

# SUMMARY

Thesis Title: Activity Based Modeling: Intra-Household Interaction, Attitudes and Telecommunication Use.

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Household members interact in many ways during their daily activity- and travel-related decision-making. Consequently, the activity-travel patterns of all household members become inter-dependent. There has been an increasing realization that such household interdependencies have to be accommodated explicitly within activity-based models for accurate forecasts of travel patterns and for the realistic evaluation of the impacts of policy actions. As a result, during the last few years, there have been a significant number of studies aimed to modeling the household interactions. However, critical gaps exist in some key areas. For example, regarding joint participation on activities, many gaps still exist in understanding the activity engagement behavior. The purpose of this study is to investigate the intra-household interactions, particularly; the joint activity and travel participation decision, and the role of individuals' attitudes, mobility resources, and internet and communication technology-use (ICT) in joint activity and travel participation decisions.

The primary motivation for investigating joint activity and travel is two-fold: First, from current travel behavior and the associated intra-household interactions in Cairo, as a study area, joint travel constitutes approximately 41.3% of all travel patterns (total 21 million. trips around 9 million. are joint trips), according to the 2001 Household and Personal Trip Survey Results (Greater Cairo Transport Mater Plan, CRETATES, 2001). The results also suggested a strong role of gender on joint travel generation. The

empirical results indicate that the travel patterns by females constitute a higher percentage of joint travel patterns (around 80% of all travel patterns of females). However, it is noted that females over the age of 6 years make 1.2 trips per person per day, compared with 2.1 trips made by males. This reflects a greater degree of gender-based travel patterns and task allocation particularly for Cairo people. Also it reflects a significant influence of culture norms and believes on travel behavior and the interaction between household members. Second, from practical stand point, joint participation in activity and travel is important from policy implantation and practical perspective, since the level of joint participation in travel and activity patterns can strongly influence vehicle occupancy levels, trip-chaining and mode choice and thus have significant implications for congestion, air-quality, and demand estimation for transit. For instance, how a household with one car share the activities and the vehicle across household members can determine the mode choice and timing of the various trips in the household. Thus, ignoring study within-household interactions that results in joint travel and activity participation, can result in erroneous and misleading demand estimates.

Due to these motivating considerations, the objectives of this study are as follows:

1. Analyzing the intra-household interactions by modeling household members' joint participation choice of daily activity and travel patterns. This objective differs from priori literature in the following respects:
  - a) It analyze explicitly intra-personal trade-offs between solo and joint in-home and out-of-home activity participation decisions, and the possible substitution patterns between them.
  - b) It captures the inter-personal trade-offs between solo and joint with whom (with household members, with others, with household members and others) for out-of-home activity participation decisions.
2. Exploring the relationships between telecommunication use and household members' joint participation choice in daily activity and travel. Specifically, the current study aims to investigate the linkages between levels of household virtual and physical mobility and individuals' daily joint activity and travel participations.
3. Investigating individuals' attitudes, perceptions, and desires towards their joint activity and travel and the role their attitudes play in their daily joint activity and travel

participations. The key premise of this objective is as follows: Joint activity itself has an intrinsically positive utility that contributes to the demand for it. The goals of this research are to better understand the causes and effects of that affinity for joint activity.

Addressing these research objectives is likely to provide insights on the behavioral basis underlying household joint participation of activities and travel, with implications for demand management, and evaluation of transportation policy actions.

In order to achieve the objectives of the study, a highly disaggregated data concerning activity episodes and related attributes in greater Cairo region is needed. Therefore, as a first step, intensive activity diary and telecommunication survey have been implemented and spanned the period from December 2005 to January 2006. The survey collected original and valuable detailed information on all activity and travel episodes as well as daily telecommunications and Internet use for a two-day period (weekday and weekend) from members of 150 households (459 respondents). For each activity episodes information was collected on the type of activity, the start and end times of activities, location of participation, and with whom the activity was pursued and for whom. The survey also collected individual and household socio-demographic information, employment- related characteristics, and individuals' joint activity and Internet use attitudes. To our knowledge, this is the first attempt to conduct an activity diary and telecommunication survey in the Arab world. Therefore, the results of this analysis will facilitate our knowledge about new facets of activity and travel behavior. The study objectives are explored at the most detailed level using a series of statistical and econometric discrete models which include: (a) cluster analysis statistical techniques, (b) discrete multinomial mixed-logit models.

We used these models to explore several hypotheses for the theoretical motivations behind joint activity and travel participation decisions. We assume that the degree to which individuals derive positive utility from joint participation reflects taste variation across individuals and households. This taste variation depends on the type of activity as well as unobserved personality, lifestyle, and related factors inside the household. Furthermore, individuals' motivations, commitments and constraints are direct functions of their role(s) in a wider social world beyond the household, culture influence, and social system. This implies that individual's motivation of joint participation in particular type

of activity is energized by his/her social network. Therefore the proposed modeling approach entails the modeling of the following two dimensions: (1) the solo and joint activity and travel participation model. (2) The solo and joint “with whom” activity and travel participation model.

The analysis of “joint with whom” activity participation extend the modeling framework to accommodate intra-individual and inter-individual variation in unobserved determinants of joint activity and travel choice. Particularly, it involves the modeling of the decision of household members to participate in activity and travel as (1) solo, (2) joint with household members, (3) joint with others from outside the household and (4) joint with household and others.

The modeling effort in this study may be distinguished from previous related studies in several ways. First, the current modeling effort accommodates heterogeneity in responsiveness to solo and joint activity and travel participations. Therefore, the study is able to accommodate the intra-individual variations in joint activity and travel participation, where some of prior literature assumed homogeneity in responsiveness to attributes of solo and joint alternatives across individuals. Second, the models determine the possible sources of any solo and joint preference heterogeneity that may exist. Third, the model explicitly captures correlation between members of the same household and within-person over different episodes. Correlations due to shared unobservable factors (including habits, lifestyle, social and culture norms) among joint and solo activity and travel participation are also analyzed, whereas, much of the prior literature treated different episodes even among the same household as mutually independent. Fourth, it is more disaggregated as it captures the dependent variable at a person-level (rather than at a role-level (head/spouse) or segment level (male/female)). Fifth, the current study uses two-day activity and travel diary data, therefore, the models are able to address intra-individual and dynamic transition in daily joint and solo activity participation over a multi-day period.

The results support many of our hypothesis regarding joint activity and travel participations. Household traditions and believes, social roles, and lifestyle are found to

be the main factors which affect joint activity and travel. Furthermore, the results suggested additional two inter-related motivations behind joint activity and travel namely opportunity and sociability. Opportunity refers to the ability of the household to engage in different in and out-home activities, which is strongly related to the household levels of virtual as well as physical mobility. Sociability refers to the degree of social networks between the household and the wider social world beyond the household.