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Gender differences in space-time constraints

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Summary *This study explores gender differences in space-time constraints and their impact on women's and men's activity-travel patterns from a time-geographic perspective. Using a travel diary data set collected in Columbus, Ohio (USA), the time-budget and fixity constraints of three population subgroups are examined. This paper concludes that space-time constraints have a significant impact on individual's activity-travel patterns.*

Introduction

Recent studies on the gender division of domestic labour have enhanced our understanding of changes in gender roles and relations within the household (eg Pinch and Storey 1992; Gregson and Lowe 1993; Wharton 1994; Robinson and Godbey 1997; Aitken 1998). These studies in general observed that, despite changes in gender roles in the past two decades, women are still primarily responsible for most household tasks, and there is a high degree of gender specialization in the allocation of these tasks. Further, the amount and types of domestic work that women undertake are only marginally affected by their involvement in paid work outside the home. As this recent literature is largely concerned with gender relations reflected by the allocation of in-home tasks, gender differences in the performance of out-of-home activities have received relatively little attention. This paper complements such focus with an examination of out-of-home activities. It analyses their space-time characteristics and their impact on activity-travel patterns.

'Out-of-home activities' in this study refers to all daily activities that take place outside the home as conventionally conceived (although 'home' can also be conceived as encompassing the social networks and relations essential for household reproduction at the neighbourhood level). While a diverse set of activities is included in this definition, they are part of the web of localized networks of social interactions and material transactions that constitute the mediating links between home and work. For instance, although many of these activities are undertaken to meet household needs (eg, childcare drop-off), their social and space-time arrangements are often made with considerations of the condition and requirements of work. The most distinctive characteristic of many of these activities is their specific space-time requirements and relations to other activities (eg, paid employment and in-home 'work'). Undertaking these activities involves negotiating the space-time tension arising from the interconnectedness and physical separation of home and work (Dyck 1989, 1990; England 1993). The dynamic dependencies between home and work can be better understood through examining how the space-time requirements of these activities impact upon individuals' activity-travel patterns (Kwan 1999a).

The need to examine out-of-home activities is partly due to their increasing importance and significant structuring role in individuals' everyday lives (Kwan 1999a,b; Pazy *et al* 1996; Pisarski 1992; Salomon and Tacken 1993).[1] Kitamura (1983), for instance, observed that the spatial and temporal fixity of certain out-of-home activities (eg, serve-passenger trips) is the most important determinant of a person's activity-travel pattern. Further, as women are still primarily responsible for most out-of-home household-serving activities and travel, the allocation and performance of these activities constitute an important part of the gender division of 'domestic' labour (Hanson and Hanson 1981; Pickup 1984; Wachs 1991). As Pratt and Hanson (1991) and

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Kwan (1999a) observed, the space-time requirements of women's out-of-home activities strongly affect their employment status and commuting distances. The space-time rigidity of certain out-of-home household-serving activities is also an important source of women's daily stress (Aitken 1998; Michelson 1985). A study of out-of-home activities and their space-time characteristics will provide important clues for understanding gender differences in other areas of life, including occupational and employment status, commuting distance, and job location (Hanson and Pratt 1990, 1995; Palm and Pred 1974; Tivers 1985).

A difficulty faced by past studies on individuals' activity-travel patterns, however, is the lack of direct measures of the space-time constraint associated with these activities. Without such measures, surrogate variables such as the number of young children are often use to represent such constraint. One major limitation of this approach is that the constraining effect of household-serving activities on an individual's freedom to pursue out-of-home activities is determine not so much by their duration as by their space-time rigidity (Kwan 1999a; Tivers 1985). To overcome this difficulty, I describe a method for directly measuring space-time constraints based on the fixity characteristics of out-of-home activities. Using data I collected in a travel diary survey in Columbus, Ohio (USA), I identify the out-of-home activities that contribute to the space-time constraint individuals encounter in their everyday lives through the time-geographic perspective. I examine this constraint in the context of the gender division of domestic labour and their relationships with women's employment status and commuting distance.

The results reveal that women, regardless of their employment status and commuting distance, experience higher level of fixity constraint both in absolute and relative terms when compared to men. Although a long commute for women of high socioeconomic status is usually understood as an indicator of their less constrained job location, the full-time employed women examined in this study still experience higher level of fixity constraint than men despite their easy access to the car, high occupational status and long journey-to-work. Before discussing these results, the next section gives an overview of the time-geographic perspective and discusses its usefulness for studying gender differences in space-time constraints and activity-travel patterns.

