

ABSTRACT

Title of Dissertation:

COMMUNICATION INTERFACE
PROXIMITY AND USER ANXIETY:
COMPARING DESKTOP, LAPTOP,
AND HAND-HELD DEVICES AS
MEDIA PLATFORMS FOR
EMERGENCY ALERTS

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This study is an experiment investigating the effects of communication interface proximity on college students' anxiety when they receive the alerts about on-campus crimes via e-mails and text messages. It proposes a new dimension for the traditional concept of proximity in journalism and suggests a shift in the emphasis of proximity from audience-to-event to user-to-interface. It draws the theoretical framework from multiple disciplines: human-computer interaction research, the information processing model, media effects research, as well as the psychological research of anxiety.

A total of 97 college students in a large mid-Atlantic university participated in this experiment. Communication interface proximity was conceptualized as three different media platforms: desktop computer (stationary), laptop computer (portable), and hand-held device (mobile). The students were assigned to one of the three device groups based on their self-reported computer usage and received four crime alerts per day for two days through one of the

devices. They were required to carry a Self-Assessment Manikin (SAM) pictorial scale during the experiment and reply to the alerts as soon as possible using the SAM and felt anxiety scales. They also filled out an online questionnaire at the beginning of the study, at the end of the first day, and at the end of the study, respectively.

Subjects who received the crime alerts on hand-held devices reported higher anxiety upon alert receipt than those receiving the alerts on desktop or laptop computers. Anxiety, valence, and arousal reported upon alert receipt for the laptop and desktop groups decreased significantly in early day two, suggesting an “overnight effect” of the crime alerts on these two groups. However, the hand-held group still reported a high level of anxiety upon alert receipt in early day two, suggesting the *ubiquitous* hand-held device is just under our skin, with no “down time”.

This study also found that anxiety predicted latency time of response to the alerts and memory for the crime alerts, indicating that anxiety serves as an adaptive heuristic in an emergency and helps people allocate their limited cognitive mental resources, as suggested by the information processing model.

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ALERTS

By

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Dedication

This dissertation is dedicated to my parents.

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It has been a pleasant experience to work on my dissertation in the past two years and I would like to express my gratitude to those who have helped and supported me in completing it.

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Table of Contents

Dedication.....	ii
Acknowledgements.....	iii
Table of Contents.....	iv
List of Tables.....	vii
List of Figures.....	viii
CHAPTER 1 INTRODUCTION.....	1
Setting the Stage at Virginia Tech.....	2
The Crime Alert Systems as a Test Bed for the Future of News Delivery.....	4
Shifting the Emphasis from Fear to Anxiety.....	6
Reevaluating the Concept of Proximity in the Study of News.....	8
CHAPTER 2 USER-INTERFACE PROXIMITY: THE UBIQUITY AND MOBILITY OF NEW COMMUNICATION TECHNOLOGIES.....	13
Ubiquity and mobility.....	14
Interface Proximity.....	16
Hand-held as the Dominant Technology.....	17
Cultivation and Interface Proximity.....	20
Cultivation Theory.....	21
Cultivation Effect and Anxiety.....	22
Cultivation Effect and Interface Proximity.....	23
CHAPTER 3 THE NATURE OF ANXIETY.....	25
Emotion, Cognition, and Media Effects.....	27
Hedonic Valence.....	28
Arousal.....	28
The Nature of Anxiety.....	30
Anxiety as a Pre-Emotional Condition.....	30
The Definition of Anxiety.....	31
The Three Stepping Stones to Anxiety.....	33
Trait or Dispositional Vulnerability.....	33
State Anxiety and Prior Life Experience.....	35
The Trigger Event.....	36
Gender, Emotion and Memory.....	38
Valence, Arousal, and Memory.....	38
Anxiety, Gender, and Memory.....	39
Gender and Emotion.....	40

CHAPTER 4 METHOD.....	43
Overview	42
Materials	45
Stimuli Creation	45
Message Selection	45
Scoring.....	46
Pilot Study: Protocol Testing	47
Purpose	47
Participants	47
Design and Procedure.....	47
Results	49
Formal Experiment.....	49
Participants	49
Design and Procedure.....	51
Measurement	53
CHAPTER 5 RESULTS	56
Anxiety Reported upon Alert Receipt.....	57
Anxiety Reported upon Alert Receipt and Time of Receipt	60
Felt Anxiety at the End of the Study	61
Valence of Subject’s Self-Reported Emotion upon Alert Receipt.....	68
Emotional Valence Reported upon Alert Receipt and Time of Receipt	69
Valence Reported at the End of the Study	70
Emotional Arousal Reported upon Alert Receipt	73
Emotional Arousal Reported upon Alert Receipt and Time of Receipt.....	74
Arousal Reported at the End of the Study.....	75
Latency Time for Response to the Alerts.....	77
Memory for the Alerts.....	79
Anxiety Difference at the Beginning and End of the Study.....	81
Arousal Difference at the Beginning and End of the Study	82
Valence Difference at the Beginning and End of the Study	83
Cultivation Effects.....	83
Difference in Feelings of Personal Safety at the Beginning and End of the Study ...	84
Difference in Estimates of the Likelihood of Being a Crime Victim at the Beginning and End of the Study	84
Difference in Estimates of Crime Rates at the Beginning and End of the Study	84

CHAPTER 6 DISCUSSION.....	86
Summary of Results	86
Interface Proximity and Anxiety	86
Anxiety	90
The Gender Bias	93
Cultivation Effect and Interface Proximity	94
Theoretical Implications.....	95
Practical Implications	101
Limitations	102
Future Research.....	104
Conclusions	106
APPENDICES	108
Appendix A Questionnaire 1	108
Appendix B Questionnaire 2	113
Appendix C Questionnaire 3	114
Appendix D Sample of Stimuli Selection	122
Appendix E Mean Scores and Standard Deviations of Stimuli Messages	123
Appendix F Online Consent Form	126
Appendix G Exit Page of the Third Online Questionnaire after the Study.....	128
Appendix H State-Trait Anxiety Inventory Form 1 (State Anxiety Inventory)	129
Appendix I State-Trait Anxiety Inventory Form 2 (Trait Anxiety Inventory).....	130
Appendix J Cutting-off Points of Latency Time for Message Responses	131
Appendix K Fractional Factorial Design	132

List of Tables

Table 1a	<i>Full-Factorial Experimental Design</i>	135
Table 1b	<i>Fractional- Factorial Experimental Design</i>	135
Table 2	<i>Proximity, Operational Functionality and Device of Media Platform</i>	20
Table 3	<i>Factor Analysis of State Anxiety Inventory</i>	65
Table 4	<i>Factor Analysis of Trait Anxiety Inventory</i>	66
Table 5	<i>Factor Analysis of Alcohol Consumption</i>	66
Table 6	<i>Anxiety Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the First Day. Hierarchical Regression (N=96)</i>	68
Table 7	<i>Valence Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the Study. Hierarchical Regression (N=96)</i>	73
Table 8	<i>Arousal Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the Study. Hierarchical Regression (N=96)</i>	77

List of Figures

<i>Figure 1a</i>	Anxiety Reported upon Alert Receipt Predicted by Media Platform and Severity	60
<i>Figure 1b</i>	Anxiety Reported upon Alert Receipt Predicted by Subject Gender and Victim Gender	61
<i>Figure 2</i>	Anxiety Reported upon Alert Receipt Predicted by Time and Media Platform	62
<i>Figure 3a</i>	Valence Reported upon Alert Receipt Predicted by Subject Gender and Severity	69
<i>Figure 3b</i>	Valence Reported upon Alert Receipt Predicted by Subject Gender and Victim Gender	70
<i>Figure 4</i>	Valence Reported upon Alert Receipt Predicted by Time and Media Platform	71
<i>Figure 5</i>	Arousal Reported upon Alert Receipt Predicted by Subject Gender and Victim Gender	74
<i>Figure 6</i>	Arousal Reported upon Alert Receipt Predicted by Time and Media Platform	75
<i>Figure 7a</i>	Latency Time for Response to the Alerts Predicted by Media Platform and Severity	79
<i>Figure 7b</i>	Latency Time for Response to the Alerts Predicted by Subject Gender and Severity	80
<i>Figure 8</i>	Memory for the Alerts Predicted by Subject Gender and Severity	81
<i>Figure 9</i>	Mean Anxiety Difference at the Beginning and End of the Study	83

Predicted by Media Platform

Figure 10 Mean Arousal Difference at the Beginning and End of the Study

84

Predicted by Media Platform

CHAPTER 1 INTRODUCTION

“The biggest business in America is not steel, automobiles, or television. It is the manufacture, refinement and distribution of anxiety.”

- Former CBS commentator Eric Sevareid¹

Soon after U.S. Airways Flight 1549 took off from LaGuardia Airport on January 16, 2009, the plane struck a flock of Canada geese, causing a catastrophic loss of power in both engines. The pilot executed a dramatic emergency landing in the only place available to him, New York City’s icy Hudson River. Miraculously, there were no deaths and only minor injuries.

One of the most astonishing things about the crash was the way passengers used their *ubiquitous mobile communication devices*, more commonly known as cell phones. One passenger sent her husband and three children a goodbye text message *as the aircraft was going down*. “My plane is crashing,” was all she had time to text. Another passenger grabbed his cell phone as the plane descended into the icy water and sent a text message to his wife, telling her an engine was on fire. At the time, she was watching television at home, distraught and fearing the worst². After the plane came to rest, passengers climbed to safety on its wings and took pictures with the same ubiquitous hand-held mobile devices on which they were texting minutes before. Janis Drums, a Sarasota, Florida was credited with publishing the first photo taken on his iPhone® and posted on Twitter only seconds after being rescued (Insider, 2009).

If news is defined as timely, proximate information about dramatic events, this was as good as it gets. Meanwhile, for what seemed like a long time, CNN had no one on the scene and the only images of the aircraft it had showed no passengers on the wings,

¹ McDonough (2008) attributes the quote to a statement made in the 1970s.

² Text messaging an important part of response. *The Washington Post*, January 17, 2009.

just the aircraft slowly sinking into the Hudson. CNN anchor Wolf Blitzer dramatized the story, wondering aloud if the people inside would have time to escape. CNN even had an aviation “expert” speculate on what would happen when the cabin was depressurized. What Blitzer did not know was that the passengers had all been safely taken ashore by nearby ferries and were calling and texting relatives and posting pictures on the Internet.

While mainstream media may not have yet figured out an effective way to deliver news to and from hand-held communication devices, they will soon have to. Hardly any event of significance passes untouched by these ubiquitous technologies. Ubiquity has become a watchword for engineers and manufacturers. For example, Apple[®] does what it can to be sure everyone will have an iPhone[®], or what its marketing calls “a computer in your pocket.” But what will be the social and personal cost of such ubiquity, and what form will it take? Winner (1978) reminds us that Shelley’s (1918) *Frankenstein: The Modern Prometheus* is above all a tale about the dark side of technology. Jorge Luis Borges (1962) reminds us that new information technologies are usually embraced with the “extravagant happiness ...[of those who] hope to be masters of an intact and secret treasure,” only to have that hope replaced later by “excessive depression [that such hope] is inaccessible.”

Setting the Stage at Virginia Tech

Not all dramatic events have happy endings like the Flight 1549 crash. On April 16, 2007, an emotionally disturbed Virginia Tech student, Seung-Hui Cho, a Korean immigrant, shot himself to death after killing 32 students and faculty, and wounding many others in what *The Washington Post* called “the deadliest mass shooting of civilians

in American history.”³ Hand-held technology played a role in the coverage of that tragedy as well, with those devices capturing some of the most dramatic video and audio. But the event itself is not the topic for this study. This project focuses on the emotional effects of alert messages sent to students on warning systems implemented at many university campuses in the wake of the Virginia Tech tragedy. This project extends research into the effects of emotionally compelling news on television viewers, generated during the last decade of the 20th century (for example, see Lang, Newhagen, & Reeves, 1996; Newhagen & Reeves, 1992), to the new ubiquitous mobile communication technology that has come to dominate the landscape of the 21st century.

In hindsight, the idea of using a university setting for this study seems obvious: just watch undergraduates unpack their backpacks at a study table. A full array of communication technology will likely appear: First a hand-held communication device capable of both voice and text communication as well as recording still images and streaming video and audio; then probably an iPod[®] or similar device for private music listening. Chances are it can also be used as a mass storage device for the laptop computer, which will likely be the next item out of the bag.

The key features shared by all these devices -- and the focus of this study -- is that they can be used anywhere and at any time because they are mobile and the entire campus is blanketed by seamless high speed broadband wireless access.

Indeed, as previously noted, after the Virginia Tech tragedy many universities across the country implemented emergency alert systems. University officials hope these systems will warn students in real time about possible threats by sending text messages and e-mails to desktop and laptop computers as well as cell phones, Blackberries[®],

³ A killer in Blacksburg; Virginia Tech’s tragedy is America’s too. *The Washington Post*, April 17, 2007.

and other hand-held devices. By April 2008, about half of the faculty and staff and two-thirds of the students of Virginia Tech had signed up for VT Alerts. A few hours away at the University of Virginia in Charlottesville, about 40 percent of the university's population of 20,000 had signed up for UVA Alerts, a similar emergency alert system⁴. Other universities in the Washington, D.C. area, including American University, Howard University and George Mason University also implemented the text-alert system⁵. Pennsylvania State University had such an alert system before the Virginia Tech but its subscribers grew from 2,000 before the tragedy to 20,000 in the weeks and months afterwards⁶.

The University of Maryland began an emergency alert system in September 2007. The UM Emergency alerts include crime reports, traffic and weather alerts, and potential terror attack alerts. Students can opt in or out of the system, and according to statistics from the Department of Police at University of Maryland, about one-fourth of students had subscribed as of October 2008. All students receive crime reports from campus and local police via e-mail on a regular basis.

The Crime Alert Systems as a Test Bed for the Future of News Delivery

The recent upsurge in university crime alert systems is an interesting research topic in its own right. However, these systems represent something much larger. They are a harbinger of what the future holds for the delivery of news in the larger society.

The latter half of the 20th century has witnessed a rapid explosion of new hand-held communication technologies. A survey conducted by a global mobile marketing

⁴ Tech sent an alert to all U.S. colleges; Text, phone warnings adopted. *The Washington Times*, April 16, 2008.

⁵ GMU is tightening security after Virginia Tech shootings. *The Washington Post*, August 26, 2007.

⁶ Easing campus insecurity. *The Washington Times*, August 19, 2007.

association showed that there are now more mobile phone subscribers in the world (1.4 billion) than there are wired phone subscribers. In the United States, by the end of 2007, there were 255.4 million mobile phone users, 21.1 percent of whom (69 million) accessed the Internet outside homes or offices (Newspaper Association of America, 2008). The wireless capabilities of mobile hand-held devices offer quick access to the digitalized contents of the Internet. Based on the increasing prevalence of standard mobile Internet phones, many forecasters suggest that in the near future, most people will access the Internet through small wireless devices equipped with a browser and a wireless connection that provide “anytime and anywhere” access (Buyukkoken, Garcia-Molina, Paepcke, & Winograd, 2000). In addition, worldwide, more than 350 billion text messages are exchanged across the world’s mobile network every month (MMAGlobal, 2006). A Pew Internet Project survey finds that Americans sent more than 600 billion text messages in 2008, 10 times the number they sent three years ago (Novotney, 2009).

Among the users of mobile devices, young people have shown highest rates of cell phone usage and mobile content adoption (M: Metrics, 2005). Surveys show that more than 95 percent of college students own cell phones, and 82 percent of wireless customers under the age of 24 use SMS (short-message service). “Text messaging is a tool by which the college students organize their lives.”⁷ ComScore Networks (2006) has labeled 18- to 24-year-olds as the “Cellular Generation.” RSS feeds and similar systems are already coming on line. The widespread transmission and reception of news to and from hand-held communication devices is inevitable.

⁷ Tech sent an alert to all U.S. colleges; Text, phone warnings adopted. *The Washington Times*, April 16, 2008.

Shifting the Emphasis from Fear to Anxiety

From the standard generic cell phone to the latest iPhone[®], hand-held communication technologies bring unprecedented convenience and test the limits of human intelligence. That may be true, however, only to a point. Beyond that point, we might be ensnarled in what Winner (1978) called “Frankenstein’s problem,” the blind faith characterizing society’s orientation toward technology.

One psychological feature that may come with the new device is anxiety. Anxiety has been defined as a central concept in experimental and abnormal psychology (Lang, 1985; Spielberg, 1972). Anxiety, to some prominent philosophers and psychologists, is at the very root of what it means to be human (Kierkegaard, 1844/1944; May, 1979). Liddell (1949) sees anxiety as the shadow of human beings’ intelligence. The more people know of the nature of anxiety, the more they will know of intellect. Freud (1914) spent much of his life confronting the mysteries of anxiety and concluded at one point: “The problem of anxiety is a nodal point, linking up all kinds of most important questions; a riddle, of which the solution must cast a flood of light on our whole mental life” (p. 101).

