C. Project Narrative

1. Project Title: Forecasting evacuation behaviors of coastal communities in response to storm hazard information

2. Principal and Associate Investigators

Ricardo A Daziano (PI), David Croll Fellow Assistant Professor, daziano@cornell.edu
Phil Liu (Co-PI), Class of 1912 Professor of Engineering, PLL3@cornell.edu
Linda Nozick (Co-PI), Professor, LKN3@cornell.edu
220 Hollister Hall, School of Civil and Environmental Engineering, Cornell University

Jonathon Schuldt (Co-PI), Assistant Professor, jps56@cornell.edu
329 Kennedy Hall, Department of Communication, Cornell University

3. Introduction / Background / Justification

Hurricane Sandy revealed the higher-risk vulnerability to natural hazards in coastal communities, including megacities such as New York. Losses due to damages in the transportation, energy, and built and natural environment systems have been estimated as the second highest in US history after Hurricane Katrina. Sandy also revealed some critical deficiencies in the area's coastal protection plans and emergency response actions. Unfortunately, experts predict that both future sea level rise and storms will exacerbate the problems caused by these deficiencies. There are several challenges to improving strength and resilience of infrastructure systems under risk and of vulnerable coastal communities. In particular, survival to storm hazards requires informed-decision making for quick and safe actions.

Between October 28th and November 29th, 2012, 117 fatalities were caused by Hurricane Sandy in New York, New Jersey, and nearby areas.[1] A number of these fatalities could have been prevented if residents had evacuated when mandated to; 45% of drowning deaths occurred in Evacuation Zone A, which had been identified as being at risk of flooding from any category of hurricane. This fact illustrates the key motivation behind studying evacuation behavior. Understanding the motives underlying survival actions is important because evacuation is the most effective way to decrease the number of fatalities that result from extreme weather events such as hurricanes.[2] Given a storm forecast and a variety of related variables (including how the information is framed), what is the probability that a household will evacuate? At what point in time will a household evacuate, where will they evacuate to, and how will they get there? If we understand how residents can be convinced to evacuate and how to facilitate the evacuation process, we can mitigate mortality in the case of extreme weather events.

Evacuation behavior has two main components: evacuation decision making, and logistics. In fact, there is an avenue of research that focuses on decision making. Evacuation decisions are unique because of its time-dependent nature. This time-dependency stems from the decision maker, the storm, and the situational context.[3] Some existing models for predicting evacuation behavior evaluate the decision of whether or not to evacuate at certain time periods.[2,4] Beyond this, however, not much has been done to include the timing of evacuation decision making into existing models in comparison to what we know about the sequence in which the decisions are made.[3] In order to represent this time-dependency in new models, researchers have been combining stated choice data – response to hypothetical storms – with data from revealed preference experiments – response to actual storms. Stated choice data better represents the time-dependency of certain behaviors rather than post-event revealed preference data.[2] Stated preferences are at risk of being affected by hypothetical bias; however, calibrating the results with revealed preference data provides a solution to this problem. (Parameters are estimated in a joint model that exploits both kinds of data.)[5]

Existing research in the field of evacuation behavior has also closely examined what different factors influence evacuation decisions and how they do so. Five of the most important factors include characteristics of the storm, risk perception, housing type, authorities' actions, and the hazard level of the area.[4] These are especially important if the housing is a mobile home, if the decision maker lives on an island, and whether the evacuation order is recommended or required.[5,6] Socio-demographic factors related to evacuation behavior are gender,[7,8] age (both of the decision maker and of household members, especially in the case of very young or elderly members), household size (whether there are one or multiple persons), income, race and ethnicity,[8] and level of education.[5,6] Physical disability,[8, 9] proximity to evacuation routes, previous experience with extreme weather events,[8] the presence of pets,[5,6] and media reports[10] also affect the decision of whether or not to evacuate in the case of an extreme weather event. In the existing literature, however, little attention has been devoted to the problem of how storm information visualization impacts evacuation actions.[11] In fact, text descriptions are the standard method used in stated preference studies for informing respondents about the characteristics of a hurricane. One interesting exception makes use of audio-visual representations of the evolution of a storm for collecting evacuation intended actions.[12] Data collected in this study was analyzed using a time-dependent sequential logit model.[4] Another recent study looks at response to hurricane risks using storm-experience simulations in a computer-based environment.[13]

Besides decision making, logistical considerations are also important components of evacuation behavior. Evacuation logistics refers to "the activities and associated resources needed to reach a safe location and remain there until it is safe to return".[14] Facets of evacuation logistics include transportation mode,[3] route, time of departure, length and cost of evacuated stay, location, and shelter type.[14,15] This is related to some of the decisions residents make when choosing whether or not to evacuate: for example, if the cost of evacuating is too high, some households will choose not to evacuate.[14] As a result, both decision making and logistics should be consider jointly.

4. General Work Plan and Milestones

This proposal requests funds to collect, analyze, and model microdata on informed evacuation behavior within coastal communities in the tri-state areas impacted by Hurricane Sandy.

Our main hypothesis is that there is an efficient mix of warnings – type of information and media – that will encourage people to quickly enact their evacuation plans. Thus, the goal of this project is to enhance our knowledge about the **opportunity to exploit social media to support evacuation**, while addressing heterogeneity in the processes of making and updating evacuation decisions. We basically expect to identify the best tools for enacting safe and effective evacuation plans, including the opportunities associated with the use of social media.

4.1. Research Objectives

Specifically, we will design a web-based[16] survey instrument to collect detailed information about awareness, preparedness, evacuation, and survival to weather hazards from households in coastal communities of New Jersey, New York, and Connecticut to achieve the following research objectives:

1. Build novel methods for both presenting and generating new data using **discrete choice experiments** [17] of behavioral response to storm hazards. Hypothetical storms and preventive information need to be presented in a way that is realistic to the individual.[12,13] An additional challenge is to account for events that present an uncertain evolution in time.[4,11] The media used to convey and visualize information is key for addressing the dynamics of weather hazards.[13] Thus, we will control for different media in a web-based, customized survey. We will also combine intended actions with actual evacuation behavior during hurricane Sandy.
2. Construct stochastic models of evacuation behavior. We will identify the causal relationship between **probabilistic measures of evacuation behaviors** (when, where, and how to evacuate) and a complete set of explanatory variables such as attributes of the dynamic predictions of weather conditions (e.g. storm intensity) and coastal impacts (e.g. flood risks), risk measures and attitudes toward risk (e.g. weather watches, warnings, and advisories, evacuation orders), network effects (e.g. evacuation behavior by neighbors and friends, social media reports), and socioeconomic characteristics of the household (e.g. region, distance to shoreline, demographics, and lifestyle and values).
3. Derive robust estimates of evacuation probabilities for heterogeneous individuals as a concrete measurement of the **impact of differing types of storm-related risk information** (e.g. impact based warnings and NOAA products used to convey and visualize wind, flood, and surge risks such as flood maps)[18,19] and **information outlets** (**social media**) on evacuation behavior.[13] Credible sets will be used to account for uncertainty in the determination and prediction of the probabilistic measures of evacuation behaviors.
4. Design **effective evacuation communication tools and policies** accounting for the differing, uncertain response of coastal communities. Using the evacuation predictors, behavioral forecasts, and empirical evidence we expect to elucidate the factors that will encourage safe evacuation. We also expect to determine the mix of most effective information tools and outlets for better-informed decisions in response to storm hazards.

