendered time use and the life course

2.1 Gendered time use
Empirical studies of gender differences in time use are so numerous that they cannot be reviewed here in detail. Most of these studies compare mean values and proportions of time allocated to different activities between men and women. Many also use regression modelling or other more complex techniques to isolate the impact of gender from other factors. Most often they focus on housework (Bianchi et al., 2000; Hook, 2010; Treas and Drobnic, 2010; Grunow et al., 2012; Mencarini and Sironi, 2012; Aassve et al., 2014). Employed work is often considered simultaneously (McGinnity and Russell, 2008; van der Lippe et al., 2011; Bonke and Jensen, 2012;

Neilson and Stanfors, 2014), while fewer studies consider leisure (Hilbrecht, 2009; Milkie et al., 2009; Anxo et al., 2011). Some studies do not study separate activity categories, but use composite measures of the complexity of overall activity patterns. These are based, e.g., on entropy, fragmentation, or multi-tasking (Bittman and Wajcman, 2000; Gille and Marbach, 2004; Scheiner, 2014a).

The general finding is that there is little gender inequality in terms of total workload including paid (employed, marketed) and unpaid (non-marketed, household/family) work (Gille and Marbach, 2004; Bauer et al., 2007; Kan and Gershuny, 2009; Neilson and Stanfors, 2014). On the other hand, a somewhat higher workload among full-time employed mothers as compared to full-time employed fathers has been found in the US (Milkie et al., 2009). Also, the figures for Italy provided by Neilson and Stanfors (2014) suggest a generally higher workload for women. More distinct differences emerge when paid and unpaid work are considered separately, with men taking on disproportionate shares of paid work and women disproportionate shares of unpaid work.

Gender structures in time use vary with geographical context. Urban areas, particularly those located in proximity to the urban centre, are frequently considered places characterised by modern partnership models with relatively equal gender relations, while suburbia is recognised as a place of more traditional gender structures (Hayden, 2002; de Meester et al., 2007; Ettema and Van der Lippe, 2009; Frank 2011; Hjorthol and Vagane, 2014).

The number and age of children consistently rank among the most striking impact factors of worksharing, with mothers' family obligations increasing with the number of children, and decreasing with the age of the youngest child (Bauer et al., 2007; McGinnity and Russell, 2008; Scheiner, 2013; Neilson and Stanfors, 2014). These findings suggest a link between time use and the life course, although they are based on cross-sectional observations. Other studies also use employment and household variables to provide similar indirect evidence for the gendered effects of the family cycle and the employment biography on time use (Apps and Rees, 2005; Cooke, 2006; de Meester et al., 2007; Cunningham, 2007; Craig and Mullan, 2010; van der Lippe et al., 2011, Anxo et al., 2011; Neilson and Stanfors, 2014; Lyonette and Crompton, 2015).

Besides situational – or social and spatial context – factors, gender attitudes have been found to affect time allocation between couples. E.g., women with traditional role expectations take on a relatively large proportion of household work, while the opposite is true for women with a more positive stance towards gender equity in the Netherlands (Cunningham, 2007; Ettema and Van der Lippe, 2009; Craig and Mullan, 2010, Aassve et al., 2014).

Gender differences in activity patterns have converged over time in various countries around the world, as observed in the Multinational Time Use Study that spans about four decades from the 1960s to the early 2000s (Fisher et al., 2007; Sayer, 2010; Hook, 2010; Kan et al., 2011; Neilson and Stanfors, 2014). Nonetheless, gendered divisions of work still exist around the world (Hook, 2010; Sayer, 2010; Bonke and Jensen, 2012; Schober, 2013; Neilson and Stanfors, 2014; Lyonette and Crompton, 2015).Greater and more persistent inequality has been found for routine housework (such as cooking, cleaning, laundry) than for non-routine work (house and yard maintenance, repairs, paperwork) (Sayer, 2010; Kan et al., 2011).

Gender convergence has also been observed in the distributions of activities over the day and the week. This means that women's temporal distribution of activities over the course of a day is becoming more similar to that of men (Fisher et al., 2007).

2.2 Gendered time use and the life course
As activity patterns are linked to specific life situations (as defined by employment, household structures and other sociodemographic variables), changes in life situation may be expected to result in changes in activity patterns. Due to the lack of life course-oriented studies in a gender context there is relatively little direct evidence for the gendered effects of key events.

Rönka et al. (2003) study what people subjectively consider the most important turning points in their own lives. They find that women consider parenthood, the health problems of close friends or kin, and residential moves as turning points more often than men, whereas men tend to think of occupational events, military service, and changes in their lifestyle . Hence, women appear to be affected more by events related to the family and their social networks, while men are more sensitive to individual and occupational events.

A number of studies focus on partnership formation, separation, and the family cycle. For the UK, Kan and Gershuny (2009) examine intra-couple specialisation in worksharing following partnership formation and the birth of a child, particularly the first child. They suggest that women subsequently accumulate human capital more slowly than men which motivates couples to further specialise worksharing. This is echoed by panel studies from the US (Cunningham, 2007), Germany (Grunow et al., 2012; Schober, 2013) and the UK (Schober, 2013) that show that interruptions in women's employment careers over the family cycle and persistent gender norms are related to a general re-traditionalisation in intra-couple worksharing over time.

Baxter et al. (2008) study the effects of marriage, separation and childbirth on housework in Australia. They find that the gender gap in housework widens when a first or higher-order child is born. Changes in marital status induce less change, but men increase the time they spend on housework after separation. Generally, events related to partnership and the family seem to affect women's housework more than men's.

In a UK study Belot (2009) shows that changes in social networks over the life course are gendered too. She highlights that child-rearing is connected to extended kin and friendship contacts for women, while the opposite is true for men. This may also contribute to gendered human capital development, as women in this stage have fewer links to employed individuals.

Trends in individual life courses are superimposed by trends in the aggregate that may affect either some population groups (e.g., cohorts) or the total population (period effects). Aggregate trends may even be opposed to life course trends. E.g., gender convergence in the aggregate is countered to some extent by re-traditionalisation in couples over the family cycle. In this vein, individualisation theory suggests a trend towards greater complexity, de-standardisation and diversity in life paths (Beck, 1992; Brückner and Mayer, 2005), especially for women (see Jackson and Berkowitz, 2005; Elzinga and Liefbroer, 2007; Widmer and Ritschard, 2009).