Further, it appears that anxiety is spreading across the planet like a psychological pandemic, as artifact of globalization. Patricia Pearson (2008) reported that more than 40 million Americans are suffering from clinical anxiety disorders. Research in psychiatry also shows that more than two-thirds of the general population may experience a significant traumatic event with the potential to produce an anxiety or stress disorder at some point in their life, and up to one-fifth of people in the United States may experience such an event in any given year (Galea, Nandi, & Vlahov, 2005). After the Virginia Tech

tragedy, mental health experts suggested that a large portion of the population not directly affected by the event would need counseling because the sadness and anxiety it caused would not lessen in a short period of time.⁸ In England, where some clinicians still believe that the young do not suffer from such disorders, a 2003 survey by the Mental Health Foundation found that 12 percent of male university students and 15 percent of female university students suffered from clinical depression.⁹ In New Zealand, one in five females and one in 10 males will experience an anxiety disorder. Mental illness, including anxiety and depression is ranked as the most significant health problem for people aged 15 to 24.¹⁰

Although anxiety was found as a central explanatory concept in almost all contemporary theories of personality, it was not until the 20th century that anxiety emerged as an explicit and pervasive problem (Spielberger, 1966, p.4). Media coverage of disturbing news events via television, radio, and print are often cited as a great source of anxiety. Advances in media technology and economic changes over the past several decades have increased the prevalence and availability of news sources. The concurrent increase in negativity and sensationalism in the news has been found to significantly increase people's psychological distress (Coleman, 1993; Hickey, 1998; Shenk, 1997). Content analysis has shown that bad news, characterized as violent and tragic in tone, increased sharply in the 1970s, jumped again during the 1980s, and continued to rise (Patterson, 1996). Although communication research has long regarded news media as a socializing agent that can cause fear and social alienation in heavy TV viewers (Gerbner, Gross, Morgan, & Signorielli, 1980; Hawkins & Pingree, 1981; Rubin, Perse, & Taylor,

⁸ Deep stress could signal cry for help, massacre leaves invisible wounds. *USA Today*, April 24, 2007.

⁹ A walk on the dark side of university life. *Birmingham Post*, April 7, 2007.

¹⁰ Teenagers "more vulnerable." *The Press*, August 1, 2007.

1988), it seems odd that the research into anxiety has been limited. This dissertation will address that void.

Reevaluating the Concept of Proximity in the Study of News

A core concept to the study of news, proximity, has to be reconsidered in light of technological advances enabling ubiquity and mobility in hand-held communication devices. An abundance of anecdotal reports suggest possible negative effects on users' psychological well-being. Proximity has traditionally been considered a core defining principle for news measured as the distance from the event to the message receiver. While timeliness is usually considered apart from physical proximity, it is in fact embedded in it. Proximity has three central dimensions that distinguish news from other kinds of messages: temporal, physical, and psychological proximity. Gibson (2007) points out, "people used to have to wait for the paper, or for the news on television" (p.239). He reflects, "we have all been doing virtual reality, every time we look at a screen. We have been for decades now. We just do it. We didn't need the goggles, the gloves. It just happened without scaring us too much." But he adds, "one day we will internalize the interface. It will have evolved to the point where we forget about it. The interface is a cultural skin, post-functionally fragile, and neurologically dangerous." (p.71) This study argues we are right at the cusp of that reality; that the ubiquity and mobility of hand-held devices diminish the proximity of communication technology to zero. Their omnipresence has the effect of being *under the user skin*, and allowing for *no down time*. This study will show that the emphasis of the concept of "proximity" has shifted from audience-to-event to user-to-interface.

This study will look at the emotional effects of news, and the crime alerts used for this study are news in the fullest sense. The effects of emotion-laden television news and political communication have been greatly studied over the last 20 years (Bucy & Newhagen, 1999; Helena, 2003; Lang, Newhagen, Reeves, 1996; Newhagen & Reeves, 1992). That work generally focused on images of distress, death and human suffering. Basic core emotions of interest are fear, disgust, and anger. That research sought to show that television has the capacity to psycho-physiologically “trick” the viewer into processing the images as if they were real. TV, at some very important levels, is “just like being there.” However, the assumption about the television interface was that it was big and getting bigger in size (and better in terms of resolution and audio fidelity). Viewers still had to go to the TV; the TV did not come to the viewer. In the early years of Internet this was still the case. Although it was clear that Internet’s architecture, the development of its graphical user interfaces (GUI’s), and high speed broadband data transmission represented a revolution in communication technology, important changes were yet to come.

The most recent technological advances, such as reduction in size and weight of mobile devices, and wireless connectivity, represent what might be called “affordance creep.” that is, while each advance was important in its own way, no individual advance had the transformative impact the original Internet had in its early days. Such advances have been the second wave, and a wave of such importance that we are just now beginning to realize its true impact.

Important changes in the very fabric of our society have coincided with the advent of these technologies. Perhaps it began on April 19, 1995 when American militia

movement sympathizer Timothy McVeigh, with the assistance of Terry Nichols, destroyed the Alfred P. Murrah Federal Building in downtown Oklahoma City, Oklahoma. It was the most significant act of terrorism on American soil at that time, claiming the lives of 168 victims and injuring more than 680. The blast destroyed or damaged 324 buildings within a 16-block radius, destroyed or burned 86 cars, and shattered glass in 258 nearby buildings. The bomb was estimated to have caused at least \$652 million worth of damage. The inclusion of terrorism as a part of our daily news reached a crescendo with the destruction of the World Trade Center. We have come to be all too familiar with a different kind of emotion – terror. Postmodern critical theorist Jean Baudrillard (2002) pointed out in a widely misunderstood essay on the Sept. 11 attacks that the attacks were an inevitable component of the society we have built around us. Terror is not new, what is new is the way it is being delivered as a media experience is new. While the people who perished in the attacks on the World Trade Center may have been the casualties, the viewing television audience was the victim, and the media system was the weapon. The dynamics of a terrorist act, that is the ability of a small group of people to create a high degree of suffering in a small but highly conspicuous location, have added a new dimension to the lexicon of media effects, and that is anxiety. A character in a recent William Gibson (2007) novel asks a government contractor (rhetorically) if the war on terrorism has been worth the cost; a cost that has included the erosion of civil liberties and restriction in access to public spaces. Although the chances of an average citizen being a victim of such an act is functionally zero, an artificially inflated, media-induced sense of danger from an ambiguous and unidentified threat that has given rise to the key emotion on which this study will focus – anxiety.

Core negative emotions are heuristically functional; they serve a purpose and prepare the organism to deal with a concrete object (Frijda, 1988). They generate two basic behavioral outcomes, approach or avoid. Even frustration, an emotion that seems to dog the culture of computers, can be functional if it leads to arousal useful to problem solving (Bessiere, Newhagen, Robinson, & Shneiderman, 2006). The same cannot be said for anxiety; it is inhibitory and dysfunctional by its nature.

This study proposes that ubiquitous mobile communication technologies *by their nature* generate anxiety in the user, especially if the content they bear is news. These technologies are not something the user seeks out; they are always there. The proximity between the interface and the user, not to the event, becomes an issue in ways it has never been before. They are almost under our skin and there is no down time.

Interface proximity is conceptualized as three different media platforms in this study: desktop computers, which represent a stationary interface, laptop computers, which represent a portable interface, and hand-held devices, representing a mobile interface. Following the tradition of cultivation research, which focuses on the effect of the crime news, the materials to be used in this study will be the crime alerts among the emergency alerts sent by the Department of Police of the University of Maryland, College Park. Students will receive several crime alerts on their desktop computers, or laptop computers, or hand-held devices. Their anxiety level will be measured before, during, and after the study. The three devices will then be compared on a proximity scale to examine their influences on anxiety.

This dissertation will be divided into six chapters. Chapter 1 is a brief introduction to the relationship between communication technologies and anxiety. Chapter 2 will

explicate the idea central to this dissertation --- the proximity of new technologies to users. Chapter 3 will introduce the concept of anxiety. Chapter 4 will explain the research methodology employed, including the participants, the materials, process of stimuli selection, measurement, design, and the procedure for the experiment. Chapter 5 will present findings from the experiment. Finally, chapter 6 will discuss both theoretical and empirical implications of the findings and draw conclusions.

CHAPTER 2 USER-INTERFACE PROXIMITY: THE UBIQUITY AND MOBILITY OF NEW COMMUNICATION TECHNOLOGIES

The concept of proximity is central to nearly any definition of news (Shoemaker 1996). However, these definitions were born in an era of one-to-many mass media communication technologies, when not much thought was given to the role of the information interface. During the heyday of mass media, message receivers had little or no control over the content they received or how they received it.

However, defining proximity as the distance between an event and the message receiver without taking the interface into account became problematic with the advent of the Internet a few decades ago when news consumers became “users,” not “readers,” or “viewers.” Giving users at least some control over what appeared on their computer monitor elevated the importance of the interface significantly.

Even though it might have seemed as if proximity only had to do with the distance between event and receiver during the reign of mass media, and the newspaper or television screen were “transparent,” they probably were not. Gibson (2007), the author who coined the term *cyberspace*, describes even the earliest media as a kind of virtual reality “that told us where to go ... without scaring us too much” (p.66). The important difference he sees between the mass media interface and ubiquitous technologies is that “people used to have to wait for the paper or the news on television television ... [but now] it will evolve to the point where we just forget about it ... the interface is a cultural skin.” McLuhan (1964/1994) suggests that the emergence of any revolutionary new media technologies forces us to consider aspects of the obsolete system we might have taken for granted. As television displaced newspapers as the

dominant communication medium, his mantra, “the medium is the message,” underscored the importance of how streaming video and audio affected the very concept of content. But he stopped just short of making the critical distinction between the interface *per se*, and still seemed to be discussing a communication system as a large institutional and technological apparatus. But when the Internet shifted control over content from the message provider to the message receiver, it forced us to consider communication technology in terms of its interface in order to truly understand its relationship to the user. Proximity is a prime example of a concept in need of repair: The human-computer interface has emerged as a central area of research for new technology, removing the veil of interface transparency and compelling us to examine the temporal, physical, and psychological distance between the user and the technology as well as the distance from the user to the event.

This re-conceptualization begs for the careful consideration of the heretofore under-studied and perhaps unintended outcomes generated by the communication interface itself, not all of which may be positive. This study looks at one such possibility; the idea that the proximity of the communication interface to the user may be a factor in generating emotion, in this case, anxiety. The study will work off two topics currently receiving a great deal of interest in the human computer interaction (HCI) arena, ubiquity and mobility, neither of which has received much attention in the study of mass communication effects.

Ubiquity and mobility

Mainframe computers, first employed for scientific research and business accounting in the 1950’s and 1960’s, used to fill up entire buildings and required

elaborated air conditioning and cooling systems; they could hardly be considered either mobile or ubiquitous. However, it took engineers only a decade or two to develop machines that fit on desktops, allowing them to migrate from central computer facilities in the office into the home. Now, just few years later, they inhabit our pockets, briefcases, and purses. Some are even attached to the user's ear. Computers have become, in a word, ubiquitous. In such a world, users must learn to *dwell* with computers, not just interact with them (Weiser, 1991). This technological development and its implications for the design of human-computer interaction have been the starting point for several lines of research in recent years and *ubiquitous computing* is one of them (Weiser, 1991). The coming ubiquitous computational artifacts move the idea of *use* to *presence* of information technology, which suggests we are not only using or interacting with information technology, but living with it (Hallnäs & Redström, 2002).

Personal computers were originally designed for an office environment and accomplish activities such as accounting and word processing. They were designed to be efficient but complex, tools best placed in the hands of professionals. Interface design was conceived to suit that setting. However, everyday life is quite different from office work. Shneiderman (2003) points out that the same users who want big screens and impressive desktop computers in their offices and homes also want small portable devices to carry everywhere else. They want big screens for viewing maps, small screens for checking stock prices, weather reports, and, more than anything else, the ability to send and receive both voice and text messages anywhere, anytime. Add to the list the “invisible” computers embedded in everything from automobiles engines to light switches and the importance of the idea of ubiquitous computing, as described by Weiser

and his colleagues some 20 years ago, becomes more and more salient (Weiser, 1991). The design intention was to replace the personal desktop computer and move the interaction with digital information into the rich physical space we inhabit. Three important engineering advances sped this process: relentless size reduction allowed for the development of laptops; advances in data transmission allowed for “broadband” access; and wireless router technology eliminated the need for a physical connection between the computer and its host network. If taken individually, none of these advances seemed earthshaking; but if taken together, computers “disappeared” as such and become part of our lives (Weiser & Brown, 1996). New mobile technologies, such as the cell phone, iPhone[®], Blackberry[®], etc., undoubtedly pushed the concept of “ubiquitous computing” one step forward. This was reflected in a very tangible way in the summer of 2009 when Apple introduced a powerful new version of its iPhone[®], which the corporation touted as a “personal computer in your pocket.”

Kakihara and Sorensen (2002) suggest there are at least two dimensions to the concept of “mobility:” spatial and temporal. Although a mobile communication medium signifies an instrument that accompanies physical travel, studies indicate that mobility as a physical-spatial concept is too narrow to fully explain it (Leung & Wei, 2000).

Interface Proximity

Proximity has traditionally been conceptualized in journalism as a measure of the physical distance between the news event and the reader or viewer. Defining news has always been a “slippery” process (Hall, 1981) including long lists of descriptors. This lack of conceptual traction may be embedded in the fact that proximity has been defined in the absence of the interface: proximity is the physical distance from the news event to

the consumer. Timeliness, while central to the discussion of what news is, appears to have been walled off from the discussion of proximity. Psychological proximity, meanwhile, has been considered under aliases such as salience, importance, or impact.

Thinking about the user-interface proximity reveals that, of course, these three dimensions are related to the same concept and are *isomorphic*, not *orthogonal*; *Mobility enhances and enables ubiquity in both space and time and magnifies the psychological component, giving it heat.*¹¹ The interface is small and portable, freeing the power outlet from the “hard wire.” It is not just physically near, it is also near in time, instantly updated in ways newspapers and even television could never achieve. And it is psychologically “hot,” or compelling.

Hand-held as the Dominant Technology

Bolter (1974) proposes that historical epochs can be defined by their dominant technology. Beniger (1986) and Innis (1964) suggest communication technologies frequently take on that role. They further suggest that the prominent features of such technologies are so pervasive that they are adopted as positive psychological characteristics. The telegraph and steam-driven high speed rotary printing presses, for instance, enabled the production of mass circulation newspapers at very low cost (Carey, 1989). Schudson (2001) points out that speed, regularity, and uniformity all became important social, political, and cultural goals. However, as powerful a force as mass-circulation newspapers were, even then there were real limits on their ability to meet the expectations suggested by the core journalistic norms of timeliness. Even though wireless

¹¹ The idea of “heat” is used here in exactly the opposite way from McLuhan's (1964/1994) categorization of media systems as “hot” or “cold”, which is counterintuitive.

radio was becoming a common feature on ships at sea, news of the sinking of the Titanic still took nearly a day to reach American and European newspapers.

Television emerged as the defining technology, pushing the boundaries of proximity even further where the “liveness” of television gave mass viewing audiences a sense of what Auslander (1999) calls “being there.” This aspect of television may have had more of a psychological reality, reflected in the viewers’ sense of immediacy and intimacy. Temporal proximity was recognized as early as when Goldsmith (1937, cited by Auslander, 1999, p.15) stated that “television with direct pick-up of an actual event is as dependent on its time of occurrence as is the eye” (p.55). Television’s intimacy, which can be seen as a function of its immediacy, transmits the events from outside into the viewer’s home. With immediacy and intimacy, television “makes all of the world a stage and every home a front-view seat for sports, drama, and news” (Dunlap, 1947, cited by Auslander, 1999, p. 16). Even then viewers still had to come to the interface, that is, to be at home or some other location where the fixed television receiver was installed.

Reductions in the size (and cost) of computer technology did not initially solve the problem of actualizing temporal proximity. A desktop computer is similar to a television in the sense it is about the same size and even more stationary; the user has to go to the computer; the computer does not go along with the user. Although smaller laptop computers began to overcome the temporal proximity problem, short battery life, restrictive bandwidth, and limited wireless access still presented obstacles to the true mobility. However, since the hand-held communication devices such as cellular telephones, Blackberry[®], PalmPilot[®], iPhone[®] and a plethora of similar exotic variations overcame size, bandwidth, connectivity, and cost factors, ubiquity and mobility have

become functional realities for many users. This suggests an important new dimension in the delivery of news and other information: interface proximity. Now the ubiquity of the interface implies the idea of the temporal, physical and psychological distance between the user and interface. Hungarian film critic Bela Balazs (1952) realized that distance in space and time between the viewer and the object on the interface disappeared as early as the advent of silent film at the beginning of the 20th century. Postmodern critic Jean Baudrillard (1983) reflected that the questions of how “real” depictions on TV monitors and computer screens were no longer even interesting; in his mind they were better than “real” and had achieved the status of being *hyper-real*.

While desktop computers are still large and stationary, laptop computers are portable and give the user access to the Internet wherever wireless connectivity is provided. But even with advances in laptop technology, they are substantial objects; they don't fit behind the user's ear.

This suggests that even within the domain of computer-mediated communication, interface proximity may make a difference in the way users process the information they receive. Desktop computers are relatively “distant” and *stationary* in the same way television receivers are, laptop computers may be *portable*, but are still somewhat awkward. But the distance between hand-held devices and the user is now functionally reduced zero. Users can talk, and even text while driving (even though there is an increasing body of research suggesting it is not safe to do so), send text messages while walking, and hear the beep of message receipt while sleeping. They are *ubiquitous*, or just under our skin and always on, allowing for “no down time.”

