

Why an Emergency Alert System isn't Adopted: The Impact of Socio-Technical Context

Philip Fei Wu
University of Maryland
College Park, Maryland, USA
fwu@umd.edu

Yan Qu
University of Maryland
College Park, Maryland, USA
yanqu@umd.edu

Jennifer J. Preece
University of Maryland
College Park, Maryland, USA
preece@umd.edu

ABSTRACT

The purpose of this study is to understand the laggard adoption of an SMS-based emergency alert system on a university campus. Based on findings from in-depth interviews and a focus group, we discuss some critical issues in designing and implementing such alert systems, with a focus on the socio-cultural factors that de-motivate people to use them. Our findings show that, even for a system with simple technology, the adoption process involves complex interactions between individual perceptions and the social context in which the system is situated.

Categories and Subject Descriptors

H.1.2 [MODELS AND PRINCIPLES]: User/Machine Systems – *Human psychology*

H.5.3 [INFORMATION INTERFACES AND PRESENTATION]: Group and Organization Interfaces – *Organizational design*

General Terms

Design, Human Factors, Theory

Keywords

Socio-technical system, technology acceptance model, motivation, emergency response, Short Message Service (SMS)

1. INTRODUCTION

Immediate emergency 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. In April 2007, the University of Maryland (UMD) launched UMD Alerts, a text-message-based alert system that allows university police to notify subscribers via brief text messages (SMS) sent to cell phones and other mobile devices. Due to legal complications, the University cannot mandate student subscription to the service and has to use various marketing strategies to solicit voluntary signup. However, after one-year of campaigning and advertising, student subscriptions were still rather low and as of April 2008 only about 7,500 students signed up, or 21% of the UMD student population. In

fact, the University of Maryland is by no means a special case. USA Today reported that at many of the schools with the SMS alert services, students are “slow to embrace text alerts” [1].

Users' reluctance to embrace the alert system leads to some key questions in information system research: What prevents potential users from adopting a system that is presumably important to their lives? And what may motivate people to adopt and use it? Through in-depth individual interviews and focus group discussion, we attempt to identify both individual and socio-technical factors that may explain the laggard adoption of UMD Alerts. We then discuss some initial findings that lay foundations for future studies of SMS-based alert system design and implementation.

2. BACKGROUND

2.1 Theoretical Background

Adoption of technology has been extensively studied in the Information System (IS) field in the past two decades. Davis' Technology Acceptance Model (TAM) is a widely accepted framework in modeling information technology adoption in business [2, 3]. TAM posits that technology usage is determined by a person's behavioral intention, which in turn is determined jointly by the person's “perceived usefulness” and “perceived ease of use” toward the technology.

However, some researchers argue that technology acceptance models developed from studying one type of users (mainly enterprise employees) might not address some unique factors of another user group. For example, Colvin and Goh [4] studied the adoption of laptop-based mobile display terminals by police officers on the West Coast and found that the two-factor TAM model did not fit well with their survey data. Instead, they suggested that “information quality” and “timeliness” were the most important determinants for patrol officers to adopt the mobile technology.

Moreover, the TAM model is based on the epistemological assumption that technology acceptance can be explained by potential adopters' cognitive perceptions of the technology itself and such perceptions are individualistic and context-free. Although Davis and his followers noted that it is important to account for social influence in the adoption process acceptance [3, 5], their interpretation of “social influence” is limited to “subjective norm” or “peer pressure” emanated from friends, relatives, co-workers, and supervisors. However, as Kling [6] points out, the use of information and communication technologies occurs in a much more complex social environment where institutional, cultural, and technological elements intertwined together, forming “socio-technical interaction networks.” The use of UMD Alerts, a seemingly straightforward communication technology, is no exception.

2.2 UMD Alerts and Its Social Environment

The main campus of University of Maryland is located 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. 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 2007, the University purchased the text alert software from Roam Secure, Inc. and deployed the UMD Alerts 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 from his or her cell phone by sending a specific text message. Since UMD Alerts is intended to warn the campus on large-scale and unfolding emergencies, the University has only sent out one alert message in the past 12 months which was about a series of carjacking incidents.

