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## THE SOCIAL DIMENSION IN THE INDIVIDUAL'S ACTIVITY-TRAVEL SCHEDULING: A MODEL OF SOCIAL EPISODE START TIME AND DURATION

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### ABSTRACT

This paper investigates a critical issue in activity scheduling decision: the social dimension of activity scheduling. The main objective is to identify how the “with whom” dimension influences scheduling decisions of social activity episodes, specifically the start times and durations. Econometric models of combined decisions regarding “with whom” to participate and when to start or how much time to spend on are estimated to investigate the correlations between “with whom” decision and the scheduling decisions: start time and duration. Data collected by a 7-day activity diary survey are used for the model developments. The findings of the investigations indicate that it is “with whom” we socialize what influences the social activity scheduling processes more than the travel time or the distances to travel.

*Keywords:* activity-travel scheduling, social networks, social activity duration and start time

### RESUMEN

El presente artículo investiga un problema crítico en las decisiones de agenda de actividades: la dimensión social de la agenda personal. El principal objetivo del estudio es identificar cómo “con quién” influencia las decisiones de agenda en los episodios de actividades sociales, específicamente en sus horas de inicio y duraciones. Modelos econométricos son utilizados para investigar la correlación entre la decisión combinada de “con quién” participar y las decisiones de agenda de cuándo comenzar (hora de inicio) o cuánto tiempo dedicarse a la actividad (duración). Para el desarrollo de estos modelos, se utilizan datos de actividades recolectadas en un período de siete días. Los resultados de la investigación indican que “con quién” se desarrollan las actividades posee una influencia mayor en los procesos de agenda de actividades sociales más que el tiempo y las distancias del viaje social.

*Palabras clave:* agenda de actividades y viajes, redes sociales, duración y hora de inicio de las actividades sociales.

## 1. INTRODUCTION

Activity-based approaches to model travel demand are increasingly moving from theoretical to operational models (Roorda *et al.*, 2007). In this context, agent-based microsimulation models are a promising approach since they explicitly conceive travel as an emergent phenomenon from peoples' activity characteristics, and more explicitly, from their *activity scheduling processes*. Behaviorally, activity-scheduling processes are not only influenced by individuals' characteristics, but also by the other people with whom they interact. Hence, the activity scheduling process has an intrinsic *social context*. In principle, agent-based microsimulation models have the capability of explicitly representing interactions among different actors, modeling their influence in their respective decision making processes (Miller, 2005; Arentze and Timmermans, 2006). However, current models in practice still rely heavily upon individualistic assumptions because of the lack of knowledge about how the social dimension affects activity-travel behavior in general, and activity scheduling processes, specifically.

The objective of this paper is to investigate how the social dimension – defined by “with whom” activities are performed – influences individuals' activity scheduling processes. The study explicitly focuses on social activities since these are the paradigmatic examples of the importance of “with whom” in activity-travel decision processes. Social activities are an understudied area that is becoming increasingly important from the policy perspective due to their relatively long trip lengths and aspects such as social cohesion and quality of life (Larsen *et al.*, 2006). However, simple statistical data analysis may not necessarily reveal the extensive behavioral details for such a complex phenomenon. This paper uses an advanced econometric method to investigate how “with whom” influences the start time and duration of social activity episodes, with the purpose of capturing the complex and multidimensional nature of people's behavior.

The study uses data from a Computerized Household Activity Scheduling Elicitor (CHASE) survey conducted in Toronto in 2002-2003 (Doherty *et al.*, 2004). CHASE focuses on capturing multi-day information on observed activity-travel patterns while tracing the underlying activity scheduling process (Doherty and Miller, 2000). The data also includes information regarding temporal and spatial flexibility, and other key activity attributes, including “with whom” the respondent's activities were performed. Using these data, a discrete-continuous econometric approach is employed to explore the relationship between this social context and social activity scheduling attributes. The combined estimation of discrete-continuous models gives quantitative evidence of how “with whom” relates to start time and time allocation to social activity episodes. In addition to behavioral understanding, it is expected these results can be useful to model activity scheduling-rescheduling processes in Toronto's operational activity-based model, TASHA (Miller and Roorda, 2003). Replacement of *rules* used to resolve scheduling conflicts by econometric models should increase policy sensitivities of the overall model. The organization of the paper is the following: next section discusses the theoretical framework, followed by a description of data and methods, model results, and conclusions.