Table 2 shows the conceptualization of “proximity” in this study. Desktop computer is conceptualized as far on the proximity scale, and its operational functionality is stationary. The proximity between the laptop computer and the user is moderate, and the operational functionality of the laptop computer is portable. The hand-held device is the nearest on the proximity scale. It is mobile and ubiquitous. Both desktop and the laptop computers have issues of access, meaning users won’t have physical access to them unless they stay in front of the computers with the power outlets, while the hand-held devices resolve the problem of physical access.

Table 2

Proximity, Operational Functionality, and Device of Media Platform

	Device	Proximity ¹²	Operational Functionality
Media Platform	Desktop	Far	Stationary
	Laptop	Moderate	Portable
	Hand-held	Near	Ubiquitous

Cultivation and Interface Proximity

Gerbner, et al. (1980) established one of the most important research streams emerging from the study of television: the idea that overrepresentation of content categories, especially violence, can lead viewers to assess the real world in terms of the media overrepresentations. That means watching violence on television leads viewers to believe the world is a more dangerous place than it really is. This stream of research is

¹² The three dimensions of proximity, temporal, geographic or physical, and psychological, are conceptually isomorphic for all three platforms.

called “cultivation.” It seems only natural to consider the possibility a cultivation effect will emerge when the emphasis of audience-event proximity is shifted to user-interface proximity.

Cultivation Theory

Cultivation theory is based on the premise that both the consistency of television portrayals in certain genres and around certain themes in American society has made it the primary source of information about the social world. The central proposition of cultivation theory predicts a positive linear relationship between the amount of exposure to television and cultivation indicators. According to Morgan and Shanahan (1997), cultivation research examines the extent to which cumulative exposure to television contributes to viewers’ conceptions of social reality in ways that reflect the most stable, repetitive, and pervasive patterns of images and ideologies that television presents.

Research has demonstrated that heavy television viewing is related to altered perceptions of reality (Diefenbach & West, 2001; Tyler & Cook, 1984; Weaver & Wakshlag, 1986). Gerbner (1969) and his associates first documented that much of the content of primetime television programs involves violence, and they argue that people who spend long periods watching those images view the world as more violent. Other studies suggest that exposure to action-adventure programs and depictions of harmful events such as earthquakes, attacks, and nuclear accidents increase fearfulness of personal safety (Bryant, Carveth, & Brown, 1981; Newhagen & Lewenstein 1992; Sotirovic, 2001; Sparks & Ogles, 1990).

More recent studies reveal the intervening variables such as trait anxiety in cultivation effects. Studies show that trait-anxious individuals exhibit an attentional bias

towards threatening stimuli (MacLeod & Matthews, 1988) and are more likely to jump to negative conclusions when presented with potential threatening information (Calvo & Castillo, 2001). Therefore, mass media can exert an additive impact on individuals beyond the impact of direct experience (Shrum, 2001; Shrum & Bischak, 2001).

However, Nabi and Riddle (2008) predicted that given the cognitive biases towards negative thoughts and threatening situations, there should be little relationship between TV viewing and violence-related cultivation outcomes for high trait-anxious people. Individuals low in trait-anxiety, however, do not see the world as dangerous and threatening, and are more likely to be affected by media messages that lead to the traditional cultivation effect.

Cultivation Effect and Anxiety

Despite solid sociologically based groundwork in cultivation research, only a few studies take a psychological approach to assessing the impact of news media exposure on fear and anxiety, both psychological constructs. Newhagen and Lewenstein's (1992) study examined the psychological process of cultivation effect after the 1989 Loma Prieta earthquake in San Francisco Bay Area. They found people's fear increased as their exposure to the compelling television images of the earthquake increased. Johnson and Davey (1997), using a pre- to post- viewing, within-subjects design, found individuals who were shown news bulletins edited to display negatively-valenced material demonstrated increases in both anxiety and sad moods. In addition, those who viewed the compelling images were more likely to "catastrophize" personal worries than those shown only clips edited to display either positive or neutral materials. Another systematic investigation conducted by Potts and Sanchez (1994) showed that depression was

associated with intensified negative feelings after viewing news broadcasts on television. Other research suggests that anxious mood states may predispose people to attend to threatening materials, which will in turn increase anxiety, regardless of actual risk factors (Mogg, Mathews, & Eysenck, 1992). Such results warrant the more systematic investigation of the psychological effects of exposure to negative or bad news.

Cultivation Effect and Interface Proximity

Until now, the cultivation research has been mostly focused on the television (Gerbner, et al., 1980; Hawkins & Pingree, 1981), and little attention has been devoted to the new communication technologies. However, as noted earlier, McLuhan (1964/1994) said, “the medium is the message,” and “the ‘content’ of any medium is always another medium.” Ubiquitous mobile communication devices have shifted the concept of proximity from the distance between the reader/viewer and the event to the distance between the user and the interface, adding new meanings to the cultivation effect beyond the news content.

Consider the example of the U.S. Airways flight landing on the Hudson River described at the beginning of this dissertation. Even live broadcasting coverage of emergency events such as the flight crash will be delayed as reporters and equipment were transported. People watching the story on television several hours later or reading it in the newspaper the next day will likely feel some degree of anxiety. However, if they are sitting at home and having dinner when they suddenly receive a text message from a loved one telling them a plane is on fire and descending, we predict that they might feel much more fearful and anxious. The story is the same, but the change in interface

increases anxiety. Compared with the television and the newspaper, the ubiquitous mobile device is more proximate and with people anytime, anywhere.

When we apply this approach to cultivation research, we hypothesize that, given the same crime news, people receiving alerts via text messages on hand-held devices will be more anxious than those who receive them via e-mails on desktop or laptop computers. In summary, this study proposes that varying the temporal, physical, psychological distance between users and new technology media platforms may generate measurable effects. Distance is operationally measured as *platform*. A desktop unit is static and distant, a laptop is mobile but still awkward, and a hand-held is ubiquitous with user proximity functionally zero on all three defining dimensions. This leads to the first research question of the study:

RQ1: Will media platform make a difference in anxiety caused by the crime alerts?

CHAPTER 3 THE NATURE OF ANXIETY

A model of anxiety as an emotion has to be situated in the larger context of an information processing theory to be useful. Three major assumptions underlie that theory. First, the information environment, or what Gibson (1979) calls the information ecology, is complex. Second, the information processor has limited cognitive resources, especially in regards to attention and memory, to make sense of it (Lang, Newhagen, & Reeves, 1996). Third, the output of the process has to help make functionally adaptive decisions about appropriate behaviors that will enhance the chances for survival in real time. Taken together, this forces the information processor to make judgments based on limited information (Beniger, 1986).

Emotions emerge as a key psychological heuristic, or a shortcut, to make this process work, especially in the face of threat (Newhagen, 1998). Emotions are now regarded as adaptive heuristic devices, or action sets, intended to prepare, adjust, and tune the human organism to rapid and usually threatening change (Frijda, 1988). That is, emotions serve an adaptive role in helping deal with the key survival issues posed in a volatile environment: to fight or flee, to approach or avoid (Plutchik, 1984). Roseman and Smith (2001), propose that emotions serve as appropriate response guides for coping. Frijda, Kuipers, and Schure (1989) define emotions as states of action readiness elicited by different appraisals. Such states manifest themselves in three ways: physiologically, psychologically, and through subjective awareness.

Fear, for instance, *prepares* the organism for action, while flight is the more conservative and generally safer course of action. When an unknown and unexpected object enters the ecology, fear helps classify the object and prepare a response. The

vascular system contracts and diastolic blood pressure increases. Attention narrows and focuses on the salient object. The organism “feels” afraid. The organism enters a state of preparedness, like a startled rabbit.

Anger, on the other hand, is marked by an increase in heart rate and systolic blood pressure. Respiration increases, and oxygen rich blood flows throughout the body, including the musculature and brain. Adrenaline flow optimizes prowess in anticipation of the attack.

Fear and anger represent two emotions that are unequivocally recognized as core heuristic emotions needed to generate functionally adaptive behaviors on limited information under extreme duress. But beyond agreement on those and a few other core states, the list of emotions can expand to from 10 to 20, and the “story” about just what function some serve is not so parsimonious (for example see Buck, 1986).

Anxiety qualifies as one of those ambiguous states, and can best be understood by examining its role during the appraisal phase of emotional engagement. Roseman and Smith (2001) describe this appraisal as a pre-emotional process, where perceptual systems are designed to notice change automatically and usually well below conscious awareness. Such change can trigger shifts in the allocation of cognitive resources, especially attention. These early states demand a nominal amount of scarce cognitive resources. Bessière, et al. (2006) point out appraisal may take place well before the need for behavioral action is necessary. It is important to note the function of these early appraisal states is to detect a *potentially* threatening change in the environment that may or may not require more specific intervention (Eyseneck, 1992). Viewed as a pattern recognition problem, pre-emotional states such as anxiety may only point to areas of

irregularity without “knowing” what they are or why they are there. Only when the locus of interest becomes sufficiently well-defined enough to warrant action will the organism engage in full-blown emotions such as anger or fear. At that point there is no equivocation about the locus of the event or provocative object.

Tetlock (1985) demonstrated how this narrowing or focusing in time of duress is reflected in rhetoric through what he call *integrative complexity* of speech. He conducted a content analysis of speeches made by Israeli and Arab diplomats in the United Nations over 30 years, and found that as turmoil in the Middle East increased, the rhetoric in speeches from both sides became increasingly focused and simple.

But what if the offensive object is difficult to define yet persists in drawing attention? What happens when the information ecology generates emotionally provocative information that lacks a locus? The study will examine new media technologies to see if they can, *by their very nature*, generate low levels of ambiguous emotional engagement sufficient to cause anxiety in their users.

Emotion, Cognition, and Media Effects

Wilbur Schramm (1971), a pioneer in communication research, once commented that a full understanding of the process of communication would be incomplete without a theory describing “the black box of the central nervous system” (p. 24-25). Geiger and Newhagen (1993) proposed the information processing model as the foundation for such theory, in which emotion plays a central role (Frijda, 1988). Negative emotions proved to be especially important in controlling attention (see Lazarus, 1984; Shoemaker, 1996). Wundt (1916) first characterized emotion as varying along two principal dimensions: hedonic valance and arousal or intensity. Lang (1985), Lang et al. (1993), and Larsen and

Diener (1992) found strong support for a two-dimensional theory of emotion when analyzing physiological reactions to images. They suggested that most named emotions could be measured by the two dimensions of valence and arousal.

Hedonic Valence

Valence refers to an organism's initial response to a stimulus as good or bad. It is operationalized as ranging from positive to negative (Bradley & P. Lang, 1994).

This focus on emotion carried over into communication research, where the effects of negative images in television news have received a great deal of attention (see Blake, Varnhagen, & Parent, 2001; Lang, Newhagen, & Reeves, 1996; Newhagen, 1998; Reeves, Newhagen, Maibach, Basil, & Kurz 1991; Zald, 2003). Reeves, Newhagen, Maibach, Basil, and Kurz (1991) found that information in public service announcements was identified more quickly when preceded by negative images than by positive images. Newhagen and Reeves (1992) found images of human death and suffering in televisions to be especially compelling, affecting both memory and attention. A. Lang (2000) explains that strong negative emotions are automatic and autonomous while positive emotions are complex and require more efforts in cognitive processing.

Arousal

Arousal represents the second dimension in the information processing model of emotion. Emotional arousal refers to the intensity of affect. Low levels of emotional arousal correspond to feeling calm, peaceful, and serene; high levels of arousal correspond to feeling alert or excited.

Wundt (1874) assumed that the optimal level of arousal that humans experience is pleasant and that they therefore try to achieve or maintain that level (cf. Berlyne, 1971;

Zuckerman, 1994). Hebb's (1955) seminal work describes cognitive performance related to arousal as inverted U curve, with performance very low at low levels of arousal. Optimum performance takes place at the top of the curve, but decreases as levels of arousal become intense. Newhagen and Reeves (1992) see increased stimuli intensity leading to heightened arousal, which may enhance an organism's cognitive performance, but only to a point. As stimulus intensity increases, more cognitive effort is required to integrate and adapt to conditions in the environment, a process that Norman and Bobrow (1975) call "graceful degradation" of resources, culminating in cognitive overload.

Vettehen, Nuijten, and Peeters's (2008) investigation of the appeal of sensationalist television news support this notion. They found that sensationalist features of a news story increase emotional arousal, which in turn increases the viewer's liking of the story, but only to a moderate level. Beyond that level, further increases in emotional arousal decrease the viewer's liking of the story, suggesting a limit to the effectiveness of production techniques intended to increase arousal in television. Grabe and Kamhawi's (2006) exploration of "hard wired for negative news" demonstrated that low-arousing stimuli often under-engage viewers, prompting them to ignore content, while high-arousing stimuli are likely to elicit automatic resource allocation to content. However, content eliciting extreme levels of arousing and negative valence in television presentations can lead to avoidance responses. Thus, research into emotional responses to media presentations has yielded results very similar to responses to the real world stimuli described by Hebb and others more than 50 years ago. This might not seem startling; popular parlance is filled with figures of speech such as "seeing is believing," giving credence to the idea that media images are processed as if they were real. It was not

unusual for a television viewer's first reaction to the collapse of the World Trade Center towers on Sept. 11, 2001 to be that "it looked like a movie." In fact, the 1988 film *Die Hard* starring Bruce Willis depicted a group of terrorists attacking and largely destroying a high rise building 13 years before the Sept. 11 attack. To sum up, Baudrillard's (1983) characterization of television as *hyper-real*, or "better than real," now has more than two decades of empirical support.

Within this theoretical framework, we ask the following research question:

RQ2: How will people's emotions be influenced when they receive the crime alerts on different media platforms?

The Nature of Anxiety

Anxiety as a Pre-Emotional Condition

Gray (1994) grouped the "three or four" core emotions, including anger, fear, disgust, happiness, and sadness into a "fight/approach" or "flight/avoidance" behavioral system. However, some emotional states such as nostalgia, glee, guilt, or regret, are vague and are not necessarily evoked by a clearly defined object. They do not, in themselves, lead to "approach" or "avoidance" behaviors. Indeed, these emotions belong to what Gray (1994) called a "behavioral inhibition" system, suggesting they are nascent or pre-emotional conditions. Thus, they are better defined as innate dispositional conditions rather than full-blown emotions (Newhagen, Zhong, & Xie 2009).

Frustration and anxiety eclipse all other pre-emotional conditions in contemporary society. Studies of human-computer interface show that moderate levels of frustration may increase arousal and cognitive performance to the top or "sweet spot" on Hebb's curve. To a degree, frustration can be functional. However, returning to Hebb's curve,

increasing frustration without resolution ultimately becomes maladaptive and inhibits problem solving. Bessièrè et al. (2006) reported that 30 percent of survey respondents in her study listed frustration as the emotion most associated with computer use. The study of human-computer interaction can be seen, at a psychological level, as an effort to minimize user frustration.

Anxiety, however, tops the list of dysfunctional emotional states, which many believe has reached epidemic proportions (Barlow, 2000). There is no “sweet spot” for anxiety; either it matures into a full-blown core emotion, such as fear, or recedes into background noise. The reason is that *information* about an event that may be distant in time and space, which makes defining a focal object problematic and ambiguous (Gray, 1994). This state of inhibition has also been identified as *learned helplessness* (Abramson, Seligman, & Teasdale, 1978). If people perceive themselves helpless in the face of an unstable, global, and external condition, the expectation of future helplessness will be chronic or acute and can be a precursor to clinical depression.

The Definition of Anxiety

Despite the vast array of psychological and mental problems that seem to be part of contemporary postmodern society, anxiety stands out as a primary reason people seek professional clinical psychological help (Oei, Moylan, & Evans, 1991). Anxiety, as a psycho-physiological state, is characterized by muscle tension, worry, restlessness, and uneasiness that often requires a great deal of effort and energy to manage (Wells, 1999).

The terms anxiety and fear have often been used interchangeably although they are two very different emotional states (Eysenck, 1997; Goodwin, 1986). Fear is usually regarded as an emotion with a *present* and *imminent* danger, while anxiety is a *future-*

oriented mood in which the source is unidentified (Barlow, 2000). Thus, anxiety is “driven by higher order information rather than direct exposure to a concrete object” (Newhagen, Zhong, & Xie 2009).

Many, including Spielberger (1966), Freud (1923), Goodwin (1986), and Cattell and Scheier (1962), have attempted to define anxiety in a way that would make it distinct from other emotional states. However, inconsistency among researchers using of the term “anxiety” has made agreement on those definitions difficult. McReynolds (1976) pointed out that a number of theorists have proposed conceptions of anxiety using theories based on cognition, others emphasizing personality, and yet others using social psychology. Unfortunately, there has been almost no communication among these various perspectives, although each appears to have a great deal to add and to learn from the other. Eysenck (1992) and P. J. Lang (1971, 1985) suggested that anxiety is a complex phenomenon and can be fruitfully studied from a number of different perspectives including behavioral, subjective or verbal, and physiological.

Despite the incongruence of the definitions, one point of agreement is that anxiety is a response to danger or threat with an ambiguous source. Anxiety, Freud said (1923), is a state of displeasure accompanied by a signal of danger. Grinker (1966) defined anxiety as an affect subjects have when they experience inexplicable foreboding or danger or disintegration. As anxiety mounts, subjects will decrease in psychological defense and lose control. Levitt (1980) described anxiety as “an uncomfortable feeling of danger, accompanied by overwhelming awareness of being powerless, unable to perceive the unreality of the threat” (p. 4). Barlow (2000), after reviewing the literature, concluded that at the heart of anxiety lies a sense of uncontrollability focused on future threats,

danger, or other upcoming potentially negative events. Thus, according to Barlow, helplessness and vigilance (or hyper-vigilance) are two defining characteristics of

Using factor analyses of roughly 800 previously used variables, Cattell and Scheier (1962) identified two distinct factors, trait anxiety and state anxiety. While state anxiety is transitory and varies both over time and intensity, trait anxiety is an individual difference, or proneness as a personality trait; it means that the individual is an *anxious person* (Levitt, 1980).

