ABSTRACT

Title of Document: USER ACCEPTANCE OF COMMUNITY EMERGENCY ALERT TECHNOLOGY: MOTIVATIONS AND BARRIERS

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The purpose of the study is to investigate the factors that motivate the acceptance of emergency alert technologies that are designated for the community's emergency preparedness and response. By investigating the acceptance case of UMD Alerts at the University of Maryland, I explore three related questions through a three-phase, mixed-methods research design: First, what are the key factors that influence the acceptance and use of emergency alert technology? Second, how are different motivational factors related to the intention to use emergency alert technology? Third, what mechanisms may be integrated into system design and implementation to motivate user acceptance? I identify key motivational factors by reviewing the literature and conducting in-depth interviews. Then, I conduct a survey to examine the relationships between the motivational factors and the intention or behavior of acceptance. Finally, I test the motivational effects of the "subjective

norm" – one of the predominant factors derived from the interview study and the survey – in a field experiment.

Integrating the findings from these three phases, this research shows that user acceptance of emergency alert technology is affected by a variety of factors that the general technology acceptance model (TAM) fails to take into account. In brief, users may be more motivated to accept such technologies if 1) the meaningful use of the technology can be observed in everyday life; 2) the technology system behavior can be easily controlled; and 3) the diffusion of the technology is promoted through the users' social networks and is compatible with the culture of the user community. This dissertation work demonstrates a "deepening" effort in applying TAM to response technology acceptance and establishes a foundation for challenging new lines of research that more closely examine the motivations and barriers to technology acceptance in sociotechnical contexts.

USER ACCEPTANCE OF COMMUNITY EMERGENCY ALERT TECHNOLOGY: MOTIVATIONS AND BARRIERS

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Chapter 1: Introduction

1.1 Introduction

Emergencies, unwelcome as they are, are part of our everyday-life experiences. With the development of modern society, we seem to face an increasing number of life-disrupting occasions caused by a variety of different incidents, ranging from individual crimes to national catastrophes. Without a doubt, emergency response professionals such as police officers and firefighters have played central role in helping affected communities to deal with these incidents. Nevertheless, the active participation in emergency preparation and response by average citizens is also critical. The pervasiveness of information and communication technologies (ICTs) nowadays further facilitates such grassroots participatory activities, and some recent disasters have highlighted the potential power of ICTs in citizen-driven emergency response. During the 2007 California wildfires, for example, residents in the affected area used Web 2.0 applications such as Google Mashup and Twitter to report and disseminate real-time updates about the crisis (Glaser, 2007). Similarly, a grassroots computer network was set up for British farmers and their families at the height of the foot and mouth disease crisis in 2001, revealing that this network not only served as an alternative information dissemination mechanism, but provided a virtual space for interpersonal contact, community discussion, and mutual help among farmers at a critical time (Hagar, 2005). Shortly after the Virginia Tech massacre, many universities in the United States began to add Short Message Service (SMS) alert systems. By pushing emergency notifications to students' cell phones, such alert

systems not only are able to warn campus communities in a more timely manner but also help university police to locate suspects in criminal incidents (Foster, 2007).

Despite the fact that more and more response technology systems have been employed in residential communities and schools, much remains to be learned about the acceptance of such systems in these communities. One central issue that remains understudied is individuals' motivations for adopting and using these response systems to protect themselves and their communities. We have learned from many past experiences that 'build it and they will come' is a false assumption. This study, therefore, aims to answer some fundamental questions such as: What factors motivate community members to adopt emergency response technology systems? And what factors prevent them from using such systems? What can be done to lower barriers to acceptance and to promote active use?

1.2 Background of the Study

A concrete example illustrating the motivation issue in emergency response technology acceptance is the deployment of UMD Alerts at the University of Maryland. The main campus of the University is located in College Park in the Baltimore-Washington, D.C. metropolitan area, with a campus population of around 45,000 students, faculty, and staff. For socioeconomic reasons, the area reportedly contains one of the highest crime rates for the country (Maryland Governor's Office of Crime Control & Prevention, 2008). To protect the University campus community, the University's Department of Public Safety (UMDPS) has installed various emergency response systems including blue light emergency phones, video camera system, Alertus emergency notification devices, among others. In April 2007, the

University purchased the text alert software from Roam Secure, Inc. and deployed the system right after the Virginia Tech shooting occurred. According to the UMD Alerts website (https://alert.umd.edu/), the service is subscription-based and it sends important alerts and updates to subscribers' cell phones in the event of an emergency. A person can either sign up from the website, or send a text message to a specific phone number with the keyword "UMD". Since UMD Alerts is intended to warn the campus in the event of large-scale and unfolding emergencies, the UMDPS has sent out very few real alert messages in the past. At the time of this writing, the most recent alert was issued on June 4th, 2008:

> *Severe weather including high winds within the next 5 to 7 minutes. Take cover indoors.*

In addition to the real alerts, the UMDPS also sends a test message on every first Wednesday of each month to ensure the system is operational:

> *First Wednesday of each month @ 11:55 am, the campus tests UMD Alert, the Alertus System and Early Warning Sirens. These are only tests.*[1]

Since subscription to UMD Alerts is voluntary, the University has put great effort into promoting the alert system to the university community using various marketing strategies (for example, displaying ads on university shuttles, repeatedly sending promotional emails to all students, setting up information desks in public places on campus, etc.). By July 2008, there were over 13,000 subscriptions from students, faculty, staff, alumni, parents of students, and campus visitors. However, student subscriptions were still rather low after all the effort of advertising and

[1] These examples are messages sent to mobile devices such as cell phones. Alert messages sent to registered email accounts include these additional lines: *Sent by UMD Alerts to Campus Visitor, Faculty/Staff, Student (E-mail, Pagers, Cell phones) through UMD Alerts. ... powered by the Roam Secure Alert Network*

promoting – only about 7,500 students signed up, or about 21% of the student population.

Immediate alerts became a priority for many universities after Virginia Tech was criticized for a slow response that some said might have given the gunman more time to kill. It is widely believed that SMS on mobile devices would allow university authorities to communicate with students in a more timely fashion when emergencies occur (e.g., L. Yuan, Dade, & Prada, 2007). Moreover, Pew researchers have reported that university students have a high mobile phone penetration rate and are highly likely to use extra cell phone features for communication and entertainment (Rainie & Keeter, 2006). Hence, it is quite puzzling to see the low rate of subscription to UMD Alerts among the University of Maryland students.

In fact, the University of Maryland is by no means a special case. Shortly after the recent Northern Illinois University shooting, *The Chronicle of Higher Education* reported that at many of the schools with the services to send emergency text messages to cell phones, fewer than half the students have signed up (cited in Williams, 2008). Matt Wagner, the Student Body President at Kansas State University expressed his frustration, which is perhaps shared by many school administrators: “I thought this would be a very simple thing that students would jump on…. The only cost to students is the 10 cents or so… It could be a matter of life or death” (Williams, 2008). Low cost plus “life or death” would seem to be a sufficient driving force for accepting a very simple response technology, but why are most students not motivated to do so?

This same motivation issue is also evident in designing and implementing other types of emergency response systems. For example, the creator of WatchJeffersonCounty.com – an online neighborhood watch system – stated that the biggest challenge for such systems is not technology, but "how to get people involved" (Hanson, 2008, personal communication). Likewise, the motivation for participation has been an important consideration in designing the Community Response Grid (CRG), a geographically-based sociotechnical network of active citizens that helps local communities become better prepared for and more resilient to emergencies (Jaeger et al., 2007a; Jaeger et al., 2007b; Shneiderman & Preece, 2007). A question that keeps coming from inside the CRG research team and from the stakeholders in the participatory design process is: What would motivate the target community to adopt and use the system once it is in place (Wu et al., 2008b)?

1.3 Purpose of the Study

Although community emergency response includes all kinds of actions taken by community members before, during, and after emergencies and disasters, this study focuses on the pre-emergency preparation due to obvious difficulties involved in investigating an on-going disaster and its aftermath. In other words, the question of interest here is why people are motivated (or not motivated) to take expected actions to protect themselves and their communities from potential risks and future emergencies. Using the acceptance of UMD Alerts as a central case, **the purpose of this study** is to investigate the key factors that motivate the acceptance of emergency alert technologies that are designated for the community's emergency preparedness and response.

1.4 Research Questions

Logically, the first step toward examining the issue of motivation in user acceptance of technology is to identify a set of potentially important motivational factors. After these factors have been identified, I then examine how each factor is associated with the intention and behavior of acceptance. Finally, I explore strategies to change some key factors that may influence the technology acceptance.

Consequently, three research questions structure my research plan:

RQ 1: What are the key factors that influence the acceptance and use of emergency alert technology?

RQ 2: How are different motivational factors related to the intention of using the alert technology?

RQ3: Given the factors identified in answering the first two research questions, what mechanisms may be integrated into emergency response system design to motivate user acceptance?

1.5 Overview of Research Plan

This study consists of three phases: identifying motivational factors (Phase 1), exploring the relationships between the factors and people's intention and/or action (Phase 2), and applying the understanding from Phases 1 & 2 to an experiment (Phase 3). The empirical case of interest is the student acceptance of UMD Alerts – an SMS-based emergency alert system currently employed at the University of Maryland. The population of subjects is all students who are currently enrolled at the University. An overview for each phase of the study is as follows:

Phase 1 – Use individual and group interviews to explore students' perceptions, attitudes, and opinions regarding emergency alert systems and to identify motivational factors that may affect the acceptance to UMD Alerts. The qualitative interview data will broaden and enrich the theoretical framework developed from the literature review, and will increase the internal validity of quantitative data to be collected in Phase 2.

Phase 2 – Use a quantitative survey questionnaire to gather data about students' motivations for using (or not using) for UMD Alerts, as well as their perceptions of campus safety in general and their demographic information. The survey data will be analyzed using statistical tools to identify patterns of responses and to test hypotheses about the relationships between the motivational factors and the intention or action of using UMD Alerts.

Phase 3 – Use a field experiment to determine the motivational effect of subjective norm in the acceptance of UMD Alerts. The goal of the experiment was to observe and compare the effects of injunctive norm (from University officials) and descriptive norm (from friends) in persuading students to register for the alert service.

This overall research plan is illustrated in Table 1.1 below:

Table 1.1: Overview of Research Plan

Research Step	Research Question	Research Method	Outcome
Phase 1: Identify motivational factors.	RQ1: What are the key factors that influence the acceptance and use of emergency alert technology?	Individual and group interviews.	A set of key motivational factors; A research model guiding the rest of the study.
Phase 2: Examine relationships between motivational factors and people's intention or behavior.	RQ2: How do different motivational factors associate with the intention of using the alert technology?	Online and paper-based surveys.	A set of relationships between motivational factors and the acceptance intention/action.
Phase 3: Explore ways to influence people's intention or action.	RQ3: What mechanisms may be integrated into emergency response system design to motivate user acceptance?	A field experiment.	A set of strategies to motivate and persuade the acceptance of emergency alert technology.

1.6 Definition of Key Terms

Emergency & Community emergency

An emergency is a sudden, unexpected event requiring immediate response due to potential threat to health, safety, environment, or property. Although dictionary definitions of emergency seem to vary little, there exist great discrepancies and confusion about the concept when it comes to differentiating between emergency and disaster. The U.S. Federal Emergency Management Agency (FEMA) defines an

emergency as a dangerous event that can be managed at the local level, while a disaster demands a greater level of response beyond the scope of local and state resources (FEMA, 2006). Ironically, although FEMA is meant for large-scale disaster response, the term "emergency" appears frequently in its publications and website and is often used interchangeably with "disaster." Other emergency management organizations, such as Ready America (http://www.ready.gov/) and Citizen Corps (http://www.citizencorps.gov/) also seem to use "emergency," "disaster," and "crisis" with little distinction.

Emergency management researchers tend to agree that there exist escalating levels of emergency that can be fitted into a hierarchical structure (Canton, 2007). At the bottom of the hierarchy is a personal emergency that impacts only a single person or family; at the top of the hierarchy is a catastrophic event resulting in massive damage to and disruption of the society. In the context of this study, I am interested in students' perception of life-disrupting events that can occur in the university community and how they cope with these events. Therefore, the focus of this study is on "community emergency", which is somewhere in the middle of the hierarchy.

Community emergencies are events that may disrupt the normal life of a single community and which usually can be handled by local resources. Community emergencies include locally severe weather, single-building fires, infectious disease outbreaks of a local scale, power outages, neighborhood crimes, and terrorist activities, among others. These events may disrupt many community members' everyday lives, or have significant impacts on community members' perception of community safety. Specifically, community emergencies in this study refer to such

events occurring within the boundary of a university campus and which would typically be handled by designated first responders (for example, the university police).

Community

Sociologists have been studying the concept of community since the late nineteenth century (Sampson, 1988; Smith, 2001). Although community is commonly defined as a place (either physical or virtual), the term often has many psychological and social meanings. To a large extent, research studies surrounding the concept of community are defined by ways of understanding the community tie, or some form of bond connecting individuals. Community ties can be structural (determined by employment, homeownership, etc.), social (determined by kinship and friendship), and psychological (personal identification and sense of belonging).

This study is situated in a university community. The term community is used to denote a geographically-bounded campus, whose members are interlinked with one another through social groups such as classes, project teams, departments, and personal friendships, and these links are mediated by both traditional means and ICTs.

Emergency response, Community response, & Citizen response

I use emergency response as an umbrella term for a wide spectrum of activities involving preparing for imminent risks, responding to unfolding crisies, and recovering from the impact of disasters. Emergency response can be performed by professional responders such as police officers and firefighters, non-government organizations (for example, the Red Cross), and all members in a community.

Grassroots activities performed by community members are often referred to as *citizen response* or *community response*. Community response is the preferred term in this study because the word "citizen" implies citizenship in the sense of national citizenship, whereas more than ten percent of students enrolled at the University of Maryland are not citizens of the United States (see http://www.international.umd.edu/ies/). Community response may involve peer-to-peer information exchange, self-organized collaboration, and mutual assistance in various ways. Community response has critical importance in various scales of emergencies as local residents are often the true "first responders" in an emergency (Palen, Hiltz, & Liu, 2007a).

Emergency response (alert) technology

Emergency response technology may refer very broadly to any tools used in response activities, ranging from two-way radios used by first responders in the field to sophisticated computer monitoring systems used by emergency management officials. In this research context, I focus on emergency alert technology, which is a subcategory of emergency response technology that designated for disseminating time-critical information to the public before or during an emergency incident. The main purpose of an emergency alert technology is for response professionals to communicate timely information to a target community that is subject to the impact of an imminent or on-going community emergency. UMD Alerts is a typical emergency alert technology system that utilizes mobile devices (cellular phones) and wireless service (SMS) to deliver authorized emergency messages to the university community. Hence, the subsequent discussions on user acceptance in this study are

about the adoption and use of alert technology by ordinary community members, while the acceptance of technology by professionals for field operations or decision-making are not covered.

User acceptance

The issue of user acceptance of technology has been tackled in many related fields such as information systems (IS), human-computer interaction (HCI), and communication studies. The present study adopts Dillon & Morris's (1996) definition of user acceptance as "the demonstrable willingness within a user group to employ information technology for the tasks it is designed to support" (p. 5). This definition emphasizes the actual acceptance *behavior* ("demonstrable") rather than the self-reported *intention* of use. However, from the standpoint of system implementation and diffusion, behavioral intention is still the most important subject in technology acceptance research, as researchers are mainly interested in understanding the social and psychological determinants of individual's intention in order to model and predict the future acceptance rather than to explain the existing adoption. Hence, while following Ajzen's (1991b) belief that intentions "capture the motivational factors that influence a behavior" (p. 181), this study pays attention to both the non-user's intention of adopting UMD Alerts and the determinants of the adoption behavior of existing users.

Another clarification to make here is about the difference between initial adoption and subsequent continued usage. Research studies have found that the determinants of continued usage of a technology system are often different from those of initial adoption (Bhattacherjee, 2001; Hsu & Chiu, 2004). Certainly, the usage

experiences during post-adoption period will impact the user's perception and attitude toward the system, which in turn might impact the continued usage. Most emergency alert systems (like UMD Alerts), however, are designed in such a way that they are "set-and-forget" in nature. That is to say, once a person adopts an emergency alert system, the actual usage will only occur when there is an emergency. Since most users are unlikely to have many usage experiences with emergency alert systems, the post-adoption evaluation is difficult to conduct for both users and the researcher. Hence, the present study concentrates only on the initial adoption of technology acceptance.

Motivation

Motivation is commonly regarded as the driving force behind goal-oriented human behaviors. In the history of psychology research, there have been many theories that attempt to explain this driving force from different perspectives. In the context of emergency response research, motivation can derive from the biological drive for survival, the cognitive assessment of risk-benefit, the normative influence from social groups, and the emotions of fear and empathy. An in-depth review of various motivation theories is offered in the literature review in Chapter 2.

1.7 Contributions of the Study

This study has both theoretical contributions and practical implications. Human motivation is a complex subject that has been studies for decades but still not well understood. One deficiency of past motivation research, as Shamir (1991) pointed out, is the lack of focus on specific contexts and domains in which motivation is situated. This dissertation work situates motivation study in a specific context,

adding the understanding of the human motivation and behavior in the domain of emergency response and preparation. Another theoretical contribution is that this work extends the technology acceptance research by contextualizing the core TAM constructs within a sociotechnical perspective (Kling, Rosenbaum, & Sawyer, 2005; Mumford, 2000). The proposed research framework establishes a systematic view of motivations and barriers involved in emergency alert technology acceptance by combining socio-psychological research on emergency response and information system research on technology acceptance.

This study also has practical implications. First of all, the results of the study will inform University of Maryland administrators in their deployment of UMD Alerts and other emergency response systems in the future. Second, both the methodology and the findings from this study may be applied to studying other universities that are implementing similar alert systems. Third, this study will assist system designers to design and deploy appropriate emergency alert systems that will be well received by the target communities.

1.8 Summary and Chapters Ahead

In this chapter, I explain the purpose of the study and provide an overview of the research plan. The three research questions and three phases of research design are proposed. The overarching research approach and specific data collection methods are outlined. A set of key concepts used in the study are defined and discussed. Finally, the expected contributions of the study are described.

Chapter 2 provides a review of the literature that lays the theoretical foundation for the research model and the research questions. The key concepts

defined in Chapter 1 are revisited in much richer intellectual contexts. Three streams of literature are critically examined: psychological studies on motivation, multidisciplinary studies on community response (with or without technology), and information system (IS) studies on technology acceptance.

Chapter 3 explains the mixed-methods approach and the steps of collecting and analyzing data.

Chapter 4 provides details about the in-depth interviews and the findings. The research model is refined based on the interview findings.

Chapter 5 describes the survey study, with an emphasis on statistical data analyses. Hypotheses proposed in the methodology chapter are tested and the results are discussed.

Chapter 6 explains the field experiment in which the factor of "subjective norm" is examined.

Chapter 7 provides a synthesis and a discussion of the empirical findings in light of the theoretical framework adopted and the main research questions. Limitations of this study and avenues for future research are also discussed.

Chapter 2: Literature Review and Research Model

This chapter begins with a brief review of research studies on human motivation and their relevance to emergency response, and then proceeds to discuss ICT-supported community response in general, followed by a review of two technology acceptance perspectives: innovation diffusion theory and technology acceptance model. The chapter ends with an integrated, cognitive-social model for studying motivations for accepting emergency alert technologies in community settings.

2.1 Motivation and Emergency Response

Motivation, defined by *Encyclopedia Britannica* ("Motivation," 2007) as "factors … that arouse and direct goal-oriented behaviour," has been a central subject of study in psychology. Numerous studies have been done to understand different factors of motivation in order to explain or alter goal-oriented human behaviors. This section reviews four different perspectives in studying motivation (biological, cognitive, social, and affective) and how each perspective is relevant to emergency response.

2.1.1 Biological Drive as Motivation

The early theories on motivation are based on the belief that motivations are biologically determined forces for the survival of organism. This stream of theories can be traced back to Charles Darwin and Sigmund Freud, who proposed that human behaviors were ultimately driven by all kinds of innate instincts. One of the most

exemplified instincts in the literature is hunger, which motivates food-seeking behavior (see, for example, Wagner, 1999).

Hull's (1943) drive reduction theory – the most popular theory in the 1940s and 1950s for explaining motivation – extended this biological view to a systematic framework for explaining human motivation. The drive reduction theory postulated that all human behaviors are rooted in biological needs that result from an imbalance in homeostasis of the organism's physiological system. The organism then strives to restore a balanced, optimal survival status by acting on satisfying these needs or drives. Once the goal of a drive is attained, the drive is temporally reduced until the next imbalance of homeostasis. Hence, motivation is defined as the inner state of an organism that energizes him or her to reduce the drive state for the purpose of optimal survival.

While the drive reduction theory seems quite straightforward in explaining some human behaviors, it fails to account for many other psychological and behavioral activities. In some situations, for example, a hungry person may give up his food to sustain another person even though he has a hunger drive to reduce. On the one hand, the theory lacks fine-grained examination of the relationship between the intensity of the drive and the strength of motivation (we do not consume food whenever we are hungry – only when the hunger reaches a certain level of intensity); on the other hand, drive reduction theory is a much simplified model for explaining human behavior as it reduces complex human motivation into a deterministic force deriving only from physiological drives (Norman, 2008; Weiner, 1992).

Maslow's famous hierarchy of needs is considered by many as a reaction to the mechanistic, reductionist approach of studying psychology from physiological psychologists, as it brings human values such as love and self-actualization back to psychology. As Maslow declared in his 1943 seminal paper, motivation theory should be "human-centered rather than animal-centered" (Maslow, 1943, p. 371). Since the first conceptualization of the hierarchy of needs, Maslow's theory has become one of the most popular and often cited theories of human motivation. Nevertheless, the hierarchy and its theoretical foundations have been harshly criticized by more recent social scientists. For example, Soper, Milford, and Rosenthal (1995) stated that Maslow's approach to motivation has more status as a belief system than it does as a scientific explanation of motivation because it has never been well supported by empirical studies. Maddock and Fulton (1998) concurred: "It is unfortunate that Maslow's hierarchy has had such a widespread reception because it does not really explain motivation. However, it is understandable when explained the way that Watson explained it: it is simple, and it is graphic" (p. 9). Indeed, Maslow's fundamental proposition that human needs arrange themselves in hierarchies so that the emergence of one need rests on the satisfaction of another lower-level need is a overly simplistic modeling of human motivation. Although this model adequately explains the priority of safety needs in an emergency, it is not an accurate model in depicting the complexity of motivation in emergency preparation and response. Just like drive reduction theory, Maslow's theory is too simple to account for the interaction and dynamics of multiple motivational factors in most social contexts.

2.1.2 Cognitive Cost-Benefit Evaluation as Motivation

Starting from the 1960s, psychologists who were not satisfied with biological explanations of motivation began to understand motivation as being cognitive in nature (Weiner, 1992). The assumption is that humans have rational expectations of attaining a goal based on information that is available to them, either from past experiences (reinforcement) or from current stimuli (incentives) (Birch, Atkinson, & Bongort, 1975; Skinner, 1974). This model is cognitive because it focuses on perceived rather than the actual outcomes that influence behavior. People are motivated to act only if they can expect some sort of reward from their action that outweighs the perceived cost associated with the action. Along with the popularity of behaviorism, this cognitive view of motivation gained wide acceptance in fields like educational psychology (Deci, 1975; Deci & Ryan, 1985) and communication studies (Fishbein & Ajzen, 1975).

In studies of emergency intervention and helping behavior, many scholars also believed that it is the balance of risk-reward calculations made by an individual that explains their motivation to help others (Dovidio et al., 1991; Penner et al., 2005; Piliavin et al., 1981). When it comes to individual's emergency preparedness, the ORC Macro report (2005) concluded that the perception of an imminent threat is probably the greatest factor in motivating people to get prepared. In a more recent *Citizen Preparedness Review*, ORC Macro (2006) identified four main explanations to an individual's lack of motivation for preparedness and all of them are related to people's perception of threat and the value of action: 1) Person does not believe that he or she is susceptible to a risk ("risk susceptibility"); 2) Person does not believe that

he or she is presented with a severe threat ("risk severity"); 3) Person does not believe that he or she needs to perform the recommended protective actions ("self efficacy"); and 4) Person does not believe that the recommended protective action will be effective ("response efficacy").

Not surprisingly, within the overall framework of cognitive theory of motivation, emergency response researchers draw heavily on a related area of research: health behavior. The health belief model (HBM) – the most widely utilized model in the study of health-related behavior (Noar & Zimmerman, 2005) – posits six constructs representing the core motivational factors that predict people's preventative health behavior: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, perceived self-efficacy, and cues to action (Glanz, Rimer, & Lewis, 2002; Harrison, Mullen, & Green, 1992; Rosenstock, Strecher, & Becker, 1988). The HBM has been applied to a broad range of health behaviors and subject populations, explaining or predicting health-promoting (e.g., diet, exercise) and health-risk (e.g., smoking) behaviors as well as vaccination and contraceptive practices (Glanz et al., 2002). These studies show that individuals assess health risks, costs, and likely benefits, before making a decision to take preventative actions or seek medical treatment. Clearly, there is a great deal of parallel between the constructs in HBM and the constructs identified in emergency response literature. In a nutshell, researchers in both fields tend to believe that the likelihood of taking preventative actions against potential risks (health or environmental) is largely determined by individual persons' cost-benefit analysis of the actions.

2.1.3 Social Identity as Motivation

Both the biological and the cognitive theories of motivation imply that humans make decisions based on their own needs and anticipate rewards that satisfy these needs. According to Shamir (1991), this "individualistic bias" is a major drawback of the traditional motivation research because motivation is conceived being related only to an individual person. The individualistic bias, as Perry (2000) stated, diminishes the explanatory power of motivation theory for understanding behaviors that transcend self-interest, such as those observed in collective, less individualistic cultures. Many researchers now consider motivation as a social construct that is shaped by a person's social identity and the social environment.

Indeed, there is widespread agreement in social psychology that group memberships shape people's behavior and motivation for behavior (Brown & Gaertner, 2001). In an experimental study, Stapel, Reicher, and Spears (1994) found that when the victim of an accident is described as an "in-group" rather than an "out-group" member, individuals are more likely to consider that the same fate might befall them. Hence, the relevance of emergency information to a person would increase, which in turn increases his or her motivation for action. In another experiment, researchers found that an injured stranger (a confederate) wearing an "in-group" soccer team shirt is more likely to be helped than that wearing a rival team shirt or an unbranded shirt (Levine et al., 2005).

These findings imply the applicability of Social Identity Theory (SIT) in studying motivation for emergency response (Hogg & Vaughan, 2002; Tajfel & Turner, 1986). The SIT posits that the favorable motivation for helping "in-group"

members is in part due to the self-other merging or "we-ness" (Batson, 1997; J. C. Turner et al., 1987). Hence, the theory suggests that perceived common identity and social categorization may lead to increased feeling of responsibility for performing collective actions. Furthermore, combining the SIT with the cognitive cost-benefit model, the increased perception of "we-ness" may increase both the cost of *not* helping while deceasing the cost of helping because helping others is regarded as helping "us" (Penner et al., 2005).