## 2. THE SOCIAL DIMENSION OF ACTIVITY SCHEDULING BEHAVIOUR

Neglecting the social dimension in transportation modeling is one of the most crucial and critical shortcomings of existing activity-based models (Axhausen, 2005). Research in activity-based

models has spread and focused on a variety of aspects, helping to understand better the different characteristics and attributes that constitute household and individual activity patterns. Modeling efforts have increasingly incorporated the insights gained by the greater understanding of activity patterns (Timmermans, 2005). However, there is still considerable room for improvements, especially in the scope and behavioral explanation these models give. In this context, understanding and modeling the influence of social interactions on activity-travel decisions is a crucial need (Bhat and Lawton, 2000). In order to incorporate formally the social dimension, researchers should take account of the existing structure of social relations represented in the *individual's social networks*, for it is within this structure that interpersonal interactions and social travel decisions are made.

The study of social networks in activity-travel behavior responds to “*the need to underpin our travel models with a better understanding of the social structures of daily life and, as we implicitly forecast/speculate about them when we predict travel behavior over long time horizons, anyway...*” as Axhausen (2002: p.3), argues. This requirement is even more germane when a series of “possible transport questions” are considered, such as “*physical spatial-temporal coherence / overlap (constraints), replacement of physical and telecommunication-based contact, interaction frequency and spatial reach, and interaction and information / knowledge transfer*” (2002: p.10). In addition, the focus in social activities is particularly interesting since interactions intuitively play a “motivator” role in the behavioral processes of those activities.

A useful way of addressing the impact of social network is to use the individual's personal network information. Personal networks constitute a useful approach to study relevance of the social structure in activity-travel decisions. A personal network is “my network” for any given individual. In personal network analysis, the respondent is referred to as “ego” and all of the people with whom he/she interacts are referred to as “alters”. The number of “alters” within an ego's personal network indicates the size of the network. Measures of the size of a personal network vary according to the purpose of study. For example, McCarty, *et al.* (2000) estimated networks of about 250 ties in a larger American sample. However, as scope conditions get more specific, the number of network members decreases. In the specific case of this study, the personal network is defined as those alters with whom the respondent (ego) had a social activity within a week. As it will be discussed later, social activities are defined using the instrument CHASE (Doherty and Miller, 2000).

### 3. DATA

The first wave of the Toronto Travel-Activity Panel Survey (TAPS, see Doherty *et al.*, 2004), which uses the CHASE instrument was used in this study. TAPS provides important empirical data to support the activity scheduling process modeling pursued in Toronto's activity-based models (Miller, 2005). The specific survey was conducted in that city between 2002 and 2003, with 271 households (426 adults) participating in the weeklong survey. The CHASE instrument was designed to collect information about activities in both planning and execution stages. For this seven-day activity diary survey, the participants are required to record the individual activity information prior to the starting of the day. The CHASE program tracks the activity information that is *added* first, and then *modified*, *deleted* and *executed* over time. The first time *added* information represents the agenda formation, which undergoes *modification* or sometimes

*deletion* for scheduling. The final scheduled observations include the information regarding scheduling pressure.

CHASE divides all activities into nine major groups, of which social is one; further details can be found in Doherty *et al* (2004). CHASE collects a variety of attributes related to the activity type, the actor of the activity and the household within which the actor resides. In addition to this general information, some specific information about the activity is collected by actively prompting the respondent in an *End of Week Review* (EWR). EWR systematically queries stated spatial and temporal flexibilities, normal duration, and frequency of the activity type of concern. After cleaning some observations, 294 individuals in 208 households were selected for analyses. Total number of individual social episodes for these 294 people was 1223. 124 of the sampled persons are male and 170 are female.