While none of these studies is on time use in a strict sense, Sharmeen et al. (2013) study the effects of key events on time use for subsistence, maintenance and leisure activities and related trips, based on data from the Netherlands. Using structural equation modelling, they find various significant effects of events on time use. Sharmeen et al. (2014) add interrelations with social networks. However, the gendering of key events is not studied in either paper.

Scheiner (2014a) studies the effects of key events on changes in entropy in activity patterns in Germany. He finds that entry into the labour market results in increased entropy, for women even more so than for men, while leaving the labour market reduces entropy only for women. Household and access-related key events yield only weak, though significant, effects. He also found changes in car use to be positively associated with changes in entropy.

To sum up, there is overwhelming evidence for gender differences in daily time use. However, most research on gendered activity patterns is static in character. Researchers have only just begun to develop the potential of life course approaches for activity/travel studies, particularly with respect to gender issues. This paper contributes to research by linking these different strands. It studies changes in time use over the life course for various activities from a gender perspective, while taking into account period effects and path dependencies. The literature, and indeed theoretical reasoning, suggest key events may significantly affect time use, with family events being more important for women and occupational events being more important for men.

Associations with spatial context and mobility may also be expected, e.g. in terms of more gender equity in urban than rural contexts.

3. Methods

3.1 Data

The data used is the German Mobility Panel (GMP) 1994 to 2014[2]. The GMP is a household survey with the sample organised in overlapping waves. Every household is surveyed three times over a period of three consecutive years (KIT, 2012), e.g. from 1994-1996, before being excluded from the survey. A trip diary is used to collect information on trips and associated activities at the destination over a whole week from all household members aged ten years or over. Sociodemographic attributes for the household and its members are collected, as are spatial context attributes at the residence and at the household members' places of work or education.

The GMP has a number of advantages over other data sources that suit the purpose of this paper. First, the seven-day record allows activity and trip patterns on the individual level to be detected, while this is not possible with single- or two-day activity/trip diaries. This is because a week represents the typical temporal organisation of daily life. Second, the GMP allows the inclusion of rich information about mobility and access, e.g. to detect associations between time use and car use. Third, the GMP is a long-standing panel survey, thus allowing period effects to be studied.

On the other hand, activity categories are rather coarse, and thus differ from time use diaries. What is more, household income has only been recorded since 2002. Income is thus excluded from this analysis. Education level is used as a rough proxy for income, as education level and income are positively correlated. Coding multiple life course events results in missing values in many cases (see Scheiner, 2011, for details). As life course events are relatively rare events in an individual's life, in cases of uncertainty no event is assumed. The coefficients estimated are thus based on changes among those for whom an event occurred, while some of those for whom no event is assumed may in fact have experienced one. Another limitation is that, as in most other German data, there are no small-scale geocodes available.

The data include a total of 35,655 individual weeks of report. Among these, 17,208 weeks are 'last-time-reports' for which no change to the next year can be detected. For 7,158 (men) and 7,722 (women) weeks complete information (other than that discussed above) is available, and these are used in regression modelling. This sample is composed of 4,352 men and 4,667 women, while for 2,806 men and 3,055 women two observations of change are available (from the first to the second and from the second to the third year of report). Two outliers (from the same person) were excluded from any analysis presented here. This person reported a non-plausible -7,885 minute change in employment, followed by a +7,885 minute change, corresponding to a 19 hour change per day over the full week. All other change values were considered plausible (see descriptives in Table 1).

3.2 Analysis approach

This paper employs regression modelling to study the effects of key events and other variables on changes in the time used for activities. Descriptive analysis illustrates gender differences for a number of key events. Unweighted data are used for regression modelling and any tests of significance to avoid distortions of significance, but weighted data are used for the descriptive analysis to account for biased sociodemographic representations of the population. A significance level of 5 percent is generally used for interpretation, but marginally significant effects ($p<0.10$) are considered where appropriate. The modelling process was started using interaction terms

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[2] The GMP is conducted by the University of Karlsruhe on behalf of the Federal Ministry of Transport, Building and Urban Development (BMVBS). The data are provided for research use by the Clearingstelle Verkehr (www.clearingstelle-verkehr.de).

between gender and any other variable to account for gendered differences in the effects of life circumstances. This resulted in exorbitant multicollinearity in many cases. Therefore separate models are presented for men and women. Over the course of modelling a large number of statistically insignificant variables were excluded in a stepwise process (see Section 3.3).

The data include non-independent (clustered) observations due to the panel survey design used, which violates a basic assumption of statistical analysis. The use of OLS regression may thus result in underestimated standard errors and, hence, overestimated parameter significance (Hedeker et al., 1994). Thus, a cluster-robust estimation based on pooled data is employed. This model controls for autocorrelation within subjects emerging from the temporal order of records. The correlation matrix of within-subject dependencies is thus estimated as part of the model. Similar to OLS, the standard errors may be too small when the number of clusters is finite (Wooldridge, 2003; Nichols and Schaffer, 2007). However, the cluster-robust estimator converges to the true standard error as the number of clusters (not the number of observations) approaches infinity (Kézdi, 2004; Nichols and Schaffer, 2007). Given the large sample and number of clusters (4,352 men, 4,667 women), this issue should not raise serious concern. The SPSS procedure GEE (generalised estimating equations) is used for the analysis. The coefficients reported may simply be interpreted as population average estimates, as in ordinary regression.

Concerning model specification (see Garson, 2010, for details), the autoregressive correlation type is used due to the temporal order of within-subject measurements. This means that values at a given point in time are a function of prior values plus error term. The dependent variables used are continuous in nature, and normal distribution may well be assumed, as a graphical inspection reveals.

There is no determination coefficient available for cluster-robust regression. SPSS reports a quasi-likelihood under independence criterion (QIC) which is an extension of the Akaike Information Criterion (AIC) for repeated measures (Garson, 2010). It is available in a corrected form (QICC) that penalises model complexity and small sample size. QICC works in a 'the smaller the better' form. It is reported for the final models as well as for the intercept models. However, there is no formal test of significance in model improvement available. Hence, for comparison, OLS regressions with a random subsample of one observation per individual are estimated. The R^2 values from the OLS regressions are reported in the results table to judge model fit for readers' convenience.

