2010

PNNL INC Project

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PNNL INC Project
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1. Executive Summary

This project evolved out of a workshop hosted by CREATE in June 2006. Leading risk perception and communication researchers were invited to share their insights about where the field was and should be heading. They were invited to submit proposal ideas, which were then assembled into a white paper. Detlof von Winterfeldt and Bill Burns drafted a proposal that was funded in April 2009. Many participants, excited to move forward initiated their research in summer 2006 with no budget and effectively donating their time. This project would eventually involve the direct collaboration of investigators from three DHS University Centers (CREATE, START, NCFPD), Pacific Northwest National Lab (PNNL) and six university or research institutes (USC, ASU, UKY, UCI, RTI and Decision Research). Three subsequent conferences were held that collectively involved over 80 participants from leading universities, governmental agencies, research institutes and policy consulting firms. These conferences along with the work of the project’s principle investigators have produced over 30 papers and 55 presentations. A special issue in Risk Analysis currently has 12 of these papers under review. Five nationwide surveys were conducted. Two of these longitudinal surveys tracked public response to real time crises.

1.1. Summary Insights
For a more detailed explanation of these summary findings a report Understanding Terrorism Risk Perception and Improving Risk Communication: Final Report by Bill Burns is available upon request.

Understanding Public Response Amidst Crises
A number of experiments and surveys have been conducted over the duration of this project that seek to understand how the public might respond to different types of disasters including natural disasters, terrorist attacks and even the financial crisis. Experiments have manipulated types and levels of disasters to understand which characteristics are associated with the highest perceived risks, strongest emotional response and most determined intentions to avoid the particular risk. These experiments have included disasters such as a major earthquake and biological, radiological and MANPADS attacks. On occasion,
events have allowed surveys in the field to capture how people respond in real time (e.g., financial crisis, Christmas Day and Times Square terrorist attempts, Haiti earthquake and BP oil spill). These longitudinal surveys have provided insight into how perceptions, emotions and behaviors change over time in response to adverse events.

- Consistent across this work is that terrorism looms large in terms of perceived risk, emotions like fear and anger and avoidance behavior relative to natural disasters.
- Regarding technological accidents and terrorists attacks, biological and radiological events appear more frightening than do explosions though both are of great concern.
- Negative emotions like fear, anger, worry and anxiety appear positively correlated with perceived risk and avoidance behavior.
- Perceived risk and negative emotions clearly decay over time and they decline most quickly directly following the peak of an event.
- Rapid escalation of perceived risk, negative emotion and risk-related behaviors typically follows a dramatic risk event that comes as a complete surprise (e.g., 9/11, earthquake in Haiti and to a lesser extent the two most recent terrorist attempts) but not always.
- Fear and avoidance behavior appear to increase as a crisis escalates-at least up to a point.
- Individuals vary greatly in their perceptions of risk and negative emotions with respect to most hazards and this variation may be related to gender, numeracy, worldviews and possibly income.
- The economic impact of technological accidents or terrorist attacks may be critically effected by public perceptions and risk-related behaviors.

The Role of Risk and Crisis Communication

Nationwide surveys, simulation experiments, focus groups and case studies were used to examine how best to communicate with the public during a crisis. Types of crises included terrorist attacks (i.e. RDD, food contamination, anthrax, IED attacks), a flu outbreak, a 7.8 earthquake affecting Los Angeles and the financial crisis.

- Risk and crisis communication messages need to be tested well in advance of their intended use.
- For any risk there will be a gap between expert understanding and public understanding of this risk.
- There are certain characteristics of messages, messengers and audience that make risk and crisis communication more compelling.
- Risk and crisis communication need to consider how initial and evolving levels of uncertainty will be expressed during a crisis.

Modeling and Methodological Challenges

A number of different modeling approaches were employed to summarize data (multilevel models, latent growth curve models), structure decisions (influence diagrams, multi-attribute utility models-MAU), simulate public response to different adverse events (system dynamics models) and simulate economic impacts (computable general equilibrium-CGE models). The purpose of these efforts has been to describe what people are likely to do during a crisis and to prescribe what risk and policy managers would like people to do. Related to this objective has been an effort to understand how perceptions, emotions and risk-related behaviors translate into economic impacts.