In addition to socio-economic and activity specific variable, this paper incorporates variables regarding *the* social context where the activity-travel decisions occur. From an empirical perspective, an efficient way of addressing the impact of the social context is by considering the individual's *personal network* information. Personal networks constitute a useful approach to study the relevance of the social structure in activity-travel decisions. A personal network is "my network" for any given individual. In personal network analysis, the respondent individual is referred to as an "ego" and all of the people with whom he/she interacts are referred to as "alters". The number of "alters" within an ego's personal network indicates the size of the network. Measures of the size of a personal network vary according to the purpose of study. For example, McCarty, *et al.* (2000) estimated networks of about 250 ties in an American sample. However, as scope conditions get more specific, the number of network members decreases.

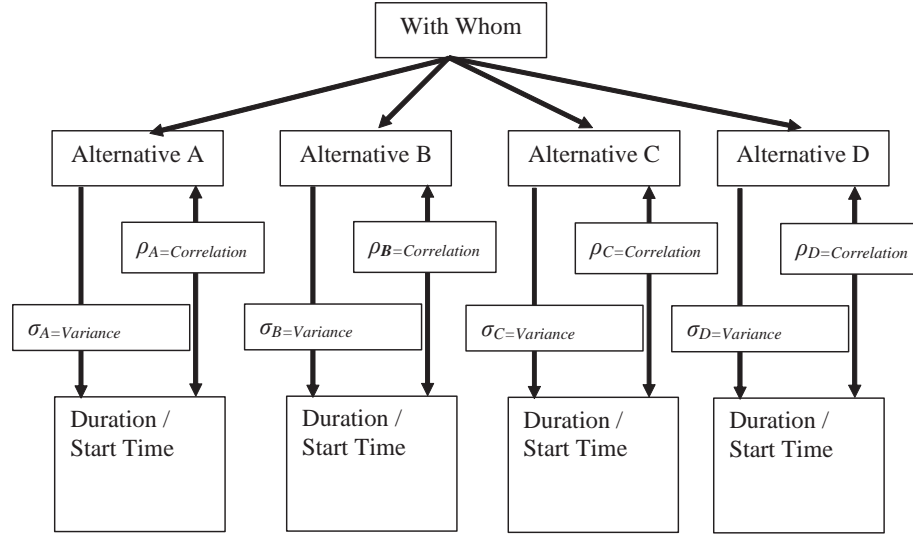
Following that approach, personal networks are devised in this paper based on information of the people (alters) with whom a respondent (ego) socializes. Constructing these personal networks is feasible since the CHASE instrument records the specific persons with whom the respondent socialized in each episode. For the purposes of this paper, alters are divided in two categories: "family", which correspond to both close and extended family members; and the "friends", which correspond to all the other people who are not family members. At the same time, CHASE also records whether the alters are household members or not. The following personal network variables are studied in this paper:

- *Total number of family members, total number of friends, total number of alters* with whom the respondent socialized that week.
- *Proportion of family members and proportion of friends*. This is the ratio between the number of friends and the total number of people with whom the respondent had social activities.
- *Variability of with whom*. For each alter, a variability index is constructed calculating the ratio between the number of social episodes s/he had with the respondent and the total number of episodes that the respondent performed during the week. The average variability index of all the alter members from the respondent's personal network corresponds to the *variability of the with whom* variable. This variable measures the "variety seeking" on social contacts, serving as a proxy of the fragmentation of the respondent's personal network. A number close to one involves a *low* variability of people, that is, the respondent tends to have social episodes mostly with the same people for all the episodes, whereas a number close to zero involves a *high* variability of people, where most of the social episodes involved different alters.

#### 4. METHODS

As discussed before, the central question of this paper is how “with whom” influences the *start time* and *duration* of social activity episodes (see Figure 1). The “with whom” dimension is classified into four options:

1. Socialize with family members together with household members
2. Socialize with friends together with household members
3. Socialize with family members without any household member
4. Socialize with friends without any household member



**Figure 1: Graphical Presentation of Joint Decision Process**

Start time and duration are considered as continuous variables. The start time of an activity episode is expressed as the fraction of the twenty-four hours in a day, and the duration is expressed in terms of the total minutes spent. Thus, the hazard-based modeling approach is appropriate for such continuous start time and duration modeling. The overall method estimates jointly the effect of the discrete “with whom” choice, and the continuous start time and duration decisions. Joint estimation of these two types of decisions leads to the sample selection econometric structure proposed by several authors, notably Duncan (1980) and Lee (1983); for a recent application, see Munizaga *et al.* (2006). Since the “with whom” decision option is more than binary, in both start time and duration decisions, the model becomes a continuous time hazard model with multinomial logit sample selection.