Activity-travel patterns and the time-geographic perspective

In time-geographic conception, an individual's activities and travel in a day can be represented as a path in space-time within a 'prism' defined by a set of constraints (Burns 1979; Hägerstrand 1970; Lenntorp 1976). Since certain activities are relatively 'fixed' in time and/or space, an individual's choice of activities is limited to those which could be undertaken within a feasible region determined by the space-time requirements of these fixed activities. Activities with a high degree of space-time fixity act as 'pegs' around which other activities are organized (Burnett 1980; Cullen *et al* 1972; Kitamura 1983; Michelson 1988).

Many past studies on women's out-of-home activities used the time-geographic perspective. Palm and Pred (1974) showed that women with young children are particularly disadvantaged in terms of job choice and location because of the space-time fixity of many child care and household-serving tasks. Pickup (1984, 1985) found that women undertake many temporally fixed activities that impose 'hard constraints' on their activity-travel pattern and job location. In a study on the women in two rural towns in Colorado, Palm (1981) observed that most professional-level or highly paid employment opportunities lie outside their daily paths. Miller (1982, 1983) applied a time-geographic simulation model to examine women's access problems in Nineteenth-Century American suburbs. He concluded that household structure and role requirements made it difficult for many women to participate in necessary and enriching activities. Tivers (1985, 1988) found that household-serving tasks dominate the out-of-home activities of women with young children and that the space-time requirements of these tasks limited their activity space for weekday activities.

Other studies also observed the significant impact of space-time constraints on women's activity-travel patterns and employment. Hanson and Pratt (1990, 1995) observed that women in female-dominated jobs face greater space-time constraints on their employment-related decisions and have shorter work-trips than do women in other lines of work (see also Pratt and Hanson 1991). Droogleever Fortuijn and Karsten (1989) examined how women in two different areas in North Holland combined tasks in their daily lives and concluded that the time-budget constraint of paid employment was most important

in affecting activity patterns. Dyck (1989, 1990) and England (1993) extended the time-geographic notion of space-time constraints to focus on the social basis and gendered nature of the constraints women face in their everyday lives. They emphasized the spatially contingent nature of the relationships between women's household responsibilities, their position in the local labour market and their activity-travel patterns in space-time. Localized social networks, which are enabling and constraining at the same time, were found to be crucial in shaping women's everyday spatiality. Kwan (1999a) found that the level of day-time fixity constraint an individual faces is determined more by gender and the extent to which household responsibilities are shared by other adults in the household than on the conventional measures of household responsibilities.

These studies suggest that time-geography provides an integrative framework for the analysis of activity-travel patterns in space-time. It helps focus our attention on restrictive personal circumstances and social processes in a particular locale. The usefulness of time-geography for understanding women's spatiality, however, was questioned by the feminist critique of Rose (1993a,b), who criticized time-geography for its masculinist conception of space and the body, its repression of feminine subjectivity, and its erasure of the specificity and positionality of the master subject. Based on the work of Valentine (1989) and Pain (1991), she argued that time-geography cannot take into account the effect of women's fear of violence or attack in public spaces on their mobility. Gregory (1994, 127), in turn, called into question Rose's assertion that time-geography is 'an incorrigibly phallocentric discourse inscribing patriarchal power in space'. He suggested that Rose's critique was derived from a misreading of Gould's (1981) commentary on the conception of space embedded within time-geography and that even if a space-time path registers the traces of patriarchal power, that may not necessarily involve a 'celebration of masculine space'. Rose's (1993b, 82) qualification of her argument about Gould's (1981) paper suggests that she recognized this possibility. As she indicated, the particular connotations of the word 'space' she drew upon are peculiar to the English language and that other interpretations of time-geography other than the version she critiqued are possible.