3.3 Variable definitions

Target variables
The analysis in this paper is on the individual level, and change is calculated as the difference between time use for an activity in a year of observation and the preceding year. A perhaps more conventional approach would be to study time use in a given year of report as a function of time use in the preceding year plus other variables. However, using a direct representation of change has two advantages. Firstly, target variables are symmetrically distributed around zero. Secondly, associations between key events and time use change can be directly tested.

Time use is measured in minutes per week. The time measured covers 89 percent of a week on average (8926 min), excluding time for trips, which covers 6 percent (574 min). The remaining 5 percent reflect missing information (incomplete diaries, days of non-report) for respondents whose diaries are included anyway.

The data allow distinctions to be made between eight activity types: employment, business, education, shopping/errand, leisure, escort, other, and time spent at home. These categories appear relatively rough, but are typical for travel surveys. Specifically, the broad category of leisure does not allow the types of activities that are actually performed to be more closely examined, nor does the employment category permit insights into the multiple activities that may

be undertaken throughout a workday. The same is true for the time spent at home. Escort activities are those linked to trips undertaken to accompany children or other persons (e.g. when the escorting person waits for the return trip while the child practices sports or attends a music lesson).

Regression models are reported for employment, leisure, escort, and time spent at home. The reasoning behind this choice is that escort trips/activities are known to be strongly gendered (Schwanen, 2007; Scheiner, 2013), even though gaps have narrowed over time (see the short review in Sayer, 2010). Employed work and leisure are the most prominent travel purposes and out-of-home activities in terms of kilometres travelled and time spent (for Germany see Follmer et al., 2010). Leisure is strongly gendered in terms of details, i.e. which activities are actually performed, but there is relatively little gender difference in the total amount of leisure time (Bittman and Wajcman, 2000) and trips (Follmer et al., 2010). The models for time spent at home serve as a 'negative representation' of general out-of-home activity level; there is no information about in-home activities. Additional models for business, education, and shopping/errands as well as descriptive before/after figures are available from the author upon request.

Key events and accessibility/mobility changes
This paper looks at time use changes associated with life course events. These events were chosen for testing as they were shown to have significant effects on activity pattern entropy changes in a previous paper (Scheiner, 2014a), and based on theoretical reasoning. They include the following:

- The birth of the first child in a family

- The birth of a further (higher-order) child in a family

- A child moving out of the household

- Household formation with a partner

- Separation from partner

- Entry into the labour market

- Leaving the labour market (not retirement)

- Retirement.

Other change variables reflect changes in spatial/access context or mobility rather than the life course. This includes the following access/mobility variables:

- Gaining a driving license

- Change in the public transport connection to the place of work or education

- Change in the parking situation at the place of work or education

- Change in residential location (upward versus downward in the central place hierarchy)

- Change in driving, calculated as the difference between the share of trips made as a car driver in the report week in a given year and that of the preceding year.

It is acknowledged that change in mode use is not necessarily a cause of change in time use; it may well be the other way round. However, it is worthwhile looking at the associations between mode choice and activity patterns, especially as these associations have been little studied in research on time use. The other four access/mobility variables were excluded from the final regression models, as none of them showed any significant effects here.

For reference reasons descriptive changes in time use among those who experienced no life event from one year to the next are also included in the results. Tables 1 and 2 present an overview of the full set of variables used along with their descriptive statistics.

Table 1. Continuous variables used in regression: descriptive statistics

| | | Men | | | | Women | | | |
	Type*	Min	Max	Mean	SD	Min	Max	Mean	SD
Dependent variables									
Change in time use (minutes/week) for...									
...employment	C	-4,515	4,855	2.8	908.6	-4,818	4,376	12.5	714.6
...leisure	C	-7,909	7,489	-1.8	1,344.7	-8,362	8,338	5.6	1,356.6
...escort	C	-2,478	2,005	-0.7	147.2	-3,040	2,591	-3.8	163.7
...being at home	C	-8,986	7,938	-9.3	1,835.2	-7,404	8,152	-8.0	1,820.9
Independent variables									
No. of children in household...									
... < 10 yrs	B	0	4	0.3	0.6	0	4	0.3	0.6
... 10-13 yrs	B	0	3	0.2	0.4	0	3	0.2	0.4
... 14-17 yrs	B	0	3	0.2	0.4	0	3	0.2	0.4
Age (years)	B	10	92	47.2	18.7	10	96	46.6	18.1
Age, squared, div. by 100	B	1	84.6	25.8	17.2	1	92.2	25.0	16.7
Year of survey (1994=0)	B	0	19	9.5	5.2	0	19	9.3	5.0
Baseline time use (minutes/week) for...									
...employment	B	0	5,511	1,035.7	1,199.5	0	4,891	696.6	959.7
...leisure	B	0	8,429	1,171.4	1,185.4	0	8,455	1,146.9	1,177.1
...escort	B	0	2,478	36.0	113.4	0	3,040	45.0	134.2
...being at home	B	0	10,011	5,566.7	1,568.9	0	10,080	5,837.3	1,579.0
Change in driving (share of driving in all trips)	C	-1	1	0.00	0.23	-1	1	0.00	0.20

* B = baseline variable; C = change variable.

Table 2. Dummy variables used in regression: descriptive statistics

| | | Men | | Women | |
	Type*	N	Percent 'yes'	N	Percent 'yes'
Couple	B	5,511	77.0%	5,331	69.0%
Elementary school qualification without apprenticeship or no qualification	B	887	12.4%	1,171	15.2%
Elementary school qualification plus apprenticeship	B	1,798	25.1%	1,646	21.3%
Secondary school qualification level I	B	1,653	23.1%	2,555	33.1%
University entrance qualification or higher (reference)	B	2,820	39.4%	2,350	30.4%
City size > 500,000 inh	B	1,015	14.2%	1,179	15.3%
Birth of first child	C	42	0.6%	41	0.5%
Birth of further child	C	96	1.3%	94	1.2%
Child moving out	C	145	2.0%	156	2.0%
Household formation with a partner	C	163	2.3%	148	1.9%
Separation from partner	C	96	1.3%	122	1.6%
Finished school or apprenticeship	C	426	6.0%	428	5.5%

Start of apprenticeship	C	59	0.8%	51	0.7%
Entry into labour market	C	207	2.9%	318	4.1%
Change in workplace	C	512	7.2%	499	6.5%
Leaving labour market (no retirement)	C	109	1.5%	198	2.6%
Retirement	C	152	2.1%	237	3.1%
n		7,158	100.0%	7,722	100.0%

All variables are coded as yes=1, no=0. * B = baseline variable; C = change variable.