2.1.4 Emotion as Motivation

The empathy-altruism theory advocated by Batson and his associates (Batson, 1992, 1994; Batson, Ahmad, & Tsang, 2002) suggests that an individual's empathetic emotion for others is an important motivator underlying altruistic behavior. Other studies show that empathy for individuals in need of help motivates helping even though the task is costly and there is no observable reward (Dovidio, Allen, & Schroeder, 1990; Piliavin & Charng, 1990). For example, some Katrina volunteers reported that they were just "feeling impelled" to help and there was "no logic" to their helping behavior (Avdeyeva, Burgetova, & Welch, 2006). Anxiety is another emotion that has been identified as an important motivation for driving people to deal with health risks (Norem & Cantor, 1986). For example, from a series of experimental studies, M. M. Turner et al. (2006) found that participants' high anxiety towards skin cancer was positively associated with their motivation to seek information.

One interesting phenomenon observed in empathy research is that a person's social identity may affect the way he or she feels about others. Sturmer, Snyder, and

Omoto (2005) found that the perceived in-group/out-group relationship between the helper and the helpee moderates the effect of empathy on helping intention. In their two studies, empathy predicted helping intentions when the helpee was an in-group member not when the helpee was an out-group member. The findings echo others studies in which subjects are more likely to experience the emotions of others with whom they share a common bond, be it pain (Singer et al., 2004), embarrassment (Miller, 1987), or shame (Lickel et al., 2005). This "emotional prejudice" (Leyens et al., 2000) was examined in a recent article by Cuddy, Rock, and Norton (2007) about aid in the aftermath of hurricane Katrina, and the results were astonishing. The study found that respondents believed that out-group victims experienced less "secondary emotions" (e.g., anguish, mourning, grief) – which are unique to humans – than in-group victims. In other words, respondents inferred that an out-group victim felt less anguish than an in-group victim in Hurricane Katrina, which in turn reduced their intention to offer help to the out-group victims.

2.1.5 Intrinsic Motivation vs. Extrinsic Motivation

Intrinsic motivation refers to doing something for its inherent satisfactions, whereas extrinsic motivation refers to doing something because it leads to an external reward (Sansone & Harackiewicz, 2000). This pair of concepts is often used outside the psychology field, especially in educational and organizational studies about incentives for motivating students or employees. As a result, although researchers describe intrinsic motivation as an inherent thing, it is often not situated within the biological or cognitive discourses described in the previous section. Rather, intrinsic motivation has been vaguely described as a "human nature." For example, Ryan and

Deci (2000) note that “humans … are active, inquisitive, curious, and playful creatures, displaying a ubiquitous readiness to learn and explore” (p. 56). With this understanding, Deci’s (Deci, 1971; Gagné & Deci, 2005) proposed self-determination theory which postulates that intrinsically motivated behavior gives individuals a feeling of autonomy, competence, and social relatedness and from which the individual derives satisfaction and enjoyment. Extrinsic motivation, on the other hand, is a means to an external desirable reward, so satisfaction comes not from the behavior itself but from that external reward to which the behavior leads (Gagné & Deci, 2005).

One common criticism on these enjoyment-oriented explanations is that it does not take into account social values and moral obligations. Shamir (1991) pointed out that a task may not lead to any external reward or inner enjoyment, but the individual is still motivated to perform the task because it affirms his or her social identity and/or collective affiliation. Similarly, Lindenberg (2001) argues that intrinsically motivated behavior can arise from the belief that one must behave in accordance with certain social or religious norms without pursuing external rewards. For example, a person who is motivated to volunteer in disaster rescue may do so because the person believes it is their moral obligation to help.

However, including obligation-based motivation in the realm of intrinsic motivation does not resolve a more fundamental criticism on the intrinsic/extrinsic dichotomy: intrinsic motivation is defined by the absence of obvious extrinsic motivators (Cameron & Pierce, 1994, 2002). In other words, whenever we cannot observe extrinsic motivators, we infer intrinsic motivation. Apparently, there is the

risk that a behavior that in reality is extrinsically motivated by unknown factors is mistaken for being intrinsically motivated. In fact, some scholars claimed that identifying situations without any existence of external inducements is virtually impossible (Bandura, 1977; Flora, 2004). As explained by Bandura (1977), there is a host of stimulus determinants embedded in the physical and social environments that cannot be scientifically identified or measured, yet they may exert substantial influences on an individual's behavior.

A mere dichotomy between intrinsic and extrinsic motivations, therefore, is of little practical value because motivational factors in our lives are so intertwined that a clear-cut separation is not possible. On the one hand, external motivators may be internalized by people as moral obligations (Gagné & Deci, 2005); on the other hand, internal motivators are impossible to observe without interference from the environment (Bandura, 1977). A more nuanced and domain-specific categorization of motivation is needed in order to understand human motivations.

2.1.6 Summary

In summary, from the literature of psychology and social psychology, I have identified the following aspects that are relevant to understanding motivation for emergency preparation and response:

- The innate drive of survival in human physiological system.
- The perceived risk and the perceived benefit of taking response actions.
- The social identities of bystanders and victims.
- The empathy and other emotions aroused by emergencies.

2.2 ICT-Supported Community Emergency Response

2.2.1 ICTs in Emergency Response

Technology, particularly information and communication technology (ICT), has been central to recent research in emergency response and management (Schafer, Ganoe, & Carroll, 2007). Considerable attention has been given to building and evaluating emergency communication infrastructure (Cox, 2006; Turoff et al., 2004) and to improving organizational and cross-organizational crisis management using ICTs (Ikeda, Beroggi, & Wallace, 2001; Lundgren & McMakin, 2004). Researchers tend to focus on integrating ICTs into emergency management systems for reliable communication and effective cooperation, using sensor devices (Lorincz et al., 2004), Geographic Information System (GIS) (Rauschert et al., 2002), or mobile devices to collect emergency data for centralized information processing and decision making (Y. Yuan & Detlor, 2005). However, these technologies and systems are designed for and used by emergency management professionals. By contrast, little concerted effort has focused on the human-side of how local communities can contribute to ensuring their own safety and that of those around them. There have been several attempts to set up community networks for business and social interaction, most notably in Blacksburg (Virginia), Seattle, and the San Francisco Bay Area (Chadwick, 2006; Schuler, 1996; Silver, 2004). However, these community networks were designed to support community activities in normal lives, rather than to react to disastrous events.

Only recently have researchers begun to systematically study and value ICT-enabled community involvement during emergencies. One relevant finding is that the Internet access provided by public libraries in states along the Gulf Coast was of

tremendous importance to their communities during and after the hurricanes that struck in 2004 and 2005 (Bertot, Jaeger, Langa, & McClure, 2006). For example, through the Internet in public libraries community residents located and communicated with missing, evacuated, and displaced family members and friends. The Internet was also used to check for news and updates about conditions in the communities that were evacuated. Similarly, research about the Pentalk Network – a grassroots computer network set up for farmers and their families at the height of the foot and mouth disease crisis in the UK – showcased the important role of ICTs during a national crisis, revealing how that network not only served as an alternative information dissemination mechanism, but provided a virtual space for interpersonal contact, community discussion, and mutual help among farmers at a critical time. (Hagar, 2005; Hagar & Haythornthwaite, 2005). Torrey et al. (2007) provided a nuanced analysis of how the online communities responded to the Katrina by facilitating the distribution of donated goods from ordinary people to hurricane victims. They observed two forms of "connected giving": small blog communities and large forums. Compared to large forums, small blog communities used a centralized structure that was more "immediately successful" in managing information and developing trust; however, large, more decentralized forums had more sustainability over time.

After reviewing several community-driven online activities in responding to disasters, including online forums generated by the public to find missing people following Katrina and the FluWiki created for building collective knowledge about avian flu prevention, Palen, Hiltz, and Liu (2007a) concluded that the traditional,

"linear information dissemination around crisis events from authority to news media to the public is clearly outmoded … the potential for public involvement in our 'networked world' via online forums is only just beginning to be realized" (p. 57). In a recent article, Palen et al. (2007b) described some interesting community-side information generation and dissemination activities during the Virginia Tech crisis. For example, students used instant messaging (IM), Facebook, and other social networking tools to check the safety of friends as well as to inform others about their own safety. Wikipedia also enabled students and family to collectively generate an accurate list of 32 victims before the university released the information to the public.

In light of the importance of ICT-enabled community response to emergencies, a research team at University of Maryland has begun to develop a community-based emergency response system – a Community Response Grid (CRG). First introduced by Shneiderman & Preece (2007), a CRG is a geographically-based sociotechnical network of community members that helps local communities become better prepared for and more resilient to emergencies. Empowered by the Internet and mobile technologies, the system helps local communities to establish multi-channel emergency communication, report emergencies to officials, receive information from official and community sources, coordinate peer-to-peer assistance, and provide emotional support and build trust (Jaeger et al., 2007b; Wu et al., 2007). In CRGs, phone calls, text messages, emails, instant messaging, and web-based reporting are all potential mechanisms for communication between officials and community members, and within the community itself. A CRG also includes tools to synthesize and analyze information from various sources to support decision-making

by authorities, community leaders, and community members. Previously, researchers have proposed community-oriented response systems for emergency management communities. For example, Turoff et al. (2004) suggested a "Web center" as a group coordination and knowledge building system for the professional communities. The CRG system, however, is one of the first attempts to harness the power of civilians in an ICT-enabled community by facilitating peer-to-peer assistance and social-network-based support.

2.2.2 Motivation for Community Involvement

Motivation for community involvement, by definition, suggests a prosocial orientation. It should be noted that community involvement is not equivalent to volunteerism, although volunteerism is often conceived as a representative behavior of community involvement. In this study, I adopt a broader view of community involvement as articulated by Stukas and Dunlap:

> At the most basic level, community involvement has as a primary goal the betterment of the community – such betterment can be achieved both directly, through action (for example, by painting over graffiti or cleaning up a vacant lot), or indirectly, through the building of social capital.
> (Stukas & Dunlap, 2002, p. 414)

Social capital commonly refers to the social cohesion and trust among individuals (Putnam, 2000). The quantity and quality of social capital in a residence community are closely related to the community members' willingness to intervene in emergency response and the extent to which they agree and expect the community to protect itself (Sampson, 2004). On the one hand, the willingness of local residents to intervene for the common good depends in large part on conditions of mutual trust

and cohesion among the community members; on the other hand, strong social capital in a community predicts the community's resilience to community problems and community emergencies (Sampson, Raudenbush, & Earls, 1997).

There are four levels of community involvement according to Keith Stamm (1985): attending, connecting, orienting, and manipulating. These four levels of involvement can be measured through the following four questions, respectively:

- How often one keeps up with the local news?
- How often one gets together with people who know what's going on locally?
- How often one has ideas for improving things locally?
- How often one works to bring about changes in the community?

A series of studies done by Stamm and his followers (Kang & Kwak, 2003; McLeod, Scheufele, & Moy, 1999; Rothenbuhler, 1991; Stamm, 1985; Stamm, Emig, & Hesse, 1997) show that community involvement is positively correlated to a variety of communication activities including mass communication such as newspaper reading as well as interpersonal communication. Rothenbuhler (1991) found that keeping up with local news and getting together with other people are the baseline of community involvement. In other words, actively obtaining information about the community and regularly interacting with other community members are essential conditions of community involvement. These findings are in line with the proposition that social cohesion of a community is critical in helping it combat community problems.

An interesting phenomenon related to motivation for community involvement is so-called "social loafing" (Ashforth & Mael, 1989; Latané, Williams, & Harkins, 1979). Social loafing refers to the phenomenon of reduction in motivation and effort

when individuals work collectively compared with when they work individually or coactively (Karau & Williams, 1993). The phenomenon of social loafing has been observed in both the physical world and the online world (e.g., Karau & Williams, 1995; Michinov & Primois, 2005). Understanding causes of social loafing is central to understanding the motivations of individuals and in collective tasks. One classic explanation to social loafing is the "diffusion of responsibility" (Darley & Latané, 1968) – the more people present, the less each individual feels responsible to act. This hypothesis has been validated in numerous studies in both real-life and online social settings (e.g. Barron & Yechiam, 2002; Beenen et al., 2004; Bickman, 1972; Rashid et al., 2006). This diffusion of responsibility hypothesis may also be applied to understanding the low degree of emergency preparedness in many residence communities (ORC Macro, 2006). The lack of action might be in part explained by the public's assumption that the responsibility for protecting the community is a job of emergency response professionals (Ballantyne et al., 2000).

2.3.3 Summary

Participating in community emergency response may be viewed as one type of community involvement whose purpose is for the security of the entire community. Some recent studies have showcased the great potential of ICTs in supporting such involvement at the local community level. Active information exchange and communication between community members are both a prerequisite and an indicator of high degree of social cohesion. Social loafing, caused by the diffusion of responsibility, is a well-known obstacle in community involvement. The implications from this stream of research are:

- ICTs may play an important role in community emergency response.
- Keeping up with local news (for example, signing up for emergency alert services) is a baseline of community involvement.
- Community involvement is an indicator of the community's social cohesion.
- Social loafing is a de-motivating factor that may hinder community involvement in emergency response.

2.3 Motivation for Technology Acceptance

Although these recent studies have highlighted much potential of ICTs in coping with the unfolding crisis in communities, the acceptance of such technology systems by local communities should not be assumed. In fact, previous studies have discovered that users are often unwilling to use a certain technology even if the usage would result in impressive performance gains (Jiang, Muhanna, & Klein, 2000; Swanson, 1988). Hence, the acceptance issue has been extensively studied in the field of Information System (IS) in the past two decades. The two predominant perspectives emerged are the innovation diffusion theory and the Technology Acceptance Model (TAM).

2.3.1 Innovation Diffusion Theory

Everett Rogers' (2003) innovation diffusion theory defines technology acceptance as a process by which the new technology is communicated through certain channels over time among members of a social systems. The theory has been widely used in studying diffusion of technological innovations in organizational and business contexts. Its primary intention is to provide an account of the manner in

which any technological innovation moves from the stage of invention to widespread use. Generally speaking, there are five categories of adopters depending on their speed of uptake: innovators, early adopters, early majority, late majority, and laggards. Further, Rogers and his followers plot these categories over a normal distribution where each major category represents a standard deviation of dispersion, predicting that the cumulative adoption distribution follows a sigmoidal, S-shaped curve (Brancheau & Wetherbe, 1990; E. M. Rogers, 2003; Teng, Grover, & Guttler, 2002).

While diffusion theory provides a context in which one may examine the uptake and impact of information technology over time, it provides little explicit treatment of user acceptance itself (Dillon & Morris, 1996). In other words, innovation diffusion theory offers insights into the characteristics of user groups who adopt a technology at different stages, or the characteristics inherent in the technology that may influence specific groups to adopt it; however, identifying social and cognitive determinants that determine an individual user's (or a specific user group's) motivation for accepting a technology is not the province of diffusion theory. As Dillon and Morris (1996) pointed out, modeling user acceptance at an individual level is better tackled within the theoretical framework of TAM.

2.3.2 Technology Acceptance Model

Based on the theory of reasoned action (TRA) (Ajzen & Fishbein, 1980; Fishbein & Ajzen, 1975) and the theory of planned behavior (TPB) (Ajzen, 1985, 1991a), Davis' (1989) TAM is probably the most widely cited framework for modeling technology acceptance at an individual level (Lee, Kozar, & Larsen, 2003).

Ajzen aind Fishbein's (1980) TRA uses attitudinal, normative, and intention variables to predict behavior. According to them, the direct precursor to behavior is the intention to perform that behavior, and such an intention is determined by the person's attitude toward the behavior and the person's normative beliefs (or "subjective norm"). Attitude toward behavior refers to the degree that an individual has a positive or negative reaction toward a specific behavior. Subjective norms consider the probability that important persons or groups approve or disapprove of performing a specific behavior. As Fishbein and Ajzen (1975) demonstrated through their theory, behavior is best predicted by intentions, and "intentions are jointly determined by the person's attitude and subjective norm concerning the behavior" (p. 216).

The theory of planned behavior (TPB) modifies the TRA by incorporating an additional construct "perceived behavioral control" to address situations in which individuals lack substantive control over a specific behavior. Like the TRA, the TPB suggests that rational human behavior can be determined by behavioral intention, which is influenced by attitude, subjective norms, and perceived behavioral control. Perceived behavioral control is the determinant that is unique to the TPB and refers to an individual's perception of whether or not the requisite resources or opportunities are present to perform a behavior (Ajzen, 1991a, 2002).

The TAM adapts these theories of belief, attitude, intention, and behavior into an information technology acceptance model. The core idea of the TAM is that technology acceptance is determined by a person's behavioral intention, which in turn

is determined jointly by the person's perceived usefulness (PU) and perceived ease of use (PEU) toward the technology. An illustration of the TAM is shown in Figure 2.1:

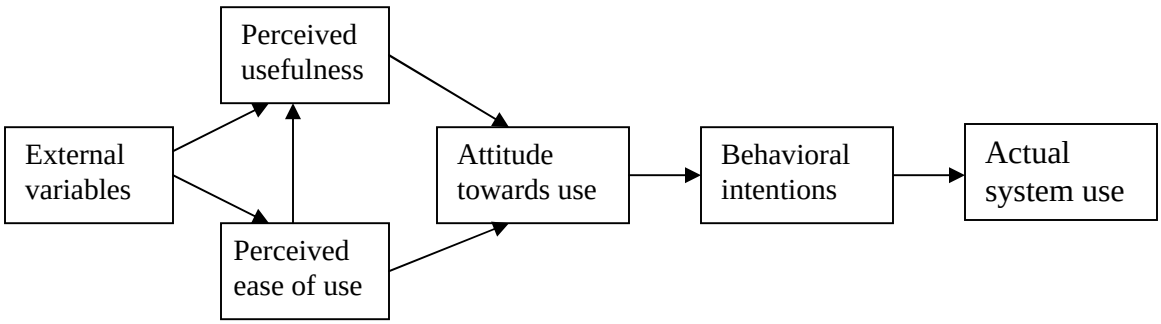

Figure 2.1: Technology Acceptance Model (Davis, Bagozzi, & Warshaw, 1989)

Interestingly, the TAM purposefully dropped the "subjective norm" construct in the TRA and TPB. Davis, Bagozzi, and Warshaw (1989) explained that subject norm was not included in TAM due to "its uncertain theoretical and psychometric status" (p. 986). In particular, they argued that it was difficult to separate the direct and indirect affects of subject norm on an individual's behavioral intention. For example, employees may intend to use a technology merely to comply with mandates from their superiors, rather than based on their own perceived use or usefulness. The issue of subject norm was later picked up by Taylor and Todd (1995) in their Decomposed TPB, which incorporates social influence and other social elements into TAM. Following Taylor and Todd, Venkatesh and Brown (2001) used the Decomposed TPB as the guiding theoretical framework in their longitudinal study of personal computer adoption in American homes. The authors distinguished social influences from "relevant others" (family members and friends) and from "secondary sources of information" (mass media), and the field data demonstrated that the social influences from relevant others played a key role in household adoption of computers.

More recently, Venkatesh et al. (2003) proposed a Unified Theory of Acceptance and Use of Technology (UTAUT) model, attempting to combine all major theoretical constructs in previous IS literature into one definitive framework. They theorize that three constructs play a significant role as direct determinants of user's behavioral intention in technology acceptance: performance expectancy, effort expectancy, and social influence. From a business management perspective, these three constructs are defined as following:

- *Performance expectancy*: the degree to which an individual believes that using the technology will help him or her to increase job performance;
- *Effort expectancy*: the degree of ease associated with the use of the technology;
- *Social influence*: the degree to which as individual perceives that important others believe he or she should use the technology (Venkatesh et al., 2003, pp. 447-451).

Although not discussed in the article, the three constructs correspond very well to the three basic aspects of human motivation reviewed in Section 2.1: cost, benefit, and social identity. Effort expectancy, or PEU in TAM, concerns one type of cost (cognitive effort) a person needs to pay; performance expectancy, or PU in TAM, is based on cognitive perception of the benefit gained from an action; and social influence from others is closely related to how the person identifies him- or herself in his/her social groups. Since the IS literature is mostly concerned with effective motivators for accepting a certain technology in corporate settings, it is not surprising to see that the conceptual components in TAM model (and variations of

TAM) are hardly original to motivation research *per se*. For example, IS researchers are interested to know whether and to what degree people are motivated by their colleagues, but they barely discuss why such influence would occur. Nevertheless, the IS literature does provide us a domain-specific framework to examine and measure human motivation, and the measurement instruments (with minor variations) are validated by many studies.

It is also noted that measurement instruments developed for one type of users and/or one type of technologies might not address the unique factors of another user group or technology. For example, Hu et al. (1999) suggested that TAM was able to provide a reasonable depiction of physicians' intention to use telemedicine technology, but it is necessary to incorporate additional factors in order to improve the model's specificity and explanatory utility in a health-care context. Colvin and Goh (2005) studied the acceptance of laptop-based mobile display terminals by police officers. The terminals facilitated computerized dispatch, access to crime information database, and writing reports. They surveyed over 400 patrol officers on the West Coast and found that the two-factor TAM model (PU and PEU) did not fit well with the survey data. Instead, their exploratory factor analyses suggested a four-factor model: ease of use, usefulness, information quality, and timeliness. Further, they suggested that "information quality" and "timeliness" were the most important components of technology acceptance by patrol officer because of the nature of patrol work. Although it is a questionable approach to separate the two information components from the conception of usefulness of technology, the study does highlight the importance of high-quality and timely information in emergency response

activities and how different sets of factors may affect technology acceptance for different user groups.

2.3.3 Summary

In this section, I discussed two predominant technology acceptance perspectives: Everett Rogers' innovation diffusion theory and Fred Davis' technology acceptance model, with an emphasis on the latter. According to this stream of literature reviewed above, individual persons' intention to use a technology system is influenced by their perceived reality regarding the utility of the system (PU), the effort to use the system (PEU), and other people's opinion about accepting the system (SN). However, care must be taken when applying these "universal" constructs to different user groups and different technologies.

2.4 Research Framework

2.4.1 Summary of Literature Review

Motivation for accepting emergency response technologies is a complex topic that needs to be examined from multiple perspectives. First of all, emergency is one type of environmental stimuli that trigger a basic inner need that motivates humans to act in order to survive (Maslow, 1943, 1970). However, even if there are such stimuli, humans as rational beings also evaluate the ratio of cost-benefit of a certain action to determine if the action is worthwhile. At the same time, humans as social beings always live in communities where emergency response has to be a collective action. This social element in community response links directly to empathy-altruism research and social identity research in social psychology studies. In addition, in a

community context, the costs and benefits of an individual's response should be evaluated in terms of what everyone gives to and receives from the community (Stukas & Dunlap, 2002). This has been a central theme in the research of social capital and collective efficacy, which highlights the shared responsibility and mutual dependence among community members when facing community problems.

Finally, there is the technology component in ICT-supported community response. There is no doubt that technology can empower communities and help them deal with emergencies, but technology creates barriers, too. People are often discouraged by perceived costs (time, money, effort, etc.) associated with the use of ICTs. Information system researchers have tried to explain technology acceptance within the classic cognitive behaviorism framework (such as perceived utility and perceived effort) plus a social dimension accounting for the normative influence from peers and communities.

2.4.2 Theoretical Framework

Conceptually, motivation for using emergency response ICTs in a community encompasses three interrelated components: *emergency response*, *emergency response in a community*, and *emergency response using ICT*. The three components correspond to three angles of motivation research in this context: *individual*, *social*, and *technological*. These three angles of studying motivation, in turn, can be examined under the following theoretical perspectives in the literature:

- *Biological* motivation for emergency response. This perspective accounts for the innate drive for human beings to take action when their survival is under risk (Hull, 1943).

- *Cognitive* motivation for emergency response. Perception of risk and perception of benefit of action are two key factors determining motivation for responding to emergencies (Dovidio et al., 1991; ORC Macro, 2006).
- *Cognitive* motivation for technology acceptance. In the tradition of information system research, perceived usefulness and perceived ease of use have been used as two deterministic factors in explaining people's motivation for using ICT products (Davis, 1989).
- *Affective* motivation for emergency response. Anxiety over imminent risks can be a motivator behind actions of emergency preparedness, while empathy toward others' suffering often prompts people to offer help in emergency situations (Batson, 1992; M. M. Turner et al., 2006).
- *Social* perspective on motivation for community response and on motivation for technology acceptance. This perspective concerns the motivational factors originating from an individual conformity to the "subjective norm" or the expectation of significant others (Shamir, 1991; Venkatesh et al., 2003).

To further synthesize previous research, I use Table 2.1 to show the mapping between the conceptual components, the angles of study, and the theoretical perspectives on human motivation:

Table 2.1: Mapping of Concepts, Dimensions, and Perspectives

Conceptual Components	Angles of Study	Theoretical Perspectives
Emergency response	Individual	Biological drive Risk-benefit assessment Affective influence
Emergency response in a community	Social	Social influence
Emergency response using ICT	Technological	Technology acceptance

One thing to note here is that all these concepts in the table are not independent from one another. For example, "technological" is listed as a separate angle from "individual" and "social," but in reality technology acceptance has always been studied in association with individual or community characteristics (this thinking is partly reflected in Table 2.2). Nevertheless, the elements and structure shown in Table 2.1 provide a relatively comprehensive framework for understanding a variety of motivational factors involved in user acceptance of emergency response technologies.

The present study is about user acceptance of emergency alert technology in a university community. Therefore, the study takes a sociotechnical angle focusing on the factors influencing technology acceptance. I purposefully exclude the biological perspective for the following reasons:

1) To a large extent, the biological need for survival is a fundamental motivator underlying all human activities, which makes the explanatory power of biological theories limited for this particular case study.

2) The drive-reduction hypothesis is difficult to test and validate when the drive is aroused by a complex stimulus such as community emergencies. Unlike thirst

or hunger, the safety need is less objective as it involves more personal characteristics and social influences.

3) Measuring the imbalance in homeostasis – the underlying physiological concept in drive-reduction theory (Norman, 2008) – requires considerable knowledge in physiology and falls far outside of the scope of this research.

I also decide not to examine affective factors mentioned in previous literature (mainly in the literature on helping behavior). This is in part because the nature of this research does not fit in the theoretical context of emergency-aroused emotions such as empathy. Past research on such emotions has been built upon observations on real-life disastrous events that create an arousal state in the observer. Since the present research concentrates on behaviors at the pre-emergency preparation stage, the applicability of those theories on affective factors is very limited. Moreover, emotion as an independent motivator in emergency response is still an on-going debate. For example, Neuberg et al. (1997) argue that the empathy-motivated behavior might be driven by a more selfish desire to relieve one's own frustration at seeing others suffer, rather than by so-called altruism. My analysis in section 2.1.4 "Emotion as Motivation" also indicates that emotional factors are hardly independent from social and cognitive factors.