Despite Rose's critique, the possibility of a post-structuralist/feminist time-geography is revealed by several recent studies. Drawing upon the work of Grosz (1992, 1994), Foucault (1977), and Young (1989), Laws (1997) explored such possibility based on their theories on embodied female identities, corporeality, and feminine spatiality. Hanson and Pratt's (1995) re-interpretation of their earlier observations in terms of feminist containment narratives based on the reciprocal constitution of feminine subjectivity and bodily comportment suggests a similar direction. Further, Rose's (1993) criticisms on the discrete body boundary of time-geography have been aptly addressed by Adam's (1995) re-theorization of personal boundaries that overcomes several difficulties of Hägerstrand's original framework. Lastly, a variety of representational strategies may be used to compose rich pictorial narratives of women's and men's everyday spatiality (Gregory 1994, 249–251). These studies together suggest that a feminist time-geography is not only possible, but will provide new ways for understanding the spatio-temporal experiences associated with the mundane practices of everyday life.

Methods

To examine gender differences in space-time constraints and their impact on activity-travel patterns, I use data from a travel diary survey to identify two types of constraints: the time-budget constraint and the fixity constraint. The time-budget constraint arises from the limited time available to an individual after allowing for the essential maintenance activities (eg, sleeping) of a day. In this study, the total amount of time available after allowing for the time spent on work and maintenance activities is used as a measure of the time-budget constraint. Work time is also included because its space-time fixity and duration significantly reduce a person's time for discretionary out-of-home activities.[2]

The fixity constraint is due to the space-time rigidity of out-of-home activities. As few studies in the past attempted to measure the fixity constraint directly, very little is known to date about the extent to which women and men experience the fixity constraint. In this study, I follow the approach used in Cullen *et al* (1972) and Stephens (1975), where a number of specially designed questions were used in travel diary surveys to solicit information for establishing the fixity of activities. For each activity recorded, four questions were included in the travel diary used in this study: (a) Could you have done this elsewhere? (b) How easy is it for you to change the location for this activity? (c) Could you have done

this at any other time of the day? (d) How easy is it for you to change the time of day for this activity? While answers to questions (a) and (c) are simply 'yes' or 'no', the difficulty in changing the location or time of an activity as elicited by questions (b) and (d) are expressed on a five-point scale from easy (1) to difficult (5).

Three types of fixity are subsequently defined using these subjective fixity ratings. An activity is spatially fixed if the answer to (a) is 'no' or the spatial fixity rating for (b) is 4 or above. This means that a spatially fixed activity is one whose location is either impossible or very difficult to change. Likewise, using answers to questions (c) and (d), an activity is identified as temporally fixed if it is impossible or very difficult to change its time. The third type of fixity is specified when an activity is both spatially and temporally fixed, hereafter designated as 'ST fixed'. Usefulness of these fixity ratings is supported by their strong correlations with a number of variables collected in the survey which are asserted to be important in determining the constraining effect of an activity (Cullen *et al* 1972). These other variables largely reflect the importance, commitment, priority, and obligatory nature of an activity.

Using these subjective fixity ratings, the space-time constraint is examined in relations to different categories of out-of-home activities. Given the small number of out-of-home activities (461 in total) relative to the variety of activities recorded in the survey (70 different activities), the originally recorded activities need to be grouped into broad activity types. There are, however, different ways to group these activities. First, out-of-home activities can be classified into broad categories based on the description given by the respondent. This is the method commonly used in past studies on activity-travel patterns (eg, Michelson (1985) identified 11 activity types). Another method is to derive broad groups of activities based on a theoretical perspective. For example, Gregson and Lowe (1995) identified different daily social reproductive tasks in terms of three areas: the reproduction of adult labour power, generational reproduction (ie childcare), and the structural upkeep of the household. One difficulty of these two methods is that the primary purpose of an activity may deviate from the description of the activity given by the respondent since the same activity may be performed for different purposes (eg, a shopping trip may be undertaken primarily for social or recreational purpose; whereas an apparently household-serving activity may be performed 'for pleasure'). Further, it is difficult to derive conceptual categories which accurately reflect how a respondent perceives or feels about a particular activity and different respondents may feel differently about the same activity. For instance, an activity usually considered as 'childcare' by the researcher may actually be a 'leisure' activity to the respondent.