4. Results

4.1 Before and after a key event: time use changes

In the following, key results concerning the changes induced by key events are presented. The interpretation is sorted by key event and summarises changes in time use as appropriate.

From Table 3 it can be seen that in the total sample there is little change from one year to the next for those who experience no event. These observations meet the expectation that behaviour is robust from one year to the next as long as no event occurs[3].

When a woman gives birth to her first child, time spent on employment strongly decreases, and leisure time increases. This (seeming) increase in leisure may be explained by the fact that taking a stroll or another trip with a baby would not be classified as escorting the baby, but rather as leisure. Time spent at home also decreases strongly, though insignificantly, for women, which supports the idea of extended strolls or time spent outside with the baby.

Men do not exhibit any significant change in time use after the birth of their first child. If change is apparent, they tend to increase time spent on employed work (and business purposes, not included in the table), and decrease their leisure time. Whether one values these insignificant changes or not, the differences between men and women reflect the enormous strength of 'doing gender' processes when a family is formed, which has been referred to as 're-traditionalisation' in worksharing among couples (Kan and Gershuny, 2009; Grunow et al., 2012; Schober, 2013).

Table 3. Time use (minutes per week) according to key events, categorised by gender

			Employ-ment	Leisure	Escort	Time at home	n
Birth of first child	M	before	1,737	1,142	19	4,876	53
		after	1,875	973	20	5,017	53
	W	before	**1,024**	**1,282**	71	5,812	55
		after	**293**	**1,812**	62	5,274	55
	All	before	**1,398**	1,208	43	5,320	108
		after	**1,124**	1,371	40	5,139	108
Birth of further child	M	before	1,518	1,005	47	5,458	98
		after	1,425	930	45	5,545	98
	W	before	**581**	1,081	70	6,210	105
		after	**318**	1,165	76	6,216	105
	All	before	**1,060**	1,042	59	5,825	203

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[3] Non-reported results show that changes in time spent on shopping and education are significant despite their minor magnitude. The decrease in time spent on education is probably because respondents are much more likely to finish than to start school or an apprenticeship while part of the sample. The slight decreases in shopping time may be due to period effects (e.g. replacing daily grocery shopping with weekly shopping, or changing from physical to virtual shopping).

		after	**884**	1,045	60	5,873	203
Child moving out	M	before	1,168	1,062	43	5,275	151
		after	1,215	1,021	26	5,295	151
	W	before	753	1,068	**33**	**5,693**	168
		after	761	1,246	**18**	**5,488**	168
	All	before	950	1,065	**38**	5,494	319
		after	977	1,139	**22**	5,396	319
Entry into labour market	M	before	**577**	1,251	41	**5,979**	237
		after	**1,532**	1,182	42	**5,302**	237
	W	before	**307**	1,215	**66**	**6,230**	358
		after	**1,045**	1,071	**47**	**5,981**	358
	All	before	**420**	1,230	**55**	**6,125**	595
		after	**1,249**	1,118	**45**	**5,697**	595
Leaving labour market (no retirement)	M	before	**1,250**	988	32	**5,457**	124
		after	**275**	1,103	56	**6,248**	124
	W	before	**1,025**	**873**	60	5,995	228
		after	**210**	**1,228**	63	6,138	228
	All	before	**1,115**	**919**	49	**5,780**	352
		after	**236**	**1,178**	60	**6,182**	352
Retirement	M	before	**589**	1,474	42	**5,669**	188
		after	**132**	1,436	43	**6,257**	188
	W	before	**363**	1,121	26	6,054	303
		after	**126**	1,118	25	5,919	303
	All	before	**441**	1,242	32	**5,921**	491
		after	**128**	1,227	31	**6,035**	491
Move to periphery	M	before	1,102	1,115	36	5,423	224
		after	1,153	1,219	36	5,367	224
	W	before	814	1,182	33	5,804	255
		after	728	1,284	31	5,901	255
	All	before	951	1,150	34	5,623	479
		after	930	1,253	33	5,647	479
Move to centre	M	before	867	1,103	30	5,616	215
		after	990	1,099	33	5,724	215
	W	before	**553**	1,023	25	6,007	267
		after	**692**	1,078	36	5,887	267
	All	before	**688**	1,057	28	5,839	482
		after	**821**	1,087	35	5,817	482
No life event experienced	M	before	769	1,327	33	5,729	1,503
		after	733	1,261	32	5,711	1,503
	W	before	444	1,214	35	5,917	1,664
		after	438	1,173	32	5,913	1,664
	All	before	595	1,266	34	5,829	3,167
		after	576	1,214	32	5,819	3,167

M: Men, W: Women. Bold: significant change (5%, two-tailed t-test)

When a higher-order child is born, employed time declines further for women. Time spent at home does not change much either for men or for women, which seems reasonable, given that another child (in most cases an infant) is already there.

When a child moves out of the household, escort time decreases for both parents (but only significantly for mothers). Time spent at home also decreases for mothers, suggesting that the level of time spent out-of-home by women increases when their children leave the parental home.

Entry into the labour market obviously involves more time being spent on employed work. Time at home is strongly reduced, even more so for men than women. For women, entry into the labour market is also associated with a reduction in the time spent for escort purposes. Leisure time is only marginally reduced for both genders.

Leaving the labour market to enter a stage of unemployment (not retirement) strongly decreases employed time. Women increase their out-of-home leisure time, while men strongly increase their time spent at home, suggesting that men and women react distinctly differently to unemployment.