The specification for selecting “with whom” is defined by the utility function:

$$U_{wh} = V_{wi} + \varepsilon_{wi} = \beta_{wi} x_{wi} + \varepsilon_{wi} \quad (1)$$

Where  $V_{wi}$  indicates the indirect utility of alternative  $i$  (with whom),  $x_{wi}$  is the vector of explanatory variables,  $\beta_{wi}$  is the vector of corresponding coefficients, and  $\varepsilon_{wi}$  is the unobserved error term. The subscript  $w$  indicates each observation.

Alternative  $i$  (with whom) is chosen if and only if it gives maximum utility compared to all other alternatives:

$$U_{wi} > \max_{j=1 \dots M, j \neq i} U_{wj}$$

$$V_{wi} = \left\{ \max_{j=1 \dots M, j \neq i} U_{wj} \right\} - \varepsilon_{wi} \quad (2)$$

If the error term has a Type I Extreme Value distribution, the choice model takes the form of multinomial logit model:

$$\Pr(wi) = F(\varepsilon_{wi}) = \frac{\exp(V_{wi})}{\exp(V_{wi}) + \sum_{j \neq i} \exp(V_{wj})} \quad (3)$$

In the case of the continuous component, the dependent variable is time. For the episode duration, it corresponds to the total time spent for the episode; for the start time, it corresponds to the time from midnight to the start time of the episode. Recognizing the inherent dynamics of the behavioral processes, an accelerated time hazard specification is the most appropriate approach (Lee and Timmermans, 2007). Hence, the survival time,  $t$  of the events is expressed as follows:

$$\ln(t_i) = \gamma Z_i + \alpha_i \quad (4)$$

Where  $Z_i$  is the vector of covariates of the “with whom” alternative,  $\gamma$  is the vector of corresponding coefficients, and  $\alpha_i$  is the unobserved error term.

The distribution function of this error term determines the different types of accelerated hazard model. In the case of the Normal distribution assumption, it takes the form of a certain lognormal accelerated time hazard model. Considering that  $\alpha_i$  has a Normal distribution with mean and variance, it becomes:

$$f(\alpha_i) = N(\mu, \sigma_i) \quad (5)$$

The parameterization of the mean accommodates the covariate function:

$$\mu = \gamma Z_i \quad (6)$$

Then, the hazard function  $h(t_i)$  of the accelerated time hazard model has the following expression:

$$h(t_i) = \frac{f(t_i)}{S(t_i)}$$

$$f(t_i) = h(t_i) * S(t_i)$$

$$f(t_i) = \frac{1}{t_i \sigma_i \sqrt{2\pi}} \exp\left[\frac{-1}{2\sigma_i^2} \{\ln(t_i) - \gamma Z_i\}^2\right] \quad (7)$$



Where  $S(t_i)$  is the survival function and  $f(t_i)$  is the first derivative of the cumulative distribution function with respect to time.

The joint estimation of these discrete and continuous decisions requires assuming that the error terms  $\varepsilon_{wi}$  and  $\alpha_i$  are correlated. Given that these two error terms have different types of distribution, it is required to define the equivalent standard distribution for deriving the joint probability of discrete and continuous decisions. According to Lee (1983), any random variable can be expressed as a standard normal distribution. Transforming the previous error terms in (1) and (4) to corresponding standard Normal distributed values, we get:

$$\begin{aligned}\varepsilon_{wi}^* &= J_1(\varepsilon_{wi}) = \Phi^{-1}F(\varepsilon_{wi}) \\ \alpha_i^* &= J_2(\alpha_i) = \Phi^{-1}F(\alpha_i)\end{aligned}\tag{8}$$

The combined decision process is modeled by assuming a bivariate distribution:

$$C(\varepsilon_{wi}^*, \alpha_i^*, \rho_i) = B[J_1(\varepsilon_{wi}), J_2(\alpha_i), \rho_i]\tag{9}$$

Where  $\rho_i$  is the correlation between the discrete choice alternative  $i$  and the corresponding continuous decision.