Anxiety has become the focus of the study of emotion, something surely driven by its alarming emergence as the most common dysfunctional clinical condition in contemporary society (Marshall, Bryant, Amsel, Suh, Cook, & Neria, 2007). As more has been learned about the condition, three distinct components of anxiety have been identified: trait, early life experience, and a trigger event.

The Three Stepping Stones to Anxiety

Three components have been identified as factors in anxiety (Barlow, 2000). It is important to understand that each component can, in isolation, account for anxiety, but that their co-presence is cumulative. Thus, the disposition to anxiety increases with the addition or presence of each component factor.

Trait or Dispositional Vulnerability

Previous studies have demonstrated three vulnerabilities relevant to the development of anxiety, the first of which is genetic and biological vulnerability. Evidence suggests that the fundamental trait of being high-strung and nervous has a genetic component and runs in families. Studies of trait anxiety, neuroticism, negative affect or behavioral inhibition also revealed a genetic component (Clark, Watson, &

Mineka, 1994). In these studies, genetic contributions to the expression of anxiety are estimated to explain 30 percent to 50 percent of measured variance (Clark, Watson, & Mineka, 1994; Trull & Sher, 1994; Zinbarg & Barlow, 1996).

Trait anxiety. Eysenck and Prell (1951), Eysenck (1956), and Shields (1968) found personality traits to have a significant genetic component. Psychological research has also established that personality variables, in particular the interaction between neuroticism and extroversion, contribute to an important vulnerability for the later development of anxiety and its disorders (Gershuny & Sher 1998). This genetic vulnerability could also influence the propensity to develop conditioned emotional responses when experiencing panic and anxiety (Mineka & Zinbarg 1996).

Shields (1968) has also found personality traits to have a significant genetic component. Strelau (1994) describes trait anxiety as primarily innate and relatively stable in life. Beatty, McCroskey, and Heisel (1998) suggested that individual differences in trait anxiety are largely genetically determined.

Alcohol consumption. Partanen, Bruun, and Markkanen (1966), in a study of the inheritance of alcohol drinking, coffee drinking, and cigarette smoking behaviors, found that, of the alcohol drinking variables, density of drinking (a combine factor of frequency and regularity) and amount of drinking showed a genetic component and significant heritability from parents. Perry's (1973) study also found that attitude towards alcohol can be ruled out as having a significant genetic component. But the amount of alcohol consumption had a significant genetic component and 56 percent of the variances in alcohol consumption could be explained by heritability.

State Anxiety and Prior Life Experience

The second vulnerability has to do with the experiences of early life. Early life experiences have been shown to predict later manifestations of anxiety and can elicit feelings of unpredictability and uncontrollability (Altman, Alberts, & Sapolsky, 1992; Sapolsky & Ray, 1989). Barlow (2000) points out that to activate the specter of an anxiety disorder, genetic personality traits must incubate in the fertile ground of early experience.

This argument was supported and extended by Marshall, et al. (2007) who found that psychopathological responses to risks may be strongly mediated by relative risk appraisal, which is “an active and multidimensional process that mediates the relation between environment events and the individual’s meaningful appraisal of them.” This model proposes that people facing risk will make use of adaptive cognitive shortcuts, or heuristics, to make a judgment for a current situation, as suggested by Tversky and Kahnemman (1974). They also found that relative risk appraisal may cause people to expect future experiences to have the same harmful outcome as past traumatic experiences; an expectation that is reinforced by re-experiencing a similar situation. In these cases risk heuristics could be maladaptive by unnecessarily increasing anxiety.

Media as the mediated early life experience of anxiety. Besides direct exposure, early life experience of trauma can be mediated as well. Television viewing of the Sept. 11 attacks has been linked to cases of Post Traumatic Stress Disorder (PTSD) in the general U.S. population (Schlenger, Caddell, Ebert, Jordan, & Rourke, 2002). Another study found that the number of hours of television coverage watched in the days after Sept. 11 was one of four factors that predicted PTSD, along with age, sex and direct

exposure (Galea & Resnick, 2005). Mass media, and increasingly new media, expose viewers and users to rare but devastating events, sometimes natural and sometimes human. One such event was the Oklahoma City bombing on April 19, 1995 when American militia movement sympathizer Timothy McVeigh, with the assistance of Terry Nichols, destroyed the Alfred P. Murrah Federal Building in downtown Oklahoma City, Oklahoma. Modern history is replete with examples, including the April 20, 1999 Columbine High School massacre in Littleton, Colorado which left 12 students and one teacher dead, and 24 injured, or the April 16, 2007 Virginia Tech massacre that took place on the campus of Virginia Polytechnic Institute and State University (Virginia in Blacksburg, Virginia. In an essay discussing the Sept. 11 attacks, Baudrillard (2002) points out that the time and place for such events cannot be predicted, nor can the motive for their execution. This, of course, makes their very possibility real but ambiguous and provides a textbook example of how such news can be a source of state anxiety.

The Trigger Event

The third component of anxiety relates to a specific object or event that triggers the onset of anxiety or depression. Frijda's (1988) laws of emotion suggest the emotional impact of a traumatic event never really wanes. On the contrary, emotions surge when stimuli resembling the original stimuli are encountered or triggered by a specific sequence of events.

After Virginia Tech shooting in April 2007, many universities across the country, especially those in the area close to Virginia Tech, adopted new strategies to alert students and faculty about emergencies in real time. Text message emergency alert systems were a natural vehicle due to the high adoption rate of cell phones among college

students. Twitter and other advances in the use of hand-held devices afford the opportunity for real time dissemination of the type of message capable of triggering anxiety.

When trait anxiety, state anxiety, and the trigger are combined, contemporary college undergraduates may be especially at risk of experiencing anxiety dysfunctional to their life.

Trait Anxiety: If a student has a genetic component disposition to anxiety, they are especially at risk.

State Anxiety: Chances are that the cohort current to this study were exposed to media coverage of the Sept. 11 attacks and Virginia Tech campus shooting. The Virginia Tech shootings should be salient to the particular members of the population from which subjects for this study were selected because they attended a university nearby and are in the same athletic conference.

Triggers: The university where the study was conducted sends the crime alerts via e-mails and cell phones under certain circumstances.

Thus, the idea that media interface can affect user anxiety can be tested across all three functional operationalizations of proximity; stationary (desktop), portable (laptop), and ubiquitous (hand-held). This suggests the following research questions:

RQ3a: Will the trait anxiety factors such as alcohol use affect users' anxiety upon receipt of crime alerts? (Trait anxiety)

RQ3b: Will mediated life experience factors, such as media exposure to the Virginia Tech shootings, affect users' anxiety upon receipt of crime alerts? (State anxiety)

RQ3c: Will a trigger event, such as the receipt of a crime alerts, affect users' anxiety? (Trigger event anxiety)

Gender, Emotion and Memory

Valence, Arousal, and Memory

Numerous studies show that valence and arousal of message content can affect recognition memory for news (Lang, Newhagen, & Reeves, 1996; Newhagen, 1998; Newhagen & Reeves, 1992), public service announcements (Lang & Friestad, 1993), and political commercials (Biocca, 1991). Generally these studies found that negative messages compel attention and enhance recognition memory. For example, Newhagen (1998) found that recognition memory is better for negative compelling television news images that evoke anger than for emotionally neutral television news images. A study about recognition of public service announcements shows that recognition memory is better for arousing messages than for calm messages (Lang, Bradley, Park, Shin, Chung, 2006). The study yielded no decrease in recognition or cognitive overload during the study. Potter (2000) detected a cognitive overload for subjects' recognition of radio messages three seconds after voice changes, but subjects remembered arousing messages more than calm messages.

In this study, the emotional valence and intensity of crime alerts are conceptualized as crime severity. High-severity crimes such as forcible rapes and robberies with gunfire are supposed to induce higher arousal among the receivers than low-severity crimes such as theft and loss of personal properties.

This suggests the following research question:

RQ4: Will the emotional valence and intensity of crime alerts measured as crime severity, affect memory?

Anxiety, Gender, and Memory

Beck and Emery (1985) report that anxious subjects recalled threatening messages better than non-anxious subjects, but subjects did not differ in their recall of nonthreatening messages. Mayo (1983) asked his subjects to recall real-life personal experiences in response to a set of words and found that neuroticism was significantly associated with the number of unpleasant memories retrieved, whether or not mood state at the time of testing was controlled. Coles, Turk, Heimberg and Fresco's (2001) experiment with subjects with generalized anxiety disorders found that anxious individuals exhibit memory biases for threat information that is specific to their domains of worry. This is consistent with the prediction of Williams, Watts, MacLeod, and Mathews (1997) that anxious individuals would be characterized by increased accessibility of threat information relevant to their concerns. Thus, we ask the following research question:

RQ5: Will trait anxiety influence subjects' memory for the crime alerts?

Perception of crime threat may be gender-specific, especially in cases of violent rape. Grabe and Kamhawi (2006) show that controlling for message intensity; men have higher recognition memory of negative news than positive news stories, while women have higher recognition memory scores for positively framed news than negatively framed news stories.

While a main effect for subject gender has been found on subject recognition, it is less clear if subject gender and crime alert victim gender would interact. This leads to the following research question:

RQ6: Will subject gender and victim gender of the crime alerts interact to affect memory of the alerts?

Gender and Emotion

Although emotion research has been prolific in the field of communication in recent years, this theory is relatively underutilized in studying the influence of demographic variables (Grabe & Kamhawi, 2006). There are studies employing social class (Grabe, Lang, Zhou, & Bolls, 2000) and age (Lang, Chung, Lee, Schwartz, & Shin, 2005; Fox, Lang, Chung, Lee, Schwartz, & Potter, 2004) as predicting variables, but gender stands underexplored as a component in the study of memory for emotion-laden news studies.

Studies in neuropsychology and psychophysiology vary in arousal manipulation stimuli, with some testing gender differences in emotional versus non-emotional stimuli, while others test gender differences only under arousing circumstances. All results clearly show that in moderately intense conditions, message emotion plays a greater role for women than men in memory for news (Grunwald, Borod, Obler, Erhan, Pick, Welkowitz, et al., 1999; Johnsen, Thayer, & Hugdahl, 1995; Thayer & Johnsen, 2000).

However, gender differences are hard to isolate when subjects are asked to evaluate serious threats to survival. In fact, at high arousal levels, negatively arousing environmental stimuli will create a ceiling effect across gender, which suggests that subjects are predisposed to flee regardless of gender (Knight, Guthrie, Page, & Fabes,

2002; Zillmann, 1983). Thus, depending on the intensity of the emotional content of a message, gender may provoke an array of outcomes. Self-report and physiological results also show that at moderate levels of arousal, negative stimuli produced gender differences in line with the so-called negativity bias hypothesis: men tend to approach whereas women tend to avoid negative stimuli (Davis & Emory, 1995; Knight, Guthrie, Page & Fabes, 2002; Miller, Danaher, & Forbes, 1986). When discussing positive a few studies demonstrated the opposite results: Men's memory is not affected by positive stimuli, while women seem to be more engaged (Ahmed & Bigelow, 1993; Fujita, Diener, & Sandvik, 1991). These studies were further supported by findings about gender differences in news consumption at moderate levels of arousal and negative valence. Grabe & Kamhawi (2006) found that women report relatively higher levels of arousal for positively framed news stories than negative stories. Men, in contrast, show greater engagement with negative stimuli and report higher arousal to negatively framed news stories than positively framed news stories.

Within this framework, we ask the following research question:

RQ7a-c: Will gender make a difference in subjects' anxiety/valence/arousal, respectively, when they receive the crime alerts?

CHAPTER 4 METHOD

Overview

This was a 2 x 3 x 2 x 2 x 2 fractionally factorial experiment. The between-subject factors included subject gender (female, male) and interface proximity (far, moderate, and near). Alert victim gender was a within-subject factor including female and male. Crime severity (high and low) was also a within-subject factor. Message (one and two) was a repeated measure.¹³ Demographic characteristics, such as age, gender, dwelling location, and years at the university were included as independent variables. Other independent variables, including questions tapping subject trait anxiety and media exposure to the April 2007 Virginia Tech campus shootings, were also measured.

¹³ This design of this experiment employed a number of strategies to ensure that any systematic variance not of theoretical interest, either within the alerts themselves or in the way they were administered, would be confounded, or randomized as error during analysis and not be confused with true variance.

Crime victim gender and crime severity, the focus of theoretical interest in this study, were the only two characteristics of the alerts that were systematically varied in message alerts. The factor *message* was included as a repeated measure to suppress the effects of any possible unmeasured attributes within a particular alert. Thus, two messages were created to satisfy each message condition in the design. For instance, one low severity message with a male victim might have described the theft of a computer owned by a male in the library, while the other might have described the theft of a bicycle also owned by a male. This strategy is particularly useful in communication and journalism research where real world stimuli are extremely complex and the research must be especially careful with some factors other than those theoretically specified that drive subject responses.

The order in which the messages were sent was randomized throughout each day, meaning subjects across all three platform groups saw different messages at different times. Different times when the subjects saw these messages and different surroundings and situations where the subjects saw these messages were also randomized.

The danger of systematic variance occurring because of some unmeasured factor in message content or administration order is that it might result in unmeasured variance being embedded in the error term of the least squares statistics employed here, and violate a critical assumption underlying the use of those statistics. The problem of systematic error in statistics such as analysis of variance and linear regression is that a significant outcome may be incorrectly attributed to the theoretical manipulation when there is none. This problem, typically called a Type I error, is considered the worst possible analytical outcome because claims may be made about the effects of the variables of interest that are unfounded. The strategies taken here are extraordinarily conservative because both the repeated measure technique and the care taken in randomization of administration order tend to inflate the error term of the statistic and, if anything, suppress evidence of true variance. This would be reflected in a reduction of the magnitude of the F statistic used as an indicator of statistical association, and increase the possibility of what is known as a Type II error. This is considered a more desirable outcome than a Type I error because in the worst case, true theoretical variance is overlooked and not reported, rather than inaccurately reporting associations that are in fact driven by some unmeasured factor.

Dependent variables included subject anxiety, memory, felt emotional valence and arousal, estimates of campus crime rates and feelings of personal safety. Latency to respond to the message alerts in minutes also was measured. Other dependent variables included feelings of personal safety, estimates of crime rates, and estimates of the likelihood of being a crime victim.

Student subjects were given a face-to-face training session four days prior to the experiment in which the emotion and anxiety scales were explained and the manner in which they were asked to respond also was explained. They filled out the first of three online questionnaires two days before the experiment, answering questions about felt anxiety, current emotional state, measured as valence and arousal, feelings of personal safety, and estimates of crime rates and the likelihood of being a crime victim.¹⁴

Subjects were assigned to receive the messages on one of three computer interfaces, desktop (stationary), laptop (portable), and hand-held (mobile), based on the use of those three devices they reported in the screening questionnaire. Subjects were assigned to the media platform group they used most frequently to monitor messages. They received a total of eight crime alerts, fashioned to resemble alerts used by the university police, over two days. Subjects in the desktop and the laptop groups received the alerts through e-mails and were asked only to use the desktop or the laptop computer to check their e-mails during the experiment. Subjects in the hand-held group received the alerts via text messages. All subjects were asked to reply to the messages as soon as they received them, reporting felt anxiety and emotion by responding to the messages using the device on which they received them. Subjects' felt anxiety, valence and arousal

¹⁴ See Appendix A for a complete first questionnaire.

were measured again at the end of the first day in the second questionnaire¹⁵. At the end of the two-day period subjects filled out a third questionnaire asking about felt anxiety, valence, arousal, and other characteristics including their memory of the alerts, trait anxiety, state anxiety, estimates of crime rates, media exposure, etc.¹⁶

During the study subjects were asked to assess their current emotion, measured by valence and arousal by referring to a pictorial SAM scale provided to them prior to the experiment, as soon as they read the messages. They also reported their felt anxiety on a 5-point Likert-like scale.

This study was implemented as a field experiment rather than an experiment confined to a laboratory to increase the ecological validity or the “realism” of the study. The main difference between the two approaches is the setting of the experiment. In a lab experiment, subjects come to an artificial laboratory setting, while a field experiment allows subjects to function normally in their everyday social roles with little investigator interference or environmental restructuring (Westley, 1986). The major advantage of field experiments is their external validity, since study conditions closely resemble natural settings in which subjects usually reflect “a truer picture of their normal behavior situation and are not influenced by the experimental situation” (Wimmer & Dominick, 2006, p.245).

This chapter will give a detailed description of the participants, the materials, the design and the procedure and the measurement in the questionnaires.

¹⁵ See Appendix B for a complete 2nd questionnaire.

¹⁶ See Appendix C for a complete 3rd questionnaire.

Materials

Stimuli Creation

The stimuli used in this study were based on the crime alerts transmitted to student in the academic year of 2007 – 2008¹⁷. For ethical and safety purposes, stimulus messages included a tag identifying them as part of the study to ensure students would not confuse them with actual alerts. The stimuli were about 50 to 100 words, and effort was taken to make them appear as much like real alert messages as possible.