Retiring obviously also reduces employed time. For women these changes are less pronounced as their employed working hours are shorter than men's anyway. Time spent at home increases strongly for men, but not for women. Men also spend more time at home after retiring than women in absolute terms, suggesting that the loss of their major daily routine strongly impairs their out-of-home behaviour.

Residential moves towards a more central location are associated with increases in women's employed time, which supports the idea of more gender equity in cities.

Changes in activity patterns are related to mode choice. Change in driving is positively correlated with change in employed time (r=0.111; all correlations significant at p=0.01), and negatively with leisure (r=-0.096). The link between driving and employment is even more pronounced for women (r=0.144) than for men (r=0.088). This suggests that women may drive more when they have tight time schedules, while men tend to drive anyway.

4.2 Regression analysis: effects of key events on time use changes

The results of multivariate models are presented in the following, sorted by explanatory variable (Tables 4 and 5). I start by looking at state variables effects.

Baseline time use. The strongest state variable effects are those exhibited by baseline time use levels, suggesting marked path dependencies. Decreases in time use for an activity are strongest among those who spend the most time on this activity at the baseline point in time. The contrary also applies. Path dependence is a phenomenon well known in travel studies (Scheiner, 2014a and 2014b; Klinger and Lanzendorf, 2016). The strong negative effects found here indicate that behavioural extremes are likely to converge towards the mean over time.

Having children. It is interesting to note that the presence of children in a household affects changes in time use in many respects, even when the number of children does not change. The time women use for employed work decreases with the number of children they have in the age brackets < 10 years and 10-13 years. Conversely, men's employed time increases over time with the number of smaller children in the household. Out-of-home leisure decreases over time for both genders with the number of children, most pronouncedly when children are small, but for men the effect is almost equally strong when children are aged 10-13 years. Time use for escorting other persons increases with the number of small children, more so for mothers than fathers. Time spent at home strongly increases for mothers with the number of children they have in all age groups, but most for small children. Fathers also increasingly tend to spend more time at home when they have small children, but the effect is less pronounced than for mothers. When they have elder children (14-17 years) fathers tend to be at home less over time, rather than the other way round.

Table 4. Cluster-robust regression models of changes in time used for employment and leisure activities

		Change in...											
		...employment						...leisure					
		Men			Women			Men			Women		
		B	SE	Sig.	B	SE	Sig.	B	SE	Sig.	B	SE	Sig.
Constant		-117.2	78.8	0.14	118.6	58.0	0.04	1,134.3	113.2	0.00	960.2	106.2	0.00
Baseline activity duration	B	-0.33	0.01	0.00	-0.29	0.01	0.00	-0.56	0.02	0.00	-0.56	0.02	0.00
No. of children in household (< 10 yrs)	B	37.6	16.0	0.02	-61.3	12.0	0.00	-72.1	18.9	0.00	-71.0	19.9	0.00
No. of children in household (10-13 yrs)	B	25.2	22.2	0.26	-72.7	14.6	0.00	-63.4	28.1	0.02	-22.7	26.0	0.38
No. of children in household (14-17 yrs)	B	17.6	22.6	0.44	-12.0	17.1	0.48	-4.8	29.4	0.87	-33.3	25.9	0.20
Age	C	35.2	3.2	0.00	18.6	2.2	0.00	-22.4	4.2	0.00	-15.9	4.0	0.00
Age, squared, div. by 100	C	-45.9	3.3	0.00	-27.1	2.2	0.00	23.8	4.2	0.00	17.6	4.2	0.00
Couple	B	16.5	19.4	0.40	-58.5	14.7	0.00	17.7	29.8	0.55	24.4	27.1	0.37
Education level (reference: university entrance qualification or higher) Elementary school qualification without apprenticeship or no qualification	B	-217.0	41.6	0.00	-126.2	25.1	0.00	-75.3	63.8	0.24	-42.6	50.7	0.40
Elementary school qualification plus apprenticeship	B	-4.4	21.7	0.84	-48.7	18.2	0.01	-16.8	33.0	0.61	-4.6	36.8	0.90
Secondary school qualification level I	B	31.2	23.1	0.18	-13.3	17.3	0.44	3.9	32.8	0.91	-35.9	30.7	0.24
City > 500,000 inh	B	-19.7	22.0	0.37	43.0	17.9	0.02	-7.5	35.2	0.83	-47.1	30.4	0.12
Year of survey (1994 = 0)	B	-2.7	1.6	0.08	0.9	1.3	0.50	-0.1	2.5	0.98	1.3	2.5	0.61
Birth of first child	C	127.6	137.5	0.35	-594.7	128.2	0.00	-249.2	185.2	0.18	606.3	249.8	0.02
Birth of further child	C	-98.9	89.9	0.27	-279.6	64.6	0.00	22.7	120.6	0.85	154.3	128.4	0.23
Move out of child	C	22.0	61.1	0.72	86.3	63.7	0.18	-55.4	79.0	0.48	170.4	100.9	0.09
Household formation with partner	C	0.3	66.6	1.00	59.8	62.3	0.34	47.0	92.9	0.61	166.2	99.9	0.10
Separation from partner	C	-78.0	91.1	0.39	59.2	54.3	0.28	133.9	128.2	0.30	-158.2	79.5	0.05
Finished school or apprenticeship	C	40.2	39.2	0.31	70.7	32.5	0.03	-56.9	57.6	0.32	-56.4	62.3	0.37
Start of apprenticeship	C	-521.1	153.6	0.00	-515.4	131.8	0.00	-64.3	126.5	0.61	175.7	217.5	0.42

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Entry into labour market	C	718.9	86.5	0.00	464.9	49.8	0.00	-26.2	86.7	0.76	-3.5	60.1	0.95
Change in place of work or education	C	76.5	45.9	0.10	146.8	41.2	0.00	-17.6	46.7	0.71	50.2	54.3	0.36
Leaving labour market (no retirement)	C	-1,035.0	99.4	0.00	-736.9	59.3	0.00	23.7	109.7	0.83	113.6	83.4	0.17
Retirement	C	-595.3	61.6	0.00	-286.5	40.7	0.00	111.4	103.9	0.28	-40.6	75.5	0.59
Change in driving (share of driving in trips)	C	287.2	54.9	0.00	402.5	46.5	0.00	-477.1	68.9	0.00	-528.9	72.0	0.00
Scale / 10exp3		620			379			1,241			1,287		
QICC / 10exp7		4,424			2,919			8,855			9,906		
QICC / 10exp7 (intercept model)		5,908			3,943			12,942			14,209		
n (observations)		7,158			7,722			7,158			7,722		
R² adjusted (from OLS regressions)		0.262			0.261			0.332			0.293		

B = baseline variable; C = change variable. Change in duration of activity (minutes per week) without time spent for trips.

