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The gender dimensions of travel time use in Germany

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Abstract

Time use during travel has been the subject of considerable research in recent years thanks to its crucial role in determining the utility of travel time. While most of these studies have documented the effects of demographics and trip characteristics on travel time use, the effect of gender is still ambiguous. To understand the role of gender in travel time use, we explore the effect of gender interaction with non-travel time use behavior (daily habits, multitasking and preferences), joint travel (travel companion), and economic situation (income and working hours) on various time use activities (reading, ICT use and talking) during travel. Moreover, we address the mixed and scant evidence from prior studies regarding the effect of sociodemographic, residential and trip characteristics on travel time use. The study used the cross-sectional German Time Use Survey 2012/13 data and employed multi-level binary logistic regression for analysis. The results indicate four important findings: (1) women's socializing during travel is principally influenced by primary time spent on interaction with children and ICT usage, while men's socializing during travel is positively influenced by traveling with their partners and socializing habits; (2) both women's and men's solitary activities during travel (e.g. reading/ICT use) are influenced by their economic situation (e.g. income, working hours) and daily non-travel time use habits (reading habits/ICT use habits); (3) individuals' solitary time use during travel is positively influenced by other potential determinants such as living in semi-urban areas/East Germany, driving or traveling by public transport; and (4) socializing during travel is positively influenced by living with partners, having young children, evening/night/weekend trips, maintenance/leisure trips, traveling by public transport and walking.

Highlights

- Men's solitary ICT use during travel is driven by their economic situation and preference for ICT use.
- Women's socializing during travel is primarily influenced by their children and preference for ICT use.
- Driving and travel duration positively impact individuals' solitary time use during travel.
- Non-work trips and family attributes positively influence individuals' socializing during travel.

Keywords Travel time use, Gender, ICT use, Reading, Socializing, Urbanity, Time use behavior

1 Introduction

Travel is an integral part of individuals' daily routines and allows them to switch between different life roles. Furthermore, it offers time to multitask various activities and provides an opportunity to personalize the travel space or remain connected with others while traveling [43]. Research finds solitary ICT use is replacing time formerly spent on local social relations, with an adverse effect on

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individual wellbeing [1, 52]. One investigation found that over six years, the availability and use of mobile technologies has doubled the proportion of time spent listening to music, which shows a transition towards personalizing the public space of the railway carriage [57]. As such, individuals' time during travel is invaded either by family members or others for socializing activities or by technology for solitary engagement in activities like reading or listening to music.

Time use is both a cause and consequence of gender inequality [29, 46]. Women's activity patterns are constrained by time and space limits due to their commitments, which include multiple duties like employment, housework, childcare and family care. In contrast, men spend most of their housework time in discretionary activities that can be flexibly scheduled at a convenient time. The overall workload of women exceeds that of men and can lead to work–family balance issues and tension within partnerships aiming for a fair household division of labor. It also generates gender differences in well-being [32]. As such, women might perceive travel as a buffer between employment and taking care of household members.

Travel behavior studies have identified that the gender differences in social and family responsibilities result in men and women displaying different travel patterns. These differences relate to their mode choice decisions, their mobility levels (number of trips, travel distance and time) and their trip purposes. On this note, many studies have found that women more often use public transport to meet their mobility needs, make shorter work trips, undertake frequent family-related trips and drive less than men [33]. From the feminist perspective, gender roles and inequalities have been debated in light of women's social roles, interests and experiences. The unequal distribution of power and resources within families forces women to undertake household responsibilities. Due to such commitments, they are often unable to enjoy their private time. For instance, research has shown that women are less engaged in media use than men, and that their right to use city space to undertake complex household escort trips is more restricted than that of men [22, 81]. Moreover, gender studies on social exchange suggest that women have more social ties and mutually gain from one another through communication. In contrast, men are more likely to spend less time on social or family interactions, as their time is dominated by technology based, solitary engagement with entertainment and information. On this note, a few travel time use studies confirm that women engage in more socializing activities than men, and men undertake more solitary activities during travel [4, 48]. However, various aspects of the role of gender remain unclear.

First, joint travel is identified as individuals traveling with other family members or other individuals and performing joint activities such as chauffeuring children, shopping and family leisure activities. It is the outcome of social/family interaction, cohesion and bonding [87]. Travel time use studies have widely analyzed the effect of joint travel on activities during travel [56, 89], without considering the gender aspect. For gender specific policies on activity travel patterns, it is important to understand the role of gender dimensions in joint travel and its effect on travel time use. This has hardly been addressed elsewhere in the literature. Hence, it remains unclear how men's and women's joint travel (with household or non-household members) influences socializing or solitary activities during travel.

Second, studies have established an association between travelers' economic characteristics and travel time use [48, 74] and found that individuals with higher incomes are more likely to use travel time productively to decrease its potential disutility. Gender-travel studies have consistently pointed out that the differential economic positions of men and women contribute to the gender gap in travel behavior [9, 65]. However, less is known in the travel time use literature about how men's and women's economic situations determine activities during travel.

Third, individuals' time use during travel is connected to their (non-travel) time use habits and preferences. For instance, possessing a multitasking attitude has been seen as an important determinant for travel time use [19, 21]. Gender time use studies have long pointed out that women report more time spent on digital media for socializing [82], multitasking [60] and leisure reading [66] than men. However, there is little information available about how men's and women's daily time use habits and preferences correspond with their activities during travel.

Considering the above limitations, this investigation sought to explore travel time use from a gender perspective using the nationwide representative German Time Use Survey (GTUS) 2012/2013. To this end we, first, constructed four measures (activities while traveling) from the GTUS data: trips with passive activities (doing nothing, sleeping, relaxing), trips with reading (for leisure/work/education), trips with ICT use (listening to music, calling, sending messages), and trips with socializing (talking with others and care-related activities). Second, travel time use by individuals, sub-categorized by gender (men vs. women), was descriptively analyzed to explore whether there are gender differences. Third, using multilevel mixed logistic regression, we explored the effect of gender interaction with joint travel (trip companion), economic situation (income and working hours) and non-travel time use habits and preferences (socializing,