3. METHODS

In order to gain a holistic view of UMD Alerts as a socio-technical system, we used in-depth individual interviews to collect qualitative data from the current UMD students. We sent invitation emails to four undergraduate classes in different departments (English, Communications, Computer Science, and Biology). In addition, we used snowball sampling to identify graduate students who are willing to participate. 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 [7].

A total of 9 students were interviewed, including 4 UMD Alerts subscribers and 5 non-subscribers. The sample consists of 5 female and 4 male students who are from different departments and in different academic years. The average interview length is 45 minutes. The interviews were semi-structured and the interview protocol was being constantly refined as the interviews accumulated. The interview questions centered on students' perceptions of and attitudes toward campus safety, the university's emergency preparedness, and the usefulness and ease of use of UMD Alerts. All except one interview were audio-recorded. Each participant received 15 US dollars as compensation to their time.

After completing all 9 interviews, we felt that the information gathered from individual students is approaching a saturation point. We then decided to conduct a focus group to solicit possible new information in a more natural and dynamic way. The focus group consisted of 4 students (2 UMD Alerts subscribers and 2 non-subscribers) and a moderator (the first author of this paper), and the session lasted about one hour. The topics of the focus group discussion 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.

Each interview recording was fully transcribed immediately after the interview. The audio recording of the focus group discussion was also transcribed. These transcripts, along with the content on the sticky notes, were imported into Nvivo 7 for coding and analysis. We first used an open coding process to identify, label, and categorize the data. The codes generated were then combined, split, clustered, or linked so as to create a thematic structure [8].

4. RESULTS

Our qualitative data suggest that the students' intentions to adopt the UMD Alerts system is affected by multiple intertwined factors related to the particular alert system in this particular school environment. For the sake of clarity, we group these factors into two categories: social and technological.

4.1 Social Factors

4.1.1 Institutional Environment

Besides the UMD Alerts system, the University police also maintain a listserv that sends "crime alerts" to all the students' email inboxes. These crime alerts 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 the crime alerts, unless he or she chooses to filter out the alerts in the email software.

Due to the relatively high crime rate in the area, the crime alert emails are being 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:

Adam¹: "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 alerts actually biased students' perception against the 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.

4.1.2 Subjective Norm

Subjective norm is a person's perception of what other people think he or she should perform a behavior [2]. In the interviews, we probed about two sources of subjective norm that have been emphasized in technology acceptance literature: peer pressure and authoritative influence.

¹ To protect participant's identity, all the participant names appeared in this paper are pseudonyms.

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 our 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."

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:

Susan: "My mom, my parents are concerned about safety of every campus we visited. ... My mom was like, very concerned about ... just make sure I'm safe. So, she was like, oh, yeah, you should sign up for this."

4.2 Technological Factors

4.2.1 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 job performance" [3]. 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."

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 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 don't want to receive a car jacking alert on my cell phone coz I have seen them too often."

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.

4.2.2 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," which is closely related to information relevancy and information overload, 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."

5. DISCUSSION

It is widely believed that SMS allows university authorities to communicate with students in a more timely fashion when emergencies occur [9], as university students have a high mobile phone penetration rate and are highly likely to use extra cell phone features for communication and entertainment [10]. Hence, it is quite puzzling to see the low rate of student subscription to UMD Alerts. Our interview results show that

the adoption of UMD Alerts is not just a simple action of “opt-in”. The use of the technology is situated in a complex socio-technical environment which greatly shapes students’ perceptions and intention of action. The suggestions we offer below are derived from our main findings, and they not only point out ways for improving the UMD Alerts system, but also shed light on designing other information and communication systems that target college student users.

- Make the Purpose Clear!

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 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!

Our 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. We suggest 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.