Table 5. Cluster-robust regression models of changes in time used for escorting other persons and time spent at home

		Change in...											
		...escort						...time at home					
		Men			Women			Men			Women		
		B	SE	Sig.	B	SE	Sig.	B	SE	Sig.	B	SE	Sig.
Constant		-9.3	13.8	0.50	-23.0	10.4	0.03	3,635.5	167.9	0.00	3,138.1	151.4	0.00
Baseline activity duration	B	-0.82	0.02	0.00	-0.92	0.02	0.00	-0.64	0.01	0.00	-0.62	0.01	0.00
No. of children in household (< 10 yrs)	B	9.6	2.2	0.00	49.7	4.0	0.00	75.5	26.1	0.00	286.9	27.9	0.00
No. of children in household (10-13 yrs)	B	0.9	3.3	0.77	-0.4	4.0	0.92	3.4	38.4	0.93	147.3	37.2	0.00
No. of children in household (14-17 yrs)	B	-1.4	3.2	0.66	4.9	2.7	0.07	-104.1	38.6	0.01	134.2	38.9	0.00
Age	C	1.0	0.5	0.06	2.0	0.4	0.00	-10.8	5.8	0.06	13.2	5.5	0.02
Age, squared, div. by 100	C	-0.8	0.5	0.15	-2.0	0.4	0.00	26.4	6.0	0.00	-2.1	5.8	0.72
Couple	B	4.7	3.1	0.13	4.5	2.8	0.11	-111.5	40.4	0.01	-65.2	36.2	0.07
Education level (reference: university entrance qualification or higher)													
Elementary school qualification without apprenticeship or no qualification	B	2.9	8.5	0.73	-12.8	4.2	0.00	176.2	85.3	0.04	38.2	69.6	0.58
Elementary school qualification plus	B	0.1	3.4	0.98	-8.1	4.1	0.05	90.1	44.4	0.04	100.0	49.0	0.04

apprenticeship

Secondary school qualification level I	B	-2.5	3.3	0.44	-3.7	3.7	0.32	23.8	44.4	0.59	89.0	39.7	0.03
City > 500,000 inh	B	-4.8	3.3	0.15	-1.0	3.8	0.80	44.5	49.0	0.36	26.0	43.1	0.55
Year of survey (1994 = 0)	B	0.2	0.3	0.47	0.5	0.2	0.03	-22.5	3.3	0.00	-25.0	3.4	0.00
Birth of first child	C	-1.7	9.3	0.85	13.5	14.9	0.36	27.7	240.4	0.91	-382.6	292.4	0.19
Birth of further child	C	5.6	9.9	0.57	7.0	10.7	0.51	148.3	136.3	0.28	167.3	164.6	0.31
Move out of child	C	-7.7	5.3	0.15	-20.9	3.9	0.00	103.8	120.7	0.39	-275.1	120.1	0.02
Household formation with partner	C	-5.5	6.3	0.38	5.5	13.1	0.67	-182.4	117.5	0.12	-281.2	123.3	0.02
Separation from partner	C	8.2	15.5	0.60	-15.5	8.0	0.05	61.3	139.0	0.66	259.3	108.1	0.02
Finished school or apprenticeship	C	9.1	7.3	0.21	-2.1	3.7	0.58	-7.8	78.9	0.92	7.2	78.9	0.93
Start of apprenticeship	C	20.0	27.0	0.46	-19.1	8.0	0.02	114.8	197.6	0.56	-252.9	204.4	0.22
Entry into labour market	C	15.0	8.8	0.09	-8.2	5.7	0.15	-205.5	119.9	0.09	48.0	82.2	0.56
Change in place of work or education	C	-4.4	4.3	0.30	0.0	6.1	1.00	-112.7	69.6	0.11	-161.3	63.3	0.01
Leaving labour market (no retirement)	C	28.2	14.3	0.05	0.5	7.1	0.94	844.1	159.1	0.00	326.1	112.6	0.00
Retirement	C	18.8	11.2	0.09	-3.5	5.0	0.48	477.4	133.3	0.00	234.9	112.9	0.04
Change in driving (share of driving in trips)	C	24.8	5.6	0.00	20.2	5.6	0.00	373.5	92.4	0.00	244.1	93.8	0.01
Scale / 10exp3		12.4			12.9			2,204			2,245		
QICC / 10exp7		88			100			15,723			17,280		
QICC / 10exp7 (intercept model)		155			207			24,106			25,600		
n (observations)		7,158			7,722			7,158			7,722		
R² adjusted (from OLS regressions)		0.491			0.496			0.375			0.333		

B = baseline variable; C = change variable. Change in duration of activity (minutes per week) without time spent for trips.

While these effects are not associated with any of the key events captured by the data they suggest changes in the time use of parents that are related to the continuous ageing process of their children, and to multiple key events that accompany the maturing of a family and children growing up but that are not captured here, such as learning to cycle, changing school, or developing new leisure activities. The negative coefficients in women's employed time and positive effects on time spent at home suggest a more or less continuous withdrawal into their homes over the course of the family cycle, while men seem to go out more when their children have reached adolescence.

Ageing. As the dependent variables are changes in time use, rather than time use per se, age effects need to be interpreted with care. For instance, the positive effect of age and the negative effect of age squared on change in employed time imply a non-linear, exponential increase in employed time. The increase decelerates from the age of about 35-40 years, but remains positive until retirement age (even taking the negative constant change into account for men). While it may sound amazing that employed time increases until older age, real-life figures would need to be calculated by taking other effects of the family cycle and employment cycle into account. The maximum increase in employed time for women occurs about five years earlier than is the case for men, suggesting that some women drop out of the labour market over their lifetimes.