For the lognormal accelerated hazard model assumption, the log-likelihood function of the combined estimation becomes (Lee, 1983):

$$LL = \sum_{s=1}^N \sum_{i=1}^M D_i \ln( (\phi(\ln(t_i) - \gamma Z_i) / \sigma_i) - D_i \ln(\sigma_i) + D_i \ln( \Phi( (J_1(\varepsilon_{wi}) - \rho_i J_2(\ln(t_i) - \gamma Z_i)) / \sqrt{(1 - \rho_i^2)} ) ) )\tag{10}$$

Where  $\phi( )$  and  $\Phi( )$  indicate the pdf and cdf of the Normal distribution, respectively;  $\sigma_i$  is the variance or ancillary parameter of the accelerated time hazard component;  $s$  indicates the individual observations;  $i$  indicates the alternative in the discrete choice section; and  $D_i$  is the indicator variable of choosing alternative  $i$ .

The log-likelihood function is estimated with code written in GAUSS using the BFGS algorithm (Aptech Systems, 2006). The standard errors of the parameters are calculated using the inverse of Hessian procedure. This modeling structure represents the sample selection model, where the duration of corresponding episode is only observed if the specific alternative of “with whom” is chosen for the social activity participation. The correlation coefficient and the alternate specific variance indicate the influence of the specific alternative of “with whom” on the corresponding episode duration. For mathematical identification purposes, one of the “with whom” alternatives is to be considered as the reference alternative.

## 5. ESTIMATED MODELS

This section presents results of the estimated models; Table 1 corresponds to the model for episode duration and Table 2 corresponds to the model for episode start time. In both tables,  $\rho$

represents the correlation between the combined decisions of “with whom” and the total duration / start time. Also in these tables,  $\sigma$  represents the variance of the duration/start time model for specific option of “with whom” participation. Considering  $t$  values greater than or equal to 1.64 as the limit of statistical significance (i.e. at the 90% level), the models are discussed next.

The statistical significance of the error correlation parameter  $\rho$  indicates that the decision of “with whom” and start time/duration are not independent of each other. The model for episode duration shows that the duration of social episodes is negatively correlated with “with whom” if household members are not involved in the activity. This finding indicates that, when people participate in social activities without other household members, they tend to spend less time in social activities. When household members are involved in the social activities together, the activity episodes are usually longer in duration. On the other hand, the model for episode start time shows that start times are negatively correlated with “with whom” if household members are involved in the activity. This result indicates that involvement of more than one household member influences the social activity to start earlier in the day, possibly due to more intensive coordination constraints.

In terms of alternative specific variance of the duration and start time models, all parameters show high statistically significant results. According to the model formulations, the higher the value of the variance, the lower the duration and the earlier the start time of the social episode. In the case of duration, the minimum duration corresponds to the case when the respondent socializes with family members but without any household member. The second lowest duration corresponds to the case when the respondent socializes with friends but without any household member. Finally, the duration is higher if the respondent socializes with household members. In the case of start times, earlier start times occur when the respondent socializes with family members but without any household member. The second earliest start time occurs when the respondent socializes with friends but without any household member. Start time is the latest if individual socialize with household members. In both of these cases, it is very clear that the involvement of household members in social activities significantly influences the time allocation decision. The higher statistical significance of  $\sigma$  in both models proves the necessity for combined estimation of such discrete-continuous decision structure.

In terms of the decision regarding “with whom” to socialize, the models show the relevance not only of the personal attributes of the respondents, but also of the characteristics of their personal networks. The same variables enter into both the duration and start time models with almost the same parameter values. It is clear that males prefer to socialize more with the friends than family members, compared with females. Household heads, either male or female, are less likely to socialize alone with the friends without any household members. In addition, adults with partners are more likely to socialize with friends together with household members, than in the case of single parents of adult children living in the household. A higher proportion of friends in the social network increases the probability of participating in social activities with friends together with the household members. On the other hand, a higher total number of friends and a higher number of alters in the personal network increase the probability of participating in social activities with friends without any household members. Finally, a higher number of family members in the social network increase the probability of participating in the social activities with family members without any household members.