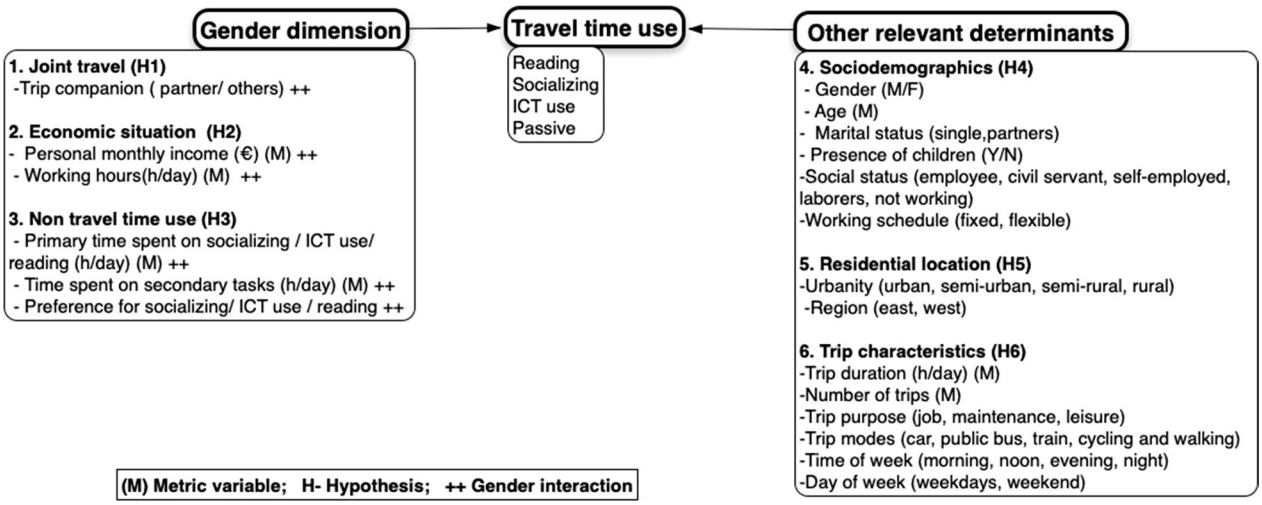

Fig. 1 Conceptual model of travel time use. *Source*: the authors

ICT use, reading habits and interaction with children) along with frequently used determinants of travel time use (demographics, social status, residential location and trip/travel behavior) on various types of time use during travel (reading, ICT use and socializing). To our knowledge, this is the first contribution to the gender and travel time use literature that studies various time use activities during travel, focusing on the effect of social, spatial and travel and non-travel time use behavior, especially in the German context. Moreover, understanding the gender issues in travel time use is crucial for transport planning and policy making processes in order to implement gender-specific efficient and equitable transport policies.

The rest of this article is organized as follows. In the next section, we briefly review previous work on travel time use activities to identify the potential determinants and to develop corresponding hypotheses. In Sect. 3, we describe the methods and data analysis. This is followed by the results and findings in Sect. 4. Finally, in Sect. 5, the paper ends with the conclusion and suggestions for future research directions.

2 Previous research

Several researchers have explored time use during travel, resulting in major advancements in travel time use research [41, 54, 59, 78, 83, 89]. While travel time is considered a disutility in transport appraisal methods, studies suggest that the time during travel can be worthwhile having a positive utility arising from activities performed while travelling. Studies have identified that activities undertaken during travel significantly reduce negative feelings associated with travel, as this allows the time to be used effectively. For instance, Wang and Loo [84] found that a greater use of ICT devices for entertainment is positively associated with pleasant non-work trips, while work-related ICT usage is positively related to reports of pleasant work-related trips. Other studies [14, 37] found that individuals engaging in offline socialising (compared to online socialising) reported pleasant travel experiences. Adding to that, studies emphasize individuals' perception of travel usefulness, whereby they perceive reading for leisure, cycling or sleeping as time spent usefully but driving as wasted time [48, 76]. In the following, we briefly review these studies to identify variables and to construct hypotheses for our analysis (Fig. 1).

2.1 Potential determinants of travel time use

In terms of individual demographics, gender and age remain key determinants of travel-based multitasking [3, 4, 27, 41, 70]. Men use ICT devices more than women [3, 4, 27, 70], while women are more likely to talk and socialize while traveling than men [42, 56, 70]. The difference in attitudes toward technology is linked to the gender gap in technology-related domains. For instance, Cai et al. [8] suggest that men have higher ICT self-efficacy and hold more favorable attitudes toward technology than women. With respect to age, younger travelers are more likely to embrace new technologies and are more influenced by ICT than older cohorts [67, 85]. As such, they tend to engage more in solitary media use (radio/mobile phone) while traveling than older travelers (e.g. [4, 26, 27, 31, 56, 70]. In contrast, older travelers tend to engage in talking with their partners or others during traveling [3, 26, 70]. In addition, those living with partners and those with young children are more likely to socialize during travel [48, 56].

Social status determines mobile media use, where workers tend to engage in more smartphone-related

activities than other non-working groups such as pensioners, students and home keepers [38]. Self-employed individuals and those with flexible working hours have more work autonomy than those who are employed, which allows them to perform more market-oriented work with less travel and engage less in routine work-related tasks during travel [76, 86].

In terms of residential location, urban dwellers tend to undertake shorter domestic trips due to better access to groceries and other facilities [15], while people residing in suburban or rural environments tend to make lengthy trips for leisure or job-related reasons [12, 58]. Connected to this, the sparse research available on the relationship between urbanity and travel time use indicates that individuals from less dense settlement areas tend to do more multitasking than those from highly dense areas [21]. Especially in Germany, regional differences have to be expected. East Germany (compared to West) is characterized by less traditional gender ideologies with both men and women equally involved in full-time work (market and non-market) and with less leisure time [49, 79]. With respect to travel patterns, residents from East (compared to West) Germany make fewer trips, travel longer and use sustainable modes such as public transport, cycling and walking more frequently [86].

Studies of trip characteristics suggest that with longer trip durations (15–30 min), individuals are more likely to perform active activities during travel, e.g., reading for leisure, getting work done for their jobs/education [77]. Focusing on trip purpose, individuals are more likely to relax or socialize with others on maintenance or leisure trips [74], while those traveling for work/study tend to engage in productive activities like sending or reading emails [62]. Regarding travel mode, driving enables passive activities, e.g. listening to audio, while traveling as a passenger enables active activities such as talking or reading [41]. In addition, evening/night or weekend trips allow more socializing activities [27, 62].

2.2 Gender and travel time use

Literature from gender studies claims that women of prime working age are the most penalized due to changes in time allocations for labor market participation, unpaid domestic work and leisure time, while men mostly benefit economically from marriage or parenthood. Recognizing these gender roles in joint travel, travel behavior studies found women make more chauffeuring trips with children than men [72, 75] or joint trips with friends and acquaintances, while men perform more solo trips or joint trips with partners [2, 50]. This is because women are presumed to be caregivers and are more likely to interact with children than their male counterparts [10, 39]. By traveling with others, it is reasonable to assume that women tend to have more social interaction than men during travel, as they have a broader network of friends and acquaintances. Although travel time use studies suggest that joint trips are more prone to multitasking compared to traveling alone, e.g. including socializing or care for others [83, 89], the extent to which gender plays a role in travel time use is less clear.

Research claims that compared to men, women are in a poorer economic situation (part-time work, low incomes), exhibit constrained and complex travel behavior (shorter commutes, a lack of car access, multiple complex trips) and tend to accept locally available job offers [9, 30]. An increase in economic opportunities could improve their quality of life but at the expense of family time, resulting in conflicts between work and family. Travel facilitates both working men and women to balance work and family demands. They can thus optimally allocate tasks during travel to maximize their objectives and to satisfy their needs with limited time. However, in the gender context, it is still unclear how the economic situation determines men's and women's activities during travel.

Individuals' daily habits or behavior are consistent and repetitive in terms of activities and this is often reflected during travel [18]. Studies have identified gender differences in socializing habits, where women spent more time on the family or social interaction (conversation with partners/others, children) than men [61, 64]. Moreover, women are more prone to use media to cope with work and parenting stress, and to overcome boredom or loneliness [64], while men are more likely to use media for information and entertainment [47]. Also, women's daily lives are considerably more turbulent than men's, and have more strained and contaminated leisure time due to interruptions and the combining of leisure time with unpaid work [10, 17, 24]. Moreover, women tend to not only multitask more often than men, but experience more negative effects and stress from multitasking than men [60]. Many travel time use studies suggest that individuals with polychronic attitudes, who tend to spend more time multitasking throughout the day, are more likely to engage in active pursuits during travel [19, 53]. However, due to the lack of data availability on non-travel time use behavior, there is hardly any research that focuses on the association between various aspects of non-travel time use behavior (daily habits, preferences and multitasking behavior) and travel time use, especially from a gender perspective.