To overcome these difficulties, I use the primary purpose of an activity given by the respondent based on her/his subjective evaluation to categorize an activity. This information was derived from the answers to a question in the survey which asks the respondent to select one out of five categories as the primary purpose of the activity in question. These five primary activity purposes are: (a) employment or employment-related activities; (b) essential household needs—grocery shopping for household need, dropping off or picking up child at childcare or school, accompanying child to dance class, etc.; (c) personal needs—banking, visiting a doctor, visiting a library or public office, mailing letter and packages, taking car to repair, hair dressing, etc.; (d) pleasure, leisure or recreational activities—aerobic class, bowling, horse-back riding, movie, etc.; and (e) social activity with friends and/or family—visiting friends and family members, attending church or other social events, etc. Further, to supplement the discussion on these aggregate categories of activities, 'serve passenger' trips are singled out for specific discussion as most of them consist of childcare drop-off or pickup trips, which are highly spatially and temporally fixed activities.

Data and study area

The data for this study were collected by the author in Franklin County, Ohio (USA), through a travel diary survey in 1995. Franklin County is located at the centre of the seven-county Columbus Metropolitan Statistical Area (MSA) in central Ohio of the US. Its main urban area consists of the city of Columbus and several smaller cities. It will have a projected population of about one million in 2000 (City of Columbus, 1993). Within the County, most establishments are located within and around the I-270 Freeway (Figure 1).

The travel diary survey obtained data from a sample of 109 adults (over 18 years of age) in 60 family households with one or more employed members in the study area. The diary recorded details of all activities and trips made by the respondents in two designated travel days, including the

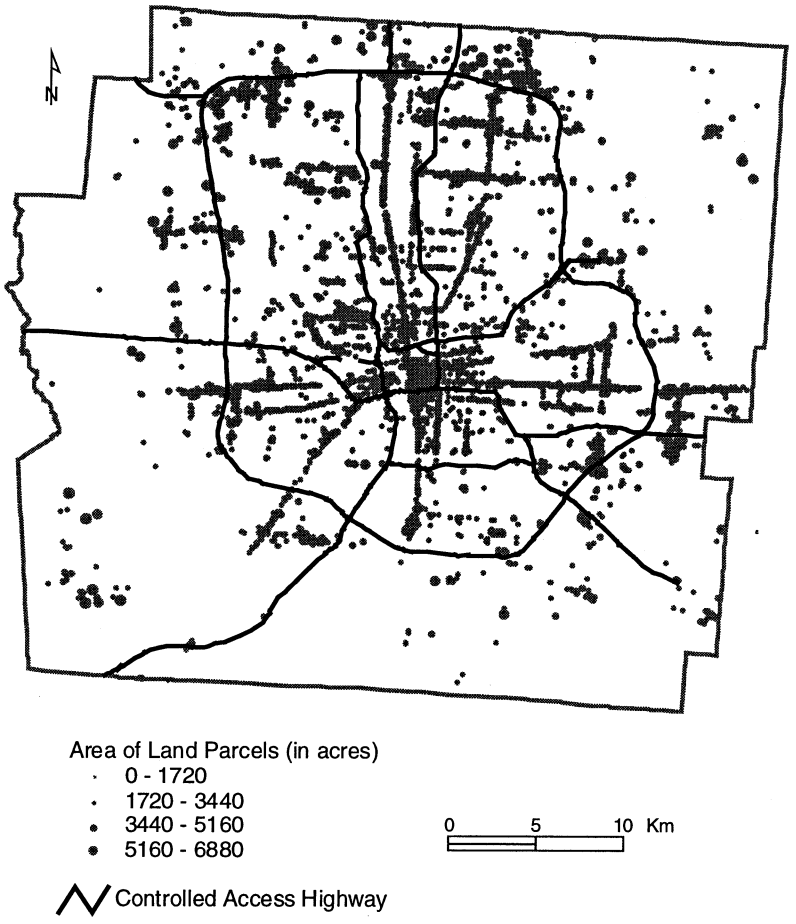

Figure 1 Location of land parcels in Columbus OH, USA

street address, travel mode used, car availability, routes taken, the primary purpose of each activity, and other individuals present when performing each activity.[3] Despite the original goal to obtain a representative sample and some targeted sample enrichment effort, many gender/ethnic groups are under-represented. For instance, less than 2% of the respondents are African Americans whereas this group accounts for 16% of the County's population in 1990. Since relatively homogenous subgroups of considerable size are required for meaningful comparative analysis, I created a subsample by selecting all gender/ethnic subgroups with more than 10 working (full-time or part-time employed) persons. This process generated a sub-sample of 72 European Americans (white) consisting of 28 full-time employed female, 13 part-time employed female (who work less than 35 hours a week), and 31 full-time employed male.