Therefore, I plan to conduct empirical studies based on the motivational factors illustrated in Table 2.2:

Table 2.2: Motivational Factors Examined in This Study

Theoretical Perspectives	Motivational Factors
Cognitive risk-benefit assessment	Perceived risk (susceptibility & severity) Perceived benefit
Social influence	Subjective norms
Technology acceptance	Perceived usefulness Perceived ease of use

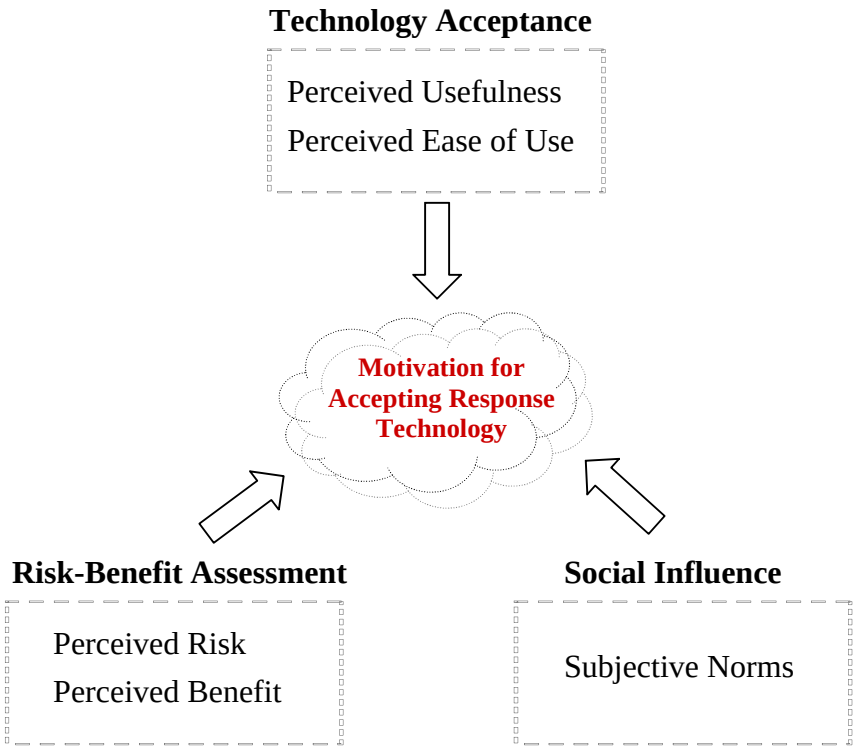

Figure 2.2: Basic Research Model

Figure 2.2 above shows the basic research model that illustrates the theoretical constructs to be examined in this study. It also helps to form the boundary of this study by narrowing the topic down to some more specific areas and factors. From the perspective of empirical investigation, the three sets of factors in the square boxes are

independent variables that may have some impact on the dependent variable in the center of the graph: motivation for accepting emergency response technology. Like any other theoretical model, this research model is a simplification of reality. It does not intend to include a comprehensive list of all the factors that may affect the motivation for technology acceptance, nor does it try to speculate about the possible interactions between these factors. Figure 2.2 is merely a depiction of basic theoretical elements examined in the study that leads to a cross-disciplinary understanding of the key factors in user acceptance of emergency response technology. This research model also serves as a start-up guide for designing the interview and survey instruments in my empirical studies.

Chapter 3: Research Methodology

3.1 Review of Research Plan

As discussed in Chapter 1, the issue of interest in this study is the voluntary acceptance of UMD Alerts – an SMS-based emergency alert system currently employed at the University of Maryland. My research plan (including data collection phases, research questions, research methods, and expected outcomes) is outlined in Table 3.1 below (reprinted from Chapter 1):

Table 3.1: Overview of Research Plan

Research Step	**Research Question**	**Research Method**	**Outcome**
Phase 1: Identify motivational factors.	RQ1: What are the key factors that influence the acceptance and use of emergency alert technology?	Individual and group interviews.	A set of key motivational factors; A research model guiding the rest of the study.
Phase 2: Examine relationships between motivational factors and people's intention or behavior.	RQ2: How do different motivational factors associate with the intention of using the alert technology?	Online and paper-based surveys.	A set of relationships between motivational factors and the acceptance intention/action.
Phase 3: Explore ways to influence people's intention or action.	RQ3: What mechanisms may be integrated into emergency response system design to motivate user acceptance?	A field experiment.	A set of strategies to motivate and persuade the acceptance of emergency alert technology.

3.2 Mixed Methods Approach

As shown in the research plan, I adopt a mixed-methods methodology to tackle the problem of interest. Increasingly, social science research is employing both quantitative and qualitative methods in the quest for research designs best suited for assessing complex issues (Rossman & Wilson, 1985, 1994). A mixed-methods approach is preferred in this study because: 1) I believe that the generalizability of quantitative techniques and the depth of qualitative methods can inform each other, resulting in a more balanced, comprehensive view of complex issues (Creswell, 2003); 2) As demonstrated by the literature review, user acceptance of emergency response technology requires both examining relationships between quantitative factors and understanding rich social context in which the technology system is situated.

The sequence, priority, and integration of the qualitative phase and the quantitative phase are illustrated in Figure 3.1. The design is adapted from the Sequential Exploratory Design proposed by Creswell (2003), except that Creswell's original model places priority on the initial qualitative data collection. The sequential explanatory design is characterized by the collection and analysis of qualitative data followed by the collection and analysis of quantitative data. In this study, the priority is given to the quantitative part and the main purpose of the qualitative part is to assist in forming hypotheses and in triangulating the survey and experiment results. The analyses from the three phases are integrated in the stage of result interpretation and discussion.

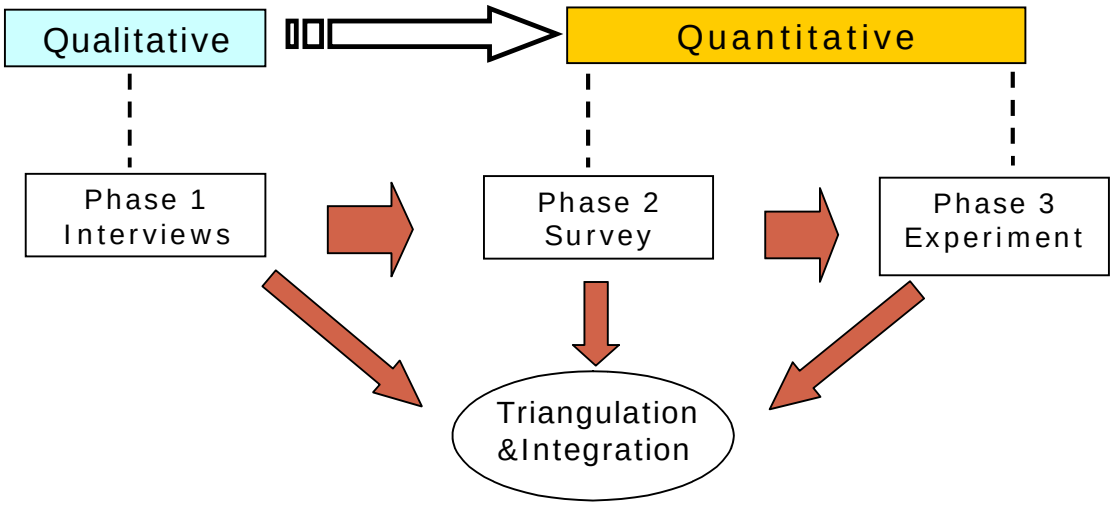

Figure 3.1: Sequential Exploratory Research Design

3.3 Phase 1: Qualitative Interviewing

The purpose of this phase of the study is to answer the research question: *What are the key factors that influence the acceptance and use of emergency alert technology?*

3.3.1 Rationale

Qualitative interviewing is a widely used data collection technique in social science research. The basic rationale of qualitative interviewing is to understand the reality from the subjects' perspective so that underlying meanings of people's experiences may be exposed (Kvale, 1996). Applied to this project, conducting in-depth interviews at the initial stage of the study has the following benefits.

First, qualitative interviews provide a holistic understanding of emergency alert technologies as they are perceived or used by interview participants. Since emergency response is a complicated social phenomenon involving many factors, a holistic picture needs to be drawn before one proceeds to examining selected, pre-

defined theoretical constructs. For instance, I want to have a reasonable grasp of what role UMD Alerts may play in students' everyday life and what situational elements may have impacted their motivation for acceptance.

Second, the codes and coding scheme developed from qualitative interviews inform the design of the questionnaire for the subsequent quantitative data collection (Creswell, 2003). Although I have conducted a fairly comprehensive review of motivational factors involved in ICT-supported community emergency response, it is still risky to derive hypotheses and build the survey instrument solely based on previous research. Failure to adequately specify key factors may result in unfocused measurement and meaningless results.

Finally, qualitative data collected from in-depth interviews can be used to cross-validate, explain, and enrich data obtained through quantitative methods. As Denzin (1978) has pointed out, the "between-method triangulation" is able to cancel out the bias inherent in one particular method and give us "a convergence upon the truth" (p. 14).

3.3.2 Sampling

After obtaining the IRB approval and the instructors' consent, I sent invitation emails to four undergraduate classes in different departments (English, Communications, Computer Science, and Biology) to solicit voluntary participants. In addition, I used "snowball sampling" technique to identify graduate students who were willing to participate. Snowball sampling refers to the procedure of identifying participants "through referrals made among people who share or know of others who possess some characteristics that are of research interest" (Biernacki & Waldorf,

1981, p.141). The selection of potential interviewees is based on the principle of purposeful sampling as described by Paton (1987). Using the "maximum variation" strategy, purposeful sampling is to get "information-rich cases" that cut across participant variations so that a great deal of information can be obtained from a limited number of participants (Paton, 1987). The demographic variations for constructing the sample in this study are gender, academic status, department, and UMD Alerts registration status. Therefore, I expected my sample to include both male and female students, undergraduate and graduate students from multiple departments, and students who have adopted UMD Alerts and those who have not. Students who volunteer to participate were screened to ensure that there is "sufficient variety of types of units of analysis" (Boyatzis, 1998, p. 59). In the end, nine students completed the individual interviews and additional four students participated in a focus group. A good variety of demographic characteristics of the thirteen interviewees is shown in Table 3.2:

Table 3.2: Demographic Distribution of Interviewees

Gender		**Academic Status**		**Area of Study**		**UMD Alerts Subscription**	
Male	Female	Undergraduate	Graduate	Sciences	Humanities	Yes	No
6	7	10	3	5	8	6	7

3.3.3 Interview Instrument

The individual interviews were all semi-structured, consisting of mainly open-ended questions. The interview questions centered on students' perceptions of and attitudes toward campus safety, the university's emergency preparedness, and UMD Alerts. Some key interview questions include:

- *Do you believe that you are well prepared for emergencies that may occur on this campus?*
- *Based on what you know and what you've learned about UMD Alerts, what do you think about this service?*
- *Have you signed up for UMD Alerts?*
    - *If yes:*
        - *Why did you sign up?*
        - *What are your experiences so far?*
    - *If no:*
        - *Why haven't you signed up?*
        - *Have you heard anything about other people's experiences?*

For a complete list of sample interview questions, please refer to the Appendix A. One thing to be noted here is that the instrument was more as a guideline for a conversation than a rigid questioning protocol. In fact, the interview protocol was being constantly refined as the interviews accumulated. This type of open-ended inquiry allowed me to elicit responses in a non-leading, natural manner (Kvale, 1996; Rubin & Rubin, 2005). The main points covered in each interview were the same, but the wording and the order of questions were spontaneous to accommodate the flow of the conversation. Short probes were also be used for the purpose of clarifying questioning or soliciting further elaboration (Rubin & Rubin, 2005). All but one interview were audio-recorded using a digital recorder. One interview was not recorded because the interviewee declined the recording. The length of interviews ranged from 30 minutes to 90 minutes, with an average of 45 minutes. Each participant who completed the interview received 15 US dollars as compensation.

After completing nine individual interviews, I felt that the information gathered from individual persons was approaching a "saturation point" (Lindlof & Taylor, 2002) . I then decided to conduct a focus group to solicit possible new information in a more dynamic way (Krueger & Casey, 2000). The focus group consisted of four students (2 UMD Alerts users and 2 non-users), and the session lasted about one hour. The topics of discussion for the focus group were extracted from the individual interview protocol, with an emphasis on the evaluation of the UMD Alerts system. Participants were asked to write down their thoughts about UMD Alerts on sticky notes and then post the notes under the four categories provided by the researchers: advantages of UMD Alerts, disadvantages of UMD Alerts, why use UMD Alerts, and why not use UMD Alerts. Subsequent probes and discussions were centered on these notes. (Figure 3.2)

Figure 3.2: Sticky Notes Written and Posted by Focus Group Participants

3.3.4 Overview of Data Analysis

All the interview recordings were fully transcribed by me immediately after each interview. The audio recording of the focus group discussions was also transcribed. These transcripts, along with the content on the sticky notes, were imported into NVivo 7 software program for coding and analysis. Instead of using open coding, this study follows Miles & Huberman's (1994) suggestion in that I started with concepts already identified from previous literature and then add new concepts that emerged from the interviews. The theoretical structure and elements outlined in Table 2.1 ("Mapping of Concepts, Dimensions, and Perspectives") and Table 2.2 ("Motivational Factors Examined in This Study") served as the initial coding scheme for the transcripts. The units of coding are linguistic segments of transcripts that may range from a single sentence to multiple paragraphs, depending on my judgment on the presence of "codable moment" (Boyatzis, 1998). Segments of transcripts were labeled with keywords (codes), and these codes were then categorized and integrated into the evolving coding scheme. If the integration fails, the coding scheme would be revised to accommodate the new codes. For a complete list of codes and the NVivo node summary, please see Appendix B. The results of data analysis are discussed in Chapter 4.

3.4 Phase 2: Quantitative Survey

The purpose of this phase of the study is to answer the research question: *How are different motivational factors related to the intention of using the alert technology?*

3.4.1 Rationale

After I identified and validated the motivational factors from the literature and the qualitative interviews, I used quantitative questionnaire items to represent and measure these factors. As depicted in Figure 3.1 above, I gave priority to the quantitative part of the study in my mixed-methods design because: 1) I expect the findings to be generalizable to the University of Maryland student population and possibly to other university campuses where similar emergency alert systems are implemented; 2) I simplify the reality to a set of categorized factors in order to objectively observe and control certain aspects of the reality; 3) Motivation research in psychology has traditionally used survey questionnaires and experiments to collect data; 4) In technology acceptance research, it is also a common practice to use survey questionnaires composed of multiple scales to measure attitudes and intentions (Colvin & Goh, 2005).

I decided to use the Web to distribute the survey and to collect the responses. The benefits of Web surveys include low cost of distribution and administration, easy access to large populations, flexibility and interactivity of instrument design, among others (Eysenbach & Wyatt, 2002; Schmidt, 1997). Nevertheless, there have been many discussions regarding the quality of Web surveys due to a variety of known limitations of the survey format (Carini et al., 2003; Gosling et al., 2004). Coverage error is considered “the biggest threat to the representativeness” (Couper, 2000, p. 467) of Web surveys, as a Web survey directly violates the principle of probability sampling by excluding those who have no access to the Web. However, thanks to the characteristics of the population I was studying, the coverage error was not likely to

be an issue because almost all college students nowadays are active Web users (Pew Research Center, 2002). I do not expect the mode of instrument would significantly limit my access to elements of interest in the target population.

3.4.2 Survey Distribution and Sampling

I initially planned to send the invitation to the survey through UMD's MegaMail system, which maintains a comprehensive list of all the students' email addresses. However, due to the university's tight policy on controlling mass email, the request to use MegaMail was not approved by the President's Office. Upon the suggestion by the staff in the Office, the invitation message was instead sent to students as part of the daily SFYI ("Undergraduate Student For Your Information") and GSFYI ("Graduate Student For Your Information"). The FYIs are listservs maintained by the President's Office for announcing special campus programs and activities of general interest to students. The first invitation to survey (see Appendix C) was included in the April 24th (Thursday) issue of the GSFYI. Due to a technical glitch, the SFYI did not include the invitation message until the next day, April 25th (Friday), 2008.

For traditional mail-based surveys, reminders are typically sent approximately one week after the initial mailing. However, since Web survey returns begin almost immediately after distribution and fall off at a rapid rate, some scholars argue that Web survey may require a shorter lag between initial invitation and reminders (Crawford, Couper, & Lamias, 2001; Kwak & Radler, 2002). In addition, such invitations should avoid weekends and Mondays (Carini et al., 2003). Therefore, I decided to send the first reminder on April 29th (Tuesday) and the second reminder on

May 1st (Thursday) through both FYI systems.

The number of responses was not up to the initial expectation. Three weeks after the first invitation, only 288 responses were collected, of which 224 were usable. 108 respondents identified themselves as undergraduate students, and 114 as graduate students. Given approximately 25,000 undergraduate and 10,000 graduate student enrollments, the response rate is very low. A possible reason for this low rate might be that many students do not read FYI messages when they receive them, or even filter FYI messages into Junk Mail using email client software. For those who did open the FYI email and glanced through it, the invitation could be easily missed because it was buried among a number of other unrelated announcements.

In order to increase the number of respondents (especially undergraduate student respondents) and to check non-response bias, a paper version of the questionnaire was distributed in July 2008 in course offered by the College of Arts and Humanities and the College of Behavioral and Social Sciences. These two colleges were chosen because they had large number of undergraduate enrollments in the Summer term. The paper-base questionnaire is identical to the online one, except for some minor modifications to resemble the conditional branching in the Web survey (e.g., "If 'Yes', skip next page and proceed to question X."). I sent emails to 20 course instructors in the two colleges and 6 agreed to help. 107 completed questionnaires were collected from the 6 classes, resulting in a total of 331 usable responses with online and paper-based combined.

Much literature exists on approximations to the power and sample size of different statistical tests with on agreed-upon solution (Kim, 2004). In fact, as

Robinson (2001) points out, there is no “magical minimal sample size” that ensures a good sample – it is the *quality* rather than the *quantity* of sample that determines the data quality. According to him, a “rule-of-thumb” sample size for 5% error tolerance (or 95% confidence level) is 400. Since the survey has about 30 items for all the factors, the 400 estimation is actually exceeds the recommended sample size in another “rule-of-thumb” proposed by Aguinis and Harden (2009): a ratio of at least 10 observations per estimated parameter. Hence, 331 appears to be a good baseline number that falls between the two recommendations (300 and 400).

3.4.3 Survey Instrument

The Web survey was compiled and implemented in the environment of SurveyMonkey.com, a leading Web survey software application in the United States. The responses from the paper-based survey were manually entered into SPSS (version 15.0) and merged with the online survey data downloaded from SurveyMonkey. SurveyMonkey provides some useful features such as automatic randomization of questions, which was used in the survey to help reduce ordering bias. "Skip logic" (conditional branching) was also used in the survey to direct the respondents to different questions based on answers they give to previous questions. For example, depending on the respondent's choice for item “Have you signed up for UMD Alerts?”, he or she will be routed to answer different questions designed specifically for UMD Alerts users and non-users, as illustrated in Figure 3.3 below. For the paper-based survey, however, I had to specify which questions were for current UMD Alerts users and which were for non-users (see Appendix D).

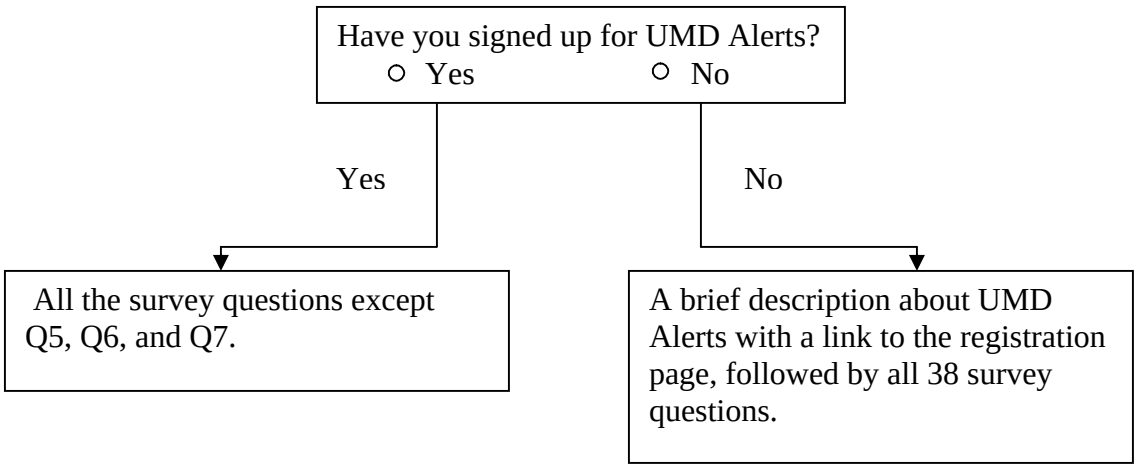

Figure 3.3: Survey Flow for UMD Alerts Users and Non-Users

The survey instrument starts with a brief introduction to UMD Alerts with either a link to or a print-out of the sign-up page. The questionnaire consists of 35 (for UMD Alerts users) or 38 (for non-users) items, which may be grouped into three categories: 1) Demographic questions asking for respondents' academic status, gender, department, and residence; 2) Questions relating to adoption and use of UMD Alerts; 3) Questions about the perception of risk and emergency preparedness in general. A total of 29 items used 7-point Likert scale with 1 = “Strongly Disagree”, 4 = “Neutral”, and 7 = “Strongly Agree”. The rest of the questionnaire were multiple choice items (some allowing open comments), plus an open-comment textbox at the end of the survey. The design of the survey items was based on the constructs in the research model, which derived from the literature and refined in the previous phase of qualitative study. The mapping between the predefined factors (from Table 2.2) and the survey items is shown in Table 3.3 (pp.59-60). Questionnaire items about perception of risk and benefit are based on several influential emergency preparedness surveys conducted in recent years, including the 2007 National Center

for Disaster Preparedness Survey conducted by Marist College Institute for Public Opinion (NCDP, 2007), the 2005 Citizen Corps Survey by Macro International (ORC Macro, 2006), and the 2004 King County Disaster and Emergency Preparedness Survey by Hebert Research (Butler & Sofsak, 2004). Items about UMD Alerts' perceived usefulness, ease of use, and subjective norms related to UMD Alerts acceptance are adapted from technology acceptance literature in Information Systems (e.g., Davis, 1989; Venkatesh et al., 2003). The response scale for these items is a 7-point Likert scale where 1 = Strongly disagree and 7 = Strongly agree. The survey instrument was pilot-tested with 3 graduate students and 5 undergraduate students. The completion time ranged from 3 minutes to 6 minutes in the pilot test, with an average of less than 5 minutes. Comments and suggestions on question sequence and wording choices were solicited, which led to several minor modifications to the questionnaire. A copy of the final version of the questionnaire is included in Appendix D.

Table 3.3: Mapping between Predefined Factors and Survey Items

Theoretical Perspectives	Motivational Factors	Survey Items
Cognitive risk-benefit assessment	Perceived risk	Q22. It is likely that I will experience some emergency when I am on or near campus. Q23. If there were a major emergency, it could have severe impact on me. Q24. I can take care of myself in the time of an emergency. Q25. There is not much I can do to improve campus safety.
	Perceived benefit	Q9. By signing up for UMD Alerts, I feel that I am doing something good for myself. Q10. By signing up for UMD Alerts, I feel safer. Q11. By signing up for UMD Alerts, I feel that I am better prepared for emergencies. Q34. This is a high crime rate area - there is not much the University can do about it. Q35. Overall I think that using UMD Alerts is worthless/beneficial.
Social influence	Subjective norms	Q26. The University officials think I should use UMD Alerts. Q27. My parents think I should use UMD Alerts. Q28. My friends think I should use UMD Alerts.

		Q29. Other people who are important to me think that I should use UMD Alerts. Q37. Overall I think that using UMD Alerts is the wrong/right thing to do.
Technology acceptance	Perceived usefulness	Q16. I believe I will receive timely information from UMD Alerts. Q17. I think the information that I receive from UMD Alerts will be relevant to my personal safety. Q18. With UMD Alerts, I can get emergency information anywhere anytime. Q19. I may get some unwanted messages from UMD Alerts.
	Perceived ease of use	Q12. I am fluent with using text messages on my mobile devices. Q13. It is/seems easy to sign up for UMD Alerts. Q14. I want to have control over the amount of text messages to be sent to me from UMD Alerts. Q15. I want to have the option to choose what type of emergency messages to receive from UMD Alerts. Q20. I may get a lot of text messages from UMD Alerts. Q36. Overall I think that using UMD Alerts is difficult/easy.

3.4.4 Overview of Data Analysis

The most important validity issue for this survey part of the study is whether the survey items measured the constructs as I proposed in the research model. Items presented in Table 3.3 were designed to measure these constructs and therefore subjected to a factor analysis to determine construct validity. Following the factor analysis, I wanted to assess if the two groups of respondents – Web survey respondents and paper survey respondents – were similar enough in terms of their factor scale ratings. This was to ensure that the sample was representative of the student population and the two sets of responses can be lumped together in my subsequent regression analyses.

After extracting the factors and checking the representativeness of responses, I proceeded to examine how well the factors were associated with survey respondents' behavior and intention of accepting UMD Alerts. I used ordinal logistic regression (OLR) to determine the percent of variance in the dependent variable (intention or behavior or acceptance) explained by the independent variables (factors). I chose OLR analysis instead of ordinary least squares (OLS) because the survey data are all non-interval. Within regression tests that handle non-interval data, both OLR and multinomial logistic regression (MLR) can be used to predict a dependent variable on the basis of categorical independents. However, since the dependent variable is measured as ordinal data with a rank order of more than two values, OLR analysis was preferred (see, for example, Harrell, 2001).

3.5 Phase 3: Field Experiment

The purpose of this phase of the study is to answer the research question: *What mechanisms may be integrated into emergency response system design to motivate user acceptance?*

3.5.1 Rationale

A field experiment was conducted to investigate the influence of subjective norm in motivating UMD Alerts subscription. There are several reasons that a field experiment is appropriate for the study. First, social norms are tacit knowledge and exist in natural social settings, and a field experiment can preserve the naturalness of research study without being subject to the artificiality problem of laboratory experiments. Second, even though tight control of extraneous variables can be challenging in field experiments, they still offer researchers opportunity to draw causal inferences through control of certain variables. Third, a field experiment overcomes many of the limitations of purely observational studies by introducing interventions to the field so that research findings can be readily applicable to real-life practices. Fourth, for this research project, a field experiment completes the triangulation – together with the interviews and the survey – by providing a different perspective with a different method.

The overall design of the field experiment is to compare the influence of the descriptive norm (exerted from friends) and the influence of injunctive norm (exerted from university authorities) in terms of their motivational effects on student subscription to UMD Alerts. It is expected that the descriptive norm is more effective than the injunctive norm in motivating students to accept the alert service.

3.5.2 Procedure

The first step of the experiment was to examine the normative influence exerted by the university authorities. A police officer at the Department of Public Safety, who is in charge of the implementation of UMD Alerts, was asked to send a UMD Alerts promotional email to two undergraduate classes in the Business School. The two classes were chosen because the size of the classes (59 and 60 students, respectively) was appropriate for this field study and the students came from a variety of different academic departments inside and outside the Business School. In addition, most of the students were in their junior year so that they should have made plenty of friends (i.e., formed some friendship-based social networks) at the University.

The email message (Appendix E) was composed by me and revised by the police officer before sending to the students. The main part of the message described the UMD Alerts system and was copied from the UMD Alerts' subscription website. Overall, the message attempted to carry a tone of formal, official, and standard communication between University authorities and students. The email was sent on a Monday to email reflectors of the two classes. Two days after the email was sent, I visited the classes and conducted an in-class questionnaire survey (Appendix F). The responses were collected immediately after. The survey contained seven items (3 "Yes or No" questions, 2 multiple-choice main questions, and 2 demographic items), plus a message for recruiting participants for the next step of the study.