Victim gender and the severity of the crime were systematically varied among the stimulus messages to reflect the study design. High severity was operationalized as crimes where the victim was present, and the crime was life-threatening. Such crimes included those with firearms, sexual assaults, strong arm robberies, and house break-ins where the victim was present. Low severity was operationalized as crimes committed when the victim was not present, and were not life-threatening, such as the theft of a computer or wallet.

Message Selection

The first step in the process was the selection of 32 crime alerts. These alerts had been sent to the students in the academic year of 2007-2008. The topics of the stimuli alerts were selected using two criteria: they contained compelling information and they covered different topic materials to guard against the effect of any particular crime category. Crime topics included sexual assault, strong arm robbery involving firearms,

¹⁷ The alerts used in this study were based on actual recent alerts and regularly seen by students. That is, the stimulus did not include any material that would cause psychological distress beyond the alerts and crime reports distributed to the students by campus security officials, or typical crime reports seen or read in main stream media on a daily basis.

house break-in, loss of personal properties, and other thefts. Each alert then was rewritten to resemble a news story, varying the gender the victims and severity of the crimes.

All 32 messages were printed on separate sheets of paper along with a pencil-and-paper version of Self-Assessment Manikin (SAM) pictorial scale used to measure emotion (Bradley & Lang, 1994; Hodes, Cook, & Lang, 1985) (For details, see Appendix D). A total of 18 undergraduate students (10 women and eight men, with an average age of 20) rated the messages. The order of all of the messages was randomized.

Message valence and intensity were measured using the SAM rating system (see Appendix D). SAM was designed to represent a range of emotional responses along valence and arousal dimensions using five figures for each dimension. The valence dimension depicted a figure that ranged from *happy* to *unhappy*. The corresponding SAM figures ranged from a smiling face to a frowning face. The arousal dimension ranged from *calm* to *excited*, ranging from having an inactive body and closed eyes to having an active body and open eyes.¹⁸

Anxiety was also measured on a five-point Likert scale, ranging from *not anxious at all* to *very anxious*.

Scoring

Repeated-measures analysis of variance was used to rank the messages on severity and victim gender, the two embedded manipulations. Both crime severity, $F(1, 17) = 45.27, p < .001, \eta^2 = .73$ and victim gender, $F(1, 17) = 8.05, p < .01, \eta^2 = .32$, were statistically significant predictors of rater anxiety.

¹⁸ There is a third dimension, not shown in Appendix I, but included in the full SAM scale, measuring feelings of dominance in reaction, with SAM figures ranging from *small in size* (controlled) to *large* (in control).

The four messages with the highest and lowest mean anxiety scores in each condition were chosen from the pool, for a total of 16 messages to be used in the experimental stimulus. The cutoff mean for the lower boundary for high severe crimes was 3.5 or above, and the cutoff mean for the upper boundary for low severe crimes was 2 or below, where 1 represented “this message doesn’t make me feel anxious at all” and 5 represented “this message makes me feel very anxious.” Appendix E contains a complete listing of the four conditions and the 16 messages used in this study with the means and standard deviations.

Pilot Study: Protocol Testing

Purpose

The purpose of the pilot study was to test the entire protocol and the implementation of the experiment for its feasibility.

Participants

Thirty undergraduate students (16 women and 14 men) enrolled in a business course in a large mid-Atlantic research university participated in the study. They received 2 extra credits for their participation. Their ages ranged from 19 to 25 with a mean of 20.10 (SD = 1.87).

Design and Procedure

The pilot study was conducted in December 2008. In a screening questionnaire, the students were asked about their usage of desktop and laptop computers and hand-held devices. The 30 students were then assigned into one of the three device groups based on their usage habit. The desktop group had nine people, with four male students and five female students. The laptop group had 11 people, with six male students and five female

students. The desktop group had 10 people, with five male students and five female students.

For the desktop and the laptop groups, messages were sent by the investigator to subjects' e-mail accounts. For the hand-held group, messages were sent out through text messages instead of e-mails since only 3 people were using hand-held devices to check e-mails.

The investigator gave the participants a training session individually before the study and explained the ethical issues, including the purpose and the procedure of the study to the students. The University's Internal Review Board (IRB)-approved consent form was presented and signed during the training session.

The subjects received four messages per day for two days. The four messages were sent in the early morning, the early afternoon, the evening, and late at night each day. They also received links to three online questionnaires through e-mails on the day before the study, at the end of the first day, and at the end of the second day. Subjects' valence, arousal, and anxiety were measured in each questionnaire. The third questionnaire also included the demographic information and asked the subjects the following questions: How do you think of the length of the study?¹⁹ How do you think of the number of the messages you have received?²⁰ And generally, how anxious do you feel about these alerts?²¹

¹⁹ This question was measured based on 5-point Likert scale: 1= *Too short*; 2= *A little short*; 3= *Appropriate*; 4= *A little long*; 5= *Too long*.

²⁰ This question was measured based on 5-point Likert scale: 1= *Too few*; 2= *A little few*; 3= *Appropriate*; 4= *A little many*; 5= *Too many*.

²¹ The 5-point Likert scale for felt anxiety was: 1 = *Not anxious at all*; 2= *Little anxious*; 3= *Somewhat anxious*; 4= *Quite anxious*; 5= *Extremely anxious*.

Results

Students' felt anxiety at the end of the study ($M = 2.10$, $SD = .68$) was higher than that before the study ($M = 1.71$, $SD = .64$) ($t(30) = 2.334$, $p < .05$).

Subjects' felt valence was more negative at the end of the study ($M = 2.71$, $SD = .74$) than that before the study ($M = 2.32$, $SD = .87$) ($t(30) = 1.882$, $p = .05$).

Subjects' felt arousal at the end of the study ($M = 2.75$, $SD = .68$) was higher than that before the study ($M = 2.20$, $SD = .82$) ($t(29) = 2.01$, $p = .05$).

In terms of subjects' feelings about the study, 27 out of 30 people felt the two-day study was "appropriate," while 3 people felt it was "too long." Twenty-six out of 30 students felt the amount of the messages they have received was "appropriate" and 3 thought it was "too many," and 1 thought it was "a little few." Fifteen people felt those crime alerts made them "somewhat anxious," 8 felt "quite anxious," 4 felt "little anxious," and 3 felt "not anxious at all."

Formal Experiment

Participants

A total of 97²² students (56 women and 41 men) enrolled in different colleges and departments in a large mid-Atlantic research university were recruited to participate in the formal experiment. The course instructors of different departments disseminated the information of the experiment in class and called for the voluntary participation of the students. Participants were undergraduates (23.5 percent of freshmen, 21.4 percent sophomores, 27.6 percent juniors, 24.5 percent seniors, 3 percent unidentified). The age

²² One subject didn't finish the post-test questionnaire. However, he/she successfully replied to all of the messages. Thus, his/her message data were used, but his/her questionnaires were excluded from the analysis.

range was 18 to 22 ($M = 20.65$, $SD = 3.00$). All 97 of the initial recruits actually took part in the experiment.

Fifty of the participants received extra credit in a course not related to the experiment. The other 47 subjects received \$20 in compensation for participation.²³

The student subject pool was not drawn because of its convenience for to researcher. College students were selected because as the early adopters of new technology, they have shown the highest incidence rates of cell phone usage and mobile content adoption and are the focal group that we are interested in. Research shows that college students with jobs consume more mobile content than any other group, and are 42 percent more likely to use mobile e-mail than the average subscriber (Becker & Hanley, 2008).

Furthermore, the purpose of this study is to examine the effects of the campus crime alerts on the college students in the context of the wide execution of the emergency alert system in many universities across the country after the Virginia Tech campus shootings. Virginia Tech is part of the University's athletic conference and geographically nearby. These facts should have increased the chance that the event would represent an important factor in subjects' anxiety. Of equal importance was the fact that the university, like many others, had initiated an alert system in the wake of the Virginia Tech shootings. Thus, the student population had already had the experience of receiving crime alerts.

²³ Analysis of Variances did not show statistically significant differences on the key dependent variables between the two groups.

Design and Procedure

The formal experiment was done in April 2009. The 97 student participants were assigned to one of the three device groups based on their self-reported computer usage. That is, students most likely to read alert messages on a desktop computer were assigned to the desktop group, etc. The desktop group had 26 people, with 12 male students and 14 female students. The laptop group contained 35 people, with 16 male students, and 19 female students. The mobile group had 36 people, with 17 male students and 19 female students.

The investigator gave each participant a face-to-face training session individually three days before the study and explained the purpose of the study, what they needed to do in the study, the SAM pictorial scale, the way in which they would receive the alerts and how to respond to them. They were told that the participation was voluntary, and they could choose not to participate at all or stop at any time during the experiment without being penalized or losing any benefit. The link to the online consent form was e-mailed to students the day before the study. Students then signed the online consent form that had been approved by IRB and were directed to the first questionnaire. Appendix F contains the online consent form. After they filled out the third questionnaire at the end of the study, they were directed to an exit webpage with the contact information of the investigator. This exit page gave a detailed description of the purpose and the design of the study. The subjects were also told that they were welcome to contact with the investigator if they were interested in the results of the study. Appendix G contains the exit webpage after the third online questionnaire.

The subjects received four messages per day for two days. The four messages were sent in the early morning, the early afternoon, the evening, and late at night each day. Both of the desktop and laptop groups received the messages from the investigator through e-mails. The hand-held device group received the messages through text messages. The reason was that, based on the subjects' self-report of their media use behavior in the screening questionnaire, only five people out of 97 used their hand-held devices to check e-mails. However, most subjects were using the hand-held devices to send or receive text messages. Subjects were required to reply to the alerts as soon as possible using the SAM and felt anxiety scales.

The subjects received a second online questionnaire the end of the first day measuring cumulative felt anxiety, valence and arousal. They then received a third online questionnaire at the end of the study on the second day. The links of the online questionnaires were sent to the subjects through e-mails.

Both of the first and the third questionnaires measured students' general anxiety level, state anxiety, arousal, valence, feelings of personal safety, and their estimates of actual campus crime rates as well as their possibility of being a victim in those crimes.

The third questionnaire also included questions about a) students' trait anxiety; b) their alcohol consumption; c) parents' alcohol consumption; d) exposure to the media coverage of Virginia Tech campus shootings; e) memory of the crime alerts; and f) demographics.

The questionnaire at the end of the first day only measured students' felt anxiety level, arousal, and valence.

Measurement

General anxiety level was measured by asking the question: “How anxious do you feel now?” on a 5-point Likert scale ranging²⁴. Subjects’ felt anxiety level was measured before, during, and after the study.

Arousal and valence were measured based on a 5-point Likert scale using SAM pictorial scale ranging from 1 (*Very calm/positive*) to 5 (*Very excited/excited*), as shown in Appendix C. Subjects’ arousal and valence were also measured before, during, and after the study.

State anxiety: State anxiety was measured using the State-Trait Anxiety Inventory (STAI) (Spielberger, Gorsuch & Lushene, 1970). The STAI has been a widely used measure instrument in anxiety research. It consists of separate self-report scales for measuring state and trait anxiety. The state anxiety scale consists of twenty statements that evaluate how respondents feel “*right now, at this moment.*” It contains the questions such as “I feel tense”; “I feel upset”, “I feel nervous”, etc. For the purpose of this study, only the 10 most salient questions were used. Appendix H consists of a complete list of the state anxiety inventory. Subjects’ state anxiety was measured in both of the first and the third questionnaires.

Latency to response: Latency to response is a widely accepted measure of mental effort (Zechmeister & Nyberg, 1982). In this study, latency time of response to each message was calculated as *the time when the investigator received the response from the subjects minus the time when the investigator sent out the message*. The latency times were calculated in minutes.

²⁴ The 5-point Likert scale for felt anxiety was: 1 = *Not anxious at all*; 2= *Little anxious*; 3= *Somewhat anxious*; 4= *Quite anxious*; 5= *Extremely anxious*.

After all latency times were collected, data were evaluated for unusually long response time and outliers were transformed²⁵. See Appendix J for a list of the cutting-off points for each platform group.

Memory: The study included a cognition task used to test memory. Eight multiple-choice questions, one from each message, were created, with four varying crime severity and four varying victim gender. For example, for a question testing subjects' memory of a high severity crime, a low severity crime was created as a false choice. For a question testing subjects' memory of victim gender, the opposite gender was listed as a false choice. The answers to the memory questions were coded as 0 (false) and 1 (correct). Subjects' memory was only measured in the third questionnaire after the study.

Feelings of personal safety: One question was asked about feelings of personal safety: "How safe do you feel when walking alone after dark on or around campus?" Subjects' feelings of personal safety were measured in both of the first and the third questionnaires.

Estimates of crime rates: Subjects were asked to estimate actual campus crime rates in the preceding year: forcible rape, assault with weapons, housebreak-ins, and theft. Subjects' estimates of crime rates were measured in both of the first and the third questionnaires. Actual rates were available on a university security Web page.

²⁵ The assumption was made that usually large response time indicated that the subjects didn't perform the task according to instructions, that is, to monitor the e-mails/text messages and respond to them as soon as they could.

To transform the outliers, the sample was split into three groups based on which device they used. Then the mean response time for each message were calculated for each device group. A total of 95% of the response times were within one standard deviation. Therefore, the response time one standard deviation or more above the group mean were replaced by the score of group means plus one standard deviation. Seconds were transformed to minutes.

Trait anxiety was also measured using the State-Trait Anxiety Inventory (*STAI*) (Spielberger, Gorsuch, & Lushene, 1970). The trait anxiety scale in this inventory consists of twenty statements that assess how people *generally* feel, such as “I am a happy person,” “I am a steady person,” etc. For the purpose of this study, the 10 most salient questions were used. Appendix I contains a complete list of the trait anxiety inventory.

Media exposure to Virginia Tech campus shootings in April 2007 was measured by asking students’ newspaper reading and TV viewing of Virginia Tech campus shootings during the first week after the event.

Family history of anxiety is an indicator of trait anxiety, and was measured by asking subjects’ to estimate their own and their parents’ alcohol consumption.

Demographics include their age, gender, years in school, and residence.

CHAPTER 5 RESULTS

The dependent variables in this study included anxiety, measured as state anxiety, anxiety reported at the end of the first day and at the end of the study, and emotional valence and arousal reported upon alert receipt. Other dependent variables included latency time for response to the alerts, memory for the crime alerts, feelings of personal safety, estimates of the likelihood of being a crime victim, and estimates of the crime rates.

The independent variables included media platform proximity²⁶, subject gender, anxiety reported at the beginning of the study, trait anxiety, measured by a standard trait anxiety inventory scale and by subject's self reported alcohol consumption, and media exposure to the April 16, 2007 Virginia Tech shootings.

The following statistical procedures were employed to analyze data:

Repeated measure analysis of variance was used to examine the influences of between-subject factors (media platform and subject gender) and within-subject factors (victim gender and crime severity) and their interaction effects on subjects' self-report of

²⁶ Relationships are displayed listing media platform proximity (far, moderate, and near), operational functionality (stationary, portable, and ubiquitous), and device name (desktop, laptop, and hand-held). This was done because it is important to keep in mind that *proximity*, conceptualized as the distance between the media platform and the message receiver is the overarching focal concept of this study. Proximity corresponds to the levels of operational functionality described as *stationary*, *portable*, and *ubiquitous*. Those levels of functionality are then actualized as a *device*, described as a desktop computer, a laptop computer, and hand-held devices, respectively.

A clear distinction has to be made between the conceptual and operational descriptions of the media platforms, and has to do with the fact that the three dimensions of proximity, time, distance, and psychological salience are isomorphic. This encourages the reification of *device* as an abstract concept rather than as a physical object. Thus, a media platform categorized as *far* is usually *but not always* a desktop computer. In some circumstance, such as the case of a doctoral candidate laboring over a desktop computer day and night to complete her dissertation, the platform may be functionally *near*. Similarly, an undergraduate spending the evening watching the university basketball team play its rival on television might have an active hand-held device on the coffee table during the game. For that period, then, the hand-held device might be considered as *stationary* as the desktop computer located next to the television set. It is for this reason that the *operational functionality*, for each level of proximity is specified. With that distinction in mind, exceptions can be found to the operational association of certain media devices to their proximity to the user, but they are just exceptions. People do not generally move through the day with a desktop computer in tow, nor do they generally opt to leave a hand-held device in one location.

anxiety/valence/arousal to each single alert. Latency time of response and memory for the crime alerts will also be analyzed using the same strategy.

Hierarchical regression analysis was used to examine the influences of the genetic component, media exposure and the trigger on anxiety/valence/arousal.

Principle component analysis (PCA) was performed with the state/trait anxiety inventory variables, subject and parent alcohol consumption. Variable loading scores for factors with eigenvalues equal to or greater than one will be used to create index variables which can, in turn, be used in hierarchical regression analysis testing the effects of trait anxiety, media exposure, and current felt anxiety on appropriate dependent variables.

Paired-samples t test was used to compare the differences in anxiety, arousal, valence, feelings of personal safety, estimates of the likelihood of being a crime victim, and estimates of crime statistics before and after the study to explore the cultivation effects of the crime alerts.

General linear model univariate analysis of variance was used to examine the effects of media platform and subject gender on subjects' differences in anxiety, arousal, feelings of personal safety, and estimates of crime statistics at the beginning and end of the study.