2.3 The conceptual model

Drawing upon past and current travel time use studies, we have identified the following research gaps. First, the expanding literature on travel time use in travel behavior

research has extensively focused on productive activities (work and work related) to understand the utility and usefulness of travel, and provides limited understanding of other non-productive activities (leisure reading, listening to music, socializing). Second, we observe that there has been an overemphasis on socioeconomic and trip characteristics, while there is sparse research available regarding residential location. Third, we note that gender has not been explicitly foregrounded in the travel time use literature. It is thus still unclear how men's and women' joint travel, economic factors and non-travel time use behavior influence various activities (reading, ICT use, socializing) during travel. These limitations are mainly due to the non-availability of data that comprehensively includes travel time use and non-travel time use activities. The nationwide representative German Time Use Survey (GTUS) data used in this study provides a complete spectrum of individuals' daily allocation of travel and non-travel activities. To address the research gap to some extent, a conceptual model (see Fig. 1) is proposed that combines gender dimensions and other relevant variables to determine travel time use. The gender dimension includes three main categories: joint travel (trip with partners/others), economic situation (personal monthly income and working hours per day) and non-travel time use (primary time spent on socializing/ICT use/reading per day, time spent on secondary tasks per day and preference for socializing/ICT use/reading). These variables are included as interactions with gender in the model to understand travel time use from a gender perspective. The relevant variables that could potentially influence travel time use are extracted from the existing literature: sociodemographics (gender, age, marital status, presence of children, social status and working schedule), residential location (urbanity and region) and trip characteristics (trip duration per day, number of trips per day, trip purpose, trip modes, time of day and day of the week). These variables are included as main variables without any interaction. We derive the following six key hypotheses from the gender dimension (H1 to H3) and relevant variables (H4 to H6).

First, men's travel (compared to women's) with their partner is primarily motivated by considerations of companionship and/or altruism [73] and family leisure [68]. Women's travel is affected by household responsibilities and care for others. Moreover, compared to men, women are more expressive and share their thoughts and feelings with others [7, 81]. For these reasons, we expect a gender difference regarding joint travel. Thus men traveling with partners are more likely to socialize during travel than women, while women traveling with others are more likely to socialize during travel than men (H1).

Second, as there is general agreement that men do more paid work than women, we expect economic variables (monthly income and working hours) to have a larger effect on male than female respondents, as reflected in interaction effects (H2).

Third, individuals' non-travel time use habits and preferences could be potentially reflected in their activities during travel. Based on this assumption, we expect that non-travel time use habits (primary time spent on socializing/ICT use/reading) and preferences (socializing or media use) predict both men's and women's activities (socializing/ICT use/reading) during travel (H3). Focusing on gender roles, as women are more likely to interact with their children than men, we propose that, compared to men, women's primary time spent on interaction with children is positively associated with socializing during travel (H3a).

Fourth, previous studies found significant association between individuals' time use during travel and sociodemographic characteristics such as age, gender, marital/family status and social status [3, 48, 56]. In this line, we hypothesize that being of male gender, belonging to the younger age groups, being single and having no children, being self-employed and having flexible working hours positively impact solitary reading or ICT use, while being of female gender, living with partners and young children positively determine socializing while traveling (H4).

Fifth, recognizing the geographical (urban–rural) and regional (East–West) differences from the literature, we assume that living in less dense settlements (versus highly dense or urban areas) or East (versus West) Germany is positively associated with travel multitasking (H5).

Finally, individuals' travel time use behavior vary widely by their travel characteristics, also suggested by previous studies [41, 62, 77]. As such, we expect that longer commutes, paid/educational trips, driving and morning or weekday trips are positively associated with solitary activities, while maintenance/leisure trips, evening/weekend trips are positively associated with socializing while traveling (H6).

By exploring these six hypotheses, we believe significant contributions can be made. First, the results of gender related hypotheses (H1, H2, H3) would be of interest to transport policy planners concerned with catering for the differential travel-specific needs of men and women. Such needs vary during travel due to gender differences in roles (joint trips), power (economic situation) and habits (socializing, media use and multitasking). Second, the outcome of the relevant determinant hypotheses (H4, H5, H6) can contribute to transport policy objectives on travel time use by uncovering how individuals' demographic, spatial and travel characteristics shape their time use during travel.

Table 1 Travel time use activities derived from GTUS data

Travel time use activity categories	Activity type	Details
1. Any secondary (n = 27,871/38.87%)		
a. Reading (n = 896/1.25%)	Leisure/productive activities	Leisure reading (82.95%)
		Working (13.49%)
		Studying (3.56%)
b. ICT (n = 16,618/22.74%)	Leisure activities	Listening to music using phone (96.96%)
		Talking/sending messages on phone (2.88%)
		Playing games (0.16%)
c. Socializing (n = 10,671/14.88%)	Leisure/care activities	Talking to others (79.82%)
		Talking to children (15.94%)
		Children and other errands (2.38%)
		Eating and/or drinking (1.86%)
2. No secondary or passive (n = 43,826/61.13%)		Doing nothing (99.54%)
		Time passing by (0.30%)
		Sleeping (0.10%)

3 Methods

3.1 Data

The study uses data from the German Time Use Survey (GTUS), conducted by the Federal Statistical Office in 2012/2013 [25]. The GTUS is a cross-sectional survey, which is repeated every ten years. The data is representative of the German population and comprises the socio-demographics, activity, travel and mode-use patterns of all household members (aged 10 years and older). Like other time use surveys (e.g., UK Time Use Survey, General Social Survey for Canada, American Time User Survey for the US), the respondents self-report the daily activity and travel mode (if applicable) in the activity diary for a continuous 24 h (i.e., from 4:00 to 4:00 a.m. next day) over three random days (two weekdays and one weekend day) with ten-minute intervals.

3.2 Sample setting

As our study focuses on travel time use, we included respondents who made daily trips. A trip here denotes one-way travel with a sequence of one or more stages between two consecutive activities. For our analysis, we included trips of all purposes made by an individual per day. Altogether, our sample comprises 71,697 trips (M:31,199; W:40,498) reported by 8362 respondents (M:3813; F:4549). Each of these trips may or may not have a secondary activity.

3.3 Variables used for the analysis

For our regression analysis, we assumed two variations in travel time use among secondary activities carried out on trips: solitary and socializing. Regarding solitary time use, individuals with busy lifestyles tend to use opportunities to spend time alone for carrying out leisure activities or productive work during travel. For this reason, we chose two solitary active pursuits varied by activity purpose: reading and ICT usage during travel (see Table 1). Reading for leisure or working/studying requires the attention of eyes and mind, while ICT use requires the attention of eyes, mind and ears, and in our study, it is mostly linked to leisure based activities (see Table 1). Concerning socializing time use, individuals engaging in social time are characterized by shared lifestyles, interdependence and mutual interaction. As such, socializing activities, in contrast to solitary activities, are performed with others (partners/children/co-passengers) while traveling. Hence, we include socializing or child care-related activities during travel (family conversations, socializing with friends and others) (see Table 1).

