Center for <u>T</u>eaching <u>O</u>ld <u>M</u>odels <u>Ne</u>w <u>T</u>ricks (TOMNET)

A USDOT Tier 1 University Transportation Center

Title: Exploration of the Relationships between Leisure Activity Participation Frequency and Social Capital

Principal Investigator: Michael Maness, Assistant Professor, Department of Civil and Environmental Engineering, University of South Florida

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1. Introduction/Problem Statement

Transportation has recently become an umbrella name that no longer refers only to improving congestion or increasing public transit use, but it has also started to include research relating to human behavior, health, as well as human interactions with the built environment and each other. The need to travel is dictated by the need to connect with activities such as employment and entertainment as well as the people who belong to one's formal and informal social networks. Recently, there has been an increased focus to study how the need to travel fits into the context of one's social capital and relates to participation in various leisure activities (Luong and Maness, in review). Because activity-oriented approaches have gained considerable attention in the field of travel behavior (Axhausen and Gärling, 1992) and the methodology to study them was expended to not only explore the activity type but also incorporate its timing and duration jointly (Bowman and Ben-Akiva, 2001), increased focus on leisure activities in the literature has been observed.

Carrasco and Miller (2009) found that social network characteristics including the number of its members and the composition and their relative location can serve as a good explanation of social activity-travel generation. While examining the social activity-travel, it is worth emphasizing the presence of multiple dimensions and significant complexity of leisure related travel. As the literature suggests, in addition to the issue of simultaneously studying the activity type, its timing, and its duration, social activity-travel can also be studied from a perspective of social capital and social networks (i.e. Lin, 2001; van den Berg et al., 2010; Lin and Wang, 2014). Because combining social sciences and human interactions in the context of travel behavior has been a rapidly evolving field, there has been an increased interest in exploring the nature of variety and frequency of leisure activities.

Maness (2017) argued that social capital essentially captures the value of social networks whereas social networks enable individuals to perform actions that could not be performed individually. The individuality of an activity becomes an important factor while studying leisure activities with respect to the relationship between social capital and activity types or frequencies. Sadri et al. (2015) analyzed the characteristics of individuals' strong ties on joint trip frequency for different activity types while Maness (2017) expanded this finding and concluded that the size of an individual's core network (strong ties) positively impacts the frequency of leisure activity participation. Strong ties and accessible resources are measures of expressive support to help individuals strengthen their social connections. Instrumental

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support, on the other hand, is defined as the new resources that one can reach out for profit or influential gain through a variety of different activities. Thus, an increase in participation frequency in a particular leisure activity is hypothesized as the capitalization of expressive support rather than instrumental support.

This study examines the effects of social capital on the increased frequency of leisure activity participation. This research proposed two research questions to test the two dimensions of social capital on the leisure activity participation frequency outcome:

1. Does expressive support play a more significant role than instrumental support in increasing the participation frequency of leisure activities, thus suggesting that activity frequency is an expressive outcome as people maintain and strengthen their social connections?
2. How sensitive are the instrumental and expressive social capital measures on the participation frequency of different forms of leisure activities?

This study aims to answers those questions using insights gathered from a self-administered web-based survey designed specifically to measure differences in social capital and its relevance in a leisure activity context.

2. Project Objectives
This project will have the following objectives:

1. Process, review and manage multiple activity behavior survey dataset involving leisure activity behavior, social capital, and pandemic-related factors
2. Analyze social network and leisure activity data to explore the effects of social capital on leisure activity behavior, specifically frequency of participation
3. Compare and contrast leisure activity behavior between the pre-pandemic and in-pandemic periods

3. Proposed Methodology and Data
Data for this study (the Leisure Activity and Social Resources Survey, see Luong and Maness (in review)) were collected in November and December of 2019 and targeted the population of adults that were at least 18 years old based in the geographical region of the United States. The survey collected data on individuals' basic socio-demographic characteristics, their social capital, mobility and accessibility, leisure activity variety and frequency as well as household related tasks, maintenance activities, and other responsibilities (e.g. work and school). There were three sampling frames used in the data collection; (1) Qualtrics Panels which included adults with internet access in an internet-based survey panel, (2) Prolific that included women with internet in an internet-based survey panel, and (3) Amazon MechanicalTurk that incorporated registered US MTurk workers. The final number of observations obtained was 1,297 responses.