4.2. Work Plan and Milestones

To achieve the research objectives above, a multidisciplinary approach combining elements from extreme events engineering, transportation engineering, economics, statistics, and social science (risk communication) will be adopted. The work plan is built according to the following tasks:

Task 1) **Exploratory Analysis**

The first task of this project is to perform a qualitative analysis of the metrics for both the objective and subjective risk factors and how these metrics influence evacuation decisions. Focus groups and in-depth interviews will be used to assess attitudes, knowledge, and behaviors related to both coastal hazards and the products and tools that are used to both **communicate** and **visualize risks** and emergency actions. Local emergency response workers will also be contacted to understand their practice and needs for better outreach.

Rather than focusing on general perceptions of the tools that have already tested, we will examine the effect of the products on **behavioral intentions of evacuation** by the communities under risk. Of particular interest is to look at perceptions about the destructive potential of a storm with a given set of conditions that characterize the storm and its evolution. For examining these perceptions we will use NOAA products (maps and impact based warnings).[16,17] In addition, targeting at the broad audience of vulnerable communities, we will explore efficient mechanisms to convey technical risk measures and we will investigate understanding of alert words such as "watches" and "warnings", and concepts such as "hurricane shelter" and "evacuation center". Although differing perceptions about these alert words have been studied before, our goal is to measure the impact on intended actions.

Task 2) **Design of Dynamic Discrete Choice Experiments**

People enact their evacuation plans in response to severe weather based on information they receive from a mix of sources. The **likelihood of evacuation** given a set of storm attributes will be measured using **discrete choice experiments**,[12,15] which is a statistical technique that originated in mathematical psychology. Discrete choice experiments are based on conjoint analysis techniques, where **stated preferences** measure intended actions in response to hypothetical storms. Although response to actual storms – revealed evacuation behavior – is a relevant source of data,[4] hypothetical storms allow researchers to anticipate behavior under a wider range of event conditions that are controlled and efficiently built using concepts from statistical experimental design.[12] The behavioral intentions measured in discrete choice experiments are informative because they are the immediate antecedent of actions. In fact, intentions correspond to the cognitive representation of the strength of an individual's willingness to perform a given action.

The **hypothetical storms** will be optimally constructed to determine the impact of the causal factors of evacuation behaviors, including the following **attributes** and potential **attribute levels**:

1. Hurricane category (1-5)
2. Projected path (cone) and time to landfall as a function of projected speed
3. Storm surge hazard (low, moderate, high, extreme)
4. Damaging winds (low, moderate, high, extreme)
5. Severe weather alerts (flood warning, flood watch, hurricane warning, tropical storm warning, tropical storm watch)
6. Time-dependent evacuation instructions (none, recommendation-voluntary, order-mandatory)
7. Contextual condition controls

One of the benefits of discrete choice experiments over other methods for elicitation of intended actions is that behavioral responses to the causal factors are measured indirectly. Discrete choice experiments avoid thus bias that can appear in other methods. In addition, we plan to create **controlled experiments** within the design of the discrete choice experiments to not only determine the factors that have an impact on evacuation behavior, but also to analyze which specific ways of communicating those factors are more effective in promoting quick and safe actions. More specifically, in the design we will test the impact on evacuation behavior of a set of NOAA products for the communication of risks.

For example, in Figure 1 we present two samples of potential choice situations that could be presented to the respondents of the web survey. Both samples contain the same attributes of a hypothetical storm, with different levels of these attributes. In addition, the instrument on the left is the forecast cone, whereas on the right the instrument is a wind map. The type of instrument being displayed can be used as a **treatment** in the experimental design that will help us determine the effectiveness of the different products to convey risks. In both situations the respondent is asked to report the likelihood of evacuation in a discrete scale from “extremely unlikely” to “extreme likely”.

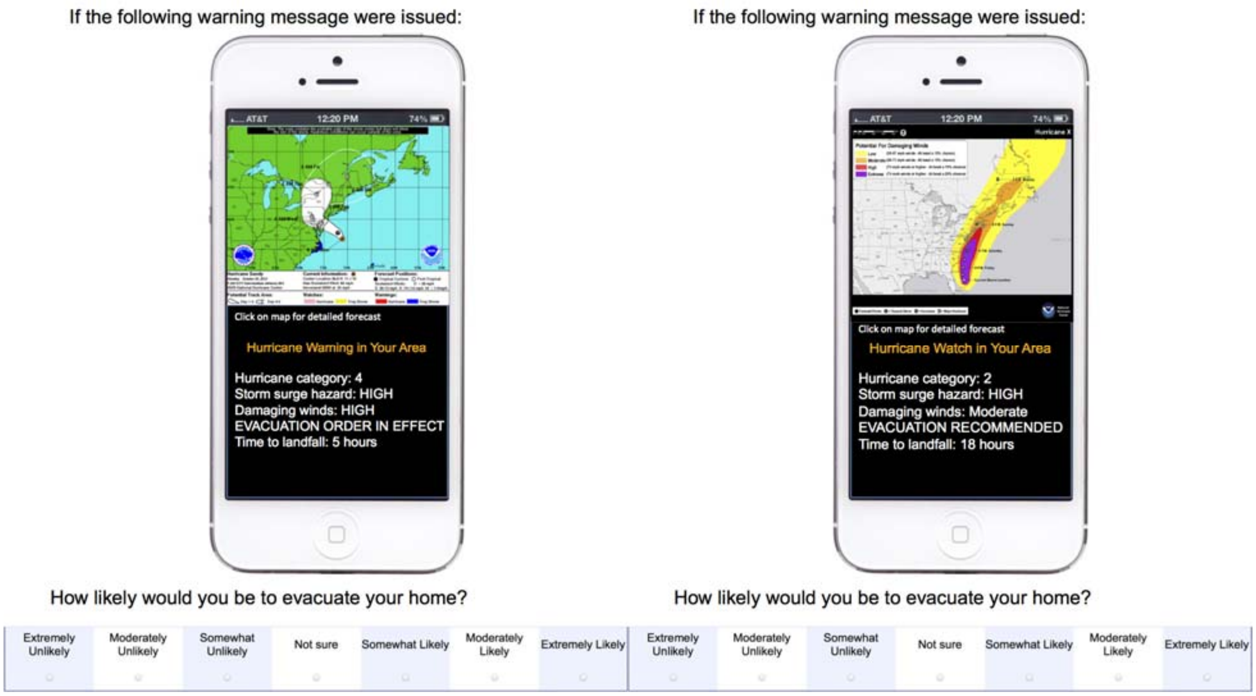

Fig 1. Hypothetical evacuation choice situations.

A challenge that we will address is how to represent the dynamics of evacuation decisions.[13] Storm forecasts and actual path change over time, and communities under risk are expected to evacuate before it is too dangerous to leave. As a result, the discrete choice experiment needs to address the evolution of the storm over time. To represent dynamics, we propose to use an approach where multiple scenarios are built, and for each of the scenarios evolution of the hypothetical storm will be updated using discrete timing. The resulting experimental design will be a time-dependent discrete choice experiment,[12] where **self-reported likelihood of evacuation** will be for each discrete time and each hypothetical storm.