**Table 1: Model for Episode Duration**

Variable Name	Parameter	Std. Error	t
<b><i>Base Alternative: With Family Members together with Household Members</i></b>			
<b>Correlation Between Discrete and Continuous Parts</b>			
$\rho_1$	0.1155	0.1232	0.938
$\rho_2$	-0.2869	0.0936	-3.066
$\rho_3$	-0.1876	0.0786	-2.385
<b>Variances of Continuous Hazard Model Part</b>			
$\sigma_1$	0.4809	0.095	5.061
$\sigma_2$	0.8656	0.0245	35.31
$\sigma_3$	0.8738	0.0336	26.025
<b>Utility Function of Multinomial Logit Components</b>			
<b><i>Alternative1: With Friends together with Household Member</i></b>			
Male (Dummy)	0.9983	0.6343	1.574
Proportion of Friends in Network	3.1694	0.9499	3.337
Adult With Partner (Dummy)	1.5981	0.6238	2.562
<b><i>Alternative2: With Family without any Household Members</i></b>			
Constant	5.1642	0.9966	5.182
Total Family Members in Network	0.6535	0.1711	3.819
Variability of With Whom	1.1163	0.3886	2.873
<b><i>Alternative3: With Friends without any Household Members</i></b>			
Constant	5.8823	0.9925	5.927
Total Friends Members in Network	0.6632	0.1776	3.734
Total Alters in Network	0.0742	0.1646	0.451
HH Head (Dummy)	-0.3688	0.1954	-1.888
<b>Covariates of Lognormal Hazard Model Component</b>			
Constant	4.0337	0.1041	38.738
Total People Involved	0.1552	0.0259	5.983
No. of Potential Locations	0.0113	0.0088	1.286
Duration Flexibility( Dummy)	0.191	0.0568	3.362
Travel Time (Minutes)	0.0011	0.001	1.126
Total HH Children	-0.072	0.0324	-2.224
No. of HH Automobiles	0.0877	0.0386	2.269
Full Time Worker (Dummy)	0.0147	0.0543	0.271
Weekly Frequency	-0.033	0.0061	-5.377

Overall, considering the alternate specific constant of the “with whom” selection model, it is clear that people prefer social activities with friends or family members but without household members. In the case of duration, the constant coefficient is very high with a high  $t$  statistic, indicating that there is still scope to incorporate more variables to explain the process. However, it is clear that the higher the number of people involved in the social activity, the longer the duration, although a higher number of household children tends to a shorter duration. A higher number of potential location for socialization influences longer duration episode. Duration flexibility of the activity also influences the duration positively. People tend to spend more time for the social activity that requires longer travel time to reach the activity location. Full time workers tend to spend more time in social activities than part time workers or people working at home. People with higher number of household automobiles are more likely to involve in longer duration social activities. Also intuitively is the relationship between higher weekly social activity frequencies and shorter durations for the individual activity episode.

**Table 2: Model for Episode Start Time**

Variable Name	Parameter	Std. Error	t
<b><i>Base Alternative: With Family Members together with Household Members</i></b>			
<b>Correlation Between Discrete and Continuous Parts</b>			
$\rho_1$	-0.4733	0.1254	-3.773
$\rho_2$	0.1551	0.1218	1.273
$\rho_3$	0.0507	0.0909	0.558
<b>Variances of Continuous Hazard Model Part</b>			
$\sigma_1$	0.2222	0.037	6.00
$\sigma_2$	0.5635	0.0154	36.568
$\sigma_3$	0.5494	0.0213	25.841
<b>Utility Function of Multinomial Logit Components</b>			
<b><i>Alternative1: With Friends together with Household Member</i></b>			
Male (Dummy)	0.9545	0.6233	1.531
Proportion of Friends in Network	3.1886	0.9517	3.35
Adult With Partner (Dummy)	1.6363	0.6124	2.672
<b><i>Alternative2: With Family without any Household Members</i></b>			
Constant	5.1866	0.9876	5.252
Total Family Members in Network	0.6836	0.1713	3.991
Variability of With Whom	1.0139	0.3919	2.587
<b><i>Alternative3: With Friends without any Household Members</i></b>			
Constant	5.8664	0.9861	5.949
Total Friends Members in Network	0.6332	0.1794	3.53
Total Alters in Network	0.1056	0.1652	0.639
HH Head (Dummy)	-0.3931	0.1997	-1.968
<b>Covariates of Lognormal Hazard Model Component</b>			
Constant	-0.3593	0.0645	-5.572
Total People Involved	-0.0407	0.0169	-2.413
No. of Potential Locations	-0.0109	0.0057	-1.902
Duration Flexibility( Dummy)	-0.0184	0.0361	-0.511
Total HH Children	-0.027	0.0211	-1.282
No. of HH Automobiles	0.034	0.024	1.419
Home Maker (Dummy)	-0.066	0.0803	-0.821
Weekly Frequency	-0.0047	0.0038	-1.229