The households in this sub-sample consist of dual-earner married couples who are spatially scattered in the study area. Individuals in this sub-sample have high income and good access to the car. Average vehicle per household is 2.3 and vehicle per adult is 1.2. Further, all persons in the sub-sample have driver's licenses and normally use their own cars for travelling to work and other out-of-home activities. Over three quarters (76.4%) of these individuals hold managerial, professional and technical occupations. Among the 46 households in the sub-sample, 25 have at least one child (that is, 54.3% of the households). The average number of children in these

Table 1 Time spent per day on different types of out-of-home activities by individuals of each group

	Full-time employed women		Part-time employed women		Full-time employed men	
	Hours per day	% of non-employment time	Hours per day	% of non-employment time	Hours per day	% of non-employment time
Visits to work sites	8.16[b]		3.92[a,c]		8.15[b]	
Non-employment activities	1.87		2.86[a,c]		1.55[b]	
Household need	0.27[b,c]	14.4	0.67[a,c]	23.4	0.12[a,b]	7.7
Personal need	0.42	22.5	0.42	14.7	0.40	25.8
Pleasure	0.39	20.9	0.42	14.7	0.36	23.2
Social	0.52[b]	27.8	0.90[a,c]	31.5	0.53[b]	34.2
Other	0.27[b,c]	14.1	0.45[a,c]	15.7	0.14[a,b]	9.0
Total out-of-home activities	0.03[b]		6.78[a,c]		9.70[b]	
Temporary home stops	0.85		1.26[c]		0.43[b]	
Total	10.88	100%	8.04	100%	10.13	100%

a Difference from full-time employed women is statistically significant at $p<0.05$
b Difference from part-time employed women is statistically significant at $p<0.05$
c Difference from men is statistically significant at $p<0.05$
Source: Travel diary survey conducted in Columbus, Ohio, 1995

households is 1.11 while the part-time employed women have significantly more children in their households (1.85) when compared to the full-time employed women (0.75). The following sections examine the space-time constraints and their impact on activity-travel patterns for the three groups of individuals in the sub-sample.

Time-budget contraints and activity patterns

To estimate the time-budget constraints faced by individuals of the three groups, this study assumes that a person has 15 hours a day for pursuing various activities besides sleeping and other essential maintenance activities. The amount of time available for out-of-home non-employment activities is obtained by deducting total work hours from this 15-hour period. Using this method, full-time employed women and men in the subsample have 6.8 hours left after the time spent on work (8.2 hours) is accounted for, while women employed part-time have about 11 hours for non-employment activities since they spent only 3.9 hours on work (Table 1). Not surprisingly, this result indicates that employment status is important for differentiating the extent of the time-budget constraint faced by individuals of the three groups. Those employed full-time, whether women or men, face more stringent time-budget constraint when compared to women employed part-time.

The effect of time-budget constraint imposed by employment on activity-travel patterns is reflected by the amount of time individuals of the three groups spend on non-employment activities. As shown in Table 1, women and men working full-time spend less time on non-employment activities per day than women employed part-time. Women employed part-time on average spend one more hour on out-of-home, non-employment activities per day than women and men working full-time. Further, women employed full-time spend slightly more time on non-employment activities than men (although the difference is not statistically significant).

In terms of the purposes of these non-employment activities, individuals of the three groups spend most of their out-of-home, non-employment time on social activities (Table 1). Besides this similarity, however, there are important differences between the three groups. The second most important purpose of non-employment activities for women employed part-time is household need, whereas it is personal need for both women and men working full-time. This indicates that, while women employed part-time in general

Table 2 Average number of out-of-home activities per day by individuals of each group