- 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. This echoes Rogers’ [11] concept of “observability” in his diffusion of innovation theory. If current subscribers and their peers observe the unique utility of the service, the perceived usefulness is likely to increase. The University can utilize the system to notify students about unusual events such as school closing. 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.

- Socialize it!

The participants in this study indicated 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 software such as Instant Messenger and Facebook. This indicates that for an information system to be widely adopted by university students, it has to fit with the young generation’s social values and culture. There are many ways that we may achieve a balance between tightly controlling critical information and harnessing the power of social networking. For example, in addition to SMS notification messages, UMD Alerts could create an online space where students can review detailed description of incidents and can discuss with fellow students. The text messages are no longer just isolated pieces of information but a series of seeds for social interactions. The University could even create a Facebook group to disseminate information, to solicit more UMD Alerts subscriptions, and to gather student feedbacks.

6. CONCLUSION

An SMS-based emergency alert system may be a “simple” system in terms of its technology design, but it does not mean that its adoption and use are straightforward actions independent of its socio-technical context. The popular two-factor TAM model may serve as a starting point to examine

such systems’ adoption, but the model fails to recognize the impact that “socio-technical interaction networks” may have on users’ perceptions toward the “usefulness” and the “ease of use.” Using qualitative methods, this study presents some preliminary findings about the acceptance of an SMS-based alert system, which demonstrates the importance of considering contextual factors when examining technology adoption. The study also provides implications and suggestions for designing and implementing SMS-based alert systems.

Other interesting motivational themes that emerged from the interviews include the perceived financial cost of receiving the text messages, perceived susceptibility to risks, and perceived self efficacy, among others. Future studies will be necessary to examine how the contextual factors fit with these individual-level, psychological factors discussed in the psychology and emergency response literature. Additional research is also needed to investigate the views of university officials and police with regard to emergency communication and response practices in order that a complete picture of using emergency alert systems can be drawn.

7. ACKNOWLEDGMENTS

Our thanks to Kenneth Fleischmann for providing helpful comments on developing the interview and focus group protocols.

8. REFERENCES

- [1] Zagier, A. S. College students slow to embrace text alerts. *USA Today* (2008, February 28).
- [2] Davis, F. D. Perceived usefulness, perceived ease of use, and user acceptance of information technology. *MIS Quarterly*, 13, 3 (Sep. 1989), 319-340.
- [3] Venkatesh, V., Morris, M. G., Davis, G. B. and Davis, F. D. User acceptance of information technology: Toward a unified view. *MIS Quarterly*, 27, 3 (Sep. 2003), 425-478.
- [4] Colvin, C. A. and Goh, A. Validation of the technology acceptance model for police. *Journal of Criminal Justice*, 33, 1 (Jan.-Feb. 2005), 89-95.
- [5] Davis, F. D., Bagozzi, R. P. and Warshaw, P. R. User acceptance of computer technology: A comparison of two theoretical models. *Management Science*, 35, 8 (Aug. 1989), 982-1003.
- [6] Kling, R. Learning about information technologies and social change: The contribution of social informatics. *The Information Society*, 16, 3 (July 2000), 217-232.
- [7] Patton, M. Q. *How to Use Qualitative Methods in Evaluation*. Sage Publications, Newbury Park, CA, 1987.
- [8] Miles, M. B. and Huberman, A. M. *Qualitative Data Analysis: An Expanded Sourcebook (2nd Edition)*. SAGE, Thousand Oaks, CA, 1994.
- [9] Yuan, L., Dade, C. and Prada, P. Texting when there's trouble: State-of-the-art systems can blast mass warnings to cellphones and PCs. *The Wall Street Journal* (April 18 2007), B.1.
- [10] Rainie, L. and Keeter, S. *Pew Internet Project data memo: Cell phone use*. Pew Internet & American Life Project, 2006.
- [11] Rogers, E. M. *Diffusion of Innovations (5th Edition)*. Free Press, New York, NY, 2003.