- Public response to large-scale disasters displays a level of complexity that goes beyond our ability to intuit what consequences might result or what risk management policies might be helpful.
- Apart from studying actual events, understanding how people might react to different crises requires developing compelling scenarios to engage respondents.
Validating models of public reaction presents a formidable challenge moving forward.

Keyword 1: Risk perception
Keyword 2: Risk communication
Keyword 3: CGE modeling
Keyword 4: System Dynamics modeling

2. Research Accomplishments

2.1. Simulated Behavior Study During California’s “Great Shake-Out” Earthquake Drill.

Receiving encouragement that our PNNL INC project would be funded researchers from CREATE and Decision Research took advantage of California’s planned 7.8 magnitude earthquake drill. It was promoted as the largest earthquake drill in U.S. history. Our data collection occurred in November 2008 during the actual drill on the USC campus. Students from the University of California participated in a simulated exercise lasting about two hours long and were paid for their involvement. Essentially a scenario was created in which students were initially trapped inside a building. They were then guided through a series of evolving events consistent with what might happen during a 7.8 magnitude earthquake. The idea was to have them talk out loud as a group about what they were thinking, feeling and planning to do as a means of surviving a crisis such as this. Particularly important was what information they would pay attention to and how they would seek to obtain it. Initially participants were concerned more about the safety of family and friends and wished to receive assurances about these matters. As the scenario evolved though an urgency developed and more concern was expressed as to their own safety and ability to survive the disaster. Women had higher perceived risk than men. Details of the study have been compiled in a paper entitled Scenario Simulation Group Reactions to the Aftermath of the Great Shake-out Magnitude 7.8 Earthquake.

2.2. Risk Perception Workshop.

In August 2009 CREATE, Decision Research and Pacific Northwest National Lab (PNNL) hosted a workshop that was attended by risk researchers from a number of different disciplines. The workshop was entitled Public Response to Threat: Cross-Disciplinary Contributions and Collaboration. Nine researchers from three DHS university centers (CREATE, START and NCFPD), three researchers from PNNL and scientists from leading academic institutions attended. Marilyn Morgan from DHS university programs participated in the workshop as well. Please see conference agenda, participants and presentations at the following link: http://www.decisionresearch.org/people/burns/threat.html

2.3. Symposium: Society for Risk Analysis.

In December 2009 Richard John (USC, CREATE), Heather Rosoff (USC, CREATE), Tim Sellnow (UKY, NCFPD), Carol Mansfield (RTI, CREATE) and Bill Burns (Decision Research, CREATE) made four presentations at a symposium during the annual Society for Risk Analysis conference in Baltimore. This symposium is focused on their respective work on this project and
is being sponsored by the Risk Communication Special Group (RCSG). The symposium is entitled Perceived Risk: Causes, Consequences and Communication. The four presentations were as follows: 1) “Comparing the economic consequences of three disasters: Accounting for fear and perceived risk” (Bill Burns); 2) “How does government risk communication and social norm affect fear, perceptions of risk, and behavioral intentions following terrorist attacks” (Richard John, Heather Rosoff); 3) “Risk Communication as a Mitigating Factor in Crisis Situations: Audience Perception and Preference” (Tim Sellnow) and 4) “The Impact of Profession on Risk Perceptions and Attitudes Towards Potential Homeland Security Programs” (Carol Mansfield).

2.4 Risk Perception and Risk Communication Conference.

In March 2010 CREATE hosted a conference that was attended by risk researchers from a number of different disciplines and a representative from the community of local emergency managers. The conference was entitled Risk Perception and Risk-Related Behaviors: Anticipated and Responding to Crisis. Twenty seven researchers and practitioners participated. Three DHS university centers (CREATE, START and NCFPD) and one national lab (PNNL) were represented. Members from three different policy or academic research institutes (RAND, Institute for Alternative Futures, Decision Research) attended. The CEO of the Los Angeles Emergency Preparedness Foundation participated. Scholars representing University of Southern California, Texas A&M, UPenn (Wharton), University of Oregon, University of Maryland, Cornell, Monash University, University of Kentucky, Georgetown University, Yale, University of Colorado, University of Pittsburgh, Cal State Los Angeles, Cal State San Marcos and Carnegie Mellon attended. Additionally, two doctoral students and two post-doctoral students from the University of Kentucky and the University of Southern California participated. Errol Southers (CREATE) who was President Obama’s first pick to head the TSA gave a dinner talk entitled Emerging Threats.