Figure 2 presents an example of how the dynamic evolution of a hypothetical storm could be presented to the respondents of the web survey. The idea is to measure the likelihood of evacuation at each discrete time.

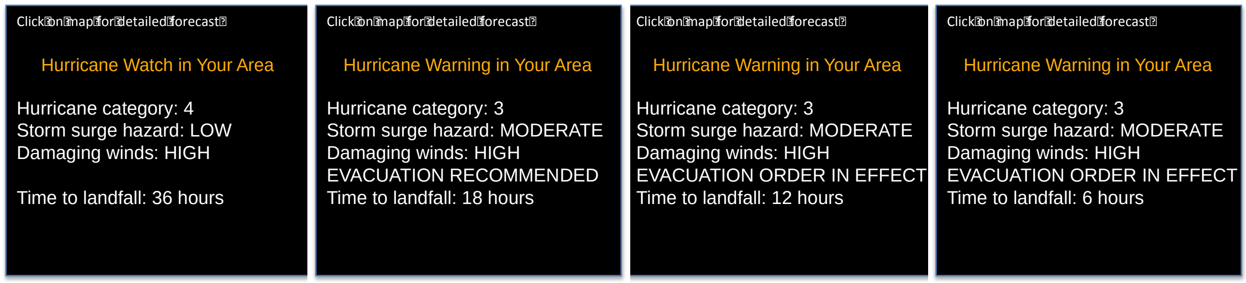

Fig 2. Evolution of a hypothetical storm in discrete time intervals, presented as a warning message.

The stated-preference experiment will be designed using a Bayesian efficient design, using the software Ngene.[20] Efficient designs go beyond traditional ways of determining fractional factorial designs. An efficient design maximizes the information extracted from each choice situation by minimizing asymptotic standard errors. In the case of a Bayesian design, there is the possibility of assuming prior parameters. Additionally, there are several decisions that need to be made during the design step of the experiment. For instance, the researcher needs to specify the underlying model, the attributes and levels for those attributes, possible interactions, number and balance of choice situations, and blocks. There are several tradeoffs that will be taken into account. For example, too many choices are exhausting for the respondent, attribute levels need to be credible but variance is required for efficient estimation of the parameters of a model, and the consideration of nonlinearities require more attribute levels.

An output of the experimental design is the minimum sample size for efficient estimation of the tradeoffs presented in the choice situations. As a result, the required sample size will be determined in this step. (However, we expect the sample size to be about 500 households.) In addition, the design will be conceived for robust inference on evacuation probabilities.

As mentioned above, design of the discrete choice experiments requires the construction of the attributes of hypothetical storm. Historically, before hurricane Sandy, there have been many hurricanes causing significant damages in the NY/NJ areas[31]. For instance Hurricane Edna (category 3; September 11, 1954) resulted the heaviest day of rainfall in NYC in 45 years. Edna cut off Montauk Point on eastern Long Island at its height, motivating temporarily relocation of 500 families. Moreover, three known tropical cyclones that have made landfall in New York City are: The 1821 Norfolk and Long Island Hurricane, the 1893 New York hurricane, and the 2011 Hurricane Irene. Depending on the locations of the target communities for the proposed study, the attributes of hypothetical storm(s) will be constructed by mimicking the characteristics of these known historical events.

Task 3) **Full Survey Design**

The web-based survey will be designed to collect information on

1. When severe weather is anticipated, what are the sources of information that coastal communities currently use, and what are the sources that are most trusted
2. How do households decide on when to evacuate
3. Where and how households plan to evacuate
4. Knowledge about the nearest evacuation center
5. Hypothetical evacuation behavior: discrete choice experiment module
6. Previous experience with super storms
7. Sociodemographics and characteristics of the residence

We will discuss the design of the survey with

For those households that experienced Sandy, we will collect information about **revealed evacuation behavior** during that event. It is of particular interest to know when they decided to evacuate, when they did so, where they went, when they arrived, and which transportation mode was used. In addition, we will ask about what were the main determinants of their decisions. We will ask about the impact of social media outlets used to obtain information about storm forecasts, evacuation orders, and shelter locations.

Detailed sociodemographic data is important, because this information will be used to identify segments of the population that exhibit differing behavioral responses.

In this project we will also explore the use of non-traditional data collection methods for elicitation of stated preferences, such as the use of **smartphone apps**. Attitudes and response to new sources of information, including Twitter and other social media, will be evaluated using sociological theories that integrate concepts such as subjective norms and behavioral control into discrete choice models. In particular, drawing on research from across the behavioral sciences, we will include survey questions that assess a number of response variables related to the effectiveness of risk messages. These include beliefs about the focal risk itself,[21] perceived efficacy of message recommendations,[22] attitudes, perceived behavioral control, and subjective norms,[23] perceptions about the visual communication tool itself (e.g., message clarity[24]), subjective psychological distance to the threat,[25] general and discrete emotional responses,[26] and intentions to act in ways that are consistent with message prescriptions.[27]

These attitudinal variables, which will constitute the main outcome measures of the survey, can be broadly divided into three categories that are theorized to underlie behavioral responses: **cognitions** (e.g., beliefs such as personal risk assessments), **emotions** (e.g., fear/anxiety, attitudes toward evacuating), and **behavioral intentions** (e.g., state likelihood of leaving one's property and evacuating a high-risk zone). Note that the discrete choice experiments described above measure one important dimension of these behavioral intentions, namely the self-reported likelihood of evacuation as a response to the storm information in each choice situation. However, there are additional dimensions of behavioral intentions that we will explore.

We will also measure individual difference variables that have been found to predict message persuasiveness, notably personal topic relevance.[28] Regardless of visual-information treatment, all survey respondents will complete the same standard set of questions, thus allowing us to establish the effect of different treatments on outcomes that have been shown to predict behavioral compliance and that are widely considered to be markers of effective risk messages involving visuals.[29] Specifically, we propose to include the following survey items that fall within the aforementioned categories:

Cognitions.
The following are sample belief-based questions that would be posed to respondents (for each hypothetical storm):

1. How severe is the depicted storm?
2. How concerned would your loved ones (family, close friends) be about this storm?
3. How close do you feel to this storm?
4. Would your loved ones want you to evacuate if officials ordered you to do so?

5. Do you believe that evacuating this area would make you safer?
6. How likely is it that you would be putting your personal health and safety at risk by disregarding evacuation orders?
7. How persuasive do you find this visual to be?
8. How soon would you expect this storm to begin?
9. How clear do you find this visual to be?

Emotions.
The following are sample affect-based questions:

1. When you think about this storm, how scared does it make you feel?
2. When you think about this storm, how angry does it make you feel?
3. How positively would you feel about evacuating if ordered to do so?
4. How much do you value the feelings and opinions of your loved ones?

Behavioral intentions.
The following are sample behavior-related questions:

1. How likely are you to share this information face-to-face with your loved ones?
2. How likely are you to share this information on social media, like Facebook?