The second step of the experiment was to test friendship-based normative influence on UMD Alerts acceptance. A group of survey respondents who

volunteered to participate in the next step of the experiment were asked to forward the UMD Alerts promotional email that they have received earlier to 10-15 of their friends, but with an addition of this line: "*Hey, I have signed up for this. I think you should do it, too*". Given the fact that young people often have many "friends" from social networking sites such as Facebook, I explicitly requested the participants to forward the email to their "real" friends at the University. Two days after the email was sent, I provided the participants with another pre-composed email message inviting the same group of the friends to take an online follow-up survey. The online survey instrument is almost identical to the questionnaire distributed in the classes, except that it included a 5-point Likert scale question asking about the "closeness" between the survey respondent and the person who sent him/her the emails.

After obtaining the survey responses from the two groups of participants, I then compare the number of new UMD Alerts registrations as a result of receiving the promotional email. Analysis of the data is presented in Chapter 6.

3.6 Summary

This chapter explained how the research questions underlying the investigation of user acceptance of emergency alert technology are operationalized and outlined in this study's research design. The research strategy relies on a three-phase research design that is based on a combination of qualitative and quantitative methods. The interviews conducted during the first phase of the research provided a first-level view of various social and technical aspects of the user acceptance of UMD Alerts and enriched the research model derived from the literature. The quantitative survey in Phase 2 consolidated the interview findings and tested certain hypotheses

that emerged from the factor analysis. Finally, the field experiment in the last phase of the research examined how subjective norm might influence user acceptance of emergency alert technology. This three-phase research is designed in such a way that the insights gained through each phase inform the focus of the next.

Chapter 4: Qualitative Interviews

4.1 Chapter Overview

This first phase of my empirical study aims to answer the research question: *What are the key factors that influence the acceptance and use of emergency alert technology?* I answer this question through conducting individual and focus group interviews with University of Maryland students regarding their perceptions and experiences with UMD Alerts. This chapter presents the results and findings from the interviews. Section 4.2 reviews the sampling and the procedures of conducting individual interviews and focus group. Section 4.3 presents the results of qualitative data analysis and discusses the findings. Section 4.4 summarizes and draws implications from the main findings of the interviews in relation to the overall research plan.

4.2 Overview of the Qualitative Method

Emails of invitation to participating in the interview were sent to four undergraduate classes in different departments. Snowball sampling technique was used to identify graduate student participants. The selection of interviewees was based on the principle of purposeful sampling so that a great deal of information can be obtained from a limited number of "information-rich cases" that cut across participant variations. A total of 13 students were interviewed, including 9 individual interviewees and 4 students who participated in a focus group. The interview questions centered on students' perceptions and attitudes toward campus safety, the university's emergency preparedness, and the use of UMD Alerts. All except one

interview were audio-recorded. All the recordings were then manually transcribed and imported into NVivo 7 software program for coding and analysis.

4.3 Results and Findings

The qualitative analysis suggest those students' intentions to accepting the UMD Alerts system is affected by multiple intertwined factors related to the particular alert system in this particular school environment (Wu, Qu, & Preece, 2008a). Following my research framework proposed in Chapter 2, I group these factors into two categories: social-contextual and technological. Certainly, when studying sociotechnical systems, it is always difficult (if possible at all) to make a clear-cut distinction between social-contextual and technological components. For example, Bishop and Star (1996) concluded that the social and technical aspects of digital libraries are intermingled in the library's design, implementation, and use. Similarly, Dawes and her colleagues (Dawes, Pardo, & Cresswell, 2004; Pardo et al., 2004) argued that the use of technological artifacts are embedded in a social process that requires a holistic view to understand the interactions between the social and the technical factors. The categories of "social-contextual factors" and "technological factors" in the following discussions, therefore, do not represent a theoretical endeavor to establish a dichotomy of concepts; rather, it is an artificial, context-specific categorization that helps organize the presentation and interpretation of interview results. To be specific, social-contextual factors refer to those factors that are peripheral to the use of UMD Alerts (such as the community context), whereas technological factors are more pertinent to the alert technology itself (such as the ease of use).

4.3.1 Social-Contextual Factors

Community Environment

Besides the UMD Alerts system, the University police also maintain a listserv that sends "Crime Alert" to all the students' email inboxes. These alert messages are the after-the-fact police reports regarding isolated crimes happened on or near campus. Receiving the crime alerts is not subscription-based – any student who has a university email account receives crime alerts, unless he or she chooses to filter out the alerts using email software. An example of the crime alerts is provided below to illustrate the nature of this service:

CRIME ALERT

INCIDENT: Strong Arm Robbery
OCCURRED: September 6, 2008 at 2:45a.m.
LOCATION: Fraternity Row
UMDPS CASE #: 08 09 001147

BRIEF DETAILS:
On September 6, 2008 at approximately 2:45a.m. the male student victim was walking across Fraternity Row when he was approached by two males. The two suspects walked from the area of #11/#12 Fraternity Row and approached him. One of the suspects approached him from the front, while the other suspect went behind him.
The suspect in front said something to him and then grabbed him and threw him to the ground. The suspect grabbed the victim's wallet from his right rear pocket and both suspects fled towards Fraternity Row #2/#3 while telling the victim to stay down. The victim was no injured.
Suspect #1 is described as black male, approximately 5 feet 10 inches tall, with shoulder-length hair. Suspect #2 is described a black male.

The University of Maryland Department of Public Safety is conducting an investigation of this crime. Individuals with any information regarding this incident, or the possible identity of the suspects, are encouraged to contact police (911 or 301-405-3555). When available for release, additional information, including updated descriptions of suspect, may be obtained by accessing the "Crime Alerts" portion of our web site:
http://www.umdps.umd.edu/police_support_services_public_crime_alert.cfm

Due to the relatively high crime rate in the area, the crime alert emails are sent out quite frequently – sometimes multiple alert emails per week. As stated by the participants, these emails have "desensitized" students' risk perception and created the problem of information overload:

> Adam[2]: "In the beginning of the year, I was very sensitive to it. Like I've seen a crime alert email, I wouldn't go out at night, I wouldn't this and that. But because I have got them so many times, you can become desensitized and you don't think the security alert is real anymore."
>
> Jeff: "I mean I have so much email in my inbox and for a crime alert I don't quickly check it. … You get so much information and you don't whether it's relevant or not."

Therefore, even though the university police have sent out only one real emergency message using UMD Alerts, the email-based Crime Alert actually biased students' perception against UMD Alerts. On the one hand, the participants who haven't signed up for UMD Alerts think that the system is just another "Crime-Alert-like" system – but instead of sending emails it sends text messages to their cell phones; on the other hand, for the current UMD Alerts subscribers the carjacking message further obfuscated, rather than clarified, the difference between UMD Alerts and Crime Alert. Hence, while being flooded by the crime alert emails, students either consciously or unconsciously are trying to avoid getting another alert service from the university.

Another interesting observation is that the high-risk local environment actually "desensitized" students' perceptions of risk, rather than motivating them to

[2] To protect participants' identities, all the participant names appearing in this thesis are pseudonyms.

take preventive actions. Out participants showed very low expectation on the community safety. “There is not much you can do” appeared to be a consistent de-motivating factor suggested by both interviewees and focus group participants:

> Dave: “Right off campus, I have people whose places had been broken into. I mean I’m from Maryland so I know this area. So, it’s sort of expected for me. I knew this is what’s going on before I got here.”

> Susan: “There are people out there because the campus is not secluded. You are coming and you can’t control that. … I always feel like those emergencies around the campus – I feel there are a lot of them actually. I feel like, you see one, [and you ask yourself]: when is the next one?”

Financial Cost

Although UMD Alerts is advertised as “a free service”, the subscribers’ wireless carrier may charge a small fee for receiving text messages. From the interviews and the focus group, there were mixed reactions to the text message cost. It is also interesting to notice that some participants are concerned about the cost of using UMD Alerts even though they themselves have unlimited text message service from their wireless carriers. One “disadvantage” of UMD Alerts as mentioned several times by both subscribers and non-subscribers in the focus group discussion is that “it’s not free for everyone.” Some spoke strongly about the text message cost as a barrier to subscription:

> Jeff: “The same reason that I don’t sign up for other types of text message systems – they cost money! Each time I receive a text message, it’s like ten cents. I think there will be reluctance on my part and on a lot of other people’s parts, for the pure fact that it costs money.”

However, others seemed not to agree:

> Adam: "10 cents, 1 dollar or 2 dollars, I don't care. I mean it's not 10 cents for me because I'm unlimited, but if it was 10 cents, I wouldn't think about it. If the university is worried about some students who were saying 'you cost me 60 cents in text messages and I rather have not' – It's so silly."

Of course, the cost judgments are relative to the perceived usefulness of the system. As one participant adequately put:

> Betty: "I'm not sure how much they charge you. I mean, that's not that important to me because if something is going to happen it could cost my life. I'm willing to spend the money for it."

Subjective Norms

Subjective norms are a person's perception of what other people think about how he or she should behave (Davis, 1989). In the interviews, I probed about two sources of subjective norms that have been emphasized in technology acceptance literature: peer pressure and authoritative influence.

Peer pressure is about whether or not a person participates or intends to participate in a behavior is influenced by his or her friends, colleagues, or other members in a community. To my surprise, neither the UMD Alerts subscribers nor the non-subscribers acknowledged peer pressure as a motivational factor. For example, when asked if he would also subscribe to UMD Alerts if many of his friends already did, participant Jack replied: "No, I'm not a follower." However, some current subscribers did indicate that they might have influenced their friends:

> Jane: "But if I talk to people, 'oh well, you should sign up because I already did.' It was really easy, you just type in this, fill out your cell phone whatever,

> and they will like, ‘oh yeah, I should do it.’ It just takes somebody telling them it’s that simple to get it done.”
>
> Susan: “[It’s] not like a big conversation, but at the beginning when I got the alert messages I was like ‘oh, yeah, I go these alert messages.’ And someone wanted to know about it. My roommate, she was like ‘oh, yeah, I should do that too.’”

Hence, although UMD Alerts is a one-way, “push” system that does not allow user interaction within the system, the users might have influenced their peers through other communication channels such as face-to-face. On the other hand, authoritative influence from students’ parents seems to be a strong motivational factor. The two subscribers in the focus group both said they subscribed because “my mom told me about this.” In addition, interview participants also indicated that their parents had influenced their decisions:

> Sandy: “They sent emails to parents also … and my mom said, ‘oh, you should sign up for this.’”
>
> Susan: “My mom, my parents are concerned about safety of every campus we visited. … My mom was very concerned about … just make sure I’m safe. So, she was saying, ‘you should sign up for this.’”

4.3.2 Technological Factors

Perceived Usefulness

In TAM, the usefulness of technology is vaguely defined as the user’s “subjective probability” that using a specific application system will increase his or

her task performance (Davis, 1989; Venkatesh et al., 2003). However, what exactly constitutes this "subjective probability" varies from system to system. The results of the interviews indicate that for an emergency system the characteristics of the information being transferred through the system are critical in determining the perceived usefulness. Some characteristics of information are tied to the technology itself (e.g., accessibility), whereas others have to do with the content of the message being transferred through the technology (e.g., relevancy).

The participants all acknowledged the system's usefulness in terms of its potential benefits to their safety. For example, most participants explicitly said that they think UMD Alerts is a "good thing." Further probes revealed that the usefulness of UMD Alerts is perceived by students as being based on the SMS technology's immediacy of transferring information and the accessibility to the mobile devices:

> Sandy: "Now they employed the text message thing so they can send it out really quickly to alert people. … I mean, even if they send emails, it gets a little faster I think. People are always by their phones, word would spread faster."

> Dave: "I think it's good. I think it works. It's instant access to the students, right away. Everyone has a cell phone basically."

Nevertheless, one problem observed from the interviews is the perceived relevancy of the emergency alert messages. Currently, UMD Alerts disseminates the same information to all subscribers, and the relevancy of the information is determined by the system administrators (i.e., the UMDPS). Students seem to have different viewpoints with regard to what is "relevant" emergency information to them:

> Jack: “Some people don’t want to be alerted for certain things. I mean if there is a rape, I’d be slightly less concerned because that doesn’t necessarily affect me as much as it is supposed to affect a woman who is on campus.”
>
> Jane: “If there is a tornado coming through my neighborhood, I’d like to know about it. But I don’t want to get, you know, a text message telling me that we’re having ice on this day. I personally don’t need it, I don’t have a car.”

Clearly, these students’ notion of relevancy is strictly limited to being relevant to their individual needs, rather than the needs of the entire community. Sending “irrelevant” text messages to students, who are often overloaded with digital information from all kinds of other sources (including the Crime Alert emails), created the perception of information overload as discussed earlier.

On the other hand, participants complained about not receiving information that they considered relevant from the UMD Alerts:

> Adam: “Well, I think the texting thing can be used in, not just emergency, like when the school closes. The weather was very icy last semester, and I was staying home doing my project. I only found out [about the school closing] through my teacher because I had no idea. If it were put on text message, I would have received it hours earlier. I would have planed better.”

Apparently, even though “emergency” is something that is potentially relevant to everyone, there is still a discrepancy between what the University thinks the students should know and what each individual student wants to know.

Perceived Ease of Use

Since most college students nowadays are fluent with SMS and the World Wide Web, it was expected that the participants said they were “comfortable” with

using their mobile devices to receive and read text messages and they think that the signup procedure of UMD Alerts was “easy.” The only issue that falls into the territory of “ease of use” is the controllability of receiving alert messages, which includes both the ability to customize the types of messages to be received and the flexibility to control and use the system. For example:

> Jeff: “So, set up a system where you can go and customize it. You can say – of course, you don’t have to do that – alert me to natural disasters, alert me to guns. You can pick which one.”
>
> Adam: “When it comes to a point though, you’re getting a lot of messages but you are right by your computer and you’re connected anyway, and if you could like reply “Stop” [through SMS on your cell phone], let’s say.”

Certainly, students’ desire of being able to control UMD Alerts is also a reflection of the issue of information overload as mentioned previously in this chapter.

4.4 Discussions and Implications

Data analysis suggested that the motivation for accepting UMD Alert is affected by multiple intertwined factors related to this particular technology system in this particular community environment.

First of all, the university’s sociotechnical context appeared to play a significant role in shaping students' perceptions of UMD Alerts and their intention of using it. As stated by the participants, the Crime Alert emails have “desensitized” their risk perception and created the problem of information overload. In addition, the high-risk local environment actually de-motivates students rather than motivates students to take preventive actions. “There is only so much you can do” was a

consistent theme suggested by both interviewees and focus group participants.

Despite the negative perception influenced by the existing sociotechnical environment, all participants acknowledged UMD Alerts' potential benefits to their safety, praising the speed of communication and the accessibility of the text messaging alert system. However, one problem observed from the interviews is the perceived relevancy of the emergency alert messages. Currently, UMD Alerts disseminates the same information to all subscribers, and the relevancy of the information is determined by the system administrators (i.e., the police). Students seem to have different viewpoints with regard to what is "relevant" emergency information to them. Sending "irrelevant" text messages to students, who are often overloaded with digital information from all kinds of other sources (including the Crime Alert emails), created the problem of information overload as mentioned earlier. Although the SMS technology is familiar to students and easy to use, students demand more controllability of receiving alert messages, which includes both the ability to customize the types of messages to be received and the flexibility to control the system's behavior.

The interviews confirmed the major elements such as PU and PEU in affecting people's motivation for technology acceptance. However, it was not until the interviews that I clarified what exactly I should look under the broad terms of PU and PEU. More importantly, the interview results highlighted the critical importance of community context, which was either overlooked or understudied in the popular two-factor TAM framework. Combing the findings from the literature review and the results of the interviews, an enriched research model is proposed to frame further

studies on motivation for accepting emergency response systems (Figure 4.1):

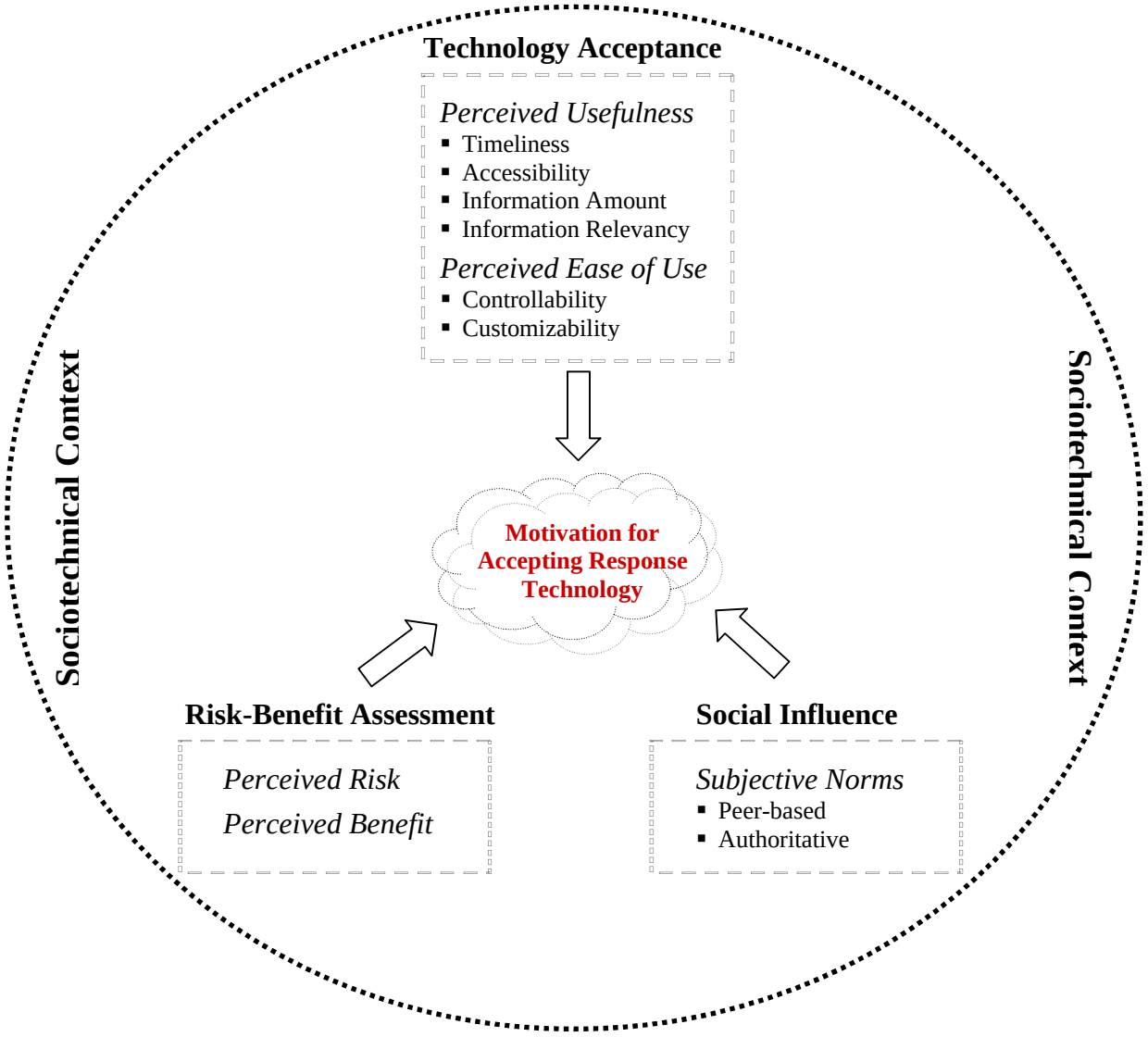

Figure 4.1: Enriched Research Model

4.5 Summary

An SMS-based emergency alert system may be a "simple" technology system in terms of its technological design, but it does not mean that its acceptance and use are straightforward actions independent of the sociotechnical context. The popular two-factor TAM model may serve as a starting point to examine such systems'

acceptance, but the model fails to recognize the impact that “sociotechnical interaction networks” (Kling et al., 2005) may have on users’ perceptions toward the technology’s “usefulness” and “ease of use”. Using qualitative methods, this part of the study presents some preliminary findings about the acceptance of UMD Alerts that are complimentary to the theoretical accounts from the literature review. The findings not only clarified the constructs of PU and PEU in this particular usage context, but also revealed some interesting inconsistencies in terms of students’ perceptions toward risk, benefit, and subjective norms. These constructs and perceptions were then further examined in the next phases of the study.

Chapter 5: Quantitative Survey Study

5.1 Chapter Overview

The purpose of this quantitative part of the research is two-fold. First, it extends and triangulates the interview study by collecting quantitative data from a larger sample to identify key motivational factors; second, it answers the research question: *How are different motivational factors related to the intention of accepting emergency response technology?* This chapter begins with a brief review of the survey method and the data collection procedure, followed by a series of detail analyses of the collected data. The chapter then discusses the implications of the data analysis results and sets goal for the next phase of the study.

5.2 Overview of the Method

The design of most survey items was anchored in the constructs in the research model, which were derived from the literature and refined in the previous phase of qualitative study. The interview results informed the survey study in several ways. First, the interviews revealed some conflicting opinions from different students regarding UMD Alerts, which warranted this further study based on a larger and more representative sample. Second, the interview results highlighted some context-specific factors that were not seen in previous research but deserved further examination. For instance, interviewees indicated that a parallel alert system (Crime Alert) biased their perceptions toward UMD Alerts. Third, the thematic analysis on the interview transcripts identified more concrete conceptual components for the constructs of PU (timeliness, accessibility, amount, and relevancy of information),

PEU (system controllability and customizability), and Subjective Norm (normative influences from parents and university, and normative influences from friends). Each of these components corresponds to at least one survey item. This fine granularity helped to design a survey instrument that is more relevant to this particular case of technology acceptance.

The survey questionnaire was compiled and implemented in the environment of SurveyMonkey.com, a leading Web survey software application in the United States. The invitation to survey messages was sent to the University of Maryland students through the university's daily FYI listservs (SFYI and GSFYI). Three weeks after the first invitation, 288 responses were collected and of which 224 were usable. In order to increase the number of respondents (especially undergraduate student respondents) and to check non-response bias, a paper version of the questionnaire was distributed in 6 undergraduate classes during the Summer term of 2008. The paper-based questionnaire is identical to the online one, except for some minor modifications to resemble the conditional branching in SurveyMonkey (e.g., "If 'Yes', skip next page and proceed to question X."). 107 completed questionnaires were collected from the 6 classes, resulting in a total of 331 usable responses with online and paper-based surveys combined. The responses from the paper-based survey were manually entered into SPSS (version 15.0) and merged with the online survey data downloaded from SurveyMonkey.

The instrument consists of 35 (for UMD Alerts users) or 38 (for non-users) items, which may be grouped into three sections: 1) Demographic questions asking for respondents' academic status, gender, department, and residence; 2) Questions

relating to adoption and use of UMD Alerts; 3) Questions about the perception of risk and emergency preparedness in general. 29 items used 7-point Likert scale with 1 = “Strongly Disagree”, 4 = “Neutral”, and 7 = “Strongly Agree”. The rest of the questionnaire consisted of multiple choice items, some allowing open comments.

5.3 Survey Data Analyses

5.3.1 Sample Characteristics

For qualitative interviews, it was relatively easy to control sample characteristics by recruiting subjects selectively. However, due to the self-selection nature of the survey, the survey sample was skewed. An overview of the demographics of the respondents is shown in Figure 5.1 (a-c). In particular, females made up 64% of the sample, and males 36%. In terms of academic year, the sample had solid representation from each group with slightly larger proportions of Juniors and Seniors, and the proportion of Graduate Students (35%) was also close to the proportion of the University population (39%).

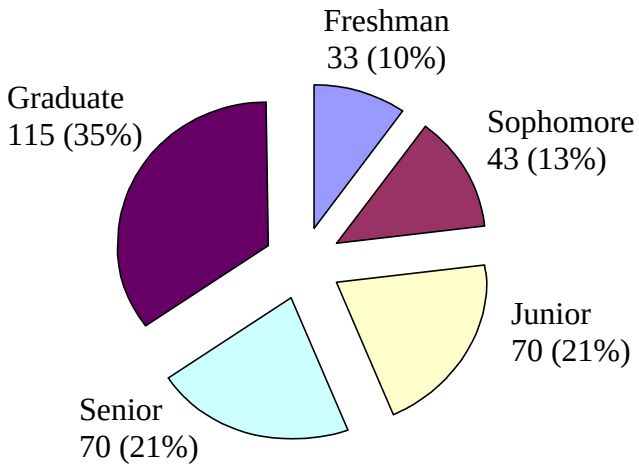

Figure 5.1(a): Demographics of Respondents - Academic Status

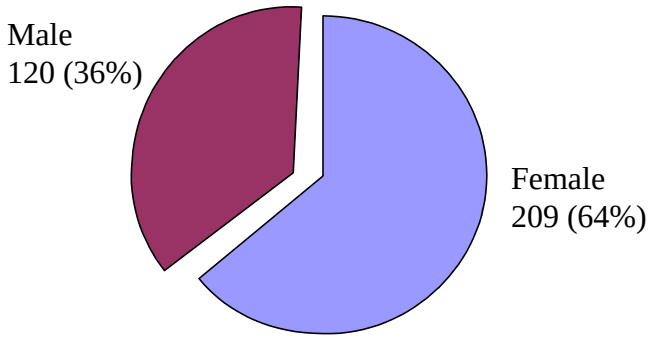

Figure 5.1(b): Demographics of Respondents - Gender

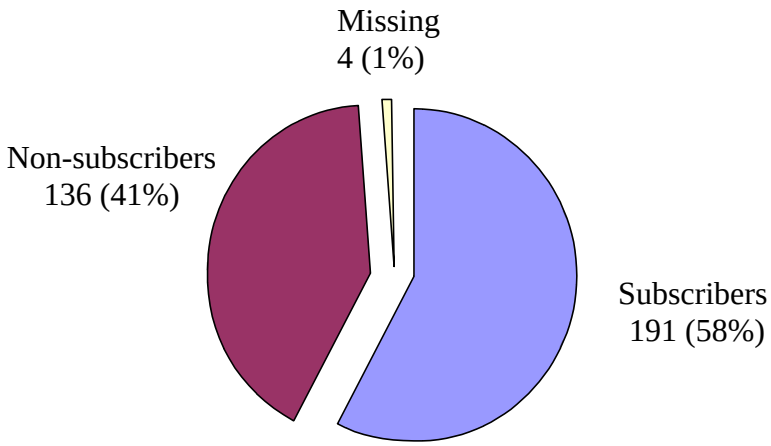

Figure 5.1(c): Demographics of Respondents - UMD Alerts Subscription

The sample was also skewed in terms of UMD Alerts subscription status. The subscription rate of the population was 21%, whereas the proportion in the sample was 58%. A larger number of non-subscribers might provide more representative data about what might associate with the lack of motivation and what could be done to encourage acceptance. A straightforward explanation to the skew is that the subscribers were those students who tend to care more about campus security and therefore were more likely to be interested in participating in the survey.

A crosstab comparison was conducted to assess the difference by gender in UMD Alerts acceptance. A Chi-square test yielded a Chi-square value of 7.572 (*df* =

1) and a significance level of $p = .006$ (< .01) (Table 5.1). This indicates that the difference between the proportions of male students and female students is statistically significant with regard to UMD Alerts subscription. The larger proportion of female respondents in the sample and the significantly higher number of females in the UMD Alerts user group might be explained by the general agreement in previous studies on gender difference of risk perception: women consistently showed more concern toward crimes and risks than men (Finucane et al., 2000; Weber, Blais, & Betz, 2002). However, since demographic variables such as gender are not readily open to change, researchers generally focus more attention on social and cognitive factors in behavioral research (Armitage & Conner, 2000).