2.5 Special Issue: Risk Analysis.

Emerging from the above March 2010 conference has been a special issue of Risk Analysis (paper reviews in progress) tentatively entitled “Risk Perception and Risk-Related Behaviors: Anticipating and Responding to Crisis.” This special issue has already been approved and Bill Burns is the guest special issue editor with Paul Slovic acting in an advisory role. This special issue represents an important opportunity because Risk Analysis is a highly regarded journal in the area of risk and uncertainty. Currently thirteen papers have undergone at least one round of reviews.

2.6 Homeland Security Policy Analysis Conference (described elsewhere by Kerry Smith and Carol Mansfield)

2.7 Five Nationwide Risk Perception Surveys and Data Sets:

A. Nationwide Longitudinal Survey of Public Response to the Financial Crisis: An Examination of How Perceived Risk Changes Amidst a Crisis. In September 2008 researchers at Decision Research began to survey a nationwide panel about their perceptions of risk to their jobs, savings, investments and retirement emanating from the economic crisis. Data collection took place for several days following September 29, 2008, October 8, 2008, November 5, 2008, December 6, 2008, March 21, 2009, June 30, 2009 and October 6, 2009. The original intent was
to understand how risk perception might change over time in response to an on-going crisis like a terrorist attack (because terrorist attacks are rare the economic crisis was a proxy). Emotions such anger, fear, sadness, worry, anxiety and stress were tracked to note their possible correlation with perceived risk. Both perceived risk and emotional response were related to people’s actions (e.g., withdrawing money from savings, reallocating portfolios, postponing spending). The researchers also inquired about how perceptions of the financial crisis compared to perceptions of terrorism, natural disasters and global warming. As it turned out concern about the ramifications of the financial crisis dwarfed any worry about the threat of terrorism, natural disasters or global warming. Risk perception declined quickly and then leveled off. The paper “Risk Perception and the Economic Crisis: A Longitudinal Study of the Decay of Perceived Risk” is available upon request by contacting Bill Burns at bburns@csusm.edu.

B. Simulated Earthquake and RDD Attack in Los Angeles. In April 2010, two scenarios were developed by researchers at CREATE and Decision Research with help from Los Angeles Emergency Management. They depicted a 6.5 magnitude earthquake with epicenter near Los Angeles and a dirty bomb attack on the financial district of Los Angeles. Over six hundred people nationwide were shown both disasters (the order of scenario presentation was varied). The central questions addressed: perceptions of risk, trust in local first responders and government officials and emotional and behavioral response. Specifically, the researchers were interested to know how these two events would affect people’s willingness to buy products, use professional services, vacation or work in Los Angeles. They specifically looked at a distribution of heightened wage premiums or discounted product prices required to get consumers or workers to resume normal activities with respect to Los Angeles. The RDD attack produced much higher perceptions of risk and fear than the earthquake. The dirty bomb scenario also caused people to report that they would delay their purchases much longer than for the earthquake. A Computable General Equilibrium economic model was used to look at the economic impacts of the RDD attack. Details are provided later under specific projects (Burns and Slovic). Also, the paper “Regional Economic Damage From Catastrophic Events: Evaluation and Comparison of Resource Loss and Fear Effects Under a Hypothetical RDD Attack Scenario” is available upon request by contacting James Giesecke at james.giesecke@buseco.monash.edu.au or Bill Burns at bburns@csusm.edu.

C. Nationwide Longitudinal Survey of Public Response to the Christmas Day and Times Square Terrorist Attempts as well as the Haiti Earthquake and BP Oil Spill. Prompted by the Christmas Day terrorist attempt five waves of survey data from a national sample were collected on December 31, 2009, January 21, 2010, February 24, 2010, May 12, 2010 and September 21, 2010. This data queried people about perceptions, emotions and behaviors in response to the Christmas Day and Times Square terrorists’ attempts as well as the Haiti earthquake and BP oil spill. The surveys inquired about people’s willingness to still board airlines or visit major U. S. cities after the two terrorist attempts. It also asked people their confidence in the Department of Homeland Security and willingness to follow it security measures. Especially important about this data set is that it tracks the same panel of people over time and hence is able to examine how people’s perceptions, emotions and behaviors change. Important insights were gained regarding public response to “near misses.” Like in the response to the financial crisis perceived risk declined quickly and then leveled off. Perceptions of risk and fear were related to intentions to avoid airlines. A white paper Public Response to Recent Terrorists Attempts in the United States: A Longitudinal Look at Perceived Risk and Support for Different Security Measures is available upon request. Contact Bill Burns regarding progress with this analysis bburns@csusm.edu.