	Average number of stops per day		
	Full-time employed women	Part-time employed women	Full-time employed men
Visits to work sites	1.21[b]	0.83[a,c]	1.48[b]
Non-employment activities by purpose	2.17[b,c]	2.63[a,c]	1.64[a,b]
Household need	0.57[b,c]	1.07[a,c]	0.25[a,b]
Personal need	0.55	0.40	0.53
Pleasure	0.49[c]	0.37	0.29[a]
Social	0.34	0.37	0.39
Non-employment activities by type			
Serve passenger	0.40[b,c]	0.67[a,c]	0.27[a,b]
Total out-of-home activities	3.38	3.46	3.12
Temporary home stops	0.61	0.80[c]	0.32[b]
Total	3.99	4.26	3.44

a Difference from full-time employed women is statistically significant at $p<0.05$
b Difference from part-time employed women is statistically significant at $p<0.05$
c Difference from men is statistically significant at $p<0.05$
Source: Travel diary survey conducted in Columbus, Ohio, 1995

spend more time on non-employment activities, they spend proportionally more time in serving household needs when compared to women and men working full-time. When compared to men, women working full-time spend more time on household-serving activities and less time on pleasure and social activities. Thus, similar employment status of women and men has not been accompanied by their equal shares in out-of-home, household-serving activities. This finding highlights the gender difference in the performance of various out-of-home activities, corroborating results of previous studies pertaining to the division of domestic tasks inside the home (Aitken 1998; Pinch and Storey 1992; Robinson and Godbey 1997).

Turning to the number and types of out-of-home activities undertaken by individuals of the three groups, Table 2 reveals an important gender difference: women undertake more non-employment activities than do men whether they are working full-time or part-time. What is significant here is that although women working full-time face similar time-budget constraint as do men (as discussed above), they undertake more out-of-home, non-employment activities than men. Although the difference of 0.53 activity per day between these two groups is small (1.64 activity per day for men as compared to 2.17 activities per day for women employed full-time), it adds up to large long term differences (eg, a difference of 3.7 activities per week) that could increase the daily stress for women working full-time. Again, this echoes the point already made that women's full-time employment has not been accompanied by commensurate reduction in their household responsibilities when compared to men with the same employment status.

Fixity constraints and their sources

An examination of the fixity constraint experienced by individuals of the three groups further reveals important gender differences. As indicated in Table 3, women encounter more fixed out-of-home activities in their daily lives than do men regardless of their employment status, or how fixity is measured (that is, whether in terms of spatial, temporal, or ST fixity). Especially noteworthy is that, while the numbers of fixed activities are comparable for both groups of women, they are about twice as many as those for men. This suggests that women face higher level of fixity constraint than men regardless of whether they work full-time or part-time.

Table 3 Spatial and temporal constraints of individuals of each group

	Women, full-time employed			Women, part-time employed			Men, full-time employed		
	SFix	TFix	STFix	SFix	TFix	STFix	SFix	TFix	STFix
Number of fixed activities per day	1.40[c]	1.64[c]	1.21[c]	1.47[c]	1.97[c]	1.30[c]	0.83[a,b]	1.08[a,b]	0.71[a,b]
% of non-employment activities which are fixed	64.4	75.7	55.7	55.7	74.7	49.4	50.5	66.0	43.3
% of fixed activities by purpose									
Household need	23.0	24.1	20.3	36.4	40.7	41.0	14.3	21.9	16.7
Personal need	24.3	23.0	25.0	13.6	15.3	12.8	32.7	28.1	31.0
Pleasure	23.0	26.4	26.6	11.4	13.6	7.7	16.3	17.2	16.7
Social	16.2	16.1	17.2	22.7	16.9	23.1	24.5	26.6	17.0
% of fixed activities by activity type									
Serve passenger	28.4	23.0	31.3	45.5	33.9	51.3	32.7	21.9	33.0

Source: Travel diary survey conducted in Columbus, Ohio, 1995

Note: SFix stands for 'spatially fixed activities', TFix represents 'temporally fixed activities', and STFix designates 'spatially and temporally fixed activities'

a Difference from full-time employed women is statistically significant at $p<0.05$

b Difference from part-time employed women is statistically significant at $p<0.05$

c Difference from men is statistically significant at $p<0.05$

Since women undertake more out-of-home, non-employment activities per day than men, the higher level of fixity they experience may simply be due to the fact that they make more trips and therefore encountered more fixed activities. A look at the percentage of non-employment activities which are fixed (Table 3), however, reveals that the proportion of non-employment activities which are fixed is higher for women than men regardless of their employment status. Thus, women face higher levels of fixity constraint in both absolute and relative terms when compared to men.