Table 5.1: Adoption by Gender Cross Tabulation

		Adopters	**Non-Adopters**	**Total**
Female	Count	133	75	208
	% within Gender	63.9%	36.1%	100.0%
	% within Adoption	70.0%	55.1%	63.8%
	% of Total	40.8%	23.0%	63.8%
Male	Count	57	61	118
	% within Gender	48.3%	51.7%	100.0%
	% within Adoption	30.0%	44.9%	36.2%
	% of Total	17.5%	18.7%	36.2%
***Pearson Chi-square* = 7.572, *df* = 1, *p* = .006**				

5.3.2 Factor Analysis

The most important validity issue for this survey part of the study is whether the survey items measured the constructs as I proposed in the research model. Items numbered Q9 – Q34 (a total of 26 variables) were designed to measure these constructs and therefore subjected to a factor analysis to determine construct validity.

A KMO and Bartlett test was first performed to measure the sampling adequacy (see Table 5.2). The KMO overall (.784) is higher than the conventional cut-off point (.60) and the Bartlett has a significant value (.000). This indicates that the correlations observed in the 26 variables are likely to contain common variance and the data are likely to factor well.

Table 5.2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.784
Bartlett's Test of Sphericity	Approx. Chi-Square	2989.124
	Df	325
	Sig.	.000**

A principal component analysis (PCA) was then conducted in SPSS to identify orthogonal factors that appear to represent the underlying latent variables. A Varimax rotation was used to simplify the interpretation of factors, and missing variables were excluded using a listwise deletion. The PCA performed in SPSS resulted in 7 factors using the default Guttman-Kaiser criterion (i.e., eigenvalue <1.0). However, recent researchers often recommend parallel analysis as an additional method to further determine the true number of factors (Child, 2006; Lance, Butts, & Michels, 2006). Using a formula proposed by Child and Child (in press), a parallel analysis chart was plotted in Excel and shown in Figure 5.2.

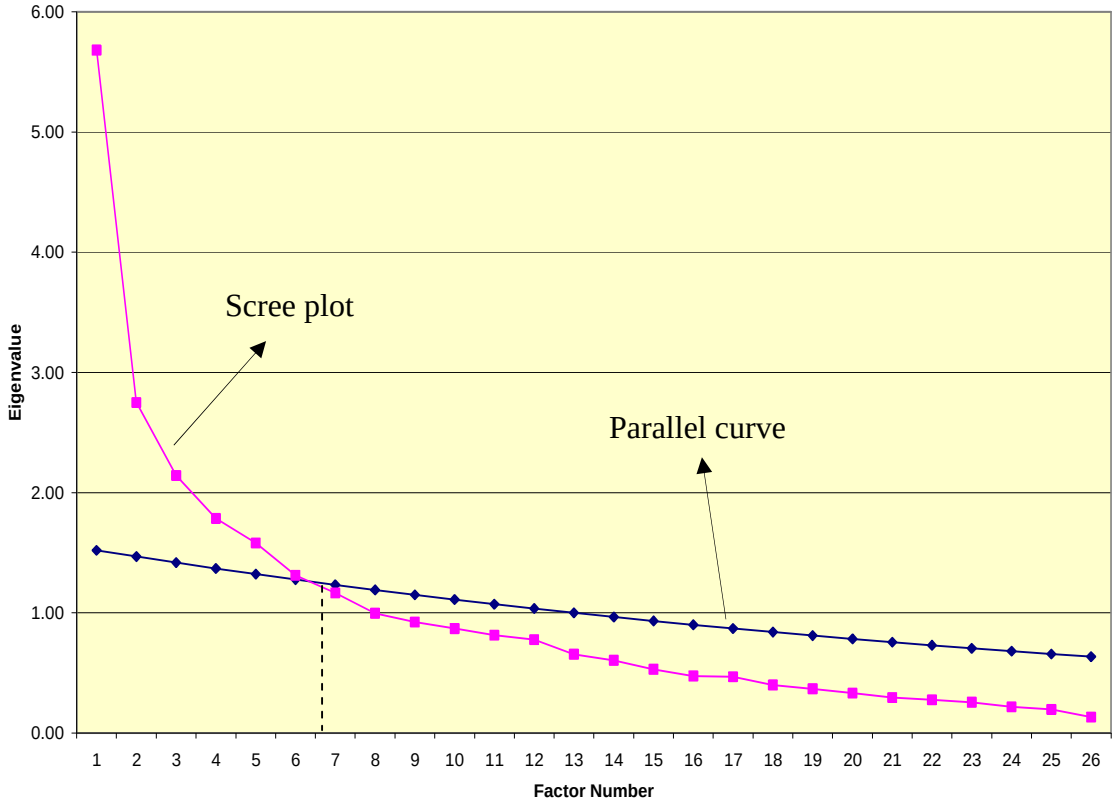

Figure 5.2: Parallel Analysis of Number of Factors

In Figure 5.2, the factor analysis scree plot shows that there are 7 points above the first eigenvalue line (eigenvalue=1), meaning that the maximum number of factors to be exacted is 7. However, the Parallel curve crosses scree plot at point 6, indicating that only the first 6 factors are meaningful and the rest can be viewed as trivial error (Child, 2006). Hence, another PCA was performed with the number of factors specified as 6. Table 5.3 presents the eigenvalues, percent of variance, and cumulative percent of variance for the resulting 6 factors before and after Varimax rotation. As shown in the table, the 6 factors combined explain more than 58% of the variance in the data.

Table 5.3: Communality and Variance Explained before and after Rotation

Component	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.682	21.854	21.854	4.785	18.404	18.404
2	2.749	10.572	32.426	2.889	11.110	29.514
3	2.142	8.239	40.666	2.582	9.932	39.446
4	1.785	6.866	47.532	1.808	6.955	46.401
5	1.581	6.080	53.612	1.658	6.377	52.778
6	1.312	5.047	58.659	1.529	5.881	58.659

Two criteria were used to determine whether a variable was retained on a factor: 1) the rotated factor loading was greater or equal to .30; and 2) if a variable loaded on more than one factor, the variable was retained on the factor with the highest loading. The group of variables loading on each factor was examined against the *a priori* constructs to see if they confirmed the existence of those constructs. Table 5.4 presents the rotated factor loadings for each variable in context of the *a priori* construct names and the questionnaire items.

Table 5.4: Factor Loadings after Rotation by *A Priori* Attribute and Questionnaire Item

Factor	**Factor Loading**	**A Priori Constructs**	**Questionnaire Item**
1	.762	Perceived Usefulness	I think the information that I receive from UMD Alerts will be relevant to my personal safety.
	.760	Perceived Benefit	Signing up makes me feel safer.
	.738	Perceived Benefit	Signing up is a good thing to do for myself.
	.730	Perceived Benefit	Signing up makes me more prepared for emergencies.
	.716	Perceived Usefulness	I believe I will receive timely information from UMD Alerts.
	.701	Perceived Usefulness	With UMD Alerts, I can get emergency information anywhere anytime.

2	.771	Perceived Ease of Use	I want to have control over the amount of text messages to be sent to me from UMD Alerts.
	.761	Perceived Ease of Use	I may get a lot of text messages from UMD Alerts.
	.739	Perceived Ease of Use	I want to have the option to choose what type of emergency messages to receive from UMD Alerts.
	.730	Perceived Usefulness	I may get some unwanted messages from UMD Alerts.
	.627	Perceived Cost	Receiving UMD Alerts messages can be costly.
3	.901	Subjective Norm	My friends think I should use UMD Alerts.
	.892	Subjective Norm	Other people who are important to me think that I should use UMD Alerts.
	.807	Subjective Norm	My parents think I should use UMD Alerts.
4	.743	Perceived Ease of Use	I am fluent with using text messages on my mobile devices.
	.506	Perceived Ease of Use	It is/seems easy to sign up for UMD Alerts.
	.466	Sociotechnical Context	The crime reports sent to me through emails are overwhelming.
	.460	Subjective Norm	The University officials think I should use UMD Alerts.
5	.679	Perceived Cost	If there were a major emergency, it could have severe impact on me.
	.562	Perceived Cost	It is likely that I will experience some emergency when I am on or near campus.
	.331	Sociotechnical Context	The crime reports sent to me through emails are useful.
	-.357	Sociotechnical Context	The University is well-prepared for major emergencies.
	-.380	Sociotechnical Context	The University is doing their best to protect this community.
6	.804	Perceived Benefit	This is a high crime rate area - there is not much the University can do about it.
	.643	Perceived Benefit	There is not much I can do to improve campus safety.

The resulting scale for each of the six factors was then examined for internal consistency using Cronbach's alpha (Table 5.5). The widely-accepted social science cut-off is that alpha should be .70 or higher for a set of items to be considered a scale. Therefore, only factors 1, 2, and 3 were retained in subsequent analyses to answer the research questions. The alpha value for each factor scale is listed in Table 5.6. To aid in further discussion of the factors, I named each according to the variables that loaded together. Factor 1 had six items from two different *a priori* constructs: perceived usefulness and perceived benefit. This indicates that although I attempted to distinguish between the general benefits of UMD Alerts and the more concrete usefulness of the technology, the responses did not seem to reflect such a distinction. Factor 1 was named "perceived utility" to denote both levels of user perception. In Factor 2 and 3, the items loaded together in such a way that they were largely made up for on *a priori* construct: perceived ease of use (Factor 2) and subjective norm (Factor 3). Upon inspection of the "perceived cost" item and the "perceived usefulness" item in Factor 2, they both imply the lack of control over the amount and type of messages. Hence, Factor 2 was named "controllability expectancy" and Factor 3 bear the name of the *a priori* construct – "subjective norm."

Table 5.5: Alpha Coefficients for Factors Resulting from Factor Analysis

Factor	# of Items in Scale	Cronbach's Alpha	Factor Name
1	6	.887	Perceived Utility
2	5	.792	Controllability Expectancy
3	3	.867	Subjective Norm
4	4	.514	(Not retained)
5	5	.484	(Not retained)
6	2	.491	(Not retained)

5.3.3 Non-Response Bias

As mentioned earlier, one purpose of the paper-based survey was to check potential non-response bias given the low response rate. Before I proceed any further with my analysis, I want to verify that the paper-based survey responses are not systematically different from online survey responses on the three factors that are to be included in the hypothesis testing. Hence, two sets of t-tests were conducted to compare: 1) UMD Alerts users' responses in online survey and those in paper-based survey, and 2) UMD Alerts non-users' responses in online survey and those in paper-based survey. The testing results generated by SPSS are shown in Table 5.6 and Table 5.7 below:

Table 5.6: Descriptive Statistics of Online Survey Responses and Paper-based Survey Responses

Have you signed up for UMD Alerts?	Factors	Online or Paper-based	N	Mean	Std. Deviation
Subscribers	Perceived Utility	Online	150	4.9467	1.17238
		Paper-based	35	5.1762	.65547
	Controllability	Online	149	4.2966	1.24001
		Paper-based	36	4.6833	1.32093
	Subjective Norm	Online	102	4.8137	1.22279
		Paper-based	27	5.2469	1.13827
Non-Subscribers	Perceived Utility	Online	57	4.2515	1.26229
		Paper-based	52	4.3942	1.15046
	Controllability	Online	58	5.4379	1.11416
		Paper-based	51	5.3098	.95609
	Subjective Norm	Online	42	3.6667	1.19393
		Paper-based	40	3.6917	1.45078

Table 5.7: T-Tests for Comparing Online Survey Responses and Paper-based Survey Responses

	Factor	Levene's Test for Equality of Variances			T-test		
			F	Sig.	t	df	Sig. (2-tailed)
Users	Perceived Utility	Equal variances assumed	9.320	.003	-1.117	183	.266
		Equal variances not assumed			-1.568	92.005	.120
	Controllability	Equal variances assumed	.070	.792	-1.658	183	.099
		Equal variances not assumed			-1.595	50.945	.117
	Subjective Norm	Equal variances assumed	.000	.983	-1.660	127	.099
		Equal variances not assumed			-1.731	43.271	.091
Non-Users	Perceived Utility	Equal variances assumed	.026	.871	-.615	107	.540
		Equal variances not assumed			-.618	107.000	.538
	Controllability	Equal variances assumed	.254	.615	.640	107	.524
		Equal variances not assumed			.646	106.943	.520

	Subjective Norm	Equal variances assumed	.768	.384	-.085	80	.932
		Equal variances not assumed			-.085	75.613	.933

Table 5.7 shows that all sig values (*p*) were greater than .05 (with or without assumed normality), which indicates that on the three extracted factor scales the responses from online survey and paper-based survey were not significantly different within user and non-user groups. These t-tests results also increased my confidence on the representativeness of the sample and the external validity of future analyses.

5.3.4 Hypothesis Testing

After exacting the three factors and checking the representativeness of responses, I further examined how well the factors were associated with survey respondents' behavior and intention of accepting UMD Alerts. First, I tested whether the three factors were able to predict the acceptance *behavior*. The dependent variable was defined by the survey item Q5: "Have you signed up for UMD Alerts?" The independent variables included the three scales determined by the factor analysis described above which were found to have adequate internal consistency. The independent variables ranged in value from 1 to 7 as each was based on the mean of the respective scale items, with 1 being least favorable and 7 being most favorable. Descriptive statistics (N, mean, standard deviation) of the three transformed independent variables are as follows:

Table 5.8: Descriptive Statistics of Independent Variables

		Perceived Utility	Controllability	Subjective Norm
N	Valid	294	294	211
	Missing	21	21	104
Mean		4.7880	4.7449	4.4281
Std. Deviation		1.21504	1.27901	1.38796

The hypotheses to be tested are:

H1: Perceived utility is positively associated with the behavior of accepting UMD Alerts.

H2: Controllability expectancy is negatively associated with the behavior of accepting UMD Alerts.

H3: Subjective norm is positively associated with the behavior of accepting UMD Alerts.

Since the value of the dependent variable is nominal (either signed up or not signed up), a logistical regression analysis was carried out. The categories of subscribers and non-subscribers were coded as 1 and 0, respectively. The SPSS output results are shown in Table 5.9 and 5.10 below:

Table 5.9: Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	70.812	3	.000**
	Block	70.812	3	.000**
	Model	70.812	3	.000**

Table 5.10: Logistical Regression: Variables in the Equation

	B	**S.E.**	**Sig.**	**Exp(B)**
Perceived Utility	.260	.194	.181	.771
Controllability Expectancy	-.804	.168	.000**	2.234
Subjective Norm	.609	.186	.001**	.544
Constant	.587	1.200	.624	.556

The likelihood ratio Chi-square of 70.812 with a *p*-value of .000 (Table 5.9) indicate that this regression model as a whole fits significantly better than an empty model. Table 5.10 shows that "controllability expectancy" (*p*=.000) and "subjective norm" (*p*=.001) were significant predictors of the adoption behavior, while "perceived utility" (*p*=.181) was not. Hence, H2 and H3 were supported, but H1 was not. "Controllability expectancy" also appeared to be a very strong predictor with a coefficient (B) value of -.804 and an odds ratio (Exp(B)) of 2.234.

After examining the associations between each of the three factors and the adoption behavior, I further explore how well the three factors might predict the *intention* of acceptance among the *non-users*. The hypotheses to be tested are:

H4: Perceived utility is positively associated with the UMD Alerts non-subscribers' intention of accepting the system.

H5: Controllability expectancy is negatively associated with the UMD Alerts non-subscribers' intention of accepting the system.

H6: Subjective norm is positively associated with the UMD Alerts non-subscribers' intention of accepting the system.

The independent variables are the same as the hypothesis testing above, and the dependent variable was defined by the survey item Q6: "Overall, how likely are

you going to sign up for UMD Alerts in the near future?" The level of measurement for this item was a 7-point Likert scale with 1 = "very unlikely" and 7= "very likely". Since there were many missing values of "subjective norm" items for non-users, pair-wise exclusion was used in the regression analysis. The regression model is described in Table 5.11–5.13:

Table 5.11: Regression Analysis for Non-Users: Model Summary

Mode	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.631(a)	.398	.375	1.511

Table 5.12: Regression Analysis for Non-Users: ANOVA

Mode		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	114.925	3	38.308	16.783	.000**
	Residual	173.479	76	2.283		
	Total	288.403	79			

Table 5.13: Regression analysis for Non-Users: Coefficients

Model		**Unstandardized Coefficients**		**Standardized Coefficients**	**t**	**Sig.**
1		B	Std. Error	Beta		
	(Constant)	-.103	1.179		-.087	.931
	Perceived Utility	.845	.169	.534	4.989	.000**
	Expected Controllability	-.160	.165	-.087	-.965	.337
	Subjective Norm	.184	.154	.127	1.197	.235

The multiple regression analysis shows that the three independent variables altogether - perceived utility, controllability expectancy, subjective norm – explained approximately 40 percent of variance in the dependent variable which is the intention of UMD Alerts adoption (R^2 = .398); the analysis of variance suggests that the model can reliably predict the dependent variable (p = .000, F = 16.783). However, only the coefficient for "perceived utility" had a p value that is significant (p = .000), whereas "controllability expectancy" and "subjective norm" did not appear to be significantly associated with the intention. Therefore, in this round of hypothesis testing, only H4 was supported.

5.4 Discussion of Survey Results

5.4.1 Perceived Utility

Although both the interview participants and the survey respondents tended to agree that the UMD Alerts system is "beneficial" and "the right thing to do", their perception of the more concrete utilities of the system appeared less optimistic. The mean score of all survey respondents for the factor "perceived utility" was 4.79, and that of non-users was 4.32 – only slightly above the "neutral" score (4). Therefore, it is not surprising that the H1 hypothesis was not supported as both users and non-users had similarly low rating over perceived utility. Nevertheless, perceived utility was the only factor that had a significant correlation with non-user's intention of adoption in the regression analysis (Table 5.13).

The seemingly confusing results regarding perceived utility demonstrated students' mixed attitudes toward the usefulness of the technology as revealed in the

interviews. On the one hand, students generally believed that a system like UMD Alerts might be able to improve the University's emergency preparedness, regardless of their acceptance status; for non-users, perceived utility is even positively correlated with the strength of their intention of adoption. On the other hand, when it comes to concrete utilities of the system such as information timeliness, information relevancy, and accessibility, students' belief of usefulness became rather weak. This might be in part due to the lack of "trialability" of UMD Alerts (and perhaps any emergency response technology), as the benefits of using the system in real-scenarios can only be assumed but not tried. Although the police send test messages on the first Wednesday of every month to ensure the system is operational, it is unknown to students whether UMD Alerts will really help in a situation like a campus shooting.

In addition, the two items addressing the influence of the "Crime Alert" emails have significant correlations with the perceived utility factor (Table 5.14), which supports the observation from the interviews that students' negative impression toward those emails biased their perception of the usefulness of UMD Alerts.

Table 5.14: Correlations Between the Perception of Crime Alert and the Perceived Utility of UMD Alerts

Survey Item		**Perceived Utility**
The crime reports sent to me through emails are overwhelming.	Pearson Correlation	-.223
	Sig. (2-tailed)	.000**
	N	293
The crime reports sent to me through emails are useful.	Pearson Correlation	.318
	Sig. (2-tailed)	.000**
	N	293

5.4.2 Controllability Expectancy

Controllability expectancy refers to the extent to which a user expects to control the behavior of a technology system. In this case, controllability encompasses the ability to control the type of alerts to receive and the amount of text messages to receive (and therefore the associated cost). Users and non-users of UMD Alerts had a significant difference in terms of how they expected the controllability of the system (see Table 5.15). Non-users had a mean score of 5.38 on the scale (vs. 4.37 for users), indicating their strong inclination on being able to control the system behavior rather than to passively receive whatever information passed down by the university authorities. Again, the survey results appear to be in consistent with the interview results discussed in Chapter 4. A somewhat surprising finding is the lack of significant association between controllability expectancy and non-users' adoption intention. This might suggest that even though controllability is an important feature desired by non-users, it is not a critical factor that affects their intention of using the technology.

5.4.3 Subjective Norm

Subjective norm in this study refers to a student's perceived expectation from people important to him or her with regard to accepting UMD Alerts. The current UMD Alerts users had a significant higher mean score (4.90) on the scale of subjective norm than the non-users (3.68), although subjective norm was not a strong predictor with an estimated odds ratio of .554. In addition, subjective norm did not seem to associate with non-users' intention of adoption (p=.235).

A further investigation of the items grouped under the scale revealed more interesting results. The crosstab showed that for both users and non-users the social pressure from parents was the strongest, whereas that from friends was the weakest (Table 5.16).

These survey results are also consistent with the interview data. In the interviews, I probed about different sources of subjective norm and neither the users nor the non-users acknowledged peer pressure from friends as a motivational factor. Instead, many interviewees indicated that their friends had (or would have) little influence on their adoption intention because they "don't talk about it." On the other hand, all current users stated that their parents had direct or indirect influence on their decision of signing up for UMD Alerts. In assessing subjective norm, researchers typically ask survey questions on whether "important others" think that one should perform a behavior. For example, Ajzen and Driver (1992) used these two items to assess subjective norm: "Most people who are important to me approve/disapprove of …" and "Most people who are important to me think I should …". However, the survey data suggested that the norms can have different degrees of effect on the adoption intention depending on where the social influence originated from. In this particular case, social pressure from parents seemed more salient than that from friends.

Table 5.15: Crosstab Comparison between Users and Non-Users on Controllability Expectancy Items

Have you signed up for UMD Alerts?		I want to have control over the amount of text messages to be sent to me from UMD Alerts.	I want to have the option to choose what type of emergency messages to receive from UMD Alerts.	I may get some unwanted messages from UMD Alerts.	I may get a lot of text messages from UMD Alerts.	Receiving UMD Alerts messages can be costly.
Subscribers	Mean	5.19	5.27	4.45	3.58	3.41
	N	190	190	187	185	186
	Std. Deviation	1.567	1.652	1.847	1.727	1.974
Non-Subscribers	Mean	5.98	5.95	5.43	5.03	4.44
	N	112	113	112	110	111
	Std. Deviation	1.280	1.267	1.400	1.499	1.852
Total	Mean	5.49	5.52	4.82	4.12	3.79
	N	302	303	299	295	297
	Std. Deviation	1.513	1.552	1.756	1.786	1.990

Table 5.16: Comparison between Users and Non-Users on Subjective Norm Items

Survey Item	Mean Score	
	Users	Non-Users
My parents think that I should use UMD Alerts.	5.42	3.88
My friends think that I should use UMD Alerts.	4.62	3.55
Other people who are important to me think that I should use UMD Alerts.	4.81	3.66

The lack of evidence for peer influence in this case does not necessarily mean that it is an unimportant motivational factor in response technology acceptance. There are some inherent limitations of the text alert technology that diminish potential peer influence. UMD Alerts is a tightly controlled information dissemination system that only allows one-way communication from authorities to students and it has no intention of supporting any other communication or interaction activities. Although college students often have tense social networks, UMD Alerts is not something "social" to this hyper-social user group. Besides, since there have been very few real emergency messages sent through UMD Alerts, the innovation has low "observability" (E. M. Rogers, 2003) as non-users have no chance to observe the results of innovation from the existing adopters.

5.4.4 Risk Perception

As reviewed in Chapter 2, previous studies in emergency response follow the research in health communication in suggesting that people's perception of risk is probably the greatest factor in motivating people to take preventative actions. (Martin, Bender, & Raish, 2007; ORC Macro, 2005). However, from Phase 1 of the

research, we know that the high-risk local environment actually de-motivated rather than motivated students to sign up for UMD Alerts. “There is only so much you can do” was a consistent theme suggested by both interviewees and focus group participants. The community’s low morale is confirmed in the survey data.\

Table 5.17 shows that there is no significant correlation between the non-users’ perceived susceptibility to risk and their intention of registering for UMD Alerts. On the other hand, there exists a strong negative correlation between non-users’ perceived response inefficacy and the acceptance intention (r = -.312, p= .001) (Table 5.18). The statistics suggest that the students’ risk perception is not likely to affect their intention of using UMD Alerts, which may be explained by their low expectation toward the efficacy of taking any response actions in a high-risk community.

Table 5.17: Correlation between Risk Perception and Acceptance Intention

		Overall, how likely are you going to sign up for UMD Alerts in the near future?
It is likely that I will experience some emergency when I am on or near campus.	Pearson Correlation	.084
	Sig. (2-tailed)	.389
	N	108

Table 5.18: Correlation between Response Inefficacy and Acceptance Intention

		Overall, how likely are you going to sign up for UMD Alerts in the near future?
There is not much I can do to improve campus safety.	Pearson Correlation	-.312
	Sig. (2-tailed)	.001**
	N	108

5.5 Implications

This survey study was able to examine a range of factors that contributed to the students' motivation for accepting UMD Alerts.

The factor analysis revealed that it was impractical to separate an individual's cognitive assessment of taking response actions and his or her perceived usefulness of a specific technology. The "perceive utility" factor included both "perceive benefit" items under cognitive category and "perceived usefulness" items under technology category. This might be due to the fact that most respondents had vague knowledge about what exactly UMD Alerts does, given that the co-existence of Crime Alert and UMD Alerts caused much confusion among students. Since it is not the University's intention to replace Crime Alert with UMD Alerts, the unique purpose and features of each system need to be clearly defined and explained to students: the former is an email-based communication system distributing after-the-fact reports about isolated crimes, while the latter is for on-going incidents that might affect the safety of the entire campus.

Moreover, the lack of "triability" of UMD Alerts (just like most emergency response systems) might have contributed to the insignificance of perceived utility in predicting adoption behavior. As Rogers (2002) points out, preventive innovations generally diffuse slowly because "the rewards to the individual from adopting a preventive innovation are often delayed in time, are relatively intangible, and the unwanted consequence may not occur anyway" (p. 991). That is, the real benefits of adopting a technology like UMD Alerts can only be assumed but not tried. Although the University police send test messages on the first Wednesday of every month to

ensure the system is operational, it is unknown to students whether UMD Alerts will really help in a situation like campus shooting.

In fact, the lack of triability reveals an inherent limitation of many current emergency response systems that leads to the vague perception of such systems' utility: the implementation of systems is still grounded on the traditional 3C (Chaos, Command, Control) model of crisis management and it only functions when there is a chaos. Such systems are intended to deal with "chaos" through the top-down "command-and-control" information dissemination, which completely ignores the importance of continuity to emergency response (Dynes, 1994). As Helsloot and Ruitenberg (2004) suggested, the existing systems that have been used in daily lives are more effective than "artificial" response systems. Hence, emergency response systems, especially those to be used by community members, should integrate more peripheral functions so that the continuous use of the system can be guaranteed. For example, UMD Alerts can be used to notify students about unusual events such as school closing and icy road conditions. A system that only deals with future emergency may be perceived as "useful", but this future utility might not be a strong motivator for potential adopters. From a theoretical perspective, when applying TAM to emergency response system acceptance, I need to be careful with the meaning of the PU construct. The usefulness of response system as perceived by potential users might refer not only to the utility when "chaos" occurs, but to the utility in dealing with peripheral tasks or even unrelated daily tasks.

Although "controllable user interface" (Shneiderman, 1997) is now accepted in human-computer interaction research, users of emergency response systems are

hardly viewed as active agents that want to be in control. In many situations it is true that average citizens have common needs when an emergency strikes; nevertheless, for emergency notification systems that are deployed in a community with a large number of users, information needs may vary depending on the nature of emergency and the contextual factors related to the user. For example, in my interviews with students, some mentioned that a recent carjacking alert sent from UMD Alerts was irrelevant to them because they do not own a car. The "controllability expectancy" is also related to "perceived utility" as the usefulness of the system is greatly influenced by users' experience with interacting with the system.