Anxiety Reported upon Alert Receipt

There was a main effect for media platform on subject anxiety reported upon alert receipt, $F(2, 85) = 7.95$, $p < .001$, $\eta^2 = .16$. Scheffé's post hoc tests showed that subjects reported being more anxious when they received the alerts on hand-held devices and laptop computers ($M=2.98$) than when they received the alerts on desktop computers

($M=2.37$). However, no significant difference was detected between the hand-held group and the laptop group.

There also was a main effect for subject gender, $F(1, 85) = 6.45$, $p < .01$, $\eta^2 = .07$. Anxiety reported upon alert receipt by female subjects ($M=3.14$) was higher than for men ($M=2.47$). Crime severity also had a main effect on subjects' anxiety, $F(1, 85) = 295.97$, $p < .001$, $\eta^2 = .75$, where anxiety reported upon alert receipt for high-severity crimes ($M=3.42$) was greater than anxiety reported upon alert receipt for low-severity crimes ($M=2.15$).

Figure 1a shows a two-way interaction between crime severity and media platform, $F(2, 85) = 3.42$, $p < .05$, $\eta^2 = .07$. Anxiety reported upon alert receipt for low-severity crimes received on desktop computers ($M=1.58$) was less than anxiety reported upon alert receipt for low-severity crimes received on laptop computer ($M=2.45$), and anxiety reported upon alert receipt for low-severity crimes received on hand-held devices ($M=2.43$). However, when crime severity was high, the desktop group still had the lowest anxiety reported upon alert receipt, but the gap between the three groups narrowed.

Figure 1a Anxiety Reported upon Alert Receipt Predicted by Media Platform and Severity

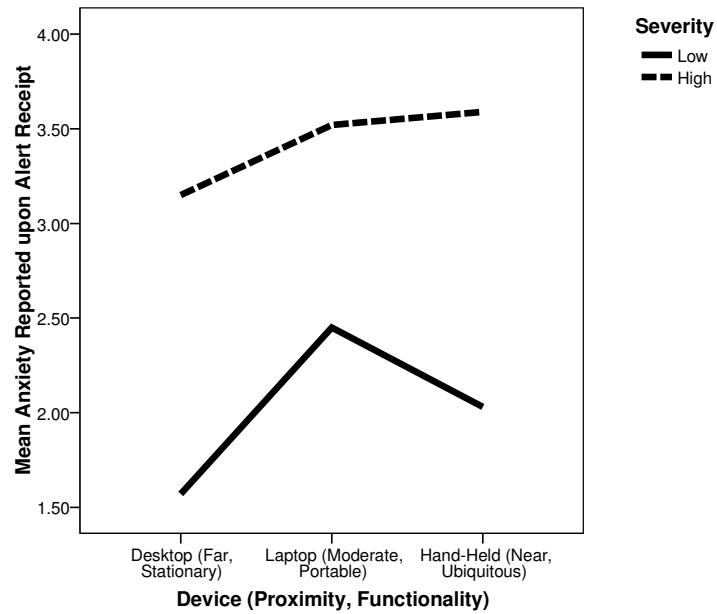
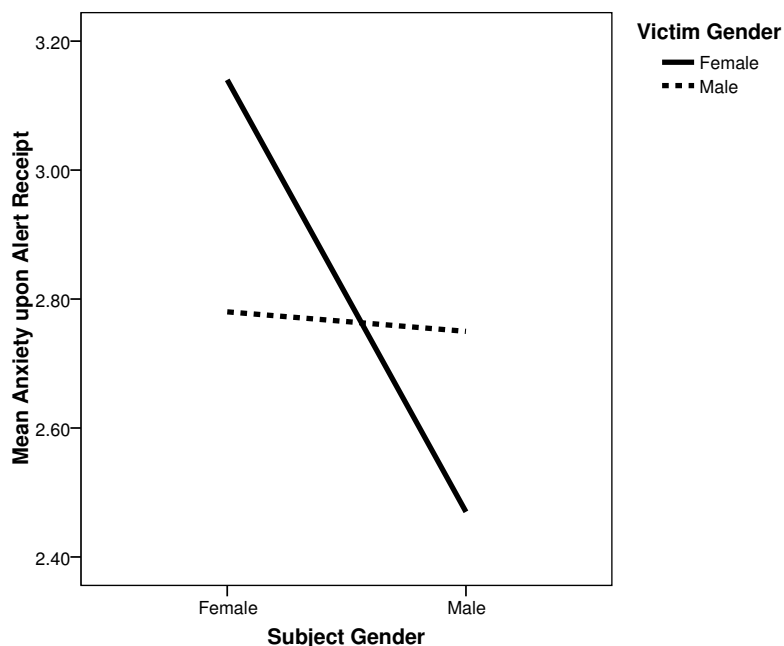


Figure 1b shows an interaction between anxiety reported upon alert receipt, subject gender, and victim gender, $F(2, 85) = 18.06, p < .001, \eta^2 = .32$. Female subject anxiety reported upon alert receipt ($M = 3.14$) was higher than that for males ($M = 2.47$). No significant difference was found for male subject anxiety.

Figure 1b Anxiety Reported upon Alert Receipt Predicted by Subject Gender and Victim Gender



To summarize, anxiety reported upon alert receipt was generally low for low-severity alerts across all media platforms and high for high-severity alerts. However, anxiety reported upon alert receipt for desktops was especially low for low-severity crimes, and continued to be below anxiety levels reported for high-severity crimes received on other media platforms.

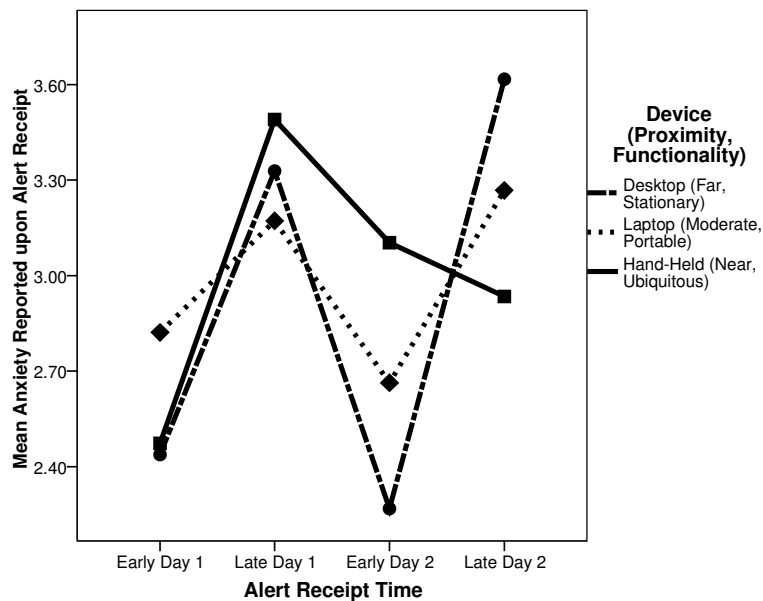
Anxiety Reported upon Alert Receipt and Time of Receipt

To examine the time effect of the crime alerts across the study, mean anxiety scores were calculated representing anxiety reported upon alert receipt early during day one, late during day one, early during day two, and late during day two.

Figure 2 shows the interaction between time and media platform on anxiety reported upon alert receipt, $F(3, 249) = 6.77, p < .001, \eta^2 = .14$. Although the desktop, laptop, and hand-held groups all reported a significant increase in anxiety ($M = 3.33$; $M = 3.17$; $M = 3.49$, respectively) on late day one, anxiety reported upon alert receipt for

the laptop (M=2.66) and desktop groups (M=2.67) significantly decreased in early day two. This suggests an “overnight effect” of the crime alerts on these two groups where anxiety ratings the next morning were lower. The hand-held group, however, still reported a high level of anxiety upon alert receipt (M= 3.10) on early day two.

Figure 2 Anxiety Reported upon Alert Receipt Predicted by Time and Media platform



Felt Anxiety at the End of the Study

Theory suggests three sources of vulnerability to anxiety: trait, media exposure, and trigger event anxiety. The strategy for this set of tests is to first examine the influence of trait factors, measured by using a standard trait anxiety inventory and self-reported alcohol consumption. The next step is to see if media exposure to the Virginia Tech shooting made a difference in subjects’ self-reported felt anxiety at the end of the study.

The last step is to see if the crime alerts represented a “trigger,” that would further increase subject felt anxiety at the end of the study.

To accomplish this goal, index variables were created using factor loading scores for the trait and state anxiety inventories, as well as for subjects’ self-report of their own and their parents’ alcohol use. Both have been found to be a reliable indicator of trait anxiety.

Table 3 shows three factors with eigenvalues greater than one. The first factor, called “anxiety,” had an eigenvalue of 2.50 and explained 25.03 percent of the total variances. The other two factors were named “calmness” and “steadiness,” and had eigenvalues of 2.44 and 1.79 respectively. They explained 24.44 percent and 17.93 percent of the variances, respectively. The reliability test showed the Cronbach’s alphas ranged from .70 to .82 for the three factors. Table 3 shows factor loadings for each factor. The four items of the first component were used to build a new index variable for state anxiety by multiplying each item score by its factor loading score and summing the results.

Table 4 shows the three components that were extracted from trait anxiety using principal component analysis with quatimax rotation method. The first component, anxiety, had an eigenvalue of 2.36 and explained 26.19 percent of the total variances. The second component, calmness, contained four items and had an eigenvalue of 1.61. The third component was called compliance and had an eigenvalue of 1.35. The second and the third component explained 17.85 percent and 14.97 percent of the variances, respectively. The reliability coefficients of Cronbach’s alpha ranged from .68 to .80 for the three components. For the purpose of this study, only the first component was used.

Therefore, a new index of trait anxiety was built by multiplying the item scores and their factor loadings on the first component.

Table 5 shows one factor was extracted from the subjects' and their parents' alcohol consumption using principal component analysis. The eigenvalue was 1.65 and the single factor explained 55.06 percent of the whole variances. A new index named alcohol consumption was then built based on the item scores and their factor loadings.

Table 3
*Factor Analysis of State Anxiety Inventory*²⁷

Variable	Factor Loadings ²⁸		
	Anxiety	Calmness	Steadiness
I feel tense now.	.893		
I feel strained now.	.892		
I feel upset now.	.735		
I feel nervous now.	.766		
I feel relaxed now.		.941	
I feel comfortable.		.768	
I feel calm now.		.721	
I feel steady now.			.931
I feel pleasant now.			.542
I feel secure now.			.423
Percent variance explained	25.03	24.44	17.93
Eigenvalue	2.50	2.44	1.79

²⁷ Quatimax rotation was employed for the final solution

²⁸ Factor loadings above .40 are reported

Table 4
*Factor Analysis of Trait Anxiety Inventory*²⁹

Variable	Factor Loadings ³⁰		
	Anxiety	Calmness	Compliance
I am a nervous person.	.856		
I always worry too much.	.700		
I am always in a state of tension.	.649		
I wish I could be happy as others.	.574		
I am a steady person.		.836	
I always feel secure.		.729	
I am a calm person.		.553	
I am a rested person.		.545	
I am a pleasant person.			.814
I am easy to be satisfied.			.618
Percent variance explained	26.19	17.85	14.97
Eigenvalue	2.36	1.61	1.35

Table 5
*Factor Analysis of Alcohol Consumption*³

Variables	Factor Loadings ⁴
	Alcohol Consumption
How much alcohol do you consume per week?	.500
How much alcohol does your father consume?	.822
How much alcohol does your mother consume?	.895
Percent variance explained	55.06
Eigenvalue	1.65

²⁹ Quatimax rotation was employed for the final solution

³⁰ Factor loadings above .50 are reported

Hierarchical regression analysis was performed to examine the influence of the three vulnerabilities of anxiety on subjects' anxiety reported at the end of the study. Subjects' anxiety reported on a five-point Likert scale at the end of the study served as the dependent variable. The index variables, reflecting the genetic component of anxiety, included trait anxiety and alcohol consumption and were entered into the regression as the first block. The second block included subjects' report of media exposure to the Virginia Tech shootings. The anxiety trigger event, measured as the subjects' anxiety at the end of the first day, was entered as the third and final block.

The full model was statistically significant, $F(5, 83) = 6.52, p < .001$. Table 6 shows the first block, the genetic component, accounted for 19 percent of total variance, $F(2, 82) = 6.04, \Delta R^2 = .19, p < .001$. Trait anxiety index had a positive relationship with subjects' felt anxiety at the end of the study, $t(82) = 2.66, \beta = .25, p < .001$. The second block, media exposure was also significant, accounting for 7 percent of total variance, $F(2, 80) = 3.64, \Delta R^2 = .07, p < .05$. The more the television coverage of Virginia Tech shootings subjects reported watching, the more anxious they felt at the end of the study, $t(82) = 2.64, \beta = .27, p < .01$. The third block, anxiety at the end of the first day, accounted for an additional 8 percent of total variances explained at the end of the study, $F(1, 79) = 9.48, \Delta R^2 = .08, p < .01$.

To summarize, all of the three vulnerabilities of anxiety had an influence on subject anxiety at the end of the study.

Table 6

Anxiety Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the First Day.
Hierarchical Regression (N=96)

Variables entered and step Number	Beta ³¹	R ²	R ² increment
1. Trait anxiety Index Score	.25**		
Subject self reported alcohol consumption	.13	.19	.19***
2. Newspaper reading of Virginia Tech shooting	-.08		
TV viewing of Virginia Tech shooting	.27**	.26	.07*
3. Anxiety reported at the end of the first day	.30**	.34	.08**

³¹ Beta coefficient for variable at final step.
 * p < .05; ** p < .01; *** p < .001.

Valence of Subject's Self-Reported Emotion upon Alert Receipt

Crime severity had a significant main effect on subject valence reported upon alert receipt, $F(1, 85) = 183.58, p < .001, \eta^2 = .68$. High crime severity made subjects report they felt more negative ($M = 4.04$) than for low crime severity alerts ($M = 3.17$).

Figure 3a shows an interaction between severity and subject gender, $F(1, 85) = 5.11, p < .05, \eta^2 = .06$, where female subjects' emotional valence reported upon alert receipt ($M = 3.31$) was more negative than males ($M = 3.03$) when crime severity was low. No significant difference was detected when crime severity was high.

Figure 3a Valence Reported upon Alert Receipt Predicted by Subject Gender and Severity

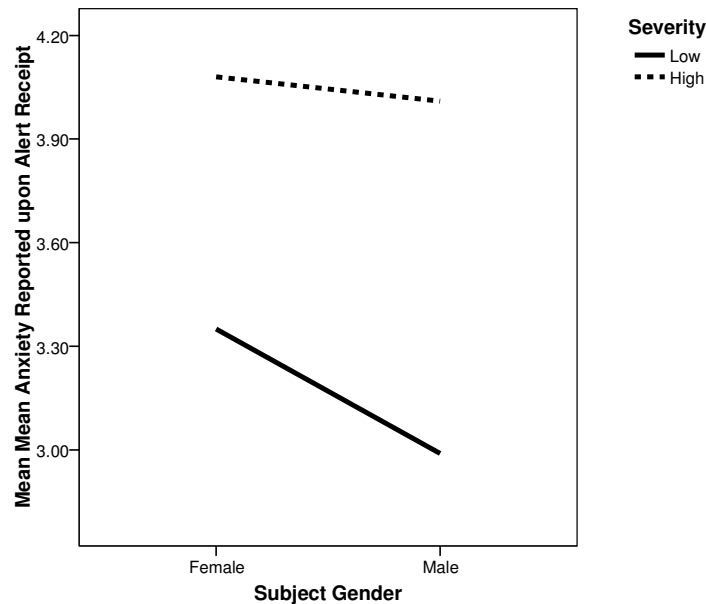
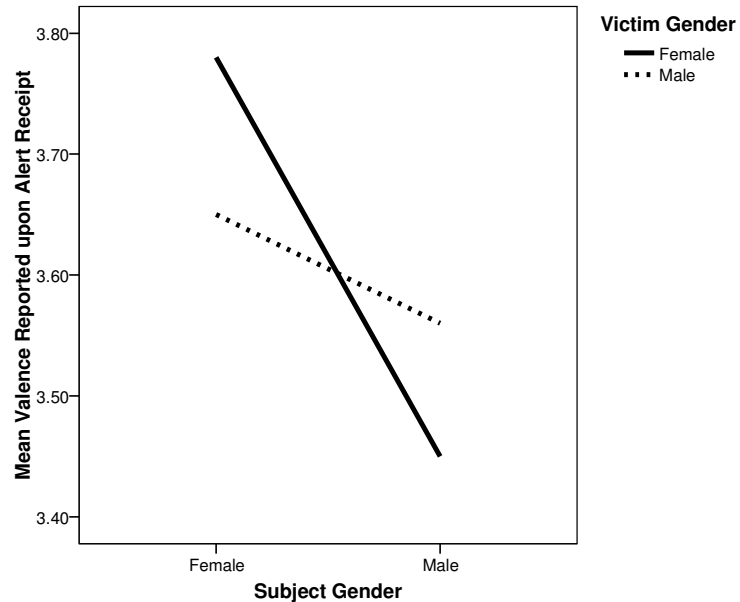


Figure 3b shows an interaction between subject gender and victim gender, $F(1, 85) = 6.83, p < .01, \eta^2 = .07$. Female subjects' valence was more negative when crime victim was female ($M = 3.78$) than when crime victim was male ($M = 3.65$). However, male

subjects' valence was more negative when crime victim was male (M= 3.56) than when crime victim was female (M= 3.45).