Table 1 provides the trips classified by (secondary) activity performed while traveling, as derived from GTUS data. About 39% of total trips include a secondary activity such as reading (1.2%), ICT use (23%) and socializing (15%), while 61% of total trips do not have any secondary activities (or involve doing nothing while traveling). The trips without secondary activities are those where people do not perform any active activities or engage in passive activities (relaxing/window gazing) while traveling. The outcome variables for our logistic regression analysis are: (1) any secondary activity (vs. no secondary activity) during travel that includes any of the three travel time use activities—reading/ICT use/socializing, (2) reading during travel, (3) ICT use during travel and (4) socializing during travel (see Table 1 for details). Each of these variables was binary.

Using a stepwise regression technique, the explanatory variables comprising a large range of variables were

pruned to 25 (including gender interaction) for the final analysis and were categorized in five groups.

3.3.1 Demographics

Individual and household demographics include four variables: age, gender, marital status and presence of children. The direct information on age is used as a continuous variable. Gender is a dummy variable coded 1 for female and 0 for male. We classified marital status into two categories: singles (widowed or separated or unmarried) and partners (or married or living together). Presence of children is a dummy that indicates if the respondent has children under 18 years of age (the value 1 is associated with presence of children and the value 0 with absence).

3.3.2 Socioeconomic attributes

We used the direct information on personal monthly income and working hours per day (from the personal questionnaire). In addition, we created gender interaction variables for income and working hours. We classified work status into five categories: employee, civil servant, laborer, self-employed and not working (students, the unemployed, retired persons, those permanently unable to work, stay-at-home husbands/wives and those with other reasons for not working). Work schedule is a dummy variable coded 1 for flexible and 0 for fixed. Other socioeconomic attributes, such as education, household income, economic sector, working in shifts and secondary jobs, were excluded due to the lack of significant effects.

3.3.3 Spatial variables

The level of urbanity was classified in line with the categories of the Federal Agency for Building, Urban and Spatial Research (Bundesamt für Bau-, Stadt- und Raumforschung, BBSR): urban or large cities, semi-urban, semi-rural and rural. Regions were classified into East and West Germany.

3.3.4 Trip or travel characteristics

Trip duration was calculated by summing the time spent on each trip stage within a trip. Also, we included the total number of trips per day.[1] We classified trip purpose into three categories: paid work trips, unpaid work trips (errands/shopping/childcare) and leisure trips. Trip modes are grouped into five categories: (1) car, motorbike; (2) public bus; (3) train; (4) cycling; and (5) walking. For travel companions,[2] we generated two variables: time spent on trips with partner per day and time spent on trips with others per day. For time of the day, we used four categories: morning (4–9:50 am), noon (10 am–2:50 pm), evening (3–7:50 pm) and night (8 pm and after) and we classified the days of the week in weekdays (Monday–Friday) and weekend (Saturday–Sunday). The time of day categories are unequal in width to balance the number of observations in each category. Other travel variables, such as commute distance and commute time (due to multicollinearity), were excluded from the analysis.

3.3.5 Non-travel time use behavior

To ascertain socializing/media use behavior, we created four measures from the time use data: primary time spent on socializing per day (for socializing); primary time spent on interaction with children per day (for family interaction); primary time spent on ICT use per day (for ICT) and primary time spent on reading per day (for reading). For multitasking behavior, we generated a metric variable: time spent multitasking (hours per day) from a direct question to respondents concerning what else they did during the episode (coded as the secondary activity). For socializing or media use preferences, we generated two separate variables—preference for socializing and preference for media use—from the open question: "Which activity do you wish you had more time for?" These variables provide direct information about respondents' preferences for socializing or preference for media use versus none (if other activities were preferred). For all time use variables, we included gender interaction variables.

3.4 Analysis

We performed descriptive analysis to examine whether there are gender differences in travel time use activities. We tested the gender differences using independent sample t-tests, paired sample t-tests and chi-square independence tests. Then, we employed multilevel mixed-effects logistic regression to examine the association between travel time use and the explanatory variables listed in Table 1. To understand the association between the activities during travel and various factors, we added four models: any secondary activity, reading, ICT use and socializing for the same sample.

[1] In time use surveys, respondents self-report the travel modes they used for each ten-minute interval. They are not instructed on how to report trips and trip stages. Note that the average number of trip stages was low compared to travel surveys. This may have resulted from missing mode information and/or an underrepresentation of short trips due to the 10-min slots in the survey instrument.

[2] Initially, we included a "travel with children" variable in the models, but later excluded it due to a multicollinearity issue with the variables "traveling with partners" and "having young children".

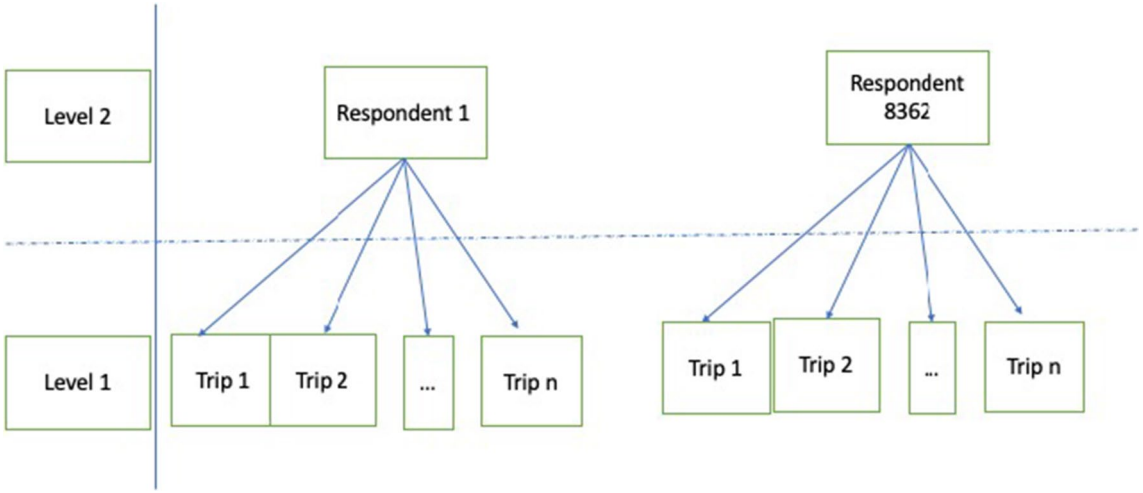

Fig. 2 Multilevel modeling with our data structure (N = 8362 respondents). *Source*: the authors

Our sample structure consists of N trips (trips, level 1) that are nested in K clusters (respondents, level 2). To deal with this unbalanced data (each respondent having an unequal number of trips), multilevel modeling is generally adopted (see Fig. 2). In our model, the fixed effects were measured by the coefficients, while the random part of the model was estimated by variance, which indicates the variation between clusters. For instance, the higher the variance, the larger the variation of the average log-odds between clusters (respondents in our study).

The intra-cluster correlation coefficient (ICC) denotes the percentage of the variance that lies between level-2 units, i.e., within trips per person in our study. The likelihood-ratio test comparing the mixed logistic regression model with ordinary logistic regression is provided and is highly significant for our models. This suggests that there is enough variability between respondents to favor a mixed effect. We checked for multicollinearity among independent variables using the variance inflation factor (VIF). All independent variables included in the model fulfilled the measurement criteria, as the mean VIF value of all variables was 1.26 and maximum VIF was 2.01, which was less than the maximum threshold value of 10. We calculated the following statistics to assess the better fit model: statistics for all models (Akaike information criterion/AIC and Bayesian information criterion/BIC). Model comparison among all multivariable models was based on Akaike's information criterion. Using the forward selection process, the best model was selected using AIC.