From both the survey data and the interview results, a high expectation of controllability over using UMD Alerts was salient. The controllability is mostly about the capability to select what type of messages to receive and how to receive them. Hence, when a user is about to sign up for the service, a set of clearly defined emergency categories with an example to each category should be provided so that the user can decide which category of emergencies to be alerted to. Once signed up, the user should be able to interact with the system through their mobile devices (replying to the message, configuring the alert behaviors, etc.) to further control the amount and the type of messages.

The weak peer influence in this case does not necessarily mean that it is an unimportant motivational factor. In fact, it brings up an interesting challenge to studying subjective norm in response technology acceptance. Previously, some researchers argued that the lack of association between subjective norms and intentions indicates that intentions are influenced primarily by personal factors – i.e.

attitude and perceived control, not by social factors (Ajzen, 2002). Others suggested that the narrow conceptualization of the normative component in the Theory of Planned Behavior (TPB) may be responsible for the attenuation of the norm-intention relation (Armitage & Conner, 2001), as there is an important distinction between injunctive norms (i.e., what significant others think the person *ought to do*) and descriptive norms (i.e., what significant others themselves *do*) (Sheeran & Orbell, 1999). Kallgren, Reno, & Cialdini (2000) further stated that, while injunctive social norms may be more useful for decreasing antisocial behavior, descriptive social norms may be more useful for increasing pro-social behavior.

Although accepting response technologies such as UMD Alerts is largely an individualistic behavior, it is a behavior that also betters the entire community. Therefore, the intent to use emergency response technology may be influenced more strongly by descriptive than injunctive social norms. As mentioned earlier, Rogers (2003) argues that the results of adopting an innovation should be visible to others so that peer observation may become a motivational factor in the technology acceptance process. A recent study on the diffusion of a Solar Water Disinfection technology suggested that the perception as to whether the members of an individual's social network actually use the technology themselves is much more effective in motivating adoption than any injunctive norms (Heri & Mosler, 2008). However, there are some inherent limitations of the text alert technology that diminish potential peer influence. UMD Alerts is a tightly controlled information dissemination system that only allows one-way communication from authorities to students and it has no intention of supporting any other communication or interaction activities. Although college

students often have tense social networks, UMD Alerts is not something "social" to this hyper-connected user group. Besides, since there have been very few real emergency messages sent through UMD Alerts, the innovation has low "observability" (E. M. Rogers, 2003) as non-adopters have no chance to observe the results of innovation from the existing adopters.

On the other hand, the interview participants in the previous phase of this study claimed that in the event of a major emergency they would "text as many friends as they could" and discuss it with friends through social networking applications such as Facebook. This implies that for a response technology to be widely adopted by university students, it has to fit with the young generation's social behaviors. There are some ways that we may achieve a balance between tightly controlling critical information and harnessing the power of social networking in motivating adoption. For example, a Facebook API can be developed to promote UMD Alerts inside Facebook's Maryland network, as well as to relay emergency messages. Current UMD Alerts users can use the API to publicize their adoption behavior to their "friends". In addition, any future emergency messages that being relayed from UMD Alerts into the API can be visible to a large number of networked student social groups on Facebook. The visibility of acceptance and the observability of benefits might greatly increase the effect of subjective norm in the diffusion process.

5.6 Summary

This phase of the research focused on examining associations between motivational factors and users' intention/behavior of accepting UMD Alerts. A

survey study was designed and conducted to collect quantitative data. A total of 331 usable responses were returned. Factor analysis on the survey data revealed six latent factors, and three of them were retained for regression analysis: perceived utility, controllability expectancy, and subjective norm. These factors are in line with the three theoretical constructs central to information system literature (PU, PEU, and subjective norm). A logistical regression analysis showed that controllability expectancy and subjective norm were significant predictors of the *acceptance behavior*, but perceived utility was a significant predictor for *non-users' acceptance intention*. This suggests that while non-users might have the motivation to adopt the alert system because of the system's utilitarian features, their actual adoption behavior is more likely to be motivated by system controllability and social norms. The finding about social norms paves the way for the next phase of the research, which consists of a field experiment on the influence of subjective norm in emergency alert technology acceptance.

Chapter 6: Normative Influence: A Field Experiment

6.1 Chapter Overview

The survey study in Phase 2 showed a weak association between subjective norms and the adoption behavior, while some interviewees in Phase 1 of the study reported potential social influence from friends with regard to UMD Alerts acceptance. This discrepancy leads to a further investigation of normative influence in this third phase of the study. The purpose of Phase 3 is to apply my understanding of normative influence to exploring possible strategies to entice students to register for the alert service. In this chapter, I first review important theories and concepts in studying normative influence in technology acceptance, and then briefly describe the procedure of the experiment. After discussing the experiment results, I draw together the main points of the analysis with a critical reflection on the experimental methodology.

6.2 Theoretical Background

In the Theory of Planned Behavior (TPB) and technology acceptance literature, social influence is conceptualized in terms of the pressure that people perceive from important others to perform, or not to perform, a behavior. “Subjective norm” is a term that is commonly used to refer to such influences. Subjective norm is a core construct in TPB-based theories and is presumed to represent a powerful source of influence on the human behavior (Cialdini, Reno, & Kallgren, 1990; Fishbein & Ajzen, 1975). On the other hand, Armitage and Conner’s (2001) meta-analysis on TPB research showed that the “norm-intention” correlation is often

significantly weaker than other relationships. The results from my qualitative interviews and the survey data analyses seemed to support this observation.

One possible account for this weak social influence is suggested by Rivis and Sheeran (2003). They argue that "the narrow conceptualization of the normative component in the TPB may be responsible for the attenuation of the subjective norm-intention relation" (p. 219). By "narrow conceptualization", Rivis and Sheeran meant that the term "subjective norm" has broader meanings than the original definition implies. For example, researchers have begun to distinguish between injunctive and descriptive norms: injunctive norms refer to the perceived social rules (i.e., what other people think I *should* do), while descriptive norms refer to the perception of others' actual behaviors (i.e., what other people themselves *do*). The lack of distinction between injunctive and descriptive norms has led to both theoretical and pragmatic difficulties in evaluating normative influences on behavior (Berkowitz, 1997; Kallgren, Reno, & Cialdini, 2000). Godin and Kok (1996) believed that the contribution of subjective norm to predicting intent might be enhanced if the assessment of descriptive norms is included. However, since TAM-based models draw heavily from TPB in which injunctive social norms are emphasized, most assessment instruments used in the technology acceptance research only measure injunctive norms. According to Venkatesh et al. (2003), the two generic items that measure subjective norm in the literature are:

1. People who influence my behavior think that I should use the system.
2. People who are important to me think that I should use the system.

In the survey instrument used in Phase 2 of this research, there are four items that measure subjective norm:

Q26. The University officials think I should use UMD Alerts.

Q27. My parents think I should use UMD Alerts.

Q28. My friends think I should use UMD Alerts.

Q29. Other people who are important to me think that I should use UMD Alerts.

Clearly, these items were variations from the two generic subjective norm items that were geared toward measuring injunctive social norms ("… *think* I should use UMD Alerts."). Thus, the weak association between the factor "subjective norm" and the UMD Alerts adoption behavior as observed in the survey study prompted me to think about potential descriptive social norms that were overlooked in the survey study.

In the four different sources of norms (university officials, parents, friends, and other), only the "friends" source is suitable for the examination of descriptive norms because the act of interest (i.e. students' acceptance of UMD Alerts) is performed by students who are likely to refer to other students as "friends." In other words, in this phase of the study, I am interested in investigating whether a student's behavior of adopting UMD Alerts is influenced by his or her friends who have already adopted the service.

For a university community where various social networks exist, such social influences are often realized through 'word of mouth' or mediated communication channels such as email and social media. In fact, the effect of 'word of mouth' in the

promotion of new products or the diffusion of technologies has been well studied in marketing research. It is believed that a consumer would become aware of, and even be influenced to buy, a specific good or service that his or her friends own (Domingos & Richardson, 2001; Kleinberg, 2007). The flow of such influence can be thought of as a cascading process of active nodes in a network and researchers have already begun to examine the "externality of the transaction" or "cascading behavior" in MySpace and Facebook with the intention to monetize social networks via the implementation of social-network-based selling strategies (Hartline, Mirrokni, & Sundararajan, 2008).

Although UMD Alerts is not exactly a consumer product, its adoption does involve financial cost and cognitive effort (no matter how minimal they are) on the user side. Therefore, effective marketing and persuasion strategies to motivate voluntary adoption are crucial in the process of diffusion. The cascading effect based on descriptive norms as discussed in marketing research may be applicable in the case of UMD Alerts acceptance. The field experiment in this phase of study aims to investigate such social influences so that some effective motivating strategies may be found to improve the acceptance.

6.3 Results of Field Experiment

6.3.1 Review of the Field Experiment Method

The overall design of the field experiment is to compare the influence of the descriptive norm (exerted from friends) and the influence of injunctive norm (exerted from university authorities) in terms of their motivational effects on student subscription to UMD Alerts. The first step of the experiment was to examine the

normative influence exerted by the university authorities. A police officer at the Department of Public Safety, who is in charge of the implementation of UMD Alerts, was asked to send a UMD Alerts promotional email to two undergraduate classes in the Business School. The two classes were chosen because the size of the classes (59 and 60 students, respectively) was appropriate for this field study and the students came from a variety of different academic departments inside and outside the Business School. The email message (Appendix E) was composed by me and revised by the police officer before sending to the students. The main part of the message described the UMD Alerts system and was copied from the UMD Alerts' subscription website. Two days after the email was sent, I visited the classes and conducted an in-class questionnaire survey (Appendix F). The responses were collected immediately after. A total of 87 completed questionnaires were returned.

Among the 87 respondents, 19 current UMD Alerts users expressed their interest in participating in a follow-up study that examines the descriptive social norm. After contacting the 19 students and explaining to them the details of the study, 6 agreed to participate. The participants were asked to forward the UMD Alerts promotional email that they received from police to 10-15 of their friends, but with an addition of this line: "*Hey, I have signed up for this. I think you should do it, too*". Two days after the email was sent, I provided the participants with another pre-composed email message (Appendix G) inviting the same group of the friends to take an online follow-up survey. The online survey instrument is almost identical to the questionnaire distributed in the classes (see Appendix F), except that it included a 5-point Likert scale question asking about the "closeness" between the survey

respondent and the person who sent him/her the emails. One participant dropped out in the middle of the study and did not send out the second email. In the end, 5 participants completed the study and they reached a total of 55 “friends” at UMD. However, only 22 responses were collected from the online survey. In order to gather more information about the “friends” group, I recruited 5 more undergraduate students from the Department of Psychology and guided them through the same experimental procedure. The second round reached 52 “friends” and collected another 22 survey responses. In total, 10 participants forwarded the UMD Alerts promotional email to 107 of their friends, with 44 of these friends responded to the online survey (41%).

6.3.2 Results of the Field Experiment

For the sake of clarity, I will use “authority group” and “friends group” hereafter to refer to the 119 students who received the promotional email from the police and the 107 students who received the same email from their friends, respectively. Due to the small number of survey respondents in the “friends group”, rigorous statistical comparison between the two groups is not feasible. However, analyses based on descriptive statistics and Chi-square analyses revealed some interesting findings that might deserve future investigation.

Pre-Experiment Registration Status

One surprising result from the study was that the majority of respondents in the “friends group” were already registered for UMD Alerts before taking part in the study. The proportion of registered users (27, 62%) in the “friends group” was much higher than that in the “authority group” (26, 33%). This resulted in a small number

of non-users (16, 36%) in the “friends group” who could be tested for normative influence of the promotional email.

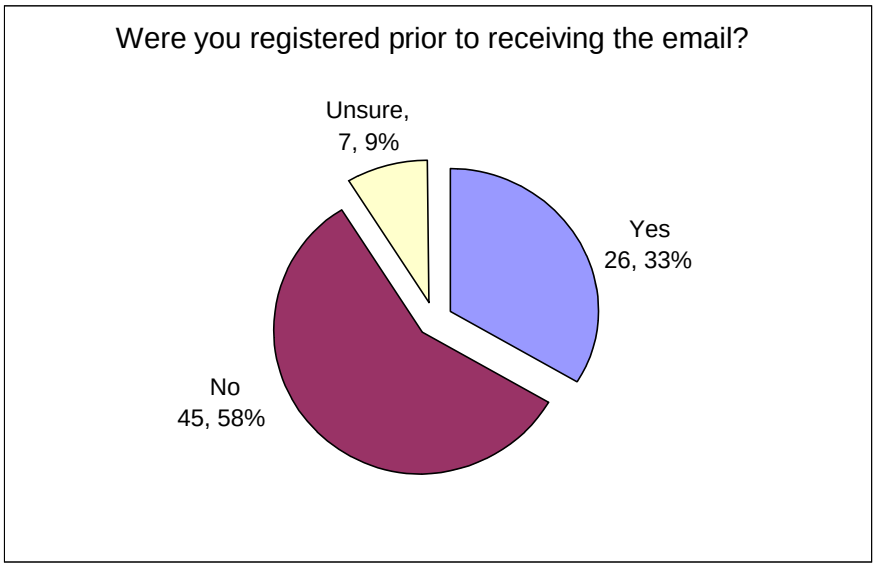

Figure 6.1(a) Registration Status (“Authority Group”)

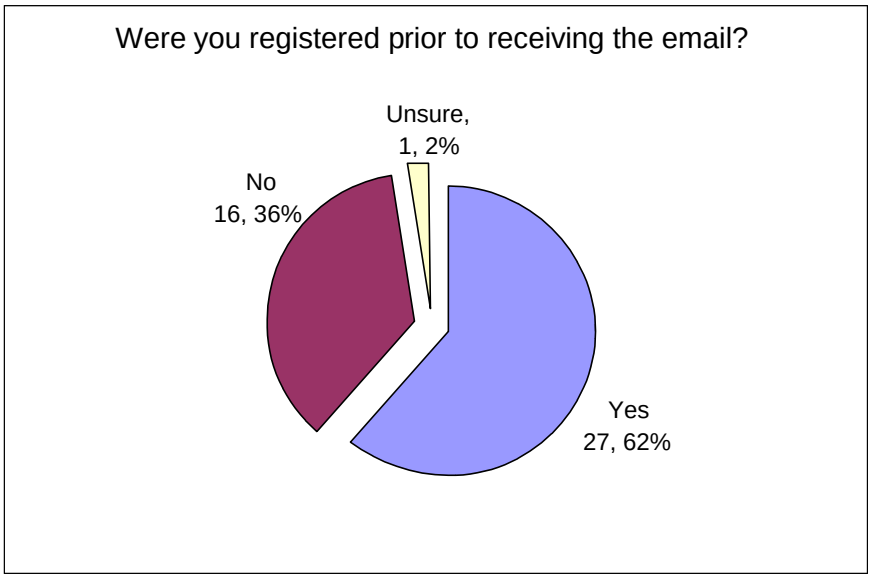

Figure 6.1(b) Registration Status (“Friends Group”)

In order to examine the group differences based on the categorical data, a Chi-square analysis was performed. Since Chi-square tests only generate non-directional

statistics for more than two categories, I first combined the "Unsure" answers with the "No" answers so that the data became dichotomous (i.e., a 2x2 contingency table). The test results (Table 6.1) show that the differences between the "authority group" and the "friends group" are statistically significant, as indicated by both *p* values from Pearson Chi-square test and from Fisher's exact test. Furthermore, the 1-sided *p* value (.002) suggests that the percentage of pre-registered users in the "friends group" is significantly higher than that in the "authority group." Possible explanations for this high registration rate in the "friends group" will be discussed later in this chapter.

Table 6.1: Chi-Square Tests: Registration Status by Group

Chi-Square Tests	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	8.996	1	.003**		
Continuity Correction	7.891	1	.005**		
Fisher's Exact Test				.004**	.002**
N of Valid Cases	122				

Awareness of the Email

As email is an asynchronous "pull" medium that requires the receiver's act, the first challenge of email-based advertising is to catch the receiver's attention and motivate him or her to read the email. Judging from the responses to the question "*Did you actually read the email?*" (Figure 6.2), it is evident that respondents in the "friends group" paid more attention to the email than those in the "authority group." While the proportions of respondents who "*opened & glanced*" at the email are about the same for both the "authority group" and the "friends group," there is a much higher percentage of respondents in the latter who read the email in detail (15% vs.

37%). In addition, 12% of the respondents in the "authority group" ignored the email ("*didn't open*"), but no one in the "friends group" did the same thing. This indicates that the sender of an email has to do with the prominence of the email – namely, students tend to pay more attention to emails from their friends than those from the university officials, even though the subject of the message is the same.

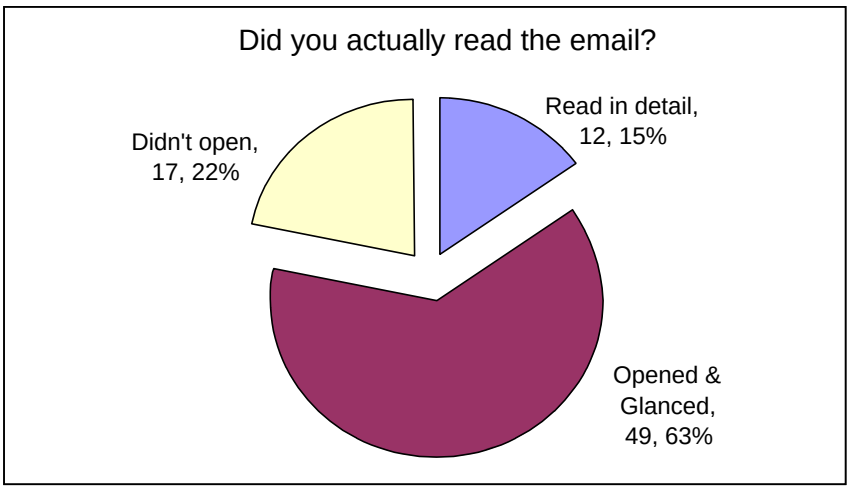

Figure 6.2(a) Aware of the Email ("Authority Group")

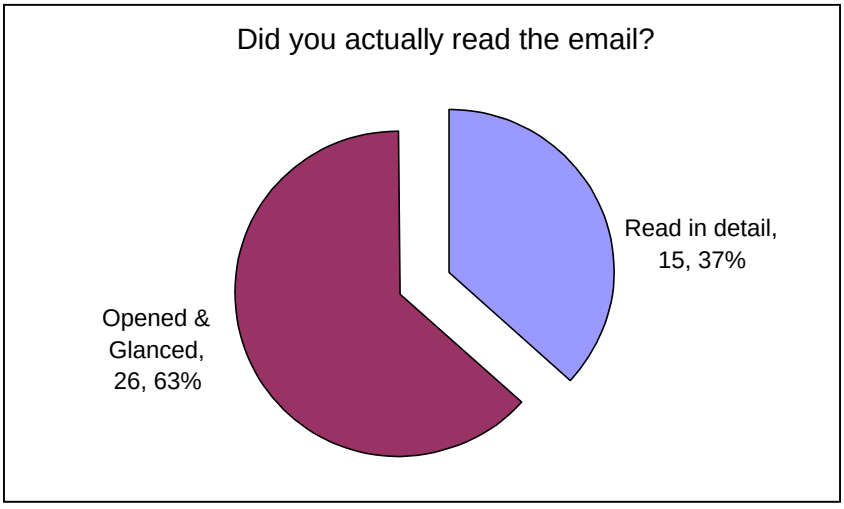

Figure 6.2(b) Aware of the Email ("Friends group")

Motivational Effect

By looking at Figure 6.3, the email sent by friends appeared to have a stronger motivational effect. When asked if the email had prompted registration, 5 (31%) out of 16 non-users in the "friends group" indicated that they signed up for UMD Alerts right after seeing the email; by contrast, only 9 out 52 (17%) students in the "authority group" acknowledged the effect of the email. Additionally, only 1 person in the "friends group" answered that he or she is "*not interested*" in registering at all, whereas 9 in the "authority group" selected this option.

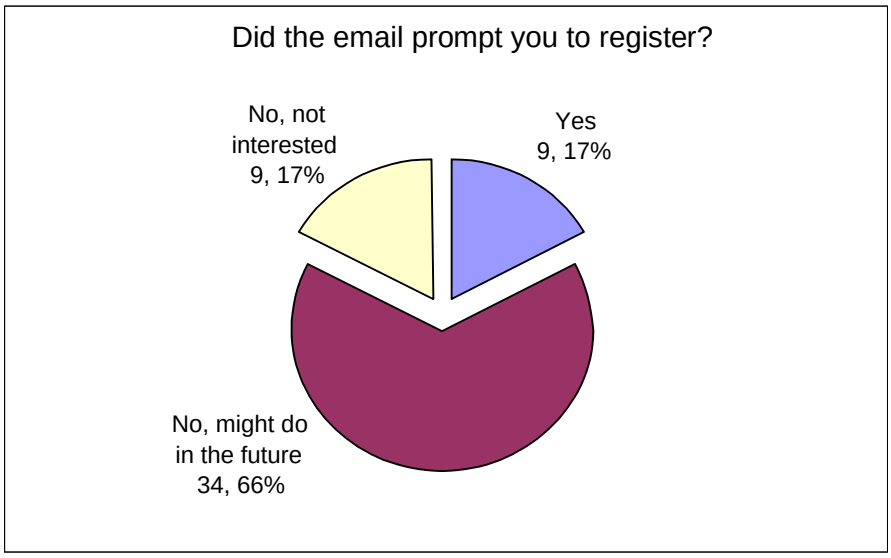

Figure 6.3(a) Normative Influence ("Authority Group")

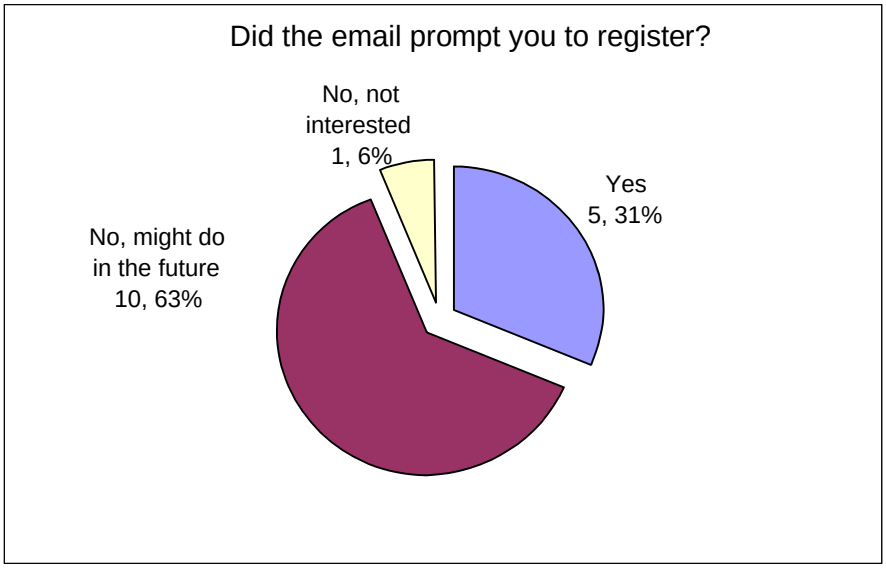

Figure 6.3(b) Normative Influence ("Friends Group")

Due to small number of cases in most of the sub-categories, a Fisher's exact probability test was performed (instead of Pearson Chi-square) to examine the statistical significance of these proportional differences. Compared to Pearson Chi-square, Fisher's exact test is able to give more accurate results for small sample sizes (Reynolds, 1984). Using the same strategy in analyzing the group difference in terms of pre-experiment registration status (see p. 115), I combined "No, might do in the future" and "No, not interested" to create a 2x2 table that is suitable for directional Fisher's exact test. Table 6.2 is the cross tabulation and Table 6.3 shows the results from the probability test. The relatively high Exact Sig values (> .05) suggest that the observed differences between the categories are not statistically significant. This surprising finding might suggest that the normative influence from friends was not as strong as expected in terms of motivating UMD Alerts registration; however, it might also result from methodological issues such as low response rate and non-response

bias. Further reflections on the motivational effect will be made in the following section and Chapter 7.

Table 6.2: Cross Tabulation: Motivational Effect by Group

		Did the email prompt you to register?		
Group		**Yes**	**No**	**Total**
Authority Group	Count	9	43	52
	%	17.3%	82.7%	100.0%
Friends Group	Count	5	11	16
	%	31.2%	68.8%	100.0%
Total	Count	14	54	68
	%	20.6%	79.4%	100.0%

Table 6.3: Chi-Square Tests: Motivational Effect by Group

Chi-Square Tests	**Value**	**df**	**Asymp. Sig. (2-sided)**	**Exact Sig. (2-sided)**	**Exact Sig. (1-sided)**
Pearson Chi-Square	1.455	1	.228		
Continuity Correction	.727	1	.349		
Fisher's Exact Test				.291	.194
N of Valid Cases	68				

6.4 Implications

This experimental study yielded some surprising results, which implies both methodological and theoretical complexities of the research.

First, the majority of the respondents in the “friends group” were already registered for UMD Alerts before participating in the study, which suggests that current UMD Alerts users are more likely to befriend people who are also registered for UMD Alerts. Previous studies in sociology support this assertion, revealing that humans tend to befriend similar others (Homans, 1974) by following the so-called

"homophily principle" (McPherson, Smith-Lovin, & Cook, 2001). The result of "homophily" is that people's social networks are homogeneous with regard to many demographic, behavioral, and sociocultural characteristics. Based on this understanding, recruiting current UMD Alerts users to reach out to those non-users might not be an effective methodological strategy. Instead, one could first try to recruit non-users and persuade them to register, and then ask these newly registered users to spread the adoption among their friends.

Second, email did not seem to be the best communication medium in this experiment, which involves observing social norms in personal interactions among young people. As Jonesa et al. (2008) point out, "As more and more social and professional relationship involve online interactions, it may be that email has come to be regarded as an even more functional, rather than personal, tool" (p. 7). For example, 12% of the "authority group" respondents did not open the email message at all; the relatively low response rate from the "friends group" could also be a result of email receivers not reading the email. Further research is needed to investigate whether social media such as IM and Facebook are better suited for this type of investigations.

Third, for the non-users of UMD Alerts, the normative influence from friends seemed stronger than that from the university authorities, but not as strong as expected. Due to limited amount of data, it is not possible to make conclusive arguments about the normative effect. Nevertheless, the experiment as a pilot study did demonstrate a promising venue to examine the causal relationships between friendship-based normative influence and the motivation for performing preventative

behaviors. In particular, a promotional message from friends is more likely to be noticed by recipients and therefore is more likely to have an impact on the recipient's behavior than that from authorities.

Fourth, the different strength of normative influences (parents, university officials, and friends) that has been observed across the three phases of this research poses an interesting challenge to further exploring the construct of social influence or subjective norm in technology acceptance. On the one hand, my observation from the field experiment echoes other researchers' findings in that friend descriptive social norm can be a significant predictor of voluntary "positive behaviors" (Kallgren et al., 2000; Okun, Karoly, & Lutz, 2002); on the other hand, the survey results from Phase 2 showed that friend descriptive norm did not appear to be strong enough in motivating UMD Alerts acceptance when compared to parents injunctive norm. These observations might suggest that there are two important dimensions in the construct of subjective norm: source (relatives, friends, co-workers, authorities, etc.) and type (descriptive and injunctive). These dimensions form a matrix in which social norms may be determined and normative influences may be better predicted. Further elaboration and testing on the hypothesized matrix of normative influence may deserve significant future work.