Escorting shows very pronounced age effects. The women's age curve is considerably more distinct than the men's, reaching a maximum increase around the age of 50. Men reach their maximum increase in time spent escorting only at 65, confirming the well-known observation that they assume less child-escort duties in the family stage. Other observations from Germany suggest that men tend to make longer, car-based escort trips, while women are more responsible for the daily routine escorts typically done on foot (Manz et al., 2015). This may explain why men's escorting increases slowly first, but faster in older age when escorting focuses more on their partner or other persons.

The leisure age gradients are inversely related to employment and escorting, reaching their lowest levels in the mid-forties for both genders. This suggests that daily life is most demanding in mid-life, confirming previous research (Apps and Rees, 2005). The age gradient is more pronounced for men than for women, which is related to men's higher levels of employed time in mid-age. Time spent at home accelerates over the course of life for men more than for women, implying that men overtake women in terms of time spent at home in their mid-age.

Household type. Relative to living alone, living in a couple reduces women's employed time significantly over time, but not men's. This seems to reflect the well-known notion of a re-traditionalisation in worksharing over time in couple households (Grunow et al., 2012). Men living in couples decrease their time spent at home over time, thus becoming more 'out-of-home oriented'. Women in couples exhibit the same trend, but it just fails to reach significance.

Education level. Respondents with lower education levels tend to decrease the time they use for employed work, more than those with university entrance qualifications. The same is true for escort activities, but only among women. Conversely, those with lower education levels increase the time spent at home more than those with higher education levels, although not all effects are significant.

City size. Women living in a large city overproportionally increase their employed time. This is in line with the idea that urban environments are associated with higher levels of female labour force participation, but also indicates that there may be divergence between female employment in large cities and in other municipalities over the life course. This suggests that women in smaller towns and the countryside either drop out of the labour market over their lifetimes more than women in large cities, or – conversely – that those living in large cities increase their employment time more strongly.

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Period effects. These are captured in the year of survey. Time spent on employment decreases for men over the survey period (effect just fails to reach significance). It is important to note that baseline employment duration has been controlled for. Hence, this effect is probably not due to a decrease in full-time employment among men over the study period. Likewise, age has been controlled for and, hence, the effect should not capture demographic ageing effects. It may be due to the postponement of labour market entry in the life course of recent generations which in turn is due to a longer period of adolescence and education (more students). In addition, it seems that increasingly more full-time employees spend less time at their workplace (Konrad, 2015), perhaps because of teleworking. It is noteworthy that no increase over time could be found in the model for business time.

A positive period effect for women can be seen in escorting. This may be due to increasing female car ownership. What is more, escorting children has generally increased over time, contributing to the family work burden of women (Hjorthol, 2008; Konrad, 2015; see also Sayer, 2010, for a short review on time used for childcare over time). Time spent at home shows decreasing period effects for both men and women, suggesting that people spend increasingly more time out-of-home.

I now turn my attention to key events.

Childbirth. The birth of a child strongly alters women's, but not men's activity patterns. This is even more so for the first than for a later child. The first child sharply decreases women's employment, while leisure increases to almost the same extent. There is no information about the character of these leisure activities, but one may well assume that they are to a large extent related to strolling the baby and other parental activities, such as joining parent meetings and attending playgroups. Even though there is much discussion about and observation of fathers caring for children in Germany and other countries, this trend is not reflected in the data.

Child moves out. A child moving out of the family household also affects mothers', but not fathers' time use: mothers' time spent at home and for escorting purposes is reduced significantly. Hence, mothers' out-of-home levels seem to increase towards the end of the family cycle, although increases in their out-of-home leisure time just fail to reach statistical significance.

Couple household formation and dissolution. Household formation and couple dissolution again affect women's time use rather than men's. Women's time spent at home decreases when they form a household with their partner, and increases when a couple separates. Conversely, women tend to increase their out-of-home leisure time when they form a partner household (effect fails to reach significance), and decrease it when a couple separates. This may reflect that women are more prone to joint undertakings while the out-of-home levels of men are more independent. Women also reduce their escort time after the dissolution of a couple household. This suggests that women accompany not just their children's but also their partner's trips.

Finishing school, starting apprenticeship. Starting an apprenticeship strongly reduces time used for employment for both genders, and it decreases the time spent on escort, but only for women. No significant effects on leisure can be detected. Conversely, finishing school or an apprenticeship slightly increases employed time, but the effect is only significant for women.

Entry into labour market. Key events related to the labour market obviously affect employed time, and the effects for men are stronger than for women, reflecting higher levels of part-time employment among women than men. Entry into the labour market obviously increases employed time, while the effects on other activities are insignificant.

Changing the workplace. Among women, changing the workplace is associated with an increase in employed time and a decrease in time spent at home. This may reflect that workplace changes among women tend to be associated with changing from part-time to full-time work, while men tend to work full-time anyway.

Leaving the labour market and retirement. The decreases in employed time induced by leaving the labour market for a stage of unemployment, parental leave or a sabbatical are even stronger than the positive effects of entry into the labour market. This is true for both genders, and it may indicate that some men enter the labour market with a part-time job, while those who leave the labour market are more likely to reduce their working hours from full-time to zero. The number of employed hours is not quite as strongly affected by entry into retirement. This is probably because a considerable number of respondents may have some sort of pre-retirement part-time contract or continue to work on a reduced basis. As for entering the labour market, leaving the labour market affects men's time use more than women's.

Decreases in employed time after leaving the labour market for retirement or another stage are accompanied by more time spent at home, and the effect magnitudes roughly correspond with the employment model. For men, entering a stage of non-employment is also associated with more time spent on escort trips. Interestingly, neither of the two forms of leaving the labour market are associated with increases in out-of-home leisure.

Driving. Changes in driving do not reflect key events, but may be gradual adaptions to changing circumstances or preferences. They are strongly related to activity patterns. More driving goes along with more time spent on employment, less out-of-home leisure, more time used for escort purposes, and – notably – more time spent at home. As noted in the previous section, I do not suggest that these shifts in time use are necessarily an effect of increased driving. Rather it is likely that employment and the need for escort trips increase driving, and the decrease in leisure is an outcome of the increase in obligatory activities. The strongly positive effect of driving on time spent at home suggests that driving tends to save respondents' out-of-home (trip) time for domestic purposes, rather than allowing them to undertake frequent or long out-of-home activities. Note that driving is measured in terms of its share in trips. That is, more driving does not imply more frequent trips or out-of-home activities here, but rather a relative inclination to drive rather than using other modes.