The survey consists of sections on activity space, social capital, mobility/accessibility, individual and household characteristics. The activity space section of the survey asks about: 1) leisure activity variety and frequency, 2) household mandatory and maintenance activities, and 3) work and school demand. Additionally, the survey will be conducted in a longitudinal fashion over 2020 and 2021. As additional data is obtained from the survey data collectors, this information will be cleaned and formatted for additional time periods as well.

Since the main objective of the study is to gain more insights into the frequency of leisure activities and their impact on social capital, the survey is specifically designed to collect the participation frequency of leisure activities. Survey respondents were presented with a list of 86 different leisure activities to select "Which of the following activities have you performed over the last three (3) months?" Adopted from Tinsley and Eldredge (1995), 77 out of their 82 activities were adopted and Nine additional leisure activities were added. The survey respondents were then asked to indicate the participation frequency for each of the activities that they participated in over the last three months using six choice categories: once, twice, once per month, 2-3 times per month, once per week, more than once per week. As this participation frequency is a cardinal variable that has increasing frequency values, the ranges between two categories are not linear. Thus, an ordered response model is appropriate to examine the participation frequency (dependent variable) for the selected activities. Since there is an explicit time period for this survey question, a zero-inflated model is needed to account for the two types of people having zero participation in a particular activity: sempiternal non-participants versus temporary non-participants. Sempiternal non-participants are the respondents who have not and will not participate in a certain activity (e.g.: a respondent who does not watch football or someone who does not play video games because they are not interested in these activities instead of other temporary constraints). Temporary non-participants are the respondents who might have participated in the past but not during our survey period of the last three months (e.g.: a respondent who does not visit relatives and friends or attend church during the last three months due to work demand).

The zero-inflated ordered probit (ZIOP) models developed by Harris and Zhao (2007) can help assess the correlations between access to social resources and increased activity participation frequency. The ZIOP modeling structure accounts for the two different stages of whether one participates in an activity, and if yes, how much would the influencing factors increase or decrease frequency. To clearly differentiate frequency effects from participation effects, this separation leads to more accurate estimation of the effect of social capital on activity frequency. Harris and Zhao (2007) specify the ZIOP model by two latent equations: a binary probit equation for zero-inflation and an ordered probit equation for categorization.

In addition to the activity variety and frequency, social capital measures were measured which consisted of instrumental support and expressive support measures. Social capital will be measured by three instruments: (1) position generator, (2) resource generator, and (3) core network size. This project will develop composite measures of these instruments to differentiate instrumental and expressive support using principal component analysis and multiple correspondence analysis.

Using the ZIOP models, activity frequency behavior will be analyzed for the different activities. It is expected that activities with higher affiliation (more social) will increase in frequency with greater expressive social support. In contrast, activities with low affiliation will not be affected by expressive social support. Hypothesis testing will be used on the frequency component of the ZIOP model for the social capital measures obtained. Additionally, marginal effects will be used to determine the frequency levels at which greater expressive social capital contributes to greater participation frequency.

4. Work Plan
Task 1: Process and clean social capital datasets
We propose to start the analysis by preparing the Leisure Activity and Social Resources Survey dataset for modeling and analysis. The components of this task are as follows:

1.1 Clean the 2019 social capital dataset: The data will need to be cleaned and compiled to cleanly delineate differences in activity participation patterns between respondents. Additionally, the measures from the survey instrument need to be converted into composite measures to conduct meaningful analysis.

1.2 Clean future longitudinal datasets: As additional datasets are obtained from the longitudinal study, these datasets will be cleaned and compiled.

Task 2: Conduct inferential study of the effect of social capital on leisure activity frequency

This study seeks to explore the hypothesis that expressive social support is relevant for greater social leisure activity frequency whereas instrumental social support has limited or no effect. Understanding this effect will aid researchers in further exploring the implications of how observing travel and activity patterns can be used to understanding the social well-being of neighborhoods and communities. To study the possibility, the following subtasks will be undertaken:

2.1 Develop a procedure to combine or differentiate leisure activity frequency: The hypothesis of more social leisure activities developing greater reliance on social support versus non-social leisure activity is non-trivial to study. Specifically, the delineation between social and non-social activity is difficult to assess. This study will need to develop a classification schema to differentiate social and non-social activities. Additionally, multiple schemas may be analyzed to explore the robustness of the hypothesis.