Task 4) **Sample recruitment**

Due to the visual discrete choice experiments that will be designed, we will use a web-based survey in this project. Web-based DCEs offer design and administrative benefits over mail or telephone surveys.[16,30,31] Below are described the tasks needed for obtaining the sample for the study.

Subtask 4.1) **Request for Proposals (RFP)**. A Request for Proposals will be prepared targeting at established market research companies to recruit the web-sample for the study. The RFP will be published in the webpage of the School of Civil and Environmental Engineering at Cornell University. The target population will be coastal communities in the tri-state area of New Jersey, New York, and Connecticut.

Subtask 4.2) **Selection of the Market Research Company**. The market research company with the leading proposal in terms of cost-competitiveness and quality after the process of competitive bidding will be selected. A specific subcontract will be then prepared.

Subtask 4.3) **Provision of the Sample**. We will obtain from the subcontracted market research company a list describing the recruited web-sample. We will validate adequacy and representativeness of the recruited sample and contact the market research company if errors in the recruitment process are detected.

Task 5) **Pretest.**

We will pretest the survey using 10% of the sample, before initiating the general data collection effort. The objective of the pretest is to reassess experimental designs of the discrete choice experiment and to reprogram logic of the survey, if necessary. The output of the pretest will be the final instrument for data collection. The final instrument will be discussed with the CSAP Program Steering Committee and relevant policymakers.

Task 6) **Full data collection.**

We will contact the sample with an email inviting to visit the link to complete the survey. Up to three reminder emails to non-respondents will be sent.

Task 7) **Data analysis**.

While the full data collection takes place, we will start the process of validation of the data in terms of cleaning, checking representativeness, initial frequency assessment of question responses, and general set up for discrete choice analysis. The deliverable of this task will be a database ready for statistical model estimation.

Task 8) **Construction of statistical models of evacuation behavior.**

The likelihood of evacuation will be modeled using the responses collected in the survey in a behavioral hazard model that will expand on both discrete choice and survival analysis methods that are common in social science (e.g. discrete time proportional odds model), and that will account for heterogeneous risk aversion or tolerance (e.g. nonlinear and noncompensatory utility, random regret minimization). Related decisions will be modeled jointly, namely whether to evacuate at all, and the necessary actions to take after the decision of evacuating has been made (e.g. when, where, and how). One of the hypotheses that will be tested with the models is the assumption of linearity by potential evacuees. Even though risk increases nonlinearly with storm conditions such as a wind speeds.

To make inference on evacuation probabilities we will use the discrete time proportional odds (DTPO) model, which is common in survival analysis. In transportation analysis, the DTPO model was first proposed as a means of incorporating air passengers' behavior into cancellation models.[32] Use of the DTPO model with a known number of periods builds on prior research on four ways. Firstly, while most survival models consider a single time dimension, this model accounts for multiple time dimensions by accommodating time-varying covariates. Secondly, it allows for the analysis of the effect of heterogeneity on the hazard probability. Thirdly, it assumes heterogeneity is fully contained within the covariates used, and that its effect on survival is separate from that of time. Finally, due to the discrete nature of the time-scale used, the model is able to test for different distributional structures of the baseline evacuation rate.

As a survival analysis method, the DTPO model can be applied to calculate the **hazard probability**, i.e. the conditional probability that a household will decide to evacuate on a certain time given that it had not done so until that moment. The DTPO model partitions the time-to-event (where the event is either the evacuation action or the household deciding not to act) of the ith household (T_i) into a number of k disjoint time intervals $(t_0, t_1], (t_1, t_2], \dots, (t_{k-1}, t_k]$, where $(t_0, t_1, \dots, t_k)$ identify the discrete periods before landfall of the storm. Additionally, the discrete hazard probability (that is, the **evacuation probability** of household i at time k) is given by $h_{ik} = P(T_i = k | T_i \geq k)$. By using conditional probability theory, the likelihood function of the entire sample can be written out explicitly. In fact, since the exact time at which the storm makes its landfall is known and can be written using a binary variable, the likelihood function is equivalent to that of a binary logistic regression model. This has known numerical solutions, thus making the DTPO model analytically attractive.

The DTPO model incorporates the storm attributes (known as covariates) into the model through the following formulation. For a set of covariates X_i, the hazard probability h_{ij} has the following functional form:

$$\log\left(\frac{h_{ij}}{1-h_{ij}}\right) = \Psi_{ij} + \beta_1 X_{ij1} + \beta_2 X_{ij2} + \cdots + \beta_l X_{ijl},$$

where Ψ_{ij} is the baseline hazard function, $j = 1,2,\ldots,k$ time intervals, $i = 1,2,\ldots,n$ observations and l is the number of covariates.

The evacuation probability h_{ik} will be used to determine a profile of the cumulative distribution of evacuating households as a time-dependent function. Confidence intervals for cancellation probabilities are important because the probability itself is not a fixed number, and thus simply reporting the mean does not hold much value. Confidence intervals are not simply important statistical results; they are also useful in demonstrating the significance of the probability estimate, allowing modelers to access how much faith to put in that probability estimate. Confidence intervals will be constructed with the Bayesian model results via post-processing of the MCMC draws.

Attitudinal dependent variables will be modeled using structural equation models. In addition, we will incorporate attitudinal response into the evacuation probability, by expanding research on hybrid choice models.[33]

5. Outcomes

In this research we expect to identify the best tools for enacting safe and effective evacuation plans, including the opportunities associated with the use of social media. **Effectiveness of communication of storm risks** will be evaluated through the impact on the estimates of evacuation probabilities. In particular, we will calculate the **elasticities** of these evacuation probabilities with respect to storm characteristics, including associated risks. Based on these elasticities we will provide **modeling** and **policy recommendations**.

A matrix describing the ranking of the determinants of evacuation in terms of expected behavioral impact will be prepared and sent to policymakers, including emergency managers, in the form of a **white paper**. The general structure of the white paper will be a summary of objectives and scope of the study, methodology, and main empirical results that are relevant for better informing evacuation policy. This white paper will also be sent to NOAA, including a discussion about effectiveness of the products they generate in terms of objective, measurable metrics (evacuation probabilities of heterogeneous households). We expect that the knowledge about behavioral response to storm hazard information that we generate will support effective design of evacuation policies aiming at protecting lives in coastal communities.

Finally, the methodology that we will use in this project will enhance research methods in the field of risk-based evacuation planning. The questionnaire will be another outcome that is part of the methodological contributions of this work. Outreach to the scientific community will include publication of scientific papers and participation in academic conferences. In particular, we believe that our work will improve the tools that are currently used for modeling demand in the logistical problem of optimal location of shelters and optimal routing in the case of evacuation.

6. Coordination

The project team will hold a kick-off meeting, interim review meetings, and a wrap-up meeting at the end of the project. One of the interim review meetings and the wrap-up meeting will be held in the New York/New Jersey area with the CSAP Program Steering Committee.

Daziano will coordinate all activities of the project, including communication with the CSAP Program Steering Committee, emergency managers, and the marketing research company that will be hired for provision of the sample. Daziano will also lead the design of the discrete choice experiment and the estimation of the discrete time proportional odds of evacuation probabilities.

Nozick will provide support in the design of the survey with a focus on modeling requirements for logistical decisions. Nozick will also support statistical modeling after the data is collected.