Figure 3b Valence upon Alert Receipt Predicted by Subject Gender and Victim Gender



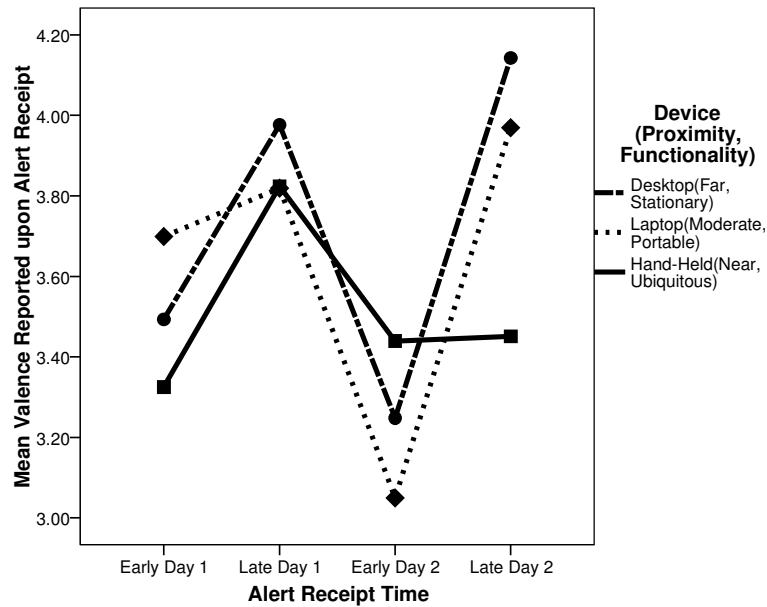
To summarize, valence reported upon alert receipt was generally less negative for low-severity alerts across all media platforms and increased for high-severity alerts. However, valence reported upon alert receipt for men was especially low when crime severity was low and when the victim was female,

Emotional Valence Reported upon Alert Receipt and Time of Receipt

Figure 4 shows an interaction between time and media platform on valence reported upon alert receipt, $F(6, 243) = 4.24, p < .001, \eta^2 = .10$. Although all three platform groups reached their most negative valence value reported upon alert receipt ($M_{desktop} = 3.98; M_{laptop} = 3.82; M_{hand-eld} = 3.82$) in late day one, for the desktop and the laptop group, subjects' valence reported upon alert receipt ($M_{desktop} =$

3.15; $M_{laptop} = 3.05$) decreased to the most positive valence level at the beginning of the second day and didn't increase to the highest level again until the end of day two. However, for the hand-held group, subjects' valence reported upon alert receipt ($M=3.51$) was still highly negative at the beginning of day two.

Figure 4 Valence Reported upon Alert Receipt Predicted by Time and Media Platform



To summarize, an “overnight effect” was detected for valence reported upon alert receipt for the desktop and the laptop groups, but not for the hand-held group, a pattern similar to that detected with anxiety reported upon alert receipt across time.

Valence Reported at the End of the Study

Hierarchical regression analysis was employed with subject valence reported at the end of the second day as the dependent variable, the same strategy as that used to analyze anxiety reported at the end of the study. The genetic component of anxiety, including trait anxiety inventory and subjects' self-reported alcohol consumption, was

entered into the first block of the independent variables. Early life experience, measured by inquiring subjects' newspaper reading and TV viewing of Virginia Tech shooting, was entered the second block. Subjects' anxiety at the end of the study was entered into the third block as a measure of the effects of the trigger - the alerts.

The full model was significant, $F(5, 84) = 4.55, p < .001$. Table 7 shows that the genetic component of anxiety, predicted 17 percent of total variance in self-reported emotional valence reported at the end of the second day, $F(2, 82) = 8.10, \Delta R^2 = .17, p < .001$. Subjects with higher trait anxiety reported more negative valence at the end of the study, $t(82) = 3.34, \beta = .33, p < .001$. Media exposure to Virginia Tech shooting also significantly predicted valence at the end of the study, $F(2, 80) = 2.89, \Delta R^2 = .06, p < .05$, accounting for 15 percent of the total variances of the model. The more newspaper accounts people read about Virginia Tech shooting, the more negative their valence was at the end of the study, $t(82) = 2.31, \beta = .25, p < .05$.

Table 7

Valence Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the Study.
Hierarchical Regression (N=96)

Variables entered and step Number	Beta ³²	R ²	R ² increment
1. Trait anxiety Index Score	.33 ^{***}		
Subject's self reported Alcohol consumption	.10	.17	.17 ^{***}
2. Newspaper reading of Virginia Tech Shooting	.25 [*]		
TV Viewing of Virginia Tech Shooting	.12	.23	.06 [*]
3. Anxiety reported at the end of the study	.06	.24	.01

³² Beta coefficient for variable at final step.
^{*} p < .05; ^{**} p < .01; ^{***} p < .001.

Emotional Arousal Reported upon Alert Receipt

Crime severity was found to have a main effect on emotional arousal reported upon alert receipt, $F(1, 85) = 147.58, p < .001, \eta^2 = .64$. Subjects were significantly more aroused ($M = 3.60$) when crime severity was high than when crime severity was low ($M = 2.67$). Figure 5 shows an interaction between subject gender and victim gender on arousal reported upon alert receipt, $F(1, 85) = 37.45, p < .001, \eta^2 = .31$. Female subjects reported higher arousal upon alert receipt ($M = 3.30$) than men ($M = 2.95$) when the crime victims were female. However, when the victims were male, male subjects' reported arousal ($M = 3.20$) was higher than female subjects' ($M = 3.08$).

Figure 5 Arousal Reported upon Alert Receipt Predicted by Subject Gender and Victim



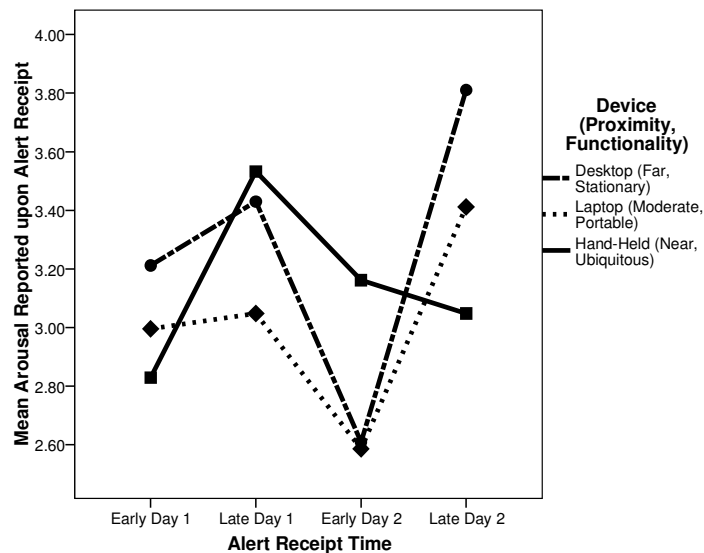
To summarize, arousal reported upon alert receipt was generally lower for low-severity alerts across all media platforms and increased for high-severity alerts. Female

subjects reported higher level of arousal than male subjects when the crime victim was female. However, males' arousal was higher than females' when the crime victim was male.

Emotional Arousal Reported upon Alert Receipt and Time of Receipt

Figure 6 shows interaction between time and media platform on arousal reported upon alert receipt, $F(6, 249) = 8.24, p < .001, \eta^2 = .17$. All three platform groups' arousal reported upon alert receipt ($M_{desktop} = 3.43; M_{laptop} = 3.05; M_{handheld} = 3.53$) significantly increased in late day one. However, the desktop and the laptop group subjects' arousal reported upon alert receipt in early day two ($M=2.61$ and $M= 2.59$, respectively) dropped to the lowest point, suggesting an “overnight effect” of the alerts on these two groups. For the hand-held group, subjects' arousal reported upon alert receipt ($M=3.15$) didn't have such significant decrease in early day two.

Figure 6 Arousal Reported upon Alert Receipt Predicted by Time and Media Platform



To summarize, an “overnight effect” on arousal reported upon alert receipt was found for the desktop and the laptop groups. The hand-held group’s arousal upon alert receipt increased faster than that of the desktop and the laptop groups in day one, and didn’t show the “overnight effect”, a pattern similar to that detected with anxiety and valence reported upon alert receipt.

Arousal Reported at the End of the Study

Hierarchical regression analysis was used again with subject self reported emotional arousal entered as the dependent variables. The analysis strategy was the same as that employed to analyze valence reported at the end of the study.

The full model was significant, $F(5, 84) = 17.56, p < .001$. Table 8 shows the genetic component totally explained 24 percent of the total variances, $F(2, 82) = 13.10, \Delta R^2 = .24, p < .001$. Subjects with higher trait anxiety reported higher arousal upon alert receipt, $t(82) = 2.70, \beta = .22, p < .01$. The second block, media exposure to Virginia Tech shootings, totally explained 6 percent of the variances of the model, $F(2, 80) = 3.28, \Delta R^2 = .06, p < .05$. Newspaper reading of Virginia Tech shooting had a positive relationship with arousal reported at the end of the study, $t(82) = 1.83, \beta = .16, p < .05$. Finally, anxiety reported at the end of the study accounted for 23 percent of the total variances, $F(1, 79) = 37.84, \Delta R^2 = .23, p < .001$.

To summarize, all three components of anxiety had significant influences on arousal reported at the end of the second day, with the effect of the genetic component and the alerts being more significant than that of media exposure to Virginia Tech shooting.

Table 8

Arousal Reported at the End of the Study by the Genetic Component of Anxiety, the Early Life Experience, and Anxiety Reported at the End of the Study.
Hierarchical Regression (N=96)

Variables entered and step Number	Beta ³³	R ²	R ² increment
1. Trait anxiety Index Score	.22**		
Subjects self reported alcohol consumption	.03	.24	.24***
2. Newspaper reading of Virginia Tech gunshot	.16*		
TV viewing of Virginia Tech shooting	.05	.30	.06*
3. Anxiety reported at the end of the study	.57***	.53	.23***

³³ Beta coefficient for variable at final step.
 * p < .05; ** p < .01; *** p < .001.

Latency Time for Response to the Alerts

The data analysis for latency time for response to alerts strategy was the same as that employed to analyze anxiety, emotional valence, and emotional arousal reported upon alert receipt. Subjects' state anxiety reported at the end of the study was also entered as a covariate in the model.

Media platform had a main effect on latency time for response to the alerts, $F(2, 78) = 30.05$, $p < .001$, $\eta^2 = .44$. Scheffé's post hoc tests showed that the hand-held group's mean ($M=31.07$ min) was faster than that of the laptop group's ($M=166.11$ min), while the laptop group's mean was faster than that of the desktop group's ($M= 241.69$ min). This result indicated that subjects who received the crime alerts on the hand-held devices responded significantly faster than those who received the alerts on the laptop and the desktop computers. Subjects who received the alerts on desktop computers responded with the slowest speed.

Subjects' state anxiety at the end of the study was a significant covariate, $F(1, 78) = 7.91$, $p < .01$, $\eta^2 = .10$. The more anxious the subjects felt at the end of the study, the longer time they took to respond to the alerts.

Figure 7a shows an interaction between media platform and severity, $F(2, 78) = 3.72$, $p < .05$, $\eta^2 = .09$. Although subjects receiving the alerts on the desktop computer lagged behind the hand-held group and the laptop group in responding to the alerts ($M_{desktop} = 220.63$ min; $M_{laptop} = 170.78$ min; $M_{hand-held} = 40.56$ min) when crime severity was low, they were even slower when crime severity was high ($M_{desktop} = 262.74$ min; $M_{laptop} = 161.43$ min; $M_{hand-held} = 21.59$ min).

Figure 7a Latency Time for Response to the Alerts Predicted by Media Platform and Severity

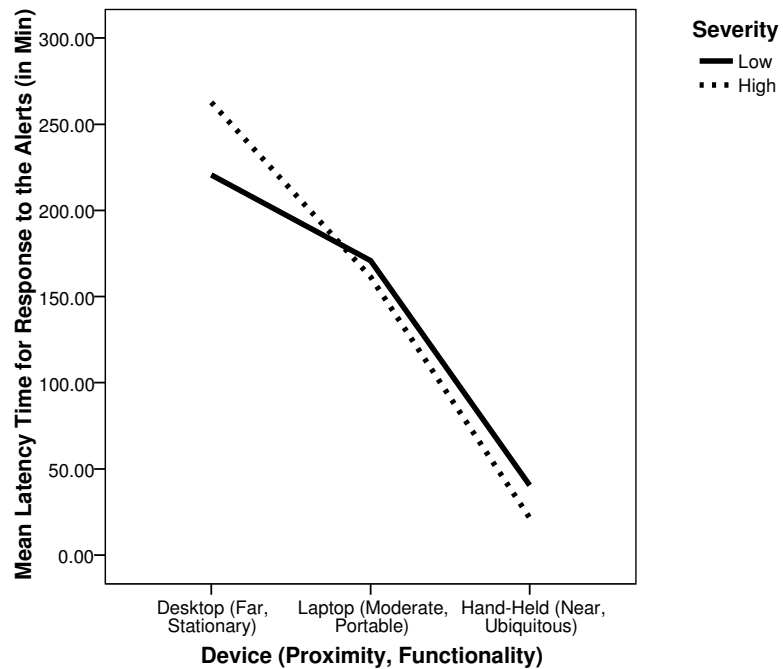
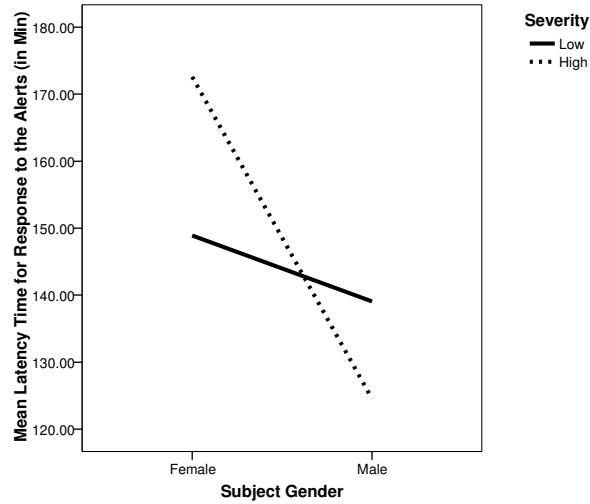


Figure 7b shows an interaction between subject gender and severity, $F(1, 78) = 6.86, p < .01, \eta^2 = .08$. Female subjects' response to the high-severity crimes was slower ($M = 172.62$ min) than to the low-severity crimes ($M = 148.91$ min). Male subjects' response to the high-severity crimes ($M = 124.55$ min) was faster than for low-severity crimes ($M = 139.07$ min).

Figure 7b Latency Time for Response to the Alerts Predicted by Subject Gender and Severity



To summarize, (1) The desktop group was generally slower in responding to the alerts than the laptop group and the hand-held group, especially when crime severity was high; (2) Female subjects responded to the alerts faster when crime severity was low, while male subjects responded to the alerts faster when crime severity was high; (3) The more anxious people felt, the less time they took to respond to the alerts.

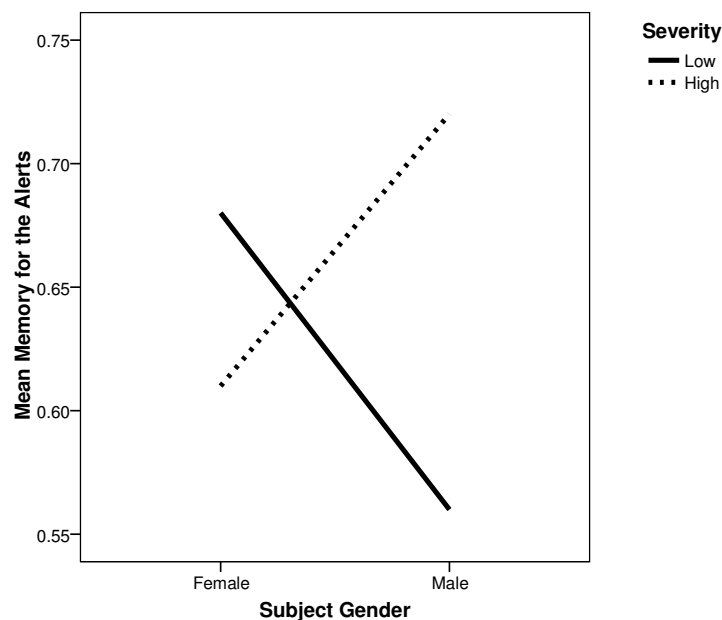
Memory for the Alerts

Memory for the alerts was also analyzed using the same strategy employed to analyze anxiety, emotional valence and arousal reported upon alert receipt. Subjects’ trait anxiety was entered as a covariate.

Regardless of subject gender, victim gender had a main effect on memory for the alerts, $F(1, 86) = 15.08, p < .001, \eta^2 = .15$. Subjects had a better memory when the victims were male ($M = .70$) than when the victims were female ($M = .58$).

Figure 8 shows an interaction between subject gender and severity, $F(1, 86) = 11.89$, $p < .001$, $\eta^2 = .12$. Female subjects' mean was greater when crime severity was low ($M = .68$) than when crime severity was high ($M = .61$). However, males' memory for the alerts was better when crime severity was high ($M = .72$) than when crime severity was low ($M = .56$).