D. A Nationwide Survey that Looks at Public Policy Preferences Regarding a Dirty Bomb Attack in Urban Areas. Conducted 2009-2010, the survey provides a description of a dirty bomb attack and the extent of contamination from a dirty bomb using a map of the respondent’s
city. Respondents’ were asked about their preferences over three plans: (1) install radiation monitors and cameras in major threat areas in cities, (2) support the allocation of sheltering space and supplies in retail and office facilities in cities for people to shelter in place in the event of an attack, and (3) fund the organization and implementation of practice evacuations to improve the responses to an attack in cities. The survey also included questions about situations where the government might keep information about the risk of terrorist attacks from the public. Respondents were then asked their preferences for government disclosure. The survey was administered to a sample from a web panel (panel members are selected randomly originally using random-digit dialing and now through address based sampling and supplied with a computer and internet access). The respondents were drawn from 33 large cities in the United States Please see Mansfield and Smith under Specific Projects for details. Also, contact Carol Mansfield and Kerry Smith for progress on this analysis (Carol Mansfield <carolm@rti.org>; Kerry Smith <kerry.smith@asu.edu>).

E. A Nationwide Survey and Experiment Involving a Terrorist Flu Outbreak Scenario. A series of studies involving a terrorist-inspired flu outbreak were carried out in 2009-2010. Video simulations were introduced as a way to investigate perceived risk and behavior change as threat situations escalate in the context of biological attacks. Researchers were interested in investigating the independent and interactive effect of proximity and cause of attack over time on emotions, cognitions, risk perception, and intended avoidance behavior. These experiments involved over 600 college students in both Los Angeles and Washington D.C. Please see John, Rosoff and Weiss under Specific Projects for details. Also contact Richard John, Heather Rosoff and David Weiss for progress on this analysis (Richard John <richardj@usc.edu>; Heather Rosoff <rosoff@usc.edu>; David Weiss <dweiss@calstatela.edu>).

3. Applied Relevance

Many of the summary findings above contribute to our understanding of risk perception and risk communication. The most important involve our better understanding of how fear and perceived risk decay over time following a crisis. It turns out that the decay rate is steep immediately following an event. This suggests that there is a critical window directly following an event in which the public has a natural tendency to recover. Please see Figure 1 below to see how these dynamics operate. Risk communication messages should be tested well in advance of a crisis and their delivery should be timely. Also, a simulated attack on the financial district of Los Angeles was created and analyzed. A nationwide survey was conducted and an economic model of Los Angeles was constructed. It turned out that losses due to behavioral factors were 16 times greater than loses due to business interruption, deaths or injuries. For the first time the ripple effects due to the social amplification of risk have been rigorously documented. Figure 2 shows these estimations. It strongly suggests how important risk management programs that build trust and develop effective risk communication strategies are.
Caption: Figure 1. A causal loop diagram describing how a mishap directly affects a community (green arrows), perceived risk amplifies (red arrows), economic impacts rise and lead to intervention (blue arrows) and perceived risk subsides (purple arrows).

Credit: Decision Research and CREATE
Permission Granted
4. Collaborative Projects

The PNNL INC project: This project would eventually involve the direct collaboration of investigators from three DHS University Centers (CREATE, START, NCFPD), Pacific Northwest National Lab (PNNL) and six university or research institutes (USC, ASU, UKY, UCI, RTI and Decision Research). Three subsequent conferences were held that collectively involved over 80 participants from leading universities, governmental agencies, research institutes and policy consulting firms. These conferences along with the work of the project’s principle investigators have produced over 30 papers and 55 presentations. A special issue in Risk Analysis currently has 12 of these papers under review. Five nationwide surveys were conducted.

5. Research Products

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5.1. Publications and Reports

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5.2. Presentations


6. Education and Outreach Products

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Currently working with a high school student who is conducting terrorism research for a nationwide project.