Liu will provide support in the design of hypothetical storms and risks that are credible, and in the creation of storm forecasts and paths that will be used in the visuals of the discrete choice experiments.

Schuldt will support design of the attitudinal questions of the survey, statistical modeling of psychometric data that will be collected in the survey, and broad assistance in the sociological representation of risk communication.

One civil and environmental engineering graduate student will work on this project, helping in the design of the visuals needed for the discrete choice experiments, and in the coding necessary for both validating the data and estimating the parameters of the DTPO model.

D. Data Management/Sharing Plan

The following guidelines will apply in the management of the different data components of the project:

Short and long term storage: with the exception of eventual proprietary data with restricted use, all data (including modeling data, modeling results, estimation codes, scientific articles, and curriculum and outreach material) will be stored, first, in the PI's personal computer. Weekly backups will be set automatically using the PI's backup system (Time Capsule). Apple's Time Capsule is a wireless network-attached storage device that works with Apple's Time Machine backup utility as a local file server. After the end of the project, all data will be kept for a minimum of 3 years. A decision for long-term storage (beyond 3 years after the end of the project) will be taken at the time when the data is stored.

Format standards: file formats that privilege future accessibility will be preferred. In general, all non-proprietary data and codes will be stored using unencrypted and uncompressed ASCII or Unicode files. For some files, PDF files will also be stored and backed up.

Sharing: non-proprietary data, codes, modeling results, and curriculum material will be shared through eCommons, the official data repository of Cornell University. (The PI plans to provide links to his personal website to the eCommons page, which works in a way that prevents broken links.) Modeling data will be stored in eCommons after a period of exclusive use of 2 years. eCommons at Cornell provides open access to the material stored therein, making it available to the scientific community as well as to the general public. All material is indexed in search engines, including Google Scholar. eCommons at Cornell ensures long-term digital archiving and preservation, acting as an additional source for long-term storage of the data.

Estimates and other parameters of the new class of discrete choice model that will result from econometric analysis of the data will be shared through tables in scientific articles and in a white paper addressed at policymakers.

All codes that will be used to estimate the behavioral models will be stored in the personal computer of the PI, and will be made publicly available upon request. Automatic backups will be performed. All programs will be written in R, which is a high-level programming language and software environment for statistical computing, data analysis and graphics. R is part of the GNU project and its source code is freely available under the terms of the GNU General Public License. R is highly extensible via packages, which contain user-created code that is made available for free by contributors.

No environmental data will be generated in this project.

E. Literature Cited

[1] Centers for Disease Control and Prevention. (2013). Deaths Associated with Hurricane Sandy — October–November 2012. Centers for Disease Control and Prevention, 24 May 2013. 07 Nov. 2013. <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6220a1.htm>.

[2] Louisiana Transportation Research Center. (2013). Tech Summary January 2013 SIO No. 3000280. Baton Rouge: Louisiana Transportation Research Center, PDF. <http://www.ltrc.lsu.edu/pdf/2013/ts_495.pdf>.

[3] Dash, N., and Gladwin, H. (2007). Evacuation Decision Making and Behavioral Responses: Individual and Household. Natural Hazards Review 8(3), 69-77.

[4] Fu, H., and Wilmot, C.G. (2004). Sequential Logit Dynamic Travel Demand Model for Hurricane Evacuation. Transportation Research Record: Journal of the Transportation Research Board 1882, 19-26.

[5] Whitehead, J.C. (2003). One Million Dollars per Mile? The Opportunity Costs of Hurricane Evacuation. Ocean & Coastal Management 46(11-12), 1069-083.

[6] Whitehead, J.C. (2005). Environmental Risk and Averting Behavior: Predictive Validity of Jointly Estimated Revealed and Stated Behavior Data. Environmental and Resource Economics 32(3), 301-16.

[7] Bateman, J.M., and Edwards, B. (2002). Gender and Evacuation: A Closer Look at Why Women Are More Likely to Evacuate for Hurricanes. National Hazards Review 3(3), 107-17.

[8] Hasan, S., Ukkusuri, S., Gladwin, H., and Murray-Tuite, P. (2001). Behavioral Model to Understand Household-Level Hurricane Evacuation Decision Making. Journal of Transportation Engineering 137(5), 341-48.

[9] Van Willigen, M., Edwards, T., Edwards, B. and Hessee, S. (2002). Riding Out the Storm: Experiences of the Physically Disabled during Hurricanes Bonnie, Dennis, and Floyd. Natural Hazards Review 3(3), 98-106.

[10] Dow, K., and Cutter, S.L. (1998). Crying Wolf: Repeat Responses to Hurricane Evacuation Orders. Coastal Management 26.4 (1998): 237-52.

[11] Sammer, G. and Ortúzar, J. de D. (2013). Survey methods to inform policy makers on energy, environment, climate and natural disasters. In Zmud, J., Lee-Gosselin, M., Munizaga, M. and Carrasco, J.A. (Eds) Transport Survey Methods: Best Practice for Decision Making. Emerald, Bingley, UK.

[12] Wilmot, C. and Gudishala, R. (2013). Collection of time-dependent data using audio-visual stated choice. In Zmud, J., Lee-Gosselin, M., Munizaga, M. and Carrasco, J.A. (Eds) Transport Survey Methods: Best Practice for Decision Making. Emerald, Bingley, UK.

[13] Meyer, R., Broad, K., Orlove, B., and Petrovic, N. (2013). Dynamic simulation as an approach to understanding hurricane risk response: insights from the Stormview lab. Risk Analysis 33(8), 1532-52.

[14] Lindell, M.K., Kang, J.E. and Prater, K.S. (2011). The Logistics of Household Hurricane Evacuation. Natural Hazards 58(3), 1093-109.

[15] Apivatanagul, P., Davidson, R.A., and Nozick, L.K. (2012). Bi-level optimization for risk-based regional hurricane evacuation planning. Natural Hazards 60(2), 567-588.

[16] Smith, C., and Spitz, G. (2010). Internet access: Is everyone online yet and can we survey them there? Transportation Research Record 2176, 35-41.

[17] Louviere, J.J., Hensher, D.A. and Swait, J.D. (2000). Stated choice methods: analysis and application. Cambridge University Press, Cambridge.

[18] Lazo, J.K. and Morrow, B.H. (2013). Survey of coastal U.S. public’s perspective on estra tropical – tropical cyclone storm surge information. Final Report. NCAR Societal Impacts Program.

[19] Eastern Research Group, Inc. (2013). Hurricane forecast improvement program: socio-economic research and recommendations. Final Report prepared for NOAA National Weather Service, Contract #EAJ33C-09-CQ-0034, Task Order #17.

[20] Rose, J.M., and Bliemer, M., 2009. Constructing Efficient Stated Choice Experimental Designs. Transport Reviews 29(5): 587-617.

[21] Sjöberg, L. (2000). Factors in risk perception. Risk analysis, *20*(1), 1-12.

[22] Witte, K. (1992). Putting the fear back into fear appeals: The extended parallel process model. Communications Monographs, *59*(4), 329-349.

[23] Ajzen, I. (1991). The theory of planned behavior. Organizational behavior and human decision processes, *50*(2), 179-211.