Figure 8 Memory for the Alerts Predicted by Subject Gender and Severity



Subjects' trait anxiety was a positive covariate of the model, $F(1, 86) = 6.95$, $p < .01$, $\eta^2 = .08$, and explained 8 percent of the total variances in memory. This result indicates a "memory bias" among anxious people, who tend to have a better memory for dangerous information, compared with those who are not anxious.

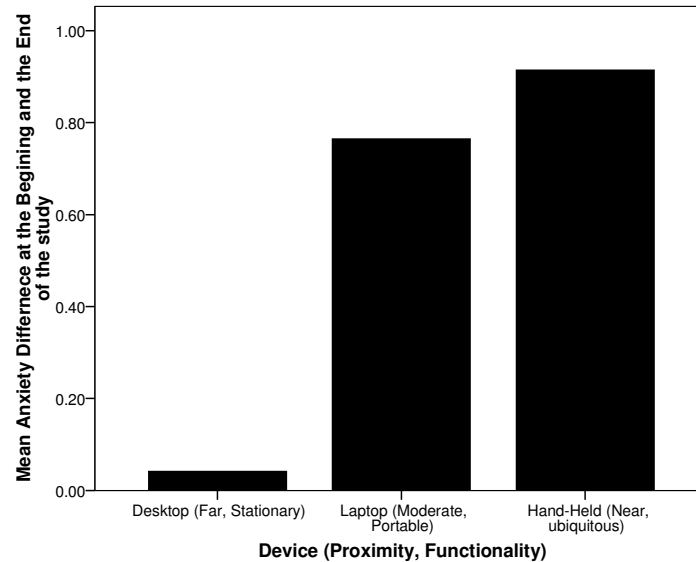
To summarize, as subject anxiety increased, so did memory. When crime severity was low, females' memory for the alerts was better than males'; however, when crime severity was high, males' memory for the alerts was better than females'.

Anxiety Difference at the Beginning and End of the Study

To examine the effects of media platform and subject gender on subjects' anxiety difference at the beginning and at the end of the study, an anxiety difference score was calculated by subtracting reported anxiety at the beginning from reported anxiety at the end of the study. Media platform and subject gender were entered as the fixed factors in the model.

There was a main effect for media platform on subject anxiety, $F(2, 87) = 4.98, p < .01, \eta^2 = .10$. Scheffé's post hoc tests show differences between all three groups, where the hand-held group showed the greatest increase in anxiety ($M = .88$) followed by the desktop group ($M = .02$) and the laptop group ($M = .76$). This result suggests that for those using the hand-held devices and the laptop computers to receive the crime alerts, their anxiety increased more significantly compared with those who received the alerts on the desktop computers, as shown in Figure 9.

Figure 9 Mean Anxiety Difference at the Beginning and End of the Study Predicted by Media Platform



Subject gender also had a main effect on anxiety difference scores, $F(1, 87) = 5.52, p < .05, \eta^2 = .06$, with female subjects' ($M = .82$) higher than that of male subjects' ($M = .26$).

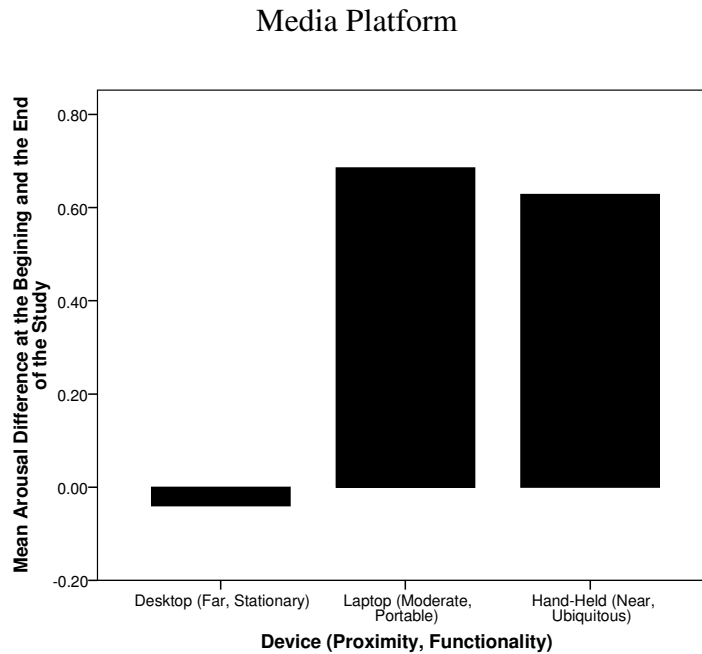
Arousal Difference at the Beginning and End of the Study

To examine the effects of media platform and subject gender on subjects' arousal difference at the beginning and at the end of the study, an arousal difference score was calculated by subtracting reported arousal at the beginning from reported arousal at the end of the study. Media platform and subject gender were entered as the fixed factors in the model.

Media platform had a main effect on subjects' arousal difference at the beginning and end of the study, $F(1, 87) = 5.52, p < .05, \eta^2 = .06$. Figure 10 shows the means of

both the laptop group ($M = .70$) and the hand-held group ($M = .64$) were greater than that of the desktop group ($M = .00$).

Figure 10 Mean Arousal Difference at the Beginning and End of the Study Predicted by



Valence Difference at the Beginning and End of the Study

The same analysis above was run with valence difference at the beginning and end of the study. However, neither media platform nor subject gender had a main effect. There was no interaction between media platform and subject gender.

Cultivation Effects

The following variables were employed to see if message platform had a cultivation effect on subjects' perception of crime levels and their personal safety, variables typically employed to measure cultivation as described in the theory chapter.

Difference in Feelings of Personal Safety at the Beginning and End of the Study

Paired-samples t tests showed that subjects felt significantly less safe walking alone on campus at night at the end of the study ($M= 3.94$) compared with at the beginning of the study ($M= 4.63$), $t(93) = 7.41$, $p < .001$.

Difference in Estimates of the Likelihood of Being a Crime Victim at the Beginning and End of the Study

Paired-samples t test showed that subjects' estimates of their likelihood of being beaten up at the end of the study ($M= 2.85$) was significantly higher than that at the beginning of the study ($M=2.62$), $t(93) = 1.96$, $p < .05$. Subjects' estimates of the likelihood of being threatened at gunpoint or by another weapon for money also significantly increased after the study ($M= 3.06$ vs. $M= 3.35$), $t(93) = 1.77$, $p=.05$. Subjects' estimates of the likelihood of themselves or their female friends/family members to be sexually assaulted at the end of the study ($M= 2.62$) was significantly higher than their estimates at the beginning of the study ($M= 2.35$), $t(93) = 2.59$, $p < .01$.

Difference in Estimates of Crime Rates at the Beginning and End of the Study

Paired-samples t tests revealed significant increase in subjects' estimates of the rate of house break-ins at the end of the study ($M= 2.66$) compared with the estimates at the beginning of the study ($M= 2.18$), $t(93) = 5.45$, $p < .001$. Estimates of the rate of forcible rapes on campus also significantly increased at the end of the study ($M= 2.99$ vs. $M= 2.61$), $t(93) = 4.62$, $p < .001$. Finally, subjects' estimates of the rate of theft on campus was significantly higher at the end of the study ($M= 2.94$) than the estimates at the beginning of the study ($M= 2.60$), $t(93) = 3.23$, $p < .001$.

To summarize, subjects' anxiety and arousal reported at the end of the study were significantly higher than anxiety and arousal reported at the beginning of the study. Subjects' feelings of personal safety significantly decreased at the end of the study compared with at the beginning of the study. They also had higher estimates of the crime rates and the likelihood of being a crime victim at the end of the study.

CHAPTER 6 DISCUSSION

This study had three main purposes. First, it examined the effects of interface proximity, which was conceptualized as far, moderate, and near. Proximity took on three corresponding levels of operational functionality, which in turn were actualized by three different media platforms, stationary (desktop computer), portable (laptop computer), and ubiquitous (hand-held devices) on subject emotion, especially anxiety, when receiving crime alerts. Second, it observed the contribution of the three “building blocks,” or components of anxiety to subject’s felt anxiety at the end of the study. Third, it explored cultivation effects of the crime alerts.

This chapter will discuss the relationships detected between the dependent variables, including anxiety, emotional valence and arousal, latency to reply to the alerts and memory for content in the alerts, and the independent variables including media platform and subject gender, trait anxiety, alert crime severity, and alert victim gender. The relationships between the independent variables will also be discussed.

Summary of Results

Interface Proximity and Anxiety

Perhaps the most striking finding of this study is the effect interface proximity had on subject anxiety. Subjects reported higher level of anxiety when they received the alerts on the laptop and hand-held devices than when they received the alerts on the desktop computer, especially when crime severity was low. In addition, the hand-held group reported the highest increase in anxiety levels from the beginning to the end of the study, followed by the laptop group and the desktop group. A similar pattern was

detected for subjects' arousal increase from the beginning of the study to the end of the study, but not for hedonic valence.

These results suggest that the communication interface itself can generate anxiety among the user, giving credence to the conceptualization of proximity as the “distance” between the media platform interface and the user. This study considers proximity not just in physical or geographic terms, but also in temporal and psychological terms. Distance, conceptualized by these three dimensions, has to do with the ubiquity and the mobility of hand-held communication technologies not fully realized by portable laptop computer and even less evident with stationary desktop computers. Ubiquitous computing as described by Weiser (1991) has been widely discussed in the field of human-computer interaction, usually as a positive outcome. This study, however, looks at unintended and unexpected outcomes the use of ubiquitous and mobile communication technologies may engender, and suggests they may not be positive.

An examination of the interaction between media platform and crime severity revealed that anxiety reported upon alert receipt for the desktop computer group was significantly lower than that for the laptop and the hand-held groups when the crime severity of the alerts was low. When crime severity was high, the difference among the three groups disappeared. This result suggests that a “ceiling” effect on subjects' emotional reactions was reached when highly arousing messages were received on laptop computers, which are moderately mobile and ubiquitous. Hand-held devices did not yield significantly higher anxiety levels as crime severity increased. However, it can be argued that anxiety for hand-held platforms was not higher due to the setting where the study took place and the way media platforms were used in that setting. First, wireless Internet

access is virtually seamless on the campus where the study took place. Second, laptops are nearly as common as hand-held devices due to their utility in classrooms and study areas. If this is the case, the proximity of laptop computers may have also been as “near” as hand-held devices for this population, elevating them as a source of anxiety.

It should be mentioned that this study looked only at “new” technologies, and did not consider traditional mainstream media platforms such as newspapers or television. This leaves open the question of new technologies’ capacity to generate anxiety *as a group*.

Another intriguing finding was the “overnight effect,” where subjects’ anxiety, valence, and arousal lessened for desktop and laptop users at the end of the first day but increased the next morning. However, this was not so for hand-held users, whose anxiety levels rose throughout the two-day study. This finding underlines the idea that the ubiquity of mobile hand-devices is palpable. This result confirms Weiser and Brown’s (1996) argument that the mobile device is “invisible” and part of our lives; it is almost under our skin and there is no “down time.”

Latency data also supported this result. As a widely accepted measure of attention (Lang, Bradley, Park, Shin, & Chung, 2006; Newhagen, in press), latency time for response to the alerts was shortest for the hand-held group, followed by the laptop and the desktop groups. In a sense, the latency data represent a manipulation check. The proximity of the mobile device allows the user to respond more rapidly than those receiving alerts on portable and stationary devices. This would seem to be an obvious artifact of the fact that hand-held devices are physically proximate.

However, latency to respond to alerts also varied according to message content, especially when crime severity was low. This result suggests the psychological dimension of proximity also plays a role in response time and validates the idea that proximity is a complex and highly nuanced construct.

These findings generally resonate with episodic evidence of an almost compulsive attachment to hand-held devices. Social barriers are already in place to control hand-held use, in movie theaters and other public places on the grounds of etiquette, and in cars on the grounds of public safety.

Another interesting finding is that, for the desktop and the laptop groups, subjects' anxiety, valence, and arousal reached the highest point again at the end of the study. However, the hand-held group's anxiety, valence and arousal curves were flat throughout the second day. This phenomenon could be explained by Hebb's (1955) inverted U curve of the relationship between arousal and cognitive performance, where cognitive performance deteriorates when arousal becomes too intense. Compared with those receiving the alerts on the desktop and the laptop computers, subjects in the hand-held group responded to the stimuli more frequently and intensively through the day, not allowing for overnight recovery. However, as more alerts came during the second day, frequency and intensity may have caused fatigue and resulted in the "graceful degradation" of performance described by Norman & Bobrow (1975). Newhagen and Reeves (1992) found a similar outcome in their study of negative compelling television news.

There are other possible explanations. One might be that the hand-held group habituated to the stimuli sooner than other groups because of the stimuli's proximity.

This seems unlikely from a functional description of emotion in the context of the information processing paradigm, which would argue that habituation does not take place to emotionally compelling stimuli. In fact, one reason that responses to emotionally compelling stimuli are important is that we do not get used to them. A third explanation might be found in a behavioral framework. Learned helplessness would be one candidate, where both lab rats and humans have been shown to give up if they reach a point where they believe they simply cannot cope with painful or difficult obstacles, regardless of the importance of the reward. While this study did not address that possibility as an outcome, it is an idea that should not be overlooked.

It would be interesting to extend the study into a third and fourth day to see if the “overnight” effect persists for users of more static platforms. It would also be useful to replicate the study in a locale where the use of wireless laptop computers is not so pervasive to see if anxiety for hand-held users would exceed levels register for laptop platform.

Anxiety

Three findings about anxiety emerged from this study. The first is that all three components of anxiety - genetic, early life experience, and the trigger event - were significant predictors of subjects’ felt anxiety at the end of the study. This supports the generally accepted model of anxiety by experimental and social psychology. It also validates the idea that media exposure can represent a source for anxiety in both early life experience and as a trigger event. Others, such as Marshall et al. (2007) have reported exposure to television coverage after the Sept. 11 attacks were related to post-traumatic

stress disorders. A common link between that study and this project is that the triggers in this project - the crime alerts - were news of negative and compelling events.

This study also verified that trait anxiety, reflected by personal traits of high neuroticism, low extroversion, or other negative affectivity (Clark, Watson, & Mineka, 1994; Trull & Sher, 1994; Zinbarg & Barlow, 1996) can also be a factor in anxiety generated by a news-like trigger event, as was the case with this study. Further, genetic vulnerability, measured by results of standard trait anxiety scales and both subject and parent alcohol consumption predicted felt anxiety, valence and arousal at the end of the study (Beatty, McCroskey, & Heisel, 1998; Perry, 1973; Shields, 1968; Strelau, 1994).

The mediated life experience of crimes, measured as media exposure to Virginia Tech campus shootings, also represented a vehicle for subjects' felt anxiety at the end of the study. The more television coverage of Virginia Tech campus shootings subjects said they watched, the more anxious they felt at the end of the study. Moreover, newspaper reading about Virginia Tech shootings was also a positive predictor of subjects' felt valence and arousal at the end of the study. This result verifies the *media exacerbation hypothesis* (Galea, Ahern, Resnick, Kilpatrick, & Bucuvalas, 2002), which proposes a positive relationship between indirect media exposure to the Sept. 11 event and the post-traumatic stress disorder among the population.

Further, the crime alerts served as a psychological trigger of anxiety, contributing to total variances in felt anxiety at the end of the study. The trigger also explained 23 percent of total variance in felt arousal at the end of the study. It is important to keep in mind that the statistical techniques used were very conservative, essentially removing variance for the genetic component and the early life experience. This result indicated

that the crime alerts in isolation would be sufficient to produce anxiety, which has implications for the general population. The significance of genetic factors and prior life experience suggest a snowball effect and should be a warning that individuals prone to anxiety and depression may be especially vulnerable to the effects of ubiquitous communication devices described here.

Another interesting finding was that although media platform significantly predicted subjects' anxiety reported upon alert receipt, it didn't predict emotional valence or arousal. This suggests that anxiety is different from full-blown emotions proposed in the theoretical explication of this project and instead represents a pre-emotional state. However, subjects' felt anxiety was a strong positive predictor for felt arousal at the end of the study, indicating that as anxiety accumulates, it could result in more serious conditions such as anxiety attacks or clinical depression.

Memory for the crime alerts and its relationship with anxiety also proved to be complex. The trigger event, the crime alert, was not in itself a significant predictor of memory for the content of the alerts. However, memory for alerts improved when trait anxiety was included in the repeated-measure models, indicating that subjects with a history of exposure to anxiety-related experience remember the content of the crime alerts better than others. Laboratory studies also have detected an "attention bias" and "memory bias" among anxious people toward threatening information. Results such as these only underscore how the complex relationship between exposure to news-like messages and anxiety is without explanation. Marshall et al. (2007) describes this complexity as "relative risk appraisal," or an active, multidimensional process that mediates the relation between environmental events and the individual's meaningful

appraisal of them. Risk appraisal is influenced by such factors as the complexity of subjects' cognitive schema, prior experience, personality, and coping style traits (Creamer, McFarlane, & Burgess, 2005; Ehler & Clark, 2000). The cognitive function of the relative risk appraisal for an organism is to determine a response to the environmental event or situation (Marshall, Bryant, Amsel, Suh, Cook, & Neria, 2007). A more recent stream of research goes further and proposes an innate ability called *emotional intelligence* that involves "sophisticated information processing ... used as a guide to thinking and behavior" (Mayer, Salovey, & Caruso, 2008). From this perspective, emotion stands to help guide the allocation of scarce