6.5 Summary

This phase of the study intended to investigate subjective norm as a motivational factor in response technology acceptance. A field experiment was carried out with two groups of participants: one group received a "standard" UMD Alerts promotional email message from the University police, and the other group

received the same message but was forwarded to them by friends who have adopted the alert service. It was expected that the latter group would be more motivated to register after seeing the email due to the effect of descriptive social norm. While the results did show a tendency of higher signup rate in the "friends group," the small sample sizes precluded me from drawing firm conclusions from this experimental study. Methodological drawbacks in this experiment are also reflected in relation to reaching and motivating non-users through social networks.

Chapter 7: Conclusions and Future Research

7.1 Introduction

Traditionally, a person's intention of adopting a certain technology has been conceived as being determined by the technology's usefulness and ease of use as perceived by the person. Consequently, studies on motivating acceptance tend to focus on increasing potential users' awareness of the technology (and its utility) or on improving technology's usability. However, the case of UMD Alerts acceptance clearly shows that perceived usefulness (PU) and perceived ease of use (PEU) are two broad concepts that require further specification and contextualization. The adoption intention and behavior are affected by a range of "non-technical" factors such as risk perception, subjective norms, and the sociotechnical environment in general. This echoes what Katz and Rice (2002) have stated about the acceptance of the Internet:

> Access barriers to the Internet are not primarily technical or financial … Rather, the barriers seem to lie heavily in the realm of cultural perceptions about what is possible with the Internet and the nature of Internet activities (p. 99).

Similarly, although college students would have minimal technical or financial problems with using UMD Alerts, their motivation for accepting the technology has been diminished by a series of sociotechnical factors that are not necessarily bounded to the technology itself. Social informatics research shows that technologies are always embedded in sociotechnical use contexts. This line of research not only stresses the importance of existing social and technical conditions in

facilitating the use of technologies, but also (and perhaps more importantly) demonstrates that technologies will also limit what can done in various conditions (Kling, 2000; Kling et al., 2005; Sawyer & Eschenfelder, 2002). These two sides of technology use interweave and interact, leading to a complex picture of user acceptance as shown in the present study. In this sense, neither the TAM models nor the fear/risk-based motivation models are able to adequately explain the lack of the motivation for using UMD Alerts. Through a three-phase, mixed-methods study, this dissertation attempts to understand how multiple sets of factors interweave and affect people's motivation for accepting emergency alert technology.

7.2 Summary of the Research Design and Findings

This dissertation study draws upon theoretical perspectives from psychology, sociology, and technology acceptance research to examine the key motivators and barriers involved in user acceptance of emergency alert technology. Three research questions are explored in the dissertation:

1) What are the key factors that influence the acceptance and use of emergency alert technology?

2) How are different motivational factors related to the intention of using the alert technology?

3) Given the factors identified in answering the first two research questions, what mechanisms may be integrated into emergency response system design to motivate user acceptance?

Three phases of empirical study triangulated my observations and contributed to these findings. In Phase 1, I interviewed thirteen University of Maryland students

regarding their acceptance (and non-acceptance) of UMD Alerts – an emergency alert system that allows the University police to send text messages to registered mobile devices in emergency situations. The interviews clarified what factors constituted the core constructs of TAM model – perceived usefulness (PU) and perceived ease of use (PEU) – in a specific sociotechnical context, as well as identified other motivational factors such as risk perception and subjective norm. Combing the literature review and the interview results, an enriched research model (Figure 7.1) is proposed to frame the study in the Phase 2.

Phase 2 of the study focused on examining associations between motivational factors and users' intention/behavior of accepting UMD Alerts. I designed a 38-item questionnaire based on my research model and distributed the survey to the University of Maryland student population. A total of 395 responses (331 usable) were collected. Factor analysis on the survey data revealed six latent factors, and three of them were retained for regression analysis: perceived utility, controllability expectancy, and subjective norm. A logistical regression analysis showed that controllability expectancy and subjective norm were significant predictors of the *acceptance behavior*, but perceived utility was the significant predictor for *non-users' acceptance intention*. This suggests that while non-users might have the motivation to adopt the alert system because of the system's utilitarian features ("perceived utility"), their actual acceptance behavior is more likely to be motivated by the system's ease of use ("controllability") and social norms ("subjective norm").

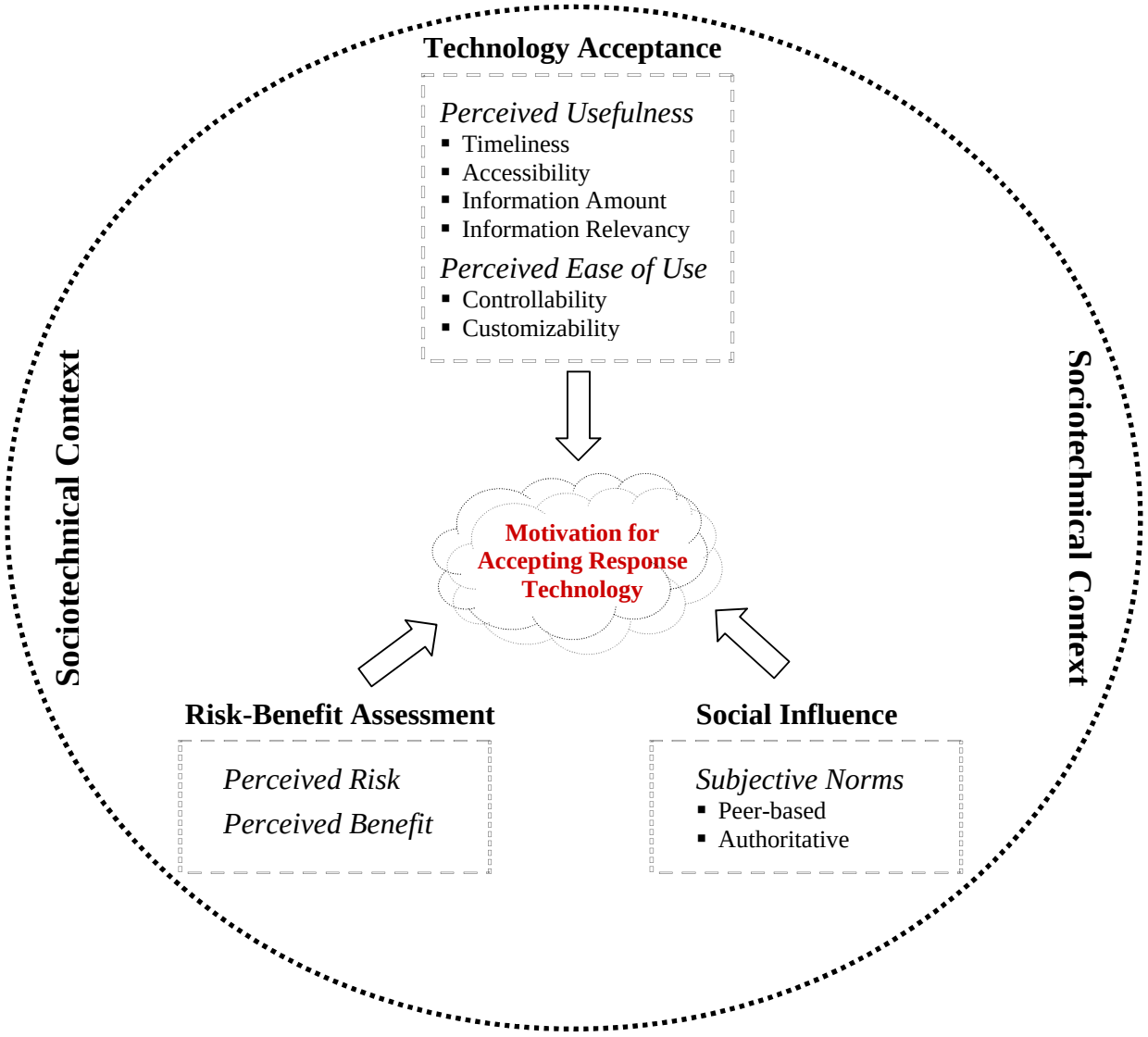

Figure 7.1: Enriched Research Model

Since the UMD Alerts system is currently in use and governed by rigid university regulations, conducting experimental study on the system's controllability is impractical if not impossible. Therefore, in the last phase of the study (Phase 3), I designed and conducted a field experiment investigating the motivational effect of subjective norm. The goal of the experiment was to observe and compare the effects of injunctive norm (from University officials) and descriptive norm (from friends) in

persuading students to register for UMD Alerts. The results of the experiment revealed the potential power of normative influence in social-network-based persuasion, as well as the methodological complexities involved in the experiment.

The overall findings of this dissertation work show that user acceptance of emergency alert technology is affected by a variety of factors that a generic TAM-base model would fail to take into account. In particular, "perceived utility" (a PU construct emerged from analysis) was not a significant factor in predicting acceptance behavior. Although both the interview participants and the survey respondents tended to agree that the UMD Alerts system is "beneficial" and "the right thing to do", their perception of the more concrete utilities of the system were equally pessimistic. Additionally, people's perception toward risk is greatly shaped by the local high-risk community context. In this case, a high-risk community "desensitized" people's awareness of risks and therefore de-motivated preventative actions. Integrating the findings from all three phases of the study, this study suggests that users may be more motivated to accept an emergency alert technology if:

- the meaningful use of the technology can be observed in everyday life;
- the technology system behavior can be easily controlled
- the diffusion of the system is promoted through the user community's existing social networks and is compatible with the culture of the community.

7.3 Discussion of Integrated Findings

7.3.1 Meaningful Utility: Emergency Technology for "Non-Emergency" Use

All the interview and survey participants in this research acknowledged the potential benefit of UMD Alerts to their safety, in spite that many had negative

attitude toward the University's emergency response system in general. Yet, one problem observed from both the user group and the non-user group is the perceived relevancy of emergency alert messages. Currently, UMD Alerts disseminates the same information to all its subscribers, and the relevancy of information is determined by the system administrators (i.e., the police). However, individual students seemed to have different viewpoints with regard to what is relevant emergency information to them. Consequently, different people have different expectations about how UMD Alerts would be useful to them – not only in the time of large-scale emergency but also in some everyday life scenarios such as icy weather or a traffic jam.

The motivational effect of individualistic needs in technology acceptance should not be overlooked. In studying motivational needs of mobility in urban areas, for example, Oulasvirta and colleagues (Oulasvirta, 2004; Kankainen & Oulasvirta, 2002) found that there exist three classes of needs related to mobility: personal needs, cognitive needs, and socially determined needs. They argue that it is these "individual level" needs that "rationalize and motivate action in a context" (p. 2). Similarly, Fogg (2002) points out that a technology will be more persuasive if "it is tailored to the individual's needs, interests, personality, usage context, or other factors relevant to the individual" (p. 38). The meaningfulness of accepting a community-oriented technology lies in its utility in terms of satisfying community members' individual wants, not some universal needs as defined by community authorities, although the two levels sometimes overlap.

Most emergency response systems (including UMD Alerts) still grounded on the traditional 3C (Chaos, Command, Control) model of crisis management. This means that: 1) these systems often run in the background in normal times and only function when there is chaos; 2) the main purpose of these systems is to realize military-like control by facilitate command operations. Hence, response systems are intended to deal with "chaos" through top-down information dissemination and communication, which tend to overlook the issue of voluntary acceptance and the critical importance of "continuity" to emergency response and preparation (Dynes, 1994).

As Helsloot and Ruitenberg (2004) pointed out, "artificial" systems are often less effective than the existing systems being used in daily lives when it comes to emergency response. Emergency response systems, especially those to be used by average citizens, should consider integrating more peripheral functions so that the continuous use of the system can be guaranteed. In the case of UMD Alerts, it could be used to notify students about unusual events such as school closing and icy road conditions, as suggested by my student interviewees. A system that only deals with future events might be perceived as "useful", but this future utility might not be a strong motivator for potential users to adopt it. The meaningful usefulness of response systems as perceived by intended users refer not only to the utility when "chaos" occurs, but to the utility in performing peripheral functions or even unrelated daily tasks.

This research suggests that peripheral functions of emergency response systems might play a crucial role in motivating user acceptance. The implication of

this finding is two fold. First, from a theoretical perspective, if we define user acceptance as the demonstrable willingness to use technology for the task it is designed to support, then the motivational elements based on peripheral uses or non-discretionary use of technology would fall outside our sight. Second, from a practical perspective, response system design may need to take a more user-centered approach by including more meaningful, daily-life features into the system.

7.3.2 "Invisibility" of Utility: The Limiting Aspect of Technology

The lack of triability of emergency response system might have also contributed to the slow acceptance of UMD Alerts. As Rogers (2002) points out, preventive innovations generally diffuse slowly because the rewards from adopting a preventive innovation "are often delayed in time, are relatively intangible, and the unwanted consequence may not occur anyway" (p. 991). That is, the real benefits of accepting a preventative technology like UMD Alerts can only be assumed but not tried or observed. Although the University police send test messages on the first Wednesday of every month to ensure the system is operational, it is unknown to students whether UMD Alerts will really help in a situation like campus shooting.

Moreover, since the benefits of using UMD Alerts are not observable, the current users' adoption behavior has little impact on the peers in their community. From the viewpoint of persuasive technology, Fogg (2002) argues that people will be more motivated to perform a behavior if they can observe others performing the same behavior and being rewarded for it. In the case of UMD Alerts acceptance, not only are rewards not observable, but the acceptance behavior itself is confined as isolated, individual act that is not seen by others. My survey study in Phase 2 and the field

experiment in Phase 3 both showed the potential importance of descriptive social norm, which is essentially about how a person's acts may be seen and followed by others.

This "invisibility" has to do with the characteristics of SMS technology itself, which is largely conceived as a private communication channel for direct interpersonal communications. In fact, marketing researchers have argued that one of the biggest obstacles in "mobile advertising" is that people generally view ads pushed to their mobile devices as "intrusive" (Dickinger et al., 2004; Yunos, Gao, & Shim, 2003). SMS messages are "pushed" to individual receivers, rather than broadcasted in public spaces where others are able to "pull" information from. Although emergency alerts from University officials are not commercial advertisements, the private nature of texting makes the technology a limiting factor in the diffusion of SMS-based alert services.

7.3.3 Cultural Mismatch: Command & Control in a Hyper-Social Community

The pervasiveness of mobile devices among young people certainly offers an opportunity to distribute critical information to this group of people. A recent report from the Pew Internet Project showed that college students are highly likely to use extra cell phone features for communication and entertainment (Rainie & Keeter, 2006). In addition, studies have suggested mobile devices such as cellular phones have moved beyond being a mere technical device to becoming a key "social object" in people's social, political, and cultural lives (Rheingold, 2002; Srivastava, 2005). For many college students, cell phones are part of their cultural identity that is formed from the hyperconnectivity with friends.

However, the popularity of mobile devices and the associated applications does not necessarily translate into a smooth diffusion of mobile alert systems. In the case of UMD Alerts acceptance, there seem to exist a mismatch between the one-to-many, top-down information distribution model adopted by emergency professionals and the peer-to-peer, social-networking-oriented information exchange model prevailing among young people. In other words, even though as a medium SMS may carry any kind of messages, the sociocultural meaning embedded in the medium greatly shapes how the messages are interpreted. This observation echoes the famous "McLuhan Equation" – "The medium is the message" (McLuhan, 2001). According to him, messages are "the personal and social consequences of any medium," and the characteristics of the medium determine how the content of a message is conceived. The limited length of an SMS message and the private nature of SMS service make it ideal for instant social interactions but not for formal communication. As Thurlow and Brown (2003) have found in their study, most text messages exchanged among college students tend to have a "high intimacy and high relational orientation", whereas "practical" use of SMS is limited (Figure 7.2). Hence, the idea of using SMS for official emergency communication might not fit in the cultural perspective of young people. Emergency alert systems such as UMD Alerts are designed in such a way that they serve as broadcasting media rather than social media.

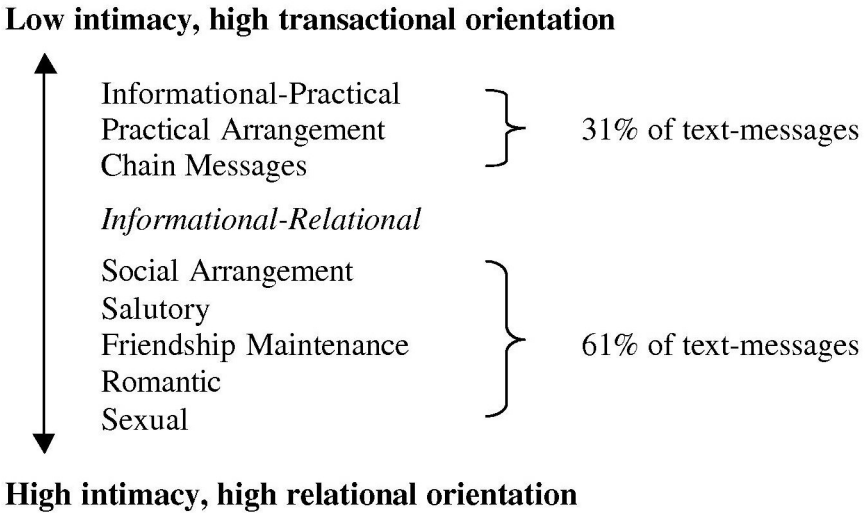

Figure 7.2: Relational Intimacy Conveyed in SMS (Thurlow & Brown, 2003)

Such a mismatch is intensified when students have already been bombarded by the Crime Alert emails from the police. The non-users in my interview study generally showed doubt toward receiving "Crime-Alert-like" messages on their personal cell phones. My survey study in Phase 2 also revealed that 63% of the non-users believed that they "may get a lot of text messages from UMD Alerts," even though they might not fully understand the purpose of the system. Also, when asked to rate agreement with the statement "I may get some unwanted messages from UMD Alerts", 73% of the respondents (including both users and non-users) rated 5, 6, or 7 on a 7-point Likert scale (7 being "Strongly Agree"). These findings and the low acceptance rate to date suggest that using SMS for official emergency communication is not an attractive idea to most of the students.

7.4 Implications of the Research

7.4.1 Theoretical Implications

Since its proposition in 1989 by Fred Davis, TAM has been the dominant paradigm in modeling user acceptance of information technology. Over the course of two decades, numerous studies have been done to validate, extend, and apply TAM in various research settings. For example, Karahanna and Straub (1999) applied TAM to studying adoptions of email and Windows operation system; Dasgupta, Granger, and McGarry (2002) extended the model to a Web-based e-collaboration environment; Yu et al. (2005) used the TAM factors to explain the adoption of electronically mediated commerce using interactive television ("t-commerce"); Chang et al. (2005) found that TAM is a valid model to explain the taxpayers' acceptance of the Internet tax-filers' system.

When it comes to refine TAM, there exist at least two general approaches. The first one is to introduce additional constructs to the model so that high predicting power may be gained. These additional variables, together with PU and PEU, determine the attitude and intention of system use. For example, when studying computer use in workplace, Davis, Bagozzi, and Warshaw (1992) introduced the "perceived enjoyment" construct to TAM. Another major expansion using this approach is the so-called TAM2, which included subjective norm as an additional predictor of intention in mandatory settings (Venkatesh & Davis, 2000). These expansions are reflected in Venkatsh et al.'s (2003) UTAUT model, which includes 41 independent variables for predicting intentions and at least 8 independent variables for predicting behavior. The second general approach to refine TAM or to resolve

conflicting findings in TAM is to include the antecedents of PU or PEU while adhering to the two central constructs as the determinants of usage intention or behavior. For instance, Venkatesh and Davis (1996) found that PEU is influenced by an individual user's computer self-efficacy and the system usability, and the latter is further influenced by the user's prior experience with the system. Chang et al. (2005) postulated that PU is influenced by "quality antecedents" such as information quality and credibility in physicians' acceptance of telemedicine technology.

Despite the continuing argument over the limitations of the original TAM, results from prior studies generally confirms the power of TAM which consistently explain more than 50% of variance in acceptance (Dillon, 2001; Venkatesh et al., 2003). Indeed, it seems parsimonious that a user's acceptance behavior is determined by his intention of usage, which in turn is determined by perceived usefulness and ease of use. Yet, parsimony is also "an Achilles' heel" for TAM in that generic constructs in TAM "seduced researchers into overlooking the fallacy of simplicity" (Bagozzi, 2007, p. 244) and steered them away from scrutinizing specific determinants in different usage contexts. The present study on the acceptance of emergency response technology, however, demonstrated a rare effort in deepening TAM through exploring local meanings of PU and PEU in a specific sociotechnical context. Thus, it is not my intention to extend TAM by adding yet another set of variables in order to better "predict" response technology acceptance. As Bagozzi (2007) adequately put, such "broadenings" without explaining how the existing variables produce the effects they do are "unwieldy and conceptually impoverished." Hence, this research aims primarily to provide a holistic view of what exactly

constitute PU and PEU in the case of UMD Alerts acceptance and why the students refuse to use such a simple technology that has obvious usefulness. Results of this research showed that the concept of usefulness has multiple levels of meanings to students, the ease of use is more about controlling the system behavior, and the subjective norm needs to be examined in a matrix of originating source and normative type. Furthermore, this research tries to highlight that the formation of these user perceptions and norms toward using a technology has much to do with the community context, the existing system, and the culture of the user group.

7.4.2 Methodological Reflections and Lessons Learned

This study adopts a mixed-methods approach to triangulate findings from qualitative and quantitative data. Surprisingly, despite the abundance of research on TAM, few studies have conducted qualitative investigations on the local meanings of PU and PEU before using the constructs in hypothesis formulation and testing. Many studies followed this path of empirical investigation: review previous literature → derive relevant factors from the literature → propose hypotheses/model → collect empirical data (usually from a quantitative survey) → test the hypotheses or validate the model. While mixed methods may not be a panacea for addressing all the threats to internal validity, the combination of qualitative and quantitative data does offer researchers more opportunities to clarify concepts, cross-validate findings, and see the complexity of the world.

The three phases of empirical investigation in this project also represent an effort to move from understanding the world to changing the world. TAM offers a framework for making comparisons among technology acceptance studies more

straightforward and interpretable. However, it might be meaningful to distinguish between “explaining” a phenomenon and “predicting" a behavior. Just as R. W. Rogers (1975) commented on the health protection model, we should be clear about whether we are using TAM as a predictive model or simply “a post hoc descriptive schema” (p. 109). Although the determinants in these two scenarios could be the same, the significance of each determinant might differ. The multiple phases of this research covered both the descriptive and the predictive sides of applying a model to a case study.

Nevertheless, this research is only a first step toward developing a theory in emergency response technology acceptance, and it claims to be no more. The proposed research framework (Figure 4.1) does not attempt to lay out all of the possible factors that might effect the motivation, but rather attempts a systematic exposition of a limited set of components that might account for a large portion of the variance in the acceptance of UMD Alerts. A more exhaustive model would have to include, for example, more contextual factors that might influence appraisal of risk. This case study demonstrates that a broader conceptual framework on technology acceptance could be achieved through an orderly progression of theory building and carefully planned case studies.

A more concrete methodological challenge encountered in this research was to reach more subjects. The response rates in both surveys (Phase 2 online survey and Phase 3 post-experiment survey) were low compared to the target population and there was no cost-effective way to reach non-respondents. The primary means used in this research to communicate with potential participants was email, as email is a

convenient and non-intrusive communication channel for reaching a large number of people. Unfortunately, young people nowadays prefer newer technologies such IM and SMS for everyday communication and email seems to become an epitome for old technology (Lenhart, Madden, & Hitlin, 2005; Wood & Li, 2007). A 2006 article from The Chronicle of Higher Education declared that college students perceive email as an outdated technology "for older people" (Carnevale, 2006). Besides this cultural bias against email, there are other sociotechnical reasons that students are becoming less fond of emailing. For example, the Chronicle article also reported that many students just ignore most "official" emails because there are too many e-mail messages of varying degrees of importance from college authorities and professors. Other unsolicited survey invitations (spam) from Internet marketers may have had further negative impact on students' willingness to participating in the study.

7.4.3 Implications for Designers and Administrators

While technology acceptance research has offered many insights with regard to what factors motivate or discourage usage, how to translate the research findings into system design remains a tricky problem (Dillon, 2001). In fact, a paradox seems to exist: technology acceptance is about user perception and experience *after* the system design is complete and the system is being employed in real life, while HCI research mainly concerns with usability during pre-employment, prototyping or pilot-testing stages. As a result, design implications derived from analyzing user acceptance can only be applied to next generations of the system in the same sociotechnical context. Yet, a sociotechnical context is likely to change as the community and the technology both evolve over time, resulting in new issues and

new factors. Hence, the following design implications are drawn from my empirical studies and should always been viewed with the UMD Alerts' sociotechnical context in mind.

Make the Purpose Clear

From a sociotechnical perspective, the relationships between a new technology system and the existing system(s) in a community deserve careful inspection. The relationship could be complimentary, conflicting, and sometimes confusing. In the case of UMD Alerts, the co-existence of Crime Alert and UMD Alerts apparently caused much confusion among students, not to say that their names are indeed very similar. The distinction has to be made clear to students: the former is an email-based communication system distributing *after-the-fact* reports about isolated crimes, while the latter is for *on-going* incidents that might affect the safety of the entire campus. Since it is not the University's intention to replace Crime Alert with UMD Alerts, the unique purpose of each system needs to be clearly defined and explained to students. This is particularly important given the fact that students already feel overloaded by the "not-so-helpful" Crime Alert emails.

Give the User Control

Shneiderman (2000) have been advocating the principle of "universal usability" for interface design in recent years. A core concept of universal usability is to give the users control over how they interact with the system so that different user needs can be accommodated. This "user control" concept is also applicable to issues beyond the interface design. My research participants repeatedly demanded more controllability over using UMD Alerts, including the capability to select what type of

messages to receive and how to receive them. One implication from the study is that when a user signs up for the service, a set of clearly defined emergency categories with an example to each category is provided so that the user can decide which category of emergencies to be alerted of. Once signed up, a user should be able to interact with the system through their mobile devices (replying to the message, configuring the alert behaviors, etc.).

Make It Visible

Visibility not only refers to the visual display of UMD Alerts ads; more importantly, it means that the usefulness and the unique purpose of UMD Alerts must be visible to students. As discussed earlier in this dissertation, this echoes Rogers' (2003) concept of "observability" in his diffusion of innovation theory. He argues that the results of an innovation should be visible to others so that peer observation may become a motivational factor in the technology adoption process. Although it is impractical to create the visibility of UMD Alerts given the purpose of the system, the University can still utilize the system to notify students about unusual events such as school closing. Once current subscribers and their peers observe the unique utility of the service, the perceived usefulness will increase. In light of the strong authoritative influence observed, the University may also consider sending emails or snail mails to students' parents to make the service more visible.

7.5 Limitations of the Study

This study is not without limitations. The limitations include questions of theoretical approach, methodology issues, and generalizability. I will address each of these in turn.

First, the study is based on multiple assumptions regarding the nature of human motivation for accepting emergency response technologies. Since no systematic study exists for this specific topic, I assume that the issue can be investigated by dividing it into three theoretical components – technology acceptance, emergency response, and social context, each supported by its own stream of literature. However, human motivation is such a complex issue that any theoretical framework may be imperfect in terms of accounting for all the factors involved in the motivation-action process as well as the interactions among these factors. Therefore, my theoretical approach can only be regarded as one attempt to tackle the problem, but not a definitive or comprehensive one.