[24] Weinstein, N. D., & Sandman, P. M. (1993). Some criteria for evaluating risk messages. Risk Analysis, *13*(1), 103-114.

[25] Morton, T. A. and Duck, J. M. (2001). Communication and Health Beliefs Mass and Interpersonal Influences on Perceptions of Risk to Self and Others. Communication Research, *28*(5), 602-626.

[26] Lerner, J. S., Gonzalez, R. M., Small, D. A. and Fischhoff, B. (2003). Effects of Fear and Anger on Perceived Risks of Terrorism A National Field Experiment. *Psychological science*, *14*(2), 144-150.

[27] Ajzen, I. (1985). From intentions to actions: A theory of planned behavior (pp. 11-39). Springer Berlin Heidelberg.

[28] Petty, R. E. and Cacioppo, J. T. (1986). The elaboration likelihood model of persuasion. In *Communication and Persuasion* (pp. 1-24). Springer New York.

[29] Lipkus, I. M. and Hollands, J. G. (1999). The visual communication of risk. *JNCI Monographs*, *1999*(25), 149-163.

[30] Adler, T., Rimmer, L., and Carpenter, D. (2002). Use of Internet-based household travel diary survey instrument, Transportation Data and Information Technology Research. Transportation Research Board National Research Council, Washington, 134-143.

[31] Rhodes, S.D., Bowie, D.A., and Hergenrather, K.C. (2003). Collecting behavioural data using the world wide web: considerations for researchers. Journal of Epidemiology and Community Health 57, 68-73.

[32] Iliescu, D.C., Garrow, L.A., and Parker, R.A. (2008). A hazard model of US airline passengers' refund and exchang behavior. *Transportation Research Part B*, 42(3), 229-242.

[33] Daziano, R.A. and Bolduc, D. (2013) Covariance, identification, and finite-sample performance of the MSL and Bayes estimators of a logit model with latent attributes. Transportation 40 (3): 647-670

[31] http://en.wikipedia.org/wiki/List_of_New_York_hurricanes

F. Project Timeline

Tasks / Activities / Milestones	Related Project Objective(s)	Funding Year 1												Funding Year 2											
		Beginning Month and Year: January 2 2014																							
		Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	Month 7	Month 8	Month 9	Month 10	Month 11	Month 12	Month 13	Month 14	Month 15	Month 16	Month 17	Month 18	Month 19	Month 20	Month 21	Month 22	Month 23	Month 24
Task 1) **Exploratory Analysis**	1,3	X	X	X																					
Task 2) **Design of Dynamic Discrete Choice Experiments**	1,3		X	X	X																				
Task 3) **Full Survey Design**	1,2,3			X	X																				
Task 4) **Sample recruitment**	1,2,3				X	X																			
Meeting with CSAP Program Steering Committee						X																			
Task 5) **Pretest**	1						X	X																	
Task 6) **Full data collection**	1,2,3								X	X	X	X	X	X											
Task 7) **Data analysis**	3									X	X	X	X	X	X										
Task 8) **Construction of statistical models of evacuation behavior**	1,2,3, 4												X	X	X	X	X								
Final Report, White Paper	4																X								
Meeting with CSAP Program Steering Committee																	X								

J. Biosketch

Ricardo A. Daziano

a. Professional Preparation.

Institution	Major	Degree	Year
University of Chile, Santiago, Chile	Industrial Engineering	B.Sc.	1999
University of Chile, Santiago, Chile	Transport Engineering	M.Sc.	2001
Laval University, Québec, Canada	Economics	Ph.D.	2010

b. Appointments.

2011-present Assistant Professor (tenure-track), School of Civil and Environmental Engineering, Cornell University, Ithaca, NY

c. Publications.

FIVE PUBLICATIONS MOST CLOSELY RELATED

[1] Daziano, RA and D Bolduc. 2013. Covariance, identification, and finite-sample performance of the MSL and Bayes estimators of a logit model with latent attributes. *Transportation* 40(3), 647-670.

[2] Daziano, RA, L Miranda-Moreno and S Heydari. 2013. Computational Bayesian statistics in transportation modeling: from road safety analysis to discrete choice. *Transport Reviews* 33(5), 570-592.

[3] Daziano, RA and **E Chiew.** 2012. Analyzing a probit Bayes estimator for flexible covariance structures in discrete choice modeling. *Transportation Research Record* 2302, 42-50.

[4] Raveau, S, R Alvarez Daziano, MF Yáñez, D Bolduc and J de D Ortúzar. 2010. Sequential and simultaneous estimation of hybrid discrete choice models: some new findings. *Transportation Research Record* 2156, 131-139.

[5] Daziano, RA and **E Chiew**. 2013. On the effect of the prior of Bayes estimators of the willingness-to-pay for electric-vehicle driving range. *Transportation Research Part D: Transport and Environment* 21, 7-13.

OTHER SIGNIFICANT PUBLICATIONS

[1] Daziano, RA. 2013. Conditional-logit Bayes estimators for the valuation of electric vehicle driving range. *Resource and Energy Economics* 35(3), 429-450.

[2] Daziano, RA and M Achtnicht. 2013. Forecasting adoption of ultra-low-emission vehicles using Bayes estimates of a multinomial probit model and the GHK simulator. *Transportation Science*, DOI 10.1287/trsc.2013.0464.

[3] Daziano, RA and **E Chiew**. 2012. Electric vehicles rising from the dead: data needs for forecasting consumer response toward sustainable energy sources in personal transportation. *Energy Policy* 51, 876-894.

[4] Daziano, RA and D Bolduc. 2013. Incorporating pro-environmental preferences towards green automobile technologies through a Bayesian Hybrid Choice Model, *Transportmetrica A: Transport Science* 9(1), 74-106.

[5] Bolduc, D, N Boucher and R Alvarez-Daziano. 2008. Hybrid choice modeling of new technologies for car choice in Canada. *Transportation Research Record* 2082, 63-71.

d. Synergistic activities.

1. "Friend" of the Committee on Transportation Demand Forecasting, Transportation Research Board of the National Academies.
2. Co-authoring a textbook on Sustainable Transportation Systems Engineering.

3. Co-author of a book for the general public about sustainable transportation in Chile. (In Spanish.) El ABC del Transporte en Santiago. In P. Lanfranco ed., Muévete por tu ciudad: una propuesta ciudadana para transporte con equidad, LOM Ediciones, Santiago, Chile, 2003.

e. Collaborators & other affiliations.

1. **Collaborators (6 total)**.

Martin Achtnicht	Centre for European Economic Research, Mannheim, Germany
Denis Bolduc	Department of Economics, Laval University, Québec, Canada
Nathalie Boucher	Agence de l'efficacité énergétique, Government of Québec
Juan de Dios Ortúzar	School of Engineering, Catholic University of Chile
Sebastián Raveau	School of Engineering, Catholic University of Chile
Francisca Yáñez	School of Engineering, Catholic University of Chile

2. **Graduate advisor (1 total)**.

Denis Bolduc	Department of Economics, Laval University, Québec, Canada

3. **Thesis advising (3 total).**

Esther Chiew, School of Civil and Environmental Engineering, Cornell University (PhD student), under supervision 2011-present

Chen Wang, School of Civil and Environmental Engineering, Cornell University (PhD student), under supervision 2012-present

Yutaka Motoaki, School of Civil and Environmental Engineering, Cornell University (MSc student), under supervision 2012-present

LIU, Philip L.-F.