Table 3 also provides important clues about the major sources the fixity constraint faced by the women in the sub-sample. For women employed part-time, the need to perform household-serving fixed activities is the most important source of the fixity constraint they face. Among all temporally and ST fixed activities they encounter, over 40% are performed to meet household needs. Among various activity types, 'serve passenger' activities, which are largely associated with chauffeuring children (75%), account for over 50% of the ST fixed activities they performed in their daily lives. This indicates that a substantial proportion of the fixity constraint for women employed part-time is associated with household- and child-serving activities. In the case of women employed full-time, household-serving activities constitute about 23% of all fixed activities, whereas personal need and pleasure are at least as important as household need in contributing to their fixity constraint. In the case of men, personal need and social activities are the major sources of space-time fixity.

Impact on activity-travel patterns

Based on these gender differences in fixity constraints, several features of women's activity-travel patterns deserve further elaboration. As Table 4 indicates, the space-time constraints faced by women working part-time have a stronger limiting effects on the spatial range of their daily activities and job location when compared to women and men employed full time. Activities and jobs of women working part-time are located closer to both home and the workplace than those of women and men employed full-time. This corroborates results of past studies that women working part-time tend to work closer to home than do full-time employed women (Pratt and Hanson 1991).

Further, among different purposes and types of activities, household- and passenger-serving activities are located particularly close to home (both

Table 4 Average distance of different out-of-home activities from home and workplace for each group

	Women, full-time employed		Women, part-time employed		Men, employed full-time	
	Distance from home (in km)[a]	Distance from work (in km)	Distance from home (in km)	Distance from work (in km)	Distance from home (in km)	Distance from work (in km)
Visits to work sites	14.90[b]	—	8.38[a,c]	—	13.79[b]	—
Non-employment activities by purpose	9.69	12.39[c]	6.32[c]	9.01	11.52[b]	8.80[a]
Household need	7.71[b]	11.88	3.67[a,c]	9.80	7.68[b]	10.35
Personal need	14.84[b,c]	8.46	7.03[a]	10.32	7.90[a]	7.15
Pleasure	6.87[c]	14.52[b,c]	6.81[c]	5.92[a,c]	13.23[a,b]	9.99[a,b]
Social	10.52[c]	18.46[b,c]	8.78	9.56[a]	6.71[a]	10.59[a]
Non-employment activities by type						
Serve passenger	6.20	12.86	4.78	9.45	5.78	11.68

Source: Travel diary survey conducted in Columbus, Ohio, 1995
Note: All distances are network distance in kilometers measured by using a digital network
a Difference from full-time employed women is statistically significant at $p<0.05$
b Difference from part-time employed women is statistically significant at $p<0.05$
c Difference from men is statistically significant at $p<0.05$

under 4.8 km) for women employed part-time (Table 4). Even when the other two groups undertake these activities, their relative locations to either home or the workplace are less spatially restrictive. It can therefore be concluded that household-serving activities not only constitute the major sources of fixity constraints for women working part-time; they also constitute a strong spatial binding effect which leads to the more local orientation of the non-employment activities of part-time women, confirming again the findings of many studies in the past (eg Hanson and Pratt, 1995; Tivers 1985).

The effect of space-time constraints on the commuting distance of individuals of the three groups can also be examined using Table 4, which includes the average distance of those out-of-home activities which are classified as 'paid work'. These distances give an idea about how far individuals of the three groups work from home. Sites of paid work are located farthest away from home for women employed full-time (14.9 km) when compared to women employed part-time (8.4 km) and men (13.8 km).[4] This result is a little unexpected in view of past studies on gender differences in the length of the commute trip which often observed shorter commute for women than men. Although some recent studies found that, for distinctive subpopulations, women travel as far as men from home to work (England 1993; McLafferty and Preston 1991, 1996; Hanson and Pratt 1995), that some subgroups of women work farther away from home than comparably situated men has not yet been observed.

This finding, perhaps, is due to the specific personal attributes of the full-time employed women, who have a very high level of travel mobility, high occupational and socio-economic status (even when compared with the men in the sub-sample). On the other hand, the case of women employed part-time is in stark contrast with the case of women employed full-time. As indicated by the survey data, no women employed part-time work more than 10 km away from home. This suggests that the fixity and gender-role constraint they face may have a rather strong limiting effect on the spatial range of their workplace and non-employment activities when compared to the other two groups.