4 Results

4.1 Descriptive analysis

The stacked bar diagrams (Fig. 3) compare the time use activities of respondents across various trips (job, maintenance, leisure) for men and women. Within each trip, each stacked bar shows the activity distribution: reading (newspaper/books/magazines), ICT use (talking/playing on phone/listening to the radio/music), socializing (talking/eating/drinking/childcare) and doing nothing (sleeping/gazing/relaxing). Across all trips, women engage more in socializing activities than men, while men engage in ICT based activities more than women (also see Table 2 for details).

More than half of the respondents on all trip purposes do not engage in any activities. Within the activities performed, respondents mostly engage in ICT based activities (M:37%, F:34%) with less socializing (M:5%, F:6%) and reading (M:3%, F:3%) on job trips, while respondents engage more in socializing (M:21%, F:26%) than ICT usage (M:20%, F:18%) on leisure trips. On maintenance trips, respondents engage almost equally in both ICT use (M:24%, F:21%) and socializing (M:17%, F:21%).

Table 2 presents the mean and proportions of the variables used in the logistic regression models. We conducted independent sample t-tests (for mean variables) and chi-square tests (for categorical variables) to examine if there is any relation between gender and variables. Within travel time use activities, the gender gap is significant for ICT use and socializing: men engage more in ICT based activities, while women tend to socialize more than men. In these activities conducted while traveling, the gender gap is consistent with findings concerning the actual gender gap in socializing and media use per day in Germany [6].

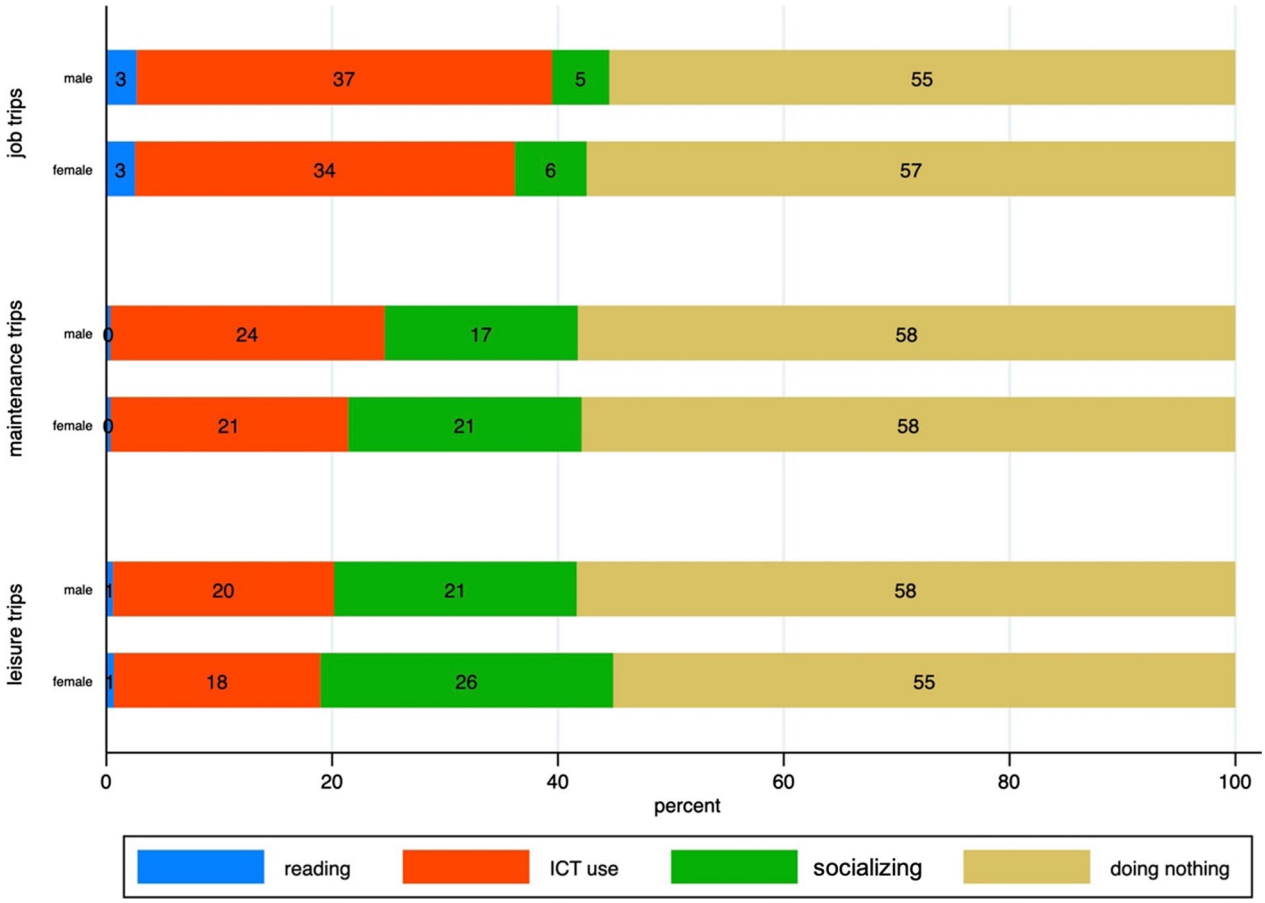

Fig. 3 Trips and travel time use (%)

In terms of socioeconomic attributes, respondents tend to have a larger gender gap in monthly income (€1028 difference) and working hours (3 h/day difference). Regarding working status, both men and women work predominantly as employees (M:33%, F:42%). More men work with flexible working schedules than women.

Regarding trip characteristics, the gender gap is significant in traveling, with men traveling longer than women (0.06 h/day). In contrast, women, on average, perform more trips than men, with a larger proportion of trips for maintenance (39% vs. 29%), while men perform more job trips (32% vs. 23%) and leisure trips (39% vs. 38%) than women. This is in line with many studies [20, 35]. Regarding the proportion of trips by travel modes, men drive (70% vs. 65%) or travel by train (3.8% vs. 3.4%) more often than women, while they travel less by other modes, such as public bus (7 vs. 8%), cycling (7% vs. 8%) and walking (13% vs. 16%), than women. When traveling with companions there is a significant gender gap: men spend more time traveling with their partners than women (0.11 h/day difference), while women spend more time on travel with children (0.11 h/day) and others (0.5 h/day) than men. Men perform more morning trips, while women make more noon/evening trips. Altogether, these findings suggest that women do more maintenance chores (shopping or escort trips) with children, as pointed out by many studies [40, 71].

Considering time use behavior, women, on average, spend more primary time on socializing and reading activities than men, while men spend more primary time on ICT usage than women, which is in line with many studies in Germany [6, 16] There is no significant gender gap in multitasking behavior. The gender gap is prevalent for time use preferences: women prefer socializing (8% vs. 6%) and reading (4.54% vs. 2.54%) than men, while men prefer ICT based activities (3% vs. 2%) more than women.