(a) Professional Preparation

National Taiwan University	Civil Engineering	B.S., 1968
M.I.T.	Civil Engineering	S.M., 1971
M.I.T.	Hydrodynamics	Sc.D., 1974

(b) Appointments

Director, School of Civil and Environmental Engineering, Cornell University	2009 – present
Class of 1912 Professor in Engineering, Cornell University	2008 – present
Kwoh-Ting Li Chair Professor, National Central University, Taiwan	2006 – present
Associate Dean for Undergraduate Affairs, College of Engineering, Cornell	1986 – 1987
Associate Director, School of Civil and Environmental Engineering, Cornell	1985 – 1986
Full Professor, Cornell University	1983 – 2008
Associate Professor, Cornell University	1979 – 1983
Assistant Professor, Cornell University	1974 – 1979

(c) Products

Five Publications Related to the Project:

1. Chan, I-C. and Liu, P.L.-F. (2012) On the runup of long waves on a plane beach. ***J. Geophys. Res***. 117, C08006.
2. Seo, S-N. and Liu P.L.-F. (2013) Edge waves generated by the landslide on a sloping beach. ***Coastal Engrg*.,** 73, 133-150.
3. Mei, C.C., Chan, I-C., Liu, P. L.-F., Huang, Z., Zhang, W. (2011) Long waves through emergent coastal vegetation, ***J. Fluid Mech***., 687, 461-491.
4. Wang, Y., Liu, P. L-F., and Mei, C. C. (2011) Solid landslide generated waves, ***J. Fluid Mech.,*** 675, 529-539.
5. Wang, X. and Liu, P. L.-F. (2006) An analysis of 2004 Sumatra earthquake fault plane mechanisms and Indian Ocean tsunami. ***J. Hydraulic Res***., 44(2): 147-154.

Five Other Significant Publications:

1. Yeh, H., Liu, P. L.-F., Briggs, M. and Synolakis, C. (1994) Propagation and amplification of tsunamis at coastal boundaries. ***Nature***, 372: 353-355.
2. Lin, P. and Liu, P. L.-F. (1998) A numerical study of breaking waves in the surf zone. ***J. Fluid Mech.,*** 359: 239-264.
3. Lynett, P. J. and Liu, P. L.-F. (2004) A two-layer approach to wave modeling. ***Proc. Roy. Soc. London***, A, 460: 2637-2669.
4. Liu, P. L.-F., Lynett, P., Fernando, H., Jaffe, B. E., Fritz, H., Higman, B., Morton, R., Goff, J., and Synolakis, C. (2005) Observations by the international tsunami survey team in Sri Lanka. ***Science,*** 308, 1595.
5. Liu, P. L-F., Park, Y.S. and Cowen, E. A. (2007) Boundary layer flow and bed shear stress under a solitary wave**. *J. Fluid Mech.,*** 574: 449-463.

(d) Synergistic Activities:

1. I have developed and produced an educational CD entitled Tsunamis: understanding the giant waves. The more than 500 CDs have been distributed among elementary schools, high schools and science museums.

2. My research group has developed several numerical models for simulating ocean waves with different scales. For example the numerical model, called COMCOT (Cornell Multi-grid Coupled Tsunami Model) has been employed in many countries, including Spain, Portugal, Sri Lanka, Korea, Taiwan and US to develop tsunami inundation maps and assess tsunami damage. Another numerical model, called COBRAS (Cornell Breaking Waves and Structures), is also being widely used in Europe, Asia and US as a research and an engineering tool for designing coastal structures.

3. I have organized several workshops, sponsored by NSF and DHS, to discuss research priorities in tsunami hazard and mitigation. Those workshops have drawn participants, including graduate students and post-docs, from the U. S., Japan, Russia, Canada, Mexico, and Korea.

4. I led a post-tsunami survey team to investigate the tsunami damage in Sri Lanka after the 2004 Indian Ocean tsunamis. Currently, I am promoting the initiative for establishing the tsunami early warning system and hazard mitigation program in the South China Sea region. Several research workshops have been conducted to identify the gaps of tsunami research and recommend future research directions in the South China Sea region.

(e) Collaborators & Other Affiliations

Collaborators and Co-Editors:
J. Borrero (USC), E. Cowen (Cornell), P. Diamessis (Cornell), H. Fritz (GTech), T. Hsu (Univ. Delaware), Z. Huang (NTU, Singapore), H.H. Hwung (National Chang Kung Univ., Taiwan), B. Jaffe (USGS), D. Jeng (U. Dundee, UK), A. Jensen (U. Oslo, Norway), J. Jenkins (Cornell), P. Lynett (USC), C. C. Mei (MIT), E.A., Okal (Northwestern), A. Orfila (UIB-CSIC, Spain), H. Oumeraci (Tech. Univ. Braunschweig, Germany), Y.-S. Park (U. Dundee, UK), S-N. Seo (KIOST, Korea), G. Simarro (CSIC, Spain), C.E. Synolakis (USC), M. Teng (U. Hawaii), V. Titov (PMEL), X. Wang (GNS Science, New Zealand), R. Weiss (VTech.), T-R. Wu (National Central Univ., Taiwan), H. Yeh (OSU).

Graduate Advisors:
Chiang C. Mei (MIT)

Thesis Advisor and Postgraduate-Scholar Sponsor: PhD# (25); Post-Doc *(9)
Lennon#, G. P. (Leigh University); Tsay#*, T. K. (National Taiwan University, Taiwan); Abbaspour#, M.T. (Iran); Wu#, C. S. (NOAA); Yoon#*, S.B. (Hang Yang University, Korea); Wu#, J. K. (National Hua-Chung University, China); Khan#, L.A. (ENSR); Wen#, J. (Canada); Iskandarani#, M. (University of Miami); Cho#*, Y. -S. (Hang Yang University, Korea); Chen#, Y. (USA); Lin#, P. (China); Chang#, K. -A. (Texas A&M University); Hsiao#*, S-C (National Chang-Kung University, Taiwan); Woo#*, S.-B. (Inha University, Korea); Lynett#, P. J. (USC); Hsu#, T-J. (Univ. Delaware); Wu#*, T.-R. (National Central University, Taiwan); Al-Banaa#, K. A. (Kuwait Institute for Scientific Research); Lara*, J. L. (University of Cantabria, Spain); Amoudry#, L. O. (Proudman Oceanographic Laboratory, UK); Zhang#, Q-H. (Lawrence Berkeley National Laboratory); Wang#, X. (GNS Science, New Zealand); Park*#, Y.S. (U. Dundee, UK); Mo#, W-H. (American Bureau of Shipping, Houston), Chan#*, I-C. (Cornell)

Linda K. Nozick

A. PROFESSIONAL PREPARATION

Institution	Major	Degree and Year
George Washington University	Systems Analysis and Eng.	B.S.E., 1989
University of Pennsylvania	Systems Engineering	M.S.E., 1990
University of Pennsylvania	Systems Engineering	Ph.D., 1990-1992

B. APPOINTMENTS

Cornell University, **School of Civil and Environmental Engineering, Ithaca, NY**
Currently, the Director of the College Program on Systems Engineering (2009-present)
Professor (2003- present),
Associate Professor with Tenure (1998-2003)
Assistant Professor (92-98)

Naval Postgraduate School, **Monterey, CA**
Visiting Associate Professor in the Operations Research Department (October 1998-August 1999).