2.2 Develop and analyze models of leisure activity frequency and social capital: Models of activity frequency (e.g. ordered response, zero-inflated ordered response models) will be developed to examine the impacts of social capital on activity behavior, specifically leisure activity frequency. In doing so, modeling methods may be developed to recognize and address the multidimensional nature of social capital indicators (as opposed to the typically used approach of treating indicators as unidimensional variables directly). The appropriateness of using a zero-inflated modeling approach to differentiate temporary non-participation versus permanent non-participation will be analyzed.

2.3 Prepare a working paper on leisure activity frequency and social capital: A journal style working paper will be developed, proofed, and revised for submission to a peer-reviewed transportation, planning, or leisure journal.

Task 3: Compare activity behavior pre-pandemic and during pandemic

Changing activity availability and travel restriction could potentially impact individuals' social well-being. To study this possibility, this study will look at changes in leisure activity participation and reported levels of social support and social well-being by analyzing a longitudinal study on leisure and social capital. The following subtasks will be performed:

3.1 Conduct a descriptive study of the differences in leisure activity behavior: First, statistical differences between pre- and in-pandemic conditions and behavior will be explored. It is expected that changes in activity diversity and frequency will occur as well as the leisure activity portfolio of participants due to restrictions on activities from the pandemic. A component of a technical report or a web vignette will be developed to show the results of the descriptive analysis.

3.2 Conduct an inferential study of changes in leisure activity behavior: Next, statistical inference will be used to observe if there were significant changes in leisure activity behavior. This will include

the diversity of activities participated in as well as differences in the impacts of social capital on social leisure activity participation frequency. This work will be the primary subject of a working paper on temporal differences in leisure activity behavior.

    3.3 <u>Prepare a working paper on temporal changes in leisure activity</u>: A journal style working paper will be developed, proofed, and revised for submission to a peer-reviewed transportation, planning, or leisure journal.

5. Project Schedule

The proposed project schedule is shown in the table below. It is expected that milestones will be accomplished after each subtask (at the end of that subtask's final month). These are denoted in parentheses below the task labels.

Subtasks	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug
Task 1: Process and clean social capital datasets												
1.1 Clean the 2019 social capital dataset (Dataset developed)	▓	▓										
1.2 Clean future longitudinal datasets (Dataset(s) developed)						▓				▓	▓	
Task 2: Conduct inferential study of the effect of social capital on leisure activity frequency												
2.1 Develop a procedure to combine or differentiate leisure activity frequency (Procedure documented)			▓	▓	▓							
2.2 Develop and analyze models of leisure activity frequency and social capital (Model results documented)					▓	▓	▓					
2.3 Prepare a working paper on leisure activity frequency and social capital (Journal article submission)							▓	▓	▓			
Task 3: Compare activity behavior pre-pandemic and during pandemic												
3.1 Conduct a descriptive study of the differences in leisure activity behavior (Report or web vignette prepared)								▓	▓			
3.2 Conduct an inferential study of changes in leisure activity behavior (Study results documented)									▓	▓	▓	
3.3 Prepare a working paper on temporal changes in leisure activity (Working paper developed)											▓	▓

6. Relevance to the Center Theme/Mission

This project's application area in electric vehicle ownership and infrastructure directly addresses FAST Act Research Priorities in (1) strengthening transportation planning and environmental decision-making. This project will contribute to TOMNET's mission to address barriers related to inclusion of alternative

behavioral theories in travel models. This will be done through data collection and analysis of social and attitudinal data. Understanding the effects social support and social capital on leisure activity will aid researchers, planners, and public health officials in further exploring the implications of how observing travel and activity patterns can be used to understanding the social well-being of neighborhoods and communities. Additionally, this work will provide valuable information for assessing the impacts of the pandemic and pandemic-related policy on social well-being.