Overall, the descriptive analysis provides useful information about the relationship between gender and the variables used in the analysis. Men earn more, work longer, perform more ICT related activities while traveling, drive more, undertake more paid and leisure trips, spend more primary time in ICT related activities and prefer ICT use. In contrast, women do more socializing

Table 2 Descriptive statistics of variables used in the analysis

	Mean (SD)		Gap (M-F)	%		Chi square
	Male	Female		Male	Female	
	(1)	(2)	(3)	(4)	(5)	(6)
Outcome variables						
Travel multitasking (any secondary = 1)				39.02	38.76	
1. Reading (= 1)				1.25	1.23	*
2. ICT use (listening to music/talking on the phone = 1)				24.57	20.91	***
3. Socializing and care (conversing with children/others) = 1				12.79	16.22	***
Demographics						
[a]Age: m(s.d)	47.28 (15.54)	45.37 (14.29)	+***			
[b]Gender: M = 0 (%)				43.60	-	
F = 1 (%)				-	56.40	
[b]Marital status: Singles (%)				60.53	50.84	***
Partners (%)				39.47	49.16	
[b]Young child (< 18 years): No (%)				55.64	50.94	***
Yes (%)				44.36	49.06	
Socioeconomic						
[a]Personal monthly income (€/month): m (s.d)	2279.64 (1286.77)	1251.34 (822.04)	+***			
[a]Working hours (h/day): m (s.d)	7.81 (2.28)	5.27 (2.63)	+***			
[b]Social status: self-employed (%)				11.67	5.56	***
Social status: civil servant (%)				9.07	6.76	
Social status: employee (%)				32.96	42.55	
Social status: laborer (%)				15.35	4.99	
Social status: not working (%)				30.94	40.14	
[b]Flexible working hours = yes (%)				55.76	46.76	***
Residential location						
[b]Urbanity: urban (%)				27.67	28.92	**
Semi-urban (%)				41.28	41.13	
Semi-rural (%)				17.87	16.90	
Rural (%)				13.18	13.04	
[b]Region: West (%)				78.49	78.70	
East (%)				21.51	21.30	
Trip characteristics						
[a]Trip duration (h/day): m (s.d)	0.46 (0.35)	0.40 (0.30)	+***			
[a]Number of trips per day: m (s.d)	3.41 (1.94)	3.63 (2.09)	−***			
[b]Trip purpose = job/education (%)				31.68	23.38	***
Maintenance (%)				29.23	38.77	
Leisure (%)				39.09	37.85	
[b] Trip mode = car (%)				69.68	65.31	***
Public bus (%)				6.51	7.47	
Train (%)				3.79	3.43	
Cycle (%)				7.32	8.16	
Walk (%)				12.70	15.63	
[a]Travel with partner (h/day): m (s.d)	0.51 (1.19)	0.40 (1.09)	+***			
[a]Travel with children (h/day): m (s.d)	0.13 (0.56)	0.24 (0.68)	− ***			
[a]Travel with others (h/day): m (s.d)	0.21 (0.77)	0.26 (0.85)	− ***			
[b]Time of the day: morning (%)				23.07	21.87	***
Noon (%)				28.02	33.15	
Evening (%)				32.41	31.03	
Right (%)				16.50	13.95	

Table 2 (continued)

	Mean (SD)		Gap (M-F)	%		Chi square
	Male	Female		Male	Female	
	(1)	(2)	(3)	(4)	(5)	(6)
[b]Day of the week: weekday (Mon-Fri) (%)				71.16	73.05	***
Weekend (Sat-Sun) (%)				28.84	26.95	*
Non-travel time use behavior						
[a]Time spent on primary social interaction (h/day): m (s.d)	0.51 (1.00)	0.54 (0.94)	− ***			
[a]Time spent on primary ICT use (h/day): m (s.d)	0.06 (0.33)	0.04 (0.23)	+ ***			
[a]Time spent on primary reading (h/day): m (s.d)	0.40 (0.72)	0.45 (0.70)	− ***			
[a]Any secondary activities (h/day): m (s.d)	2.51 (2.69)	2.52 (2.59)	−*			
[b]Preference for social interaction (= 1): (%)				6.14	8.31	***
[b]Preference for ICT use (= 1): (%)				3.46	1.59	***
[b]Preference for reading (= 1): (%)				2.54	4.54	***
N (trips)	**31,199**	**40,498**		**31,199**	**40,498**	
N (respondents)	**3813**	**4549**		**3813**	**4549**	

Values in bold are significant: *** $p < 0.001$, ** $p < 0.01$, and * $p < 0.05$; [a]2-tailed t-test; [b] Chi-square independence test (χ^2); gender gap + M > F and -M < F; Source: authors' calculations

or reading activities while traveling, perform more maintenance trips, travel with children/others, spend more primary time socializing/reading and prefer socializing/reading activities. In the following section, we discuss the results of the mixed logistic regression analysis to explore further the effects of diverse factors on various travel time use activities.

4.2 Regression analysis

We estimated four models to assess various types of travel time use: any secondary activity, reading, ICT use and socializing (see Table 3, models m1 to m4). Across models, m4 (which has the lowest AIC and BIC values) fits the data somewhat better than other models, indicating a better explanation of variables used in this study on socializing while traveling. Significant associations are discussed below.

4.2.1 Gender interaction and travel time use

Travel companions positively determine socializing, which is in line with previous studies [41, 83]. Regarding gender effect, when traveling with partners, men and women were both more likely to report socializing, but the association was stronger for men than for women (in line with H1). This finding suggests that compared to women, men traveling with partners are more likely to carry out socializing activities (and are less likely to engage in solitary ICT usage) while traveling. The effect is similar for men traveling with others (also for women) (partly in line with H1).

Of economic factors, income and working hours have strong positive effects on men's solitary reading and ICT use (in line with H2). For women, income has a similar effect on ICT usage with lesser magnitude. In contrast, working hours are significantly negative for men's (also women's) socializing (in line with H2). This suggests that high-income men are more likely to personalize their public travel space for work-related tasks due to time constraints.

Regarding non-travel time use, primary time spent on social interaction is positively associated with men's and women's socializing during travel (in line with H3) and is negatively associated with women's ICT usage during travel. These findings suggest that both men and women are more likely to socialize when they are characterized by socializing behavior. Also, primary time spent on ICT use is positively associated with men's, but possibly not women's ICT use during travel (in line with H3), although the interaction term is insignificant and, thus, this interpretation needs to be treated with care. Primary time spent on ICT use has a significant negative effect on women's but not men's socializing. Time spent on primary interaction with children is positive for women's socializing during travel, while it is highly negative for men's socializing during travel (in line with H3a).

Focusing on multitasking behavior, time spent on secondary activities is positively associated with men's (also women's) ICT use and socializing during travel (in line with H3), which suggests that polychronic attitudes are reflected in both men's and women's travel time use. A preference for social interaction has a significant positive effect on women's ICT use, but it has a strong negative effect on reading—possibly more so for men than women, but note that the interaction term is insignificant. As expected, preference for digital media

Table 3 Multilevel mixed logistics regression analysis for travel time use activities