General Motors Global Research and Development, Warren, MI
Visiting Professor in the Operations Research Department (May 1998-October 1998).

C. FIVE MOST CLOSELY RELATED PRODUCTS

N. Romera, L. Nozick, I Dobson, N., Xu, and D. Jones, "Transmission and Generation Expansion to Mitigate Seismic Risk", submitted to *IEEE Transactions in Power Systems.*

A. Li, L. Nozick, R. Davidson, B. Wolshon, N. Brown, D. Jones, "An Approximate Algorithm for Dynamic Traffic Assignment", accepted *Transportation Engineering*."

N. Romero, N. Xu, L. Nozick, I Dobson and D. Jones, "Investment Planning for Electric Power Systems Under Terrorist Threat", *IEEE Transactions on Power Systems, 27(1), 2012, 108-116.*

A Li, L. Nozick, N. Xu, R. Davidson, "Shelter Location and Transportation Planning Under Hurricane Conditions", *Transportation Research Part E*, 48(4), 2012, 715-729.

P. Apivatangul, R. Davidson, B. Blanton and L. Nozick, "Long-term Regional Hurricane Hazard Analysis for Wind and Storm Surge," *Coastal Engineering*, 58(6). 2011, pp. 449-509.

FIVE ADDITIONAL PRODUCTS

A. Reilly, L. Nozick, N. Xu, and D. Jones, "Game Theory-Based Identification of Facility Use Restrictions for the Movement of Hazardous Materials Under Terrorist Threat", *Transportation Research Part E, 48(1), 2012, pp.115-131*.

A. Li, N. Xu, L. Nozick, R. Davidson, "Bilevel Optimization for Integrated Shelter Location Analysis and Transportation Planning for Hurricane Events", *Journal of Infrastructure Systems*, 17(4), 2011, 184-192.

N. Brown, J. Gearhart, D. Jones, L. Nozick, N. Romera, N. Xu, Optimizing the Selection of Scenarios for Loss Estimation in Transportation Networks, *Proceedings of Winter Simulation 2011*, Phoenix AZ, December 2011. Nominated for Best Paper.

M. Nelson, L. Nozick and R. Davidson. "Optimizing the Selection of Hazard-Consistent Probabilitistic Scenarios for Long-Term Regional Loss Estimation", *Structural Safety*, 32(1), 2010, 90-100.

N. Romero, T.D. O'Rouke, L. Nozick and C. Davis. "Seismic Hazards and Water Supply Performance", *Journal of Earthquake Engineering*, 14, 2010, 1022-1043.

D. SYNERGISTIC ACTIVITIES

- **Director and founding member of the College Systems Engineering Program at Cornell –** This program fosters interdisciplinary activities within the college to address important systems issues including transportation, sustainability in the environment, and energy independence.
- **Member of the Nuclear Waste Technical Review Board (appointed by President Obama) –** In that capacity, I provide guidance to DOE, Congress and the President on actions which might be undertaken to address the costs and risks posed by spent fuel in the United States. My role on this board is focused on supporting the systems and risk aspects of this important issue that confronts us as a nation.

E. COLLABORATIONS AND OTHER AFFILIATIONS

- **Collaborators and Co-Editors (21 total)**
  P. Apivatanagul. (TEAM Logistics and Transport Co.), J. Bahr (NWTRB), G. Beaujon (GM), S. Becker (NWTRB), S. Bhaskaran (GM), S. Brantley (NWTRB), S. Clark (NWTRB), I. Dobson (Iowa), R. Ericson (East Carolina), R.Ewing (NWTRB), E. Foufoula-Georgiou (NWTRB), G. Frankel (NWTRB), O. Gao (Cornell), K. Huang (National Chiao Tung University), D. Jones (Sandia), J. Kruse (East Carolina), T. O'Rourke (Cornell), K. Peddicord (NWTRB), P. Turnsky (NWTRB), M. Turnquist (Cornell), M. Zoback (NWTRB)

- **Graduate Advisors and Postdoctoral Sponsors**
  B. Allen (UPENN-Thesis Advisor), A. Ganadalingm (UMD-ThesisAdvor)

- **Thesis Advisor and Postgraduate-Scholar Sponsor (14 total)**
  E. Chan (Rand - Postdoc), T. Chang (U. of Montreal), Y. Dadkar, M. Legg (Emma Willard School), A. Li (Minnesota Dept. of Transportation), J. Lin (Taiwan), J. Ma (American Airlines - Postdoc), A. Reilly (Washington, DC), A. Rios, N. Romero (Cornell), K. Vaziri (WiserTogether Inc.), P. Vaziri (RMS), N. Xu (Cornell - Postdoc), Y. Wang

Jonathon P. Schuldt

329 Kennedy Hall
Cornell University
Ithaca, NY 14853
jps56@cornell.edu
http://blogs.cornell.edu/socomm

Professional Preparation

Cornell University, Applied Economics and Natural Resources, B.S., 2004
University of Michigan, Social Psychology, M.S., 2008
University of Michigan, Social Psychology, Ph.D., 2011

Appointments

Since 2012	Assistant Professor, Department of Communication, Cornell University
2011-2012	Assistant Professor, Department of Psychology, California State University

Related Publications

- Welton-Mitchell, C., McIntosh, D.N., DePrince, A.P., & **Schuldt, J.P.** (under review). Domestic violence PSAs: Are graphic images of injured women effective?
- **Schuldt, J.P.** & Roh, S. (in press). Media frames and cognitive accessibility: What do "global warming" and "climate change" evoke in partisan minds? *Environmental Communication*: *A Journal of Nature and Culture*.
- Dickinson, J.L., Crain, R.L., Reeve, H.K., & **Schuldt, J.P.** (2013). Can deliberate design of online social networks make it easier to be "green"?
- **Schuldt, J.P.**, Konrath, S., & Schwarz, N. (2012). The right angle: Visual portrayal of products affects perceivers' impressions of owners. *Psychology & Marketing*, *10*, 705–711.
- **Schuldt, J.P.**, Konrath, S., & Schwarz, N. (2011). "Global warming" or "climate change"? Whether the planet is warming depends on question wording. *Public Opinion Quarterly*, *75*, 115-124.

Other Significant Publications

- **Schuldt, J.P.**, & Roh, S. (in press). Of accessibility and applicability: How heat-related cues affect belief in "global warming" versus "climate change." *Social Cognition*.
- Roh, S., & **Schuldt, J.P.** (in press). Where there's a *will*: Can highlighting future youth-targeted marketing practices increase support for soda taxes? *Health Psychology*.
- **Schuldt, J.P.** (2013). Does green mean healthy? Nutrition label color affects perceptions of healthfulness. *Health Communication*, *28*, 814-821.
- **Schuldt, J.P.** & Schwarz, N. (2010). The "organic" path to obesity? Organic claims influence calorie judgments and exercise recommendations. *Judgment and Decision Making*, *5*, 144-150.