Conclusions

In light of the fact that few previous studies have attempted to measure time-budget and fixity constraints directly, findings of this study are especially important. First, women employed part-time encounter more fixed activities in their daily lives than the other two groups. Many of these fixed activities are

associated with household needs which tend to exert a strong spatial binding effect on the locations of their non-employment activities and job location. Second, despite the fact that women employed full-time travel longer to work than men, they experience higher levels of fixity constraint than men. Considering the high occupational status and high level of access to private cars of the full-time employment women in the subsample, this result is even more surprising.

Overall, these findings based on an examination of out-of-home, non-employment activities reveal that, regardless of how long women travel to work and their employment status, the fixity constraint they face is still higher than that of men. This not only confirms the observation that increasing female participation in the labour force does not significantly change the gender role and space-time constraints women face in their everyday lives (eg Hanson and Hanson 1980). It also indicates that the situation of women in their everyday lives will not change much without first changing the gender relations and redressing the division of domestic labour within the household. Despite the belief that recent trends in the increasing number of women with higher occupational status and income, as well as improvement in their access to private means of transportation will lead to changes in traditional gender roles, results of this study do not support such a belief. Future research on out-of-home activities needs to examine the process through which women and men negotiate the performance of these activities and the translation of these negotiations into shared domestic responsibilities in their everyday lives.

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Notes

1 A focus on out-of-home activities, however, does not imply that in-home activities are less important than out-of-home activities (as shown in Gregson and Lowe's (1995) study on daily social reproduction in Britain), or that in-home activities do not constitute significant space-time constraints for women in a theoretical sense. Nevertheless, such a focus on out-of-home activities is justifiable in terms of the concrete socio-spatial context and the particular sub-sample used in this study, as they together render the exclusion of in-home activities less problematic.

First, all households in the sub-sample have more than one private vehicle for each adult. With their white upper-middle-class background, individuals in the sub-sample are highly mobile and enjoy a suburban lifestyle that involves a high rate of substitution of home-based household 'maintenance' activities by commercial services outside the home (eg meals in fast food chains or commercial childcare services, see related discussion in Hayden 1984). As a result, women in the sub-sample performed very little in-home 'maintenance' activities on the survey days (which are weekdays), and many in-home activities they did perform were not spatially or temporally fixed (eg cleaning). Indeed, very few of these women performed any significant amount of home-based activities besides rest and watching TV. These in-home activities therefore did not appear to have contributed significantly to either the time-budget constraint or space-time constraint for the women in the sub-sample.

Further, the actual out-of-home activity patterns of the women in the sub-sample did not suggest that their home-based activities constitute significant space-time constraints in their everyday lives (although this may not be true for individuals belonging to other gender/ethnic subgroups in the study area). The women in the sub-sample, whether full-time or part-time employed, performed a considerable proportion of their out-of-home activities in the evening. For the latter group, many out-of-home activities were also performed during the day. These activities include not only out-of-home meals, but also social/recreational activities associated with children such as dance classes or social events. Such amount and space-time patterns of out-of-home activities indicate that the constraining effect of in-home activities has not been a major factor affecting their activity patterns. Lastly, since many in-home activities with high space-time fixity are preceded or followed by spatially and/or temporally fixed out-of-home activities, a study on only out-of-home activities can still reflect the space-time constraint associated with certain in-home activities (eg preparing a child for a childcare drop-off).

2 The time-budget constraint defined here does not include the time for in-home obligatory activities (eg, domestic labour) since individuals in the sample are working adults who spend over 6 hours per day outside the home. This renders work time the most significant obligatory activity besides maintenance activities. Such definition does not imply that in-home activities are not an important part of their lives.

3 One operational limitation of this study is that the data from the survey do not include all out-of-home activities undertaken by an individual since respondents were asked to record activities that last for 15 minutes or more (including travel time). This omits many brief out-of-home activities (such as taking the dog for a walk).

4 Using a direct measure of the network distance between the home site and workplace for each of the individuals

of three subgroups (instead of considering all work sites), Kwan (1998b) found that the differences in the home-work distance between women and men working full-time, and between the two groups of women are both statistically significant ($p<0.05$). The difference in home-work distance between women employed part-time and men employed full-time is not statistically significant.

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