	(m1)	(m2)	(m3)	(m4)
Activities during travel	**Any secondary = yes**	**Reading = yes**	**ICT use = yes**	**Socializing = yes**
Variables	**Coef**	**Coef**	**Coef**	**Coef**
1. Joint travel				
Travel with partners	**0.076****	0.021	**− 0.171*****	**0.206*****
Female * Travel with partners	− 0.021	0.178	0.026	**−0.065***
Travel with others	0.022	− 0.177	**− 0.137****	**0.091****
Female * Travel with others	− 0.027	0.254	0.006	− 0.014
2. Economic factors				
Monthly income (€)	**0.167*****	**0.383*****	**0.182*****	0.021
Female*Monthly income (€)	− 0.024	0.053	**− 0.038***	0.012
Working hours (h/day)	**0.026*****	**0.157*****	**0.031*****	**− 0.036*****
Female *Working hours (h/day)	− 0.015	0.043	0.006	− 0.004
3. Non-travel time use behavior				
Time spent on primary social interaction (h/day)	0.033	− 0.101	− 0.015	**0.056***
Female * Time spent on primary social interaction (h/day)	− 0.053	0.261	**− 0.067***	− 0.018
Time spent on primary child interaction (h/day)	− 0.311	0.815	0.173	**− 0.634***
Female * Time spent on primary child interaction (h/day)	0.201	0.035	− 0.473^{+}	**0.752***
Time spent on primary ICT use (h/day)	0.148^{+}	0.002	**0.207***	− 0.030
Female * Time spent on primary ICT use (h/day)	**− 0.326***	− 0.126	− 0.209	**− 0.224***
Time spent on primary reading (h/day)	− 0.027	**0.362***	− 0.016	− 0.021
Female * Time spent on primary reading (h/day)	**0.112***	0.055	0.061	0.085
Time spent on secondary activities (h/day)	**0.113*****	− 0.015	**0.066*****	**0.144*****
Female * Time spent on secondary activities (h/day)	− 0.010	0.003	− 0.011	− 0.019
Preference for social interaction = yes	− 0.198	**− 1.288***	− 0.186	0.109
Female * Preference for social interaction	**0.314***	0.815	**0.348***	0.013
Preference for ICT based activities = yes	**0.481****	− 0.545	**0.398***	0.272
Female * Preference for ICT based activities	− 0.248	− 0.115	− 0.355	**0.113***
4. Sociodemographic				
Age	**− 0.035*****	− 0.007	**− 0.038*****	**− 0.015*****
Gender = female	**0.313***	− 0.138	0.035	**0.364****
Living with partners = yes	0.038	0.291	− 0.151^{+}	**0.198****
Young children = yes	0.055	**− 0.418***	− 0.093	**0.270*****
Social status = self employed	**− 0.385*****	− 0.305	**− 0.499*****	0.004
Social status = civil servant	− 0.029	0.078	− 0.177	**0.172***
Social status = laborer	0.086	**− 0.941***	0.093	0.063
Social status = not working	0.106	0.258	− 0.083	**0.226****
Flexible work hours = yes	**0.123***	**0.672*****	0.047	0.056
5. Residential location				
Urbanity = urban (ref.)				
Urbanity = semiurban	0.022	− 0.222	**0.183***	− 0.065
Urbanity = semirural	**− 0.187***	− 0.453^{+}	− 0.044	− 0.144^{+}
Urbanity = rural	− 0.066	− 0.009	− 0.030	− 0.052
Region = West (ref.)				
Region = East	**0.208****	0.249	**0.316*****	0.079
6. Trip behavior				
Trip duration (h/day)	**0.554*****	**0.219****	**0.395*****	**0.228*****
Number of trips per day	**0.048*****	**0.140*****	**0.058*****	0.009
Trip purpose = paid/education (ref.)				
Trip purpose = unpaid	**− 0.160*****	− 0.080	**− 0.923*****	**1.198*****

Table 3 (continued)

Activities during travel	(m1) Any secondary = yes	(m2) Reading = yes	(m3) ICT use = yes	(m4) Socializing = yes
Variables	**Coef**	**Coef**	**Coef**	**Coef**
Trip purpose = leisure	**− 0.080***	**0.401***	**− 1.044*****	**1.343*****
Tripmode = cycle (ref.)				
Tripmode = car	**3.205*****	**− 0.914****	**4.399*****	**1.075*****
Tripmode = bus	**1.972*****	**3.637*****	**1.976*****	**0.946*****
Tripmode = train	**2.466*****	**4.814*****	**1.719*****	**1.306*****
Tripmode = walk	**1.523*****	0.599	**0.668*****	**1.209*****
Time of day = noon (ref.)				
Time of day = morning	0.063^{+}	**− 0.435****	0.014	0.008
Time of day = evening	**− 0.103****	**− 0.968*****	**− 0.228*****	**0.157*****
Time of day = night	**− 0.148*****	**− 1.400*****	**− 0.332*****	**0.223*****
Day of the week (ref. weekdays)	− 0.030	**− 0.668****	**− 0.206*****	**0.159*****
Constant	**− 3.041*****	**− 9.153*****	**− 4.032*****	**− 4.959*****
var(_cons[id_persx])	**3.494*****	**4.480*****	**4.545*****	**1.769*****
N (trips)	71,697	71,697	71,697	71,697
N (respondents)	8362	8362	8362	8362
ICC	0.52	0.57	0.58	0.35
AIC	52,352.608	4445.039	40,823.025	35,670.046
BIC	52,785.277	4878.230	41,256.216	36,103.238

Values in bold are significant: *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$; *Source*: authors' calculations

use is positively associated with men's ICT use (in line with H3) (again the interaction is not significant), which indicates a link between activity preference and activity participation.

4.2.2 Other determinants of travel time use

In addition to the role of gender effects, our study confirms the effect of other potential independent variables on travel time use.

Being female (compared to male) positively determines socializing (in line with H4). Also there is a significant negative relationship between female gender and solitary ICT use. Increase in age is negatively associated with travel time use activities such as ICT use and socializing. Household demographics (living with partners, having young children) are positively associated with socializing, but living with partners negatively predicts solitary ICT use (in line with H4). These findings indicate that women, those living with partners and those with young children are more likely to socialize, while in contrast men and young age groups are more likely to engage in solitary ICT use. These findings on individual demographics are consistent with the findings from previous research [4, 27, 43].

Compared to employees, self-employed individuals are less likely to engage in solitary ICT use. Laborers (compared to employees) are less likely to engage in solitary reading. This is perhaps connected to the fact that laborers (both skilled/unskilled) have lower wages and less education than employees. Civil servants are more likely to socialize during travel, which may possibly be linked to the nature of their jobs (e.g. teaching, government bureaucrats), where they are involved in socializing with others. Also, having flexible working schedules positively determines reading (in line with H4). These findings suggest that work autonomy plays a significant role in the performing of less routine tasks (like ICT use), as pointed out by Singleton [77], and more knowledge work (like reading for leisure/work), as suggested by Holley et al. [36].

Living in semi-urban areas (compared to urban) is positively associated with solitary ICT use (partly in line with H5). However, the relationship remains insignificant for other time use activities. Regarding regional aspects, living in East (vs. West) Germany is positively correlated with solitary ICT use (in line with H5). The findings on residential location (i.e. the positive effect of living in semi-urban areas on solitary ICT use) suggest that forced mobility and active lifestyles in semi-urban areas drive individuals to travel longer to meet their daily needs, which in turn further increases solitary ICT use. In particular, the regional difference suggests individuals from East Germany (compared to West) tend to travel longer

and use public transport more, as pointed out by Kley [45].

Trip duration is positively associated with active activities like reading, ICT use and socializing (partly in line with H6). Number of trips is positively associated with reading and ICT use. In particular, maintenance/leisure trips (compared to job/education trips) are negatively associated with reading and media use but positively related to socializing (in line with H6). This indicates that solitary activities are more probable during job-related trips [51], while family or social interaction is likely during non-mandatory trips [63].

Travel modes significantly determine both solitary and social activities during travel. Driving (compared to cycling) positively determines ICT use (in line with H6) and socializing, while it is negatively associated with reading. Trips by public transport are positively associated with all activities during travel. Probing further, for ICT use, the magnitude of coefficients for public buses is slightly higher than for trains, while for non-digital activities like reading and socializing, the coefficient of train trips is higher than that of public buses. Also, walking positively determines socializing (in line with H6) and ICT use.