5. Conclusions

This paper has studied changes in time use for various activities over time from a gendered life course perspective. Changes in time use were traced back to life course events and changes in accessibility, transport and spatial context. The paper thus contributes to research by linking the strands of activity/travel pattern and life course research ('mobility biographies') together from a gender perspective, while period effects and path dependencies are taken into account simultaneously.

Regression models suggest that some key occupational and partnership- or family-related key events significantly affect time use, and that the effects differ between men and women. The birth of a child strongly alters women's, but not men's activity patterns, particularly when it is the first child. Specifically, the changes involve decreasing employment and increasing leisure. One may well assume that the latter is to a large extent related to strolling the baby, which may well be classified as caregiving rather than leisure. Other key events in partnership and the family also affect women's time use more than men's, while men are generally more affected by labour market events.

Further, there are the obvious effects on employment of entry into or leaving the labour market. Interestingly, neither of the two forms of leaving the labour market (either into retirement or into unemployment, parental leave or a sabbatical) are associated with increases in out-of-home leisure. Rather, time spent at home increases markedly, for men even more so than for women. This suggests that leaving the labour market is associated with considerable withdrawal into the home for men.

The effects of geographical context are limited, but the few significant associations suggest somewhat more gender equity in urban areas and divergence over the life course in large cities. Given the enormous variety in spatial context – from remote rural to vibrant inner-city areas – the limited nature of differences found here, as well as elsewhere (e.g., Schwanen, 2007) seem worthy of emphasis. This is in line with studies that have found lifestyles in rural and urban areas in Germany to be more similar than they are different (Spellerberg, 2011).

Some variables suggest transitions that are not directly linked to key events captured by the data. Firstly, there are a number of effects in state variables. Most notably, women's time use for employment decreases with the number of children they have, while the opposite is true for men. Out-of-home leisure decreases for both parents with the number of children, while time at home increases. These observations may be related to a number of continuous processes of re-traditionalisation in worksharing plus becoming more 'homey' in a family. Such processes may also be related to ageing, which has strong, non-linear effects on time use in itself, and events in a family that are not captured by travel diary data.

Secondly, increases in driving are linked to increases in employment, escort and time spent at home, but decreases in out-of-home leisure. Thirdly, strong path dependency is reflected in baseline time use effects, suggesting that those who devote most time to an activity are most likely to decrease the time spent for this purpose.

Last but not least, period effects suggest an increase in escorting for women that confirms other research (Konrad, 2015; Hjorthol, 2008), and a decrease in time spent at home for both genders.

Taken overall the analysis presented here provides rich findings on activity patterns affected by key events, ageing processes and period effects in gendered ways. What is more, the results support the well-known picture of women's time use being more affected by family and partnership events than men's (Baxter et al., 2008). This suggests that women either have a weak position in the household when it comes to taking on duties and responsibility in the partnership and family, or that they care more than men for partnership and family for other reasons. The idea of women occupying comparatively weak power positions in couples has been widely discussed, and mostly advocated, in the literature. It is based on a variety of arguments, including women's lack of economic and other resources, limited physical power, and patriarchy as a societal system (Bianchi et al., 2007; Baxter et al., 2008; Kan and Gershuny, 2009; Hook, 2010; Anxo et al., 2011; Aassve et al., 2014). Few researchers advocate the idea that deliberate choice may be the basis for observed gender differences (Hakim, 2000; Konrad, 2015), although sociology has clearly pointed out considerably increasing degrees of freedom in the negotiation of gender roles over recent decades (Beck, 1992).

The extent to which gender differences are based on preference or constraint cannot be addressed here, because the data used do not include information on gender attitudes. Other studies suggest a mix of preference and structure (Cunningham, 2007; Ettema and Van der Lippe, 2009; Craig and Mullan, 2010; Aassve et al., 2014). Interestingly, findings using the same data on mode use in couple households with only one car (Scheiner and Holz-Rau, 2012) suggest that preferences are at play, rather than clearly supporting the notion of women's weak position in intra-household negotiations about the car.

There are various possible directions for future research.

Firstly, this paper made use of the specific qualities of panel trip diary data that capture changes on the individual level, period effects, and associations between activity patterns and mode choice. On the other hand, it suffers from the disadvantages of these data. The lack of detail in activity categories does not allow a closer look at what people actually do between two trips. This particularly refers to the wide variety of leisure activities and time spent at home, but also to the multitude of activities undertaken at the workplace. Hence, linking the advantages of time use data and travel data on a panel basis would be a worthwhile project for the future.

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Secondly, while standardised panel data allow the effects of key events to be detected, they do little to permit interpretation of change when no traceable key event occurs. People change and develop even in the absence of any notable (or measurable) event. Other key events in the life courses of individuals, in partnerships and in families cannot be captured by sociodemographic changes, but are nonetheless likely to affect activity and travel patterns, such as a child doing the family grocery shopping for the first time, an adolescent receiving her first car as a parental gift, or a young person travelling abroad on her own for the first time. The mobility biography approach would gain from a deeper understanding of people's trajectories over time by looking at life courses without narrowing the focus to (sociodemographic) key events.

Thirdly and most importantly, future research should focus on the emergence of gender differences or similarities rather than looking at whether and how the behaviour of men and women is different or similar. The results presented in this paper (and elsewhere) inform gender policies by indicating how activity patterns change over the life courses of men and women. For instance, they trace the processes of the re-traditionalisation of intra-couple worksharing when children are born and grow up. However, in order to develop policies to promote more gender equity, it is of particular importance to ask the extent to which unequal power relations are at play here, or whether rather preference or agreement as an outcome of negotiations between two equal partners is evident. Only in the former case of unequal power relations would there be reason to point to a deficit in sustainability in terms of social inequality. Preference or agreement between two partners on an equal footing would instead indicate that the liberation of both genders is reality, no matter whether women's and men's observed behaviour is similar or different. Inequality is not a good thing from a sustainability perspective, but diversity is.

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