7. Anticipated Outcomes and Deliverables
The project will result in the following deliverables:
1. Two working paper prepared for submission to peer-reviewed journals
2. A report or web vignette documenting observed difference in leisure activity behavior pre-pandemic and in-pandemic

8. Research Team and Management Plan
Michael Maness is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of South Florida. His research interests are in the methodology and application of behavioral modeling in urban and regional systems. His dissertation, which was awarded the 2015 Eric Pas Dissertation Prize, involved incorporating social interactions into activity and travel behavior models. Maness is experienced in advanced choice models with applications to car ownership, electric vehicles, managed lanes, cycling, activity behavior, and communication behavior. His professional experience has included a postdoc at Oak Ridge National Laboratory and a graduate research fellowship at Turner-Fairbank Highway Research Center. He has published articles in top transportation journals including Transportation Research Part B, Transportation Research Part A, and Journal of Transport Geography.

Michael Maness will be involved in statistical model development and interpretation of findings. A research assistant will be involved with data cleaning and documentation as well as model development and report writing. The PI will supervise the student researcher with the student directly reporting to the PI weekly. Fred Mannering, a professor of Civil and Environmental Engineering at the University of South Florida, will provide some additional modeling guidance and support of the student research (about one-tenth month in cost-share).

9. Technology Transfer Plan
The technology transfer component of the project involves: (1) dissemination of project findings and outcomes in the form of conference presentations (such as the Transportation Research Board Annual Meeting) and peer-reviewed journal publications and (2) making the dataset available for public use through TOMNET's website.

10. Workforce Development and Outreach Plan
The project will directly provide career development opportunities for one doctoral student. The research effort will allow the doctoral student to expand their technical skills into new areas of discrete choice modeling and social network analysis. The supported doctoral student is expected to gain experience in conducting a research project and technical writing.

The project will include an educational component where data and information from the project will be provided to students to aid in their development. The PI will teach a graduate-level course on travel demand modeling. An assignment module component that involves the analysis of activity data will

be produced. Data from the general leisure activity survey will be provided and students will models of leisure activity frequency. This will serve to expose students to data cleaning, data analysis, and discrete choice analysis.

11.References

Axhausen, K., Gärling, T., 1992. Activity-based approaches to travel analysis: conceptual frameworks, models, and research problems. Transport Reviews 12 (4), 323–341.

Bowman, J., Ben-Akiva, M., 2001. Activity-based disaggregate travel demand model system with activity schedules. Transportation Research Part A 35 (1), 1–28.

Carrasco, J., Miller, E., 2009. The social dimension in action: A multilevel, personal networks model of social activity frequency between individuals. Transportation Research Part A 43, 90–104.

Harris, M.N., Zhao, X., 2007. A zero-inflated ordered probit model, with an application to modelling tobacco consumption. Journal of Econometrics, 141(2), pp.1073-1099.

Lin, N., 2001. Building a network theory of social capital. Social capital: Theory and Research (N. Lin, K. Cook, R. Burt, eds.), Transaction Publishers, 3–29.

Lin, T., Wang, D., 2014. Social networks and joint/solo activity-travel behavior. Transportation Research Part A 68, 18–31.

Luong, T., Maness, M., in review. Comprehensive analysis of leisure activity variety as an instrumental outcome of social capital. Submitted for presentation at the 2021 Transportation Research Board Annual Meeting.

Maness, M., 2017. A Theory of strong ties, weak ties, and activity behavior: Leisure activity variety and frequency. Transportation Research Record Journal of the Transportation Research Board 2665 (1), 30–39.

Sadri, A., Lee, S., Ukkusuri, S., 2015. Modeling social network influence on joint trip frequency for regular activity travel decisions. Transportation Research Record: Journal of the Transportation Research Board 2495, 83–93.

Van den Berg, P., Arentze, T., Timmermans, H., 2010. Location-type choice for face-to-face social activities and its effect on travel behavior. Environment and Planning B: Planning and Design 37, 1057–1075.

12. Qualifications of Investigators

MICHAEL MANESS

Assistant Professor, Department of Civil and Environmental Engineering

University of South Florida (USF), Tampa, FL 33620 Email: manessm@usf.edu

Education

Ph.D., Civil Engineering, University of Maryland, May 2015.

M.S., Civil Engineering, University of Maryland, December 2010.

B.S., Civil Engineering, University of Maryland, May 2009

B.S., Computer Science, University of Maryland, May 2009

Selected Employment and Professional Experience

Postdoctoral Scholar, Department of Civil and Environmental Engineering, USF, 2017-present.