In terms of start time, the constant coefficient indicates that people prefer the afternoon ( $e^{-0.3593} = 0.698 = 4:45$  pm) to start the social activities. However, when a higher number of people is involved, start times tend to be earlier. Similarly, start times tend to be earlier than 4:45 pm when there are a higher number of potential social activity locations and higher duration flexibility, as well as if the respondent has a relatively high number of children living at the household. On the other hand, a higher number of household automobile increases the options to travel and hence influences the activity to start later. It is important to note that neither the effect of distance to travel nor the travel time become statistically significant in the start time model. A possible explanation is that it is the “with whom” that defines the start time of the social activities and not the travel time to reach the activity location. Then, as the models explicitly integrated the “with

whom” decision into the start time selection model, the variable indicating the travel time to reach the activity location becomes insignificant.

Both *with whom - duration* and *with whom - start time* models provide high goodness-of-fit (see Table 3 for a summary of their goodness-of-fit). The start time model has a higher goodness-of-fit than the duration model, although the number of statistically significant parameters is higher in the duration model. A possible explanation to this phenomenon is that the selection of “with whom” is more influential on the start time selection compared to that of duration. This also favors the argument that it is not the distance or travel time to define how to schedule the social activities but it is the “with whom” we socialize. This aspect also reaffirms the need of incorporating social dimension in activity scheduling model as well as treating the social activity separately than other activity types.

**Table 3: Summary of Goodness of Fit Measures**

	<b>Duration</b>	<b>Start Time</b>
Loglikelihood of Null Model	-2865.93	-2607.41
Loglikelihood at Convergence	-1877.2	-1416.2
Number of Parameters to be considered for Adjustment	24	23
Number of Observations	1223	1223

## 6. CONCLUSIONS

This paper investigates a critical issue in activity scheduling decision: the social dimension of activity scheduling. For prototype application, social activity episodes were selected for detailed analyses. The main objective was to identify how the “with whom” dimension influences scheduling decisions, specifically start time and duration of social activity episodes. CHASE survey data collected in Toronto were used for the investigation. The individual’s social network is drawn from “with whom” respondents performed social activities in the seven-day survey period. Based on this social network approach, four classifications of “with whom” the individuals to participate the social activities are used to capture the social context of start time and duration of social activities. Econometric models of combined decisions regarding “with whom” to participate and when to start or how much time to spend on were estimated to investigate the correlations between the “with whom” decision and these scheduling decisions: start time and duration. One of the key findings was that when the social dimension is incorporated explicitly in the start time model, the effect of travel time and travel distances becomes statistically insignificant. This finding bolsters the argument that it is “with whom” we socialize what defines the social activity scheduling process and not travel time or distance. The models also provide other profound insight into the behavioral process of activity scheduling and the social dimension. Significant correlations exist between “with whom” to participate and the start time as well as duration of the social activity episodes.

Overall, the contribution of this paper is two-fold. In addition to the theoretical understanding of the questions posed to investigate in this paper, the models are useful to advance empirically in previous theoretical ideas developed regarding activity scheduling modeling (Miller, 2005a), which could serve to improve the existing operational activity scheduling model TASHA (Miller and Roorda, 2003), integrated inside the ILUTE framework (Salvini and Miller, 2006).

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