Another theoretical limitation lies in the assumption that a person's intention leads to the actual behavior. Although the high-correlation between intention and action is well-supported by the theory of reasoned action (TRA) and TRA-based studies (Ajzen & Fishbein, 1980; Venkatesh et al., 2003), the assumption still needs further empirical verification. A follow-up study can be conducted to investigate how well the intention of accepting UMD Alert is correlated to the actual registration behavior.

One of the weaknesses of the quantitative examination in Phase 2 concerns with the sampling strategy. The invitation to the online survey in Phase 2 was distributed to the student population through a campus news listserv. This strategy had two inherent problems regarding sampling. First, some students might have chosen to opt out the listserv and did not receive the invitation; second, students who responded were essentially self-selected, and those who chose to participate in the

interviews or the surveys might be more concerned about campus security than the non-participants. The second round of data collection using paper-based questionnaires remedied these problems to some extent, but a more controlled sampling strategy with pre-screening and stratification might yield a more representative sample.

Finally, the findings from this study might not be generalizable to other university campuses due to a wide range of variance on the variables of interest to the study. For example, students in universities located in small college towns may have different perception of risk from students who enroll in the University of Maryland, which is located in a metropolitan area. Further, conclusions based on studying a university community may not be applicable to studying other types of communities (residence communities, high school community, corporation community, etc.) due to obvious population differences. Nonetheless, both the research methodology and the findings of this study may be transferable to studying similar university communities in the United States where some key characteristics (e.g., geographic location, size of student population, susceptibility to disasters) are comparable.

7.6 Avenues for Future Study

This research offers several insights to future studies that aim to develop a more comprehensive, holistic picture of emergency response technology acceptance in community settings.

In light of the methodological limitations stated above, the validity and the generalizability of my findings should be tested in a large-scale survey with more rigorous sampling, in multiple university communities (as research sites), and with

similar SMS-based emergency alert systems. Not only will this determine the validity of this research work, it would also add to the understanding of how various sociotechnical contexts shape people's intention and behavior of technology acceptance. In addition, larger data sets would offer the possibility of investigating user group differences by comparing results from demographic breakdowns (origin of residence, ethnicity, gender, etc.).

Two constructs in my theoretical model – perceived susceptibility to risk and perceived severity of risk – have not been thoroughly examined in the present research, but they deserve more focused study. ORC Macro report (2005) even concluded that the perception of an imminent threat is probably the greatest factor in motivating people to take preventative actions. However, I was not able to observe the critical role of perceived risk in the case of UMD Alerts acceptance. The factor analysis in Phase 2 did not reveal this latent variable, either. The desensitization effect of the high-risk community might be one explanation (as discussed in Chapter 4 and Chapter 5), but the weak risk perception might also suggest some latent variables (such as types of risks and previous experiences with risks) which could have moderated the association between the risk perception and the adoption behavior.

Additional experimental studies may be conducted to further test the hypothesized normative influences from socially active peers. It is possible to achieve a balance between tightly controlling critical information and harnessing the power of social networking in technology acceptance. For example, in addition to short text alerts sent to cell phones (limited to 160 characters), the University could create an

online space where students can review detailed descriptions of the alerts and discuss with fellow students. By linking the text messaging with the Web-based discussion space, the messages are no longer just isolated pieces of information but a series of "seeds" for social interactions, and the behavior of adoption and the benefits of using UMD Alerts would become more visible to others. Of course, such an online space will face similar challenges related to technology adoption and community participation. Although some of the design implications discussed in this study may apply, participating in online communities of emergency response is a new topic that warrants another systematic study.

Mobile notification systems such as UMD Alerts attempt to deliver time-critical information to users in an efficient and effective manner. A comprehensive research agenda will require contributions from multiple disciplines such as psychology, communications, information science, and HCI. For example, my study has shown that the lack of controllability and interactivity of a notification system will have negative impact on users' motivation for accepting the system. To address this issue, one would require special consideration of screen space, hardware/software capability, input methods, and other interface design choices to make the system easy to interact with. Another example is the 160-charater limit of SMS messages, which greatly decreases a system's capability of conveying complex information. The format, the tone, and the wording of such messages might have different effects on people's perception and their motivation for action. As a result, the rhetoric of alert messages is an important topic that deserves careful studies from communication scholars.

With the current UMD Alerts system, several administrative strategies may be tried by the system administrators and effectiveness of each strategy may be observed. Following the suggestions presented in Section 7.4.2 (“Implications for Designers and Administrators”) above, an advertising campaign focusing on the differences between the email-based Crime Alert and the SMS-based UMD Alerts might be able to dispel the confusion among students and clarify the purpose of each alert system. Related to the intended purpose of UMD Alerts, the meaningfulness of registering for UMD Alerts is a critical problem that requires contemplation and perhaps field experiments by the system administrators. Questions to be answered may include: What kind of incidents/events should be communicated through UMD Alerts to students so that the system can become more relevant to students’ everyday life, without blurring its unique purpose as an emergency alert system? To what extent should a user be granted control over the system so that a balance between meaningful use (from user’s perspective) and efficient control (from administrator’s perspective) may be achieved?

7.7 Concluding Remarks

This information technology era happens to be an age of perils. In recent years, we have witnessed several disastrous and traumatic incidents such as Sichuan earthquake, Hurricane Katrina, and terrorist attacks. Certainly, information technologies have great value in helping both professionals and citizens combat various emergencies. Nevertheless, neither a cognitive assessment of usefulness nor the fear of danger is able to warrant a smooth diffusion of community emergency response technology. This study demonstrates that response technology exists in a

sociotechnical system where local community context, social norms, and technology usability all have various degrees of impact on people's motivation for accepting the technology. While "chaos, command, control" (3C) is still an essential paradigm for emergency response and management, we should not let the 3C model railroad our thinking. Instead, it is a time to open to customizability, decentralization, and social connectivity in designing, deploying, and distributing community-oriented alert technologies.

The results of the study have improved our understanding of average citizens' perceptions and attitudes toward emergency alert technology. In particular, this study provides a basis for a critical assessment of the TAM model in the perspective of sociotechnical research, drawing attention to the holistic nature of human motivation and balancing over-individualized conceptions of technology acceptance behavior. The examination of theoretical constructs of TAM in the case of UMD Alerts acceptance not only served a starting point for developing new theories and practices related to community emergency response, but also provided a basis for deepening our understanding of technology acceptance behavior in general. The results of the study also highlight some limiting aspects of SMS-based alert technology in relation to the technological characteristics of SMS and the cultural traits of the intended user group. Overall, this dissertation work establishes a good foundation for challenging new lines of research that more closely examine the motivations and barriers to user acceptance of community emergency response technology in sociotechnical contexts.

Appendix A: Qualitative Interview Instrument

[Introduction] Thank you for participating in this interview. The purpose of this interview is to learn about what you think about campus emergencies and the University's emergency readiness and response plans. I have a set of questions that I'd like to ask you and I'll do my best to wrap up the interview in 40 minutes. Before we get started, do you have any questions for me?

1. What kind of incidents you would consider as emergencies? Can you give me some examples of emergencies?

2. Please tell me about any emergencies that you have experienced on campus.

   [Probe] How did you/others/the University react to this emergency?

   [If the interviewee indicates that s/he has not experienced any emergencies]:

   Have you heard about other students' experiences with emergencies?

3. Would you say the university is well-prepared for emergencies and disasters? Why?

4. Do you believe that you are well prepared for emergencies that may occur on this campus? Why?

5. How do you keep up with the University news?

6. If you see a person carrying a gun on campus, what would you do? And what do you think others/the university should do?

   [Probe 1] What is the best way to notify you about such emergencies?

   [Probe 2] What would be the best way to inform the campus community about such emergencies?

   [Probe 3] After you have heard about such emergencies, where would you go to check for updates and further information?

7. Please tell me what you know about UMD Alerts.

[If the interviewee has never heard of UMD Alerts before, give this brief introduction: “UMD Alerts is a text-message-based alert system that allows the University to contact you during an emergency by sending messages to your cell phone or e-mail. Here is a brochure with more information about this service. Would you like to have a look?”]

[If the interview does know about UMD Alerts, after s/he has talked about what s/he knows, say: “Thank you. Here is a brochure with more information about this service. Would you like to have a look?”]

8. Based on what you know and what you’ve learned from the brochure, what do you think about this service?

8.1) [If the interviewee did not know about UMD Alerts prior to this interview] Based on what you just learned about UMD Alerts, would you sign up for it?

[Probe 1] If answer is “Yes” – So, what makes you want to sign up? (Probe about perception of risk, perception of benefit of action, perception of effort and cost, authoritarian influence, peer influence, and technical factors.)

[Probe 2] If answer is “No” – Why you don’t want to sign up? (Probe about perception of risk, perception of benefit of action, perception of effort and cost, authoritarian influence, peer influence, and technical factors.)

8.2) [If the interviewee knew about UMD Alerts prior to this interview but did not sign up]

Can you tell me why you haven’t signed up for the service? (Probe about perception of risk, perception of benefit of action, perception of effort and cost, authoritarian influence, peer influence, and technical factors.)

8.3) [If the interviewee indicated that s/he has already signed up]

a) Why did you sign up? (Probe about perception of risk, perception of benefit of action, perception of effort and cost, authoritarian influence, peer influence,

and technical factors.)

b) What are your experiences so far? (Probe mainly about technical factors)

9. What else can be done to improve the campus community's ability to respond to emergencies?
   [ADD ANY QUESTIONS THAT ARISE DURING THE INTERVIEW PROCESS THAT GO BEYOND PROBING AND PROMPTING ON EXISTING QUESTIONS HERE]

10. Is there anything else that you'd like to tell me about UMD Alerts and community response to emergencies on campus?

Appendix B: NVivo Node Summary Report

(Due to technical difficulties of importing the report from NVivo to Word, here I use screen captures of the report as generated by NVivo.)

Project: Emergency.Response
Generated: 8/27/2008 11:21 AM

Accessibility			Tree Node
Nickname		Words Coded	383
Created	3/24/2008 1:52 PM	Paragraphs Coded	11
Modified	4/19/2008 6:20 PM	Coding References	9
		Sources Coded	9
		Cases Coded	8

Afraid of spamming			Tree Node
Nickname		Words Coded	65
Created	3/23/2008 6:58 PM	Paragraphs Coded	2
Modified	4/1/2008 11:18 AM	Coding References	2
		Sources Coded	2
		Cases Coded	2

Cognitive effort			Tree Node
Nickname		Words Coded	395
Created	3/23/2008 6:55 PM	Paragraphs Coded	8
Modified	4/19/2008 6:17 PM	Coding References	5
		Sources Coded	3
		Cases Coded	2

Communication Context			Tree Node
Nickname		Words Coded	477
Created	3/23/2008 6:50 PM	Paragraphs Coded	14
Modified	4/19/2008 6:52 PM	Coding References	9
		Sources Coded	5
		Cases Coded	5

Community Involvement			Tree Node
Nickname		Words Coded	124
Created	3/23/2008 7:52 PM	Paragraphs Coded	3
Modified	4/12/2008 10:27 PM	Coding References	3
		Sources Coded	3
		Cases Coded	3

Confidence			Tree Node
Nickname		Words Coded	390
Created	4/9/2008 10:49 PM	Paragraphs Coded	7
Modified	4/19/2008 6:33 PM	Coding References	6
		Sources Coded	2
		Cases Coded	2

Continuous utility			Tree Node
Nickname		Words Coded	332
Created	3/23/2008 7:13 PM	Paragraphs Coded	5
Modified	4/19/2008 6:34 PM	Coding References	5
		Sources Coded	4
		Cases Coded	4

Controllability			Tree Node
Nickname		Words Coded	601
Created	4/1/2008 11:32 AM	Paragraphs Coded	10
Modified	4/19/2008 6:49 PM	Coding References	10
		Sources Coded	6
		Cases Coded	6

Definition of Emergency			Tree Node
Nickname		Words Coded	802
Created	3/23/2008 6:36 PM	Paragraphs Coded	20
Modified	4/12/2008 10:28 PM	Coding References	19
		Sources Coded	9
		Cases Coded	9

Desensitization			Tree Node
Nickname		Words Coded	484
Created	4/12/2008 10:30 PM	Paragraphs Coded	12
Modified	4/19/2008 6:55 PM	Coding References	6
		Sources Coded	3
		Cases Coded	2

Ease of use			Tree Node
Nickname		Words Coded	345
Created	3/23/2008 8:25 PM	Paragraphs Coded	12
Modified	4/19/2008 6:23 PM	Coding References	9
		Sources Coded	8
		Cases Coded	7

Email Crime Alert			Tree Node
Nickname		Words Coded	641
Created	4/12/2008 10:30 PM	Paragraphs Coded	20
Modified	4/19/2008 6:15 PM	Coding References	7
		Sources Coded	5
		Cases Coded	4

Emergency Experiences			Tree Node
Nickname		Words Coded	398
Created	3/23/2008 7:09 PM	Paragraphs Coded	11
Modified	4/19/2008 6:07 PM	Coding References	10
		Sources Coded	4
		Cases Coded	3

Existing technology			Tree Node
Nickname		Words Coded	1,158
Created	4/12/2008 10:30 PM	Paragraphs Coded	20
Modified	4/19/2008 6:28 PM	Coding References	15
		Sources Coded	4
		Cases Coded	3

Financial cost			Tree Node
Nickname		Words Coded	1,369
Created	3/23/2008 6:54 PM	Paragraphs Coded	17
Modified	4/19/2008 6:21 PM	Coding References	15
		Sources Coded	8
		Cases Coded	7

Immediacy			Tree Node
Nickname		Words Coded	450
Created	4/1/2008 11:15 AM	Paragraphs Coded	8
Modified	4/19/2008 6:49 PM	Coding References	7
		Sources Coded	7
		Cases Coded	7

Information overload			Tree Node
Nickname		Words Coded	631
Created	4/12/2008 10:30 PM	Paragraphs Coded	12
Modified	4/19/2008 6:44 PM	Coding References	6
		Sources Coded	4
		Cases Coded	3

Learned from			Tree Node
Nickname		Words Coded	224
Created	4/1/2008 11:16 AM	Paragraphs Coded	4
Modified	4/11/2008 10:11 PM	Coding References	4
		Sources Coded	4
		Cases Coded	4

Limitation of UMD Alert			Tree Node
Nickname		Words Coded	318
Created	3/23/2008 8:00 PM	Paragraphs Coded	11
Modified	4/19/2008 6:20 PM	Coding References	7
		Sources Coded	4
		Cases Coded	3

Motivator for signup			Tree Node
Nickname		Words Coded	429
Created	3/23/2008 8:18 PM	Paragraphs Coded	9
Modified	4/11/2008 11:47 PM	Coding References	7
		Sources Coded	5
		Cases Coded	5

Perception of risk			Tree Node
Nickname		Words Coded	1,431
Created	3/23/2008 6:56 PM	Paragraphs Coded	32
Modified	4/19/2008 6:35 PM	Coding References	26
		Sources Coded	9
		Cases Coded	8

Relevancy			Tree Node
Nickname		Words Coded	594
Created	3/23/2008 8:13 PM	Paragraphs Coded	11
Modified	4/19/2008 6:13 PM	Coding References	8
		Sources Coded	6
		Cases Coded	5

Self efficacy			Tree Node
Nickname		Words Coded	713
Created	3/23/2008 6:57 PM	Paragraphs Coded	16
Modified	4/11/2008 11:40 PM	Coding References	9
		Sources Coded	6
		Cases Coded	6

Social networks			Tree Node
Nickname		Words Coded	381
Created	4/12/2008 10:30 PM	Paragraphs Coded	9
Modified	4/19/2008 6:27 PM	Coding References	10
		Sources Coded	6
		Cases Coded	5

Social pressure			Tree Node
Nickname		Words Coded	308
Created	4/1/2008 11:22 AM	Paragraphs Coded	8
Modified	4/11/2008 11:30 PM	Coding References	7
		Sources Coded	4
		Cases Coded	4

Specificity			Tree Node
Nickname		Words Coded	193
Created	3/23/2008 7:58 PM	Paragraphs Coded	6
Modified	4/11/2008 11:45 PM	Coding References	4
		Sources Coded	4
		Cases Coded	4

University Preparedness			Tree Node
Nickname		Words Coded	967
Created	3/23/2008 7:41 PM	Paragraphs Coded	21
Modified	4/19/2008 6:14 PM	Coding References	14
		Sources Coded	9
		Cases Coded	8

Appendix C: Online Survey Invitation Message

Date: Thu, 24 Apr 2008 00:01:09 -0400
From: fyi-poster@umd.edu
Subject: Campus safety and UMD Alerts - We need your feedback!

Subject : Campus safety and UMD Alerts - We need your feedback!
Event Type(s) : Other

In an effort to improve the emergency preparedness of the University of Maryland, an online survey has been created to gather your opinions about campus safety and the University's emergency response systems.
The questionnaire is very brief. You can complete it in *5 minutes*. NO identifiable information will be collected from you. Your participation is voluntary but highly encouraged, as the feedback you offer will greatly increase our understanding on UMD students' safety needs and shape the University's future emergency response plans.

If you agree to contribute, simply click the link below to start the survey:
http://www.surveymonkey.com/s.aspx?sm=PMw4GOtu2xFX3NpHhrzbhg_3d_3d
This study is supported by the Office of Vice President for Research and conducted by the Maryland's iSchool researchers.

For more information, contact:
Fei Wu
College of Information Studies
+1 301 405 2033
fwu@umd.edu

Appendix D: Online Survey Instrument

UMD Campus Safety & UMD Alerts Survey Page 1/11

What is the purpose of this survey?

This survey attempts to understand UMCP students' perception of campus safety and attitude toward emergency preparedness, as well as to collect feedback about the use of UMD Alerts.

This is a very brief survey and it should take you about 5 minutes to complete. There are no known risks associated with this study. Your participation is voluntary but highly encouraged. We do NOT collect any identifiable information about you. You are free to skip questions or quit the survey at any time.

What is UMD Alerts?

UMD Alerts is an alert system that allows the University of Maryland to contact you during an emergency by sending text messages to your cell phone, pager, BlackBerry, PDA and/or e-mail account.

You must check both boxes below in order to proceed to the questionnaire.

☑ You must check both boxes below in order to proceed to the questionnaire. I am at least 18 years of age

☑ I freely and voluntarily choose to participate in this study.

This research is being conducted by Philip Wu in the College of Information Studies at UMCP. If you have any questions about the research study itself, please contact: Philip Wu (email) fwu@umd.edu, or Dr. Yan Qu (email) yanqu@umd.edu, (telephone) 301-405-8619.

If you have questions about your rights as a research subject, please contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678.

Next >>

Q1. I'm a

- Freshman
- Sophomore
- Junior
- Senior
- Graduate student
- Other

Q2. Gender:

- Female
- Male

Q3. Residency status:

- I live on campus.
- I live off campus but within walking distance from campus.
- I live off campus and I have to commute by vehicle.

Q4. I'm a student in:

- James Clark School of Engineering
- College of Agriculture and Natural Resources
- College of Arts and Humanities
- College of Behavioral and Social Sciences
- College of Chemical and Life Sciences
- College of Computer, Mathematical and Physical Sciences
- College of Education
- College of Information Studies
- Philip Merrill College of Journalism
- Robert H. Smith School of Business
- School of Architecture, Planning, and Preservation

- School of Public Health
- School of Public Policy
- Other or undecided

<< Prev Next >>

Q5. Have you signed up for UMD Alerts?

- Yes, I have signed up.
- No, I have not tried to sign up.

<< Prev Next >>

[If answered "No" to Q5]

UMD Campus Safety & UMD Alerts Survey

Q6. Overall, how likely are you going to sign up for UMD Alerts in the near future?

1 - Very Unlikely	2	3	4 - Neutral	5	6	7 - Very Likely
○	○	○	○	○	○	○

Q7. What would motivate you to sign up for UMD Alerts right away? (Check all that apply)

- ☐ If someone can convince me it's important.
- ☐ If something big occurs on this campus.
- ☐ If I can control exactly what messages I receive.
- ☐ If the alert messages are free.
- ☐ Other (please specify): _____

Q8. And which would be the most important motivational factor?

- ○ If someone can convince me it's important.
- ○ If something big occurs to this campus.
- ○ If I can control exactly what messages I receive.
- ○ If the alert messages are free.
- ○ Other (please specify): _____

Please rate your level of agreement with the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q9. If I sign up for UMD Alerts, I will feel that I am doing something good for myself.	○	○	○	○	○	○	○
Q10. If I sign up for UMD Alerts, I will feel safer.	○	○	○	○	○	○	○
Q11. If I sign up for UMD Alerts, I will be better prepared for emergencies.	○	○	○	○	○	○	○

<< Prev Next >>

[If answered "Yes" to Q5]

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q9. By signing up for UMD Alerts, I feel that I am doing something good for myself.	○	○	○	○	○	○	○
Q10. By signing up for UMD Alerts, I feel safer.	○	○	○	○	○	○	○
Q11. By signing up for UMD Alerts, I feel that I am better prepared for emergencies.	○	○	○	○	○	○	○

<< Prev Next >>

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q12. I am fluent with using text messages on my mobile devices.	○	○	○	○	○	○	○
Q13. It is/seems easy to sign up for UMD Alerts.	○	○	○	○	○	○	○
Q14. I want to have control over the amount of text messages to be sent to me from UMD Alerts.	○	○	○	○	○	○	○
Q15. I want to have the option to choose what type of emergency messages to receive from UMD Alerts.	○	○	○	○	○	○	○

<< Prev Next >>

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q16. I believe I will receive timely information from UMD Alerts.	○	○	○	○	○	○	○
Q17. I think the information that I receive from UMD Alerts will be relevant to my personal safety.	○	○	○	○	○	○	○
Q18. With UMD Alerts, I can get emergency information anywhere anytime.	○	○	○	○	○	○	○
Q19. I may get some unwanted messages from UMD Alerts.	○	○	○	○	○	○	○
Q20. I may get a lot of text messages from UMD Alerts.	○	○	○	○	○	○	○
Q21. Receiving UMD Alerts messages can be costly.	○	○	○	○	○	○	○

<< Prev Next >>

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q22. It is likely that I will experience some emergency when I am on or near campus.	○	○	○	○	○	○	○
Q23. If there were a major emergency, it could have severe impact on me.	○	○	○	○	○	○	○
Q24. I can take care of myself in the time of an emergency.	○	○	○	○	○	○	○
Q25. There is not much I can do to improve campus safety.	○	○	○	○	○	○	○

<< Prev Next >>

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q26. The University officials think I should use UMD Alerts.	○	○	○	○	○	○	○
Q27. My parents think I should use UMD Alerts.	○	○	○	○	○	○	○
Q28. My friends think I should use UMD Alerts.	○	○	○	○	○	○	○
Q29. Other people who are important to me think that I should use UMD Alerts.	○	○	○	○	○	○	○

<< Prev Next >>

UMD Campus Safety & UMD Alerts Survey

Please rate your level of agreement with each of the following statements:

	1 - Strongly Disagree	2	3	4 - Neutral	5	6	7 - Strongly Agree
Q30. The University is well-prepared for major emergencies.	○	○	○	○	○	○	○
Q31. The University is doing their best to protect this community.	○	○	○	○	○	○	○
Q32. The crime reports sent to me through emails are overwhelming.	○	○	○	○	○	○	○
Q33. The crime reports sent to me through emails are useful.	○	○	○	○	○	○	○
Q34. This is a high crime rate area - there is not much the University can do about it.	○	○	○	○	○	○	○

<< Prev Next >>

	1 - Worthless	2	3	4 - Neutral	5	6	7 - Beneficial
Q35. Overall I think that using UMD Alerts is (or will be):	○	○	○	○	○	○	○

	1 - Difficult	2	3	4 - Neutral	5	6	7 - Easy
Q36. Overall I think that using UMD Alerts is (or will be):	○	○	○	○	○	○	○

	1 - The wrong thing to do	2	3	4 - Neutral	5	6	7 - The right thing to do
Q37.Overall I think that using UMD Alerts is (or will be):	○	○	○	○	○	○	○

Q38. Any additional comments?

<< Prev Next >>

Thank you very much for completing the questionnaire! Your response has been recorded.

If you have any comments or questions regarding the study, feel free to contact us.

Philip Wu
fwu@umd.edu
Ph.D Candidate
College of Information Studies
UMCP

Dr. Yan Qu
yanqu@umd.edu
Assistant Professor
College of Information Studies
UMCP

<< Prev Done >>

Appendix E: Promotional Email from the Police

With the consent of your instructor, I am sending you this email to urge you to sign up for UMD Alerts. UMD Alerts is an emergency alert system that allows the University of Maryland to contact you during an emergency, by sending text messages to your e-mail, mobile phone, or other text-enabled devices. When an emergency occurs, UMD Alert is your personal connection to real-time updates, instructions on where to go, what to do, what not to do, who to contact and other important information. Please take a moment to prepare yourself.

Registration is available at https://alert.umd.edu/ or by text messaging 411911 with keyword UMD.

Major Jay Gruber

University of Maryland Department of Public Safety

College Park, MD 20742-6011

301-405-7045 Office

301-314-2728 Fax

301-641-0928 Cell

jgruber@umpd.umd.edu

UMD ALERT - Receive campus emergency information on your text enabled device. Subscribe at alert.umd.edu or text UMD to 411911 from your device

Appendix F: Survey Instrument for the Field Experiment

1. Are you registered for UMD Alerts?

- Yes
- No
- Unsure

2. Did you receive a promotional email about UMD Alerts sent to you on Monday, October 06, 2008?

- Yes
- No (Skip to the Question #6)
- Don't remember or unsure (Skip to Question #6)

3. Did you actually read the email?

- I opened the email and read the message in detail
- I opened the email and took a glance at the message
- I didn't open the email at all; I just saw the title.

4. Were you registered for UMD Alerts prior to receiving the email?

- Yes
- No
- Not sure

5. If you were not previously registered, did the email prompt you to register?

- Yes, I registered right after I saw the email.
- No, I haven't registered, but I might do it in the future.
- No, I just don’t want to register.

Any other comments?

6. Your academic year:

- Freshmen
- Sophomore
- Junior

- Senior
- Graduate

7. Gender:

- Male
- Female

8. We are looking for 15 participants for a follow-up study, which takes approximately 30 minutes and pays $20 cash.

If you are interested in participating, please leave your email address and we'll send you more information:

This research is being conducted by Philip Wu in the College of Information Studies at UMCP. If you have any questions about the research study itself, please contact: Philip Wu (email) fwu@umd.edu, or Dr. Yan Qu (email) yanqu@umd.edu, (telephone) 301-405-8619.

If you have questions about your rights as a research subject, please contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678.

Appendix G: Email Message for Inviting Friends to Survey

Hey,

I'm helping a Maryland researcher investigate UMD Alerts subscriptions. I forwarded you a UMD Alerts promotional email last week.

If you've got one minute (literally!), please follow the link below to take a very brief online survey:
http://www.surveymonkey.com/s.aspx?sm=nm17IJqgQ2i84fR6WMf3OA_3d_3d

There are no right or wrong answers to the survey questions, but honest answers are critical. Please note that your response is anonymous and I do NOT get to see the data.

Many thanks for your help!

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