Postdoctoral Research Associate, Center for Transportation Analysis, Oak Ridge National Laboratory, 2015-2016.

Graduate Research Fellow, Office of Operations Research and Development, Federal Highway Administration, 2013-2014.

Fields of Interest and Expertise

1. Advanced discrete choice modeling
2. Agent-based modeling of people and freight
3. The role of social networks and social interactions in decision making
4. Forecasting emerging technologies in transportation
5. Data collection and experimentation in transportation

Recent Relevant Publications

1. M. Maness (2017). Comparison of Position Generators and Name Generators as Social Capital Indicators in Predicting Activity Selection. Transportation Research Part A: Policy and Practice, 106, 374-395.
2. M. Maness (2017). A Theory of Strong Ties, Weak Ties, and Activity Behavior: Leisure Activity Variety and Frequency. Transportation Research Record: Journal of the Transportation Research Board, 2665, 30-39.
3. C. Calastri, S. Hess, A. Daly, M. Maness, M. Kowald, and K. Axhausen (2017). Modelling Contact Mode and Frequency of Interactions with Social Network Members Using the Multiple Discrete-continuous Extreme Value Model. Transportation Research Part C: Emerging Technologies, 76, 16-34.
4. M. Maness and C. Cirillo (2016). An Indirect Informational Conformity Social Influence Choice Model: Formulation and Case Study. Transportation Research Part B: Methodological, 93, 75-101.
5. M. Maness, C. Cirillo, and E. Dugundji (2015). Generalized Behavioral Framework for Choice Models of Social Influence: Behavioral and Data Concerns in Travel Behavior. Journal of Transport Geography, 46, 137-150.

Recent Honors and Awards

Appointed as a Member of the Traveler Behavior and Values Committee (ADB10), Transportation Research Board, 2017-Present

2015 Eric Pas Dissertation Prize, International Association for Travel Behaviour Research, 2017

Outstanding Student of the Year, University Transportation Centers Program, 2015

Eisenhower Transportation Fellowship, Federal Highway Administration, 2010-2012, 2013-2014

13. Budget Including Non-Federal Matching Funds

Institution: University of South Florida
Project Title:
Principal Investigator: Michael Maness
Budget Period: 8/1/2020 - 07/31/2021

CATEGORY	Budgeted Amount from Federal Share	Budgeted Amount from Matching Funds	Explanatory Notes; Identify Source of Matching Funds
Faculty Salaries	$5,278	$7,753	Salary for Michael Maness with assistance from Fred Mannering
Other Staff Salaries	$0	$0	
Student Salaries	$22,000	$0	One 12-month GA
Fringe Benefits	$3,501	$2,291	Faculty and Student Benefits
Total Salaries & Benefits	$30,779	$10,043	
Student Tuition Remission	$0	$7,993	Tuition waivers for GA (24/24/15 credits)
Operating Services and Supplies	$0	$0	
Domestic Travel	$0	$0	
Other Direct Costs	$0	$0	
Total Direct Costs	$30,779	$18,036	
F&A (Indirect) Costs	$15,236	$4,971	
TOTAL COSTS	$46,015	$23,008	

Grant Deliverables and Reporting Requirements for UTC Grants (November 2022)

Exhibit F

UTC Project Information	
Project Title	Valuation of Free Electric Vehicle Charging Bundles
University	University of South Florida
Principal Investigator	Michael Maness

PI Contact Information	Address: 4202 E. Fowler Ave, ENB 118
	        Tampa, FL 33620
	        Email: manessm@usf.edu

Funding Source(s) and Amounts Provided (by each agency or organization)	US Department of Transportation (Federal UTC): $46,015 University of South Florida (Cost Share): $23,008
Total Project Cost	$69,023
Agency ID or Contract Number	
Start and End Dates	09/01/2021 – 08/31/2022
Brief Description of Research Project	
Describe Implementation of Research Outcomes (or why not implemented) Place Any Photos Here	
Impacts/Benefits of Implementation (actual, not anticipated)	The eventual impact of this research will be to improve the collection of social capital data in travel surveys and to aid in explaining the impacts of the COVID-19 pandemic on activity behavior.

Web Links
   • Reports
   • Project Website
	Reports and data will be made available on the TOMNET website.