Compared to afternoon trips, morning trips are negatively associated with reading (not in line with H6), which contradicts previous research [27] that suggests that morning trips are suitable for reading. During evening/night trips respondents are less likely to engage in solitary activities (reading or ICT use) and they are more likely to socialize. Likewise, weekend trips are characterized by less solitary activities such as reading and ICT use, but more socializing activities (in line with H6). Altogether, these findings suggest that non-peak hours and weekend days allow more socializing and childcare activities [55].

Overall, the results on trip characteristics suggest four key points. First, the positive association between longer commutes and travel time use activities (reading, ICT use, socializing) suggests respondents tend to perform active (and not passive) activities if the commute is longer, as pointed out by many studies [4, 43, 62]. Second, the positive relationship between driving and ICT use suggests that cognitive attention necessary for driving limits the range of activities to ICT based pursuits such as hands-free calling, listening to audio and navigation, as suggested by Szameitat et al. [80]. Third, the positive association between reading and public transport highlights the fact that the interior design attributes of public transport (trains in particular), such as seating availability, level of comfort to unpack things and availability of power outlets, play a role in the type of activities respondents wish to engage in, as pointed out by previous studies [11, 83]. Fourth, the positive effect of walking on socializing is related to the fact that walking enables the personally exposed environment that positively enhances interaction with friends or strangers [63]. Finally, the positive (or negative) association between evening/night/weekend trips and socializing (or solitary) activities suggests that trips taken during evenings/night hours/weekends are characterized by flexible, multipurpose and diverse trip chains, which in turn enable individuals' socializing and childcare activities.

5 Conclusion and discussion

Using the cross-sectional time use diary from the GTUS, this study enriches the existing literature on travel time use by examining the role of gender and by identifying potential determinants of solitary and social activities during travel. The descriptive analysis revealed the significant gender gap between men and women in economic, work and trip characteristics, non-travel time use habits and preferences.

Comparing various activities during travel, the multilevel logistic regression analysis revealed that socializing during travel is positively influenced by most of the variables: gendered joint travel (with partners and others), gendered non-travel time use habits (socializing, media use, child interaction, multitasking behavior), sociodemographic (female gender, being married, having children, being a civil servant), and trip characteristics (maintenance or leisure travel, travel by train, walking, evening or weekend travel). For solitary activities during travel, factors such as gendered economic factors (income and working hours), gendered non-travel habits (media use habits and preferences), residential location (semi-urban and living in East Germany) and trip characteristics (driving, traveling by train) strongly explain ICT usage. Furthermore, in addition to economic factors, primary reading habits (non-travel) and flexible working hours strongly influence reading for leisure/work during travel.

Based on the summary of findings, our study makes the following contributions towards identifying the role of gender for the travel time use literature. First, most travel time use studies use income at the household level to predict individuals' travel time use due to a lack of data on personal income. To ascertain the effect of economic variables on travel time use in the gender context, we include personal monthly income. As such, the analysis confirms that men attach a higher value to travel time by productively using the time. Second, besides the demographic and trip characteristics, the GTUS data allows the exploration of interactions between gender and non-travel time use behavior, and their differential effect on men's and women's activities during travel. Third, concerning time use preferences, our study highlights that

men's ICT use during travel is driven by a preference for media use, while women's ICT use during travel is driven by a preference for socializing. By understanding the differential needs of men and women during travel, our research findings on gender and travel time use have important policy implications.

First, our study points out that women's socializing during travel is primarily influenced by primary time spent interacting with children and ICT usage, while men's socializing during travel is positively influenced by their socializing habits. Our study shows how family attributes (presence of children, partners as trip companions, interaction with children), daily time use behavior (socializing behavior and multitasking behavior) positively influence both men's and women's socializing during travel. In Germany, women travel mostly with their family members—predominantly with their children, while men take solo job trips or joint trips with partners for leisure [23, 34]. Besides, our study reveals that traveling by public transport provides opportunities to engage in various travel time use activities (reading, ICT use, socializing). For these reasons, improving the public transport environment provides new possibilities to enrich public places for social interaction. For instance, Russell [69] found that down time/waiting time activities such as people-watching, day-dreaming, watching for public transport and social interaction positively impact individual and social wellbeing. Hence there is a need to reconsider public transport policies with the aim of enhancing vehicle interiors (work interiors, leisure interiors, family interiors for those who travel with young children), improving public transport infrastructure (network connectivity, affordability and accessibility) and redesigning urban/road space (e.g. providing public space near waiting areas).

Second, men's activities during travel (also women's) become more solitary (e.g. reading/ICT use) with increases in factors related to economic situation (e.g. income, working hours) and daily non-travel time use habits (reading habits/ICT use habit). Men's preference for media use and women's preference for socializing are positively linked to their ICT use during travel. Both men and women are more likely to engage in ICT use during travel but for different purposes, e.g. men use ICT for entertaining or work while women use ICT mostly for socially or emotionally connecting with others. Also, our study identifies the positive impact on solitary ICT usage of other potential determinants such as living in semi-urban areas, job related trips, car driving and long travel duration. From the policy view, these results have clear implications for policies aimed at providing new transport services such as digitalization, connectivity, automation, wi-fi and smart cars. With the growth of new mobility services, autonomous vehicles provide various options to perform various activities during travel and increase the utility of travel [28]. These services may enhance productive active participation, ensure privacy, make longer commutes or driving more acceptable, and render working while traveling more attractive. Such services may generate more single occupant commuting patterns with solitary time use behavior. This would then result in few verbal and nonverbal interactions, dissatisfaction with time spent together and impacts on intimate relationships among family members (e.g., parent–child, couples' relationships). As such, the overall sustainability of these new mobility services is questionable in the long run, as they depend on travelers' trust in and perception of technology use.

Overall, the study emphasizes the need for a transition from conventional travel time use policies that focus more on reducing travel time to gender-sensitive travel time use policies to improve the quality of time during travel. This suggests the need for future research to evaluate the utility of travel based on multiple domains, including working schedules (work), childcare/family care (family), and preferences and satisfaction (life satisfaction). The transport research community could further explore the intersection of gendered travel behavior and non-travel time use patterns to direct future policy-making decisions on travel time use. This could open up new lines of research to be studied in the future to further precise understanding of gender dimensions in parallel with solitary and socializing activities during travel. More specifically, the results support future research to understand gender specific travel time use in greater depth, between subgroups of men and women (e.g. career women, working mothers) coupled with tailored family-focused analysis (e.g. single/dual earners, households with young children).

There are some limitations noted for this study that suggest opportunities for future research. First, the cross-sectional design of the research does not allow us to draw conclusions about the directions of causality for a few variables (trip purpose, mode choice, travel companions). More longitudinal studies on travel time use are required to explore this causation. Second, our study does not account for tertiary time use, due to the non-availability of data. Third, our data does not have sufficient information concerning onboard internet connectivity, interior design and the availability of equipment on public transport or preferences for activities while traveling, mode usage or car sharing, which would provide more information on travel time use. Fourth, the activities we study are non-exhaustive of all activities that could be done during travel that may have gender distinctions, such as eating/drinking or grooming. Finally, with regard to ICT

use, our data does not differentiate between virtual social activities, such as calling or sending messages, and purely solitary activities such as listening to music or watching videos, as such it is difficult to ascertain gendered time use behaviors in relation to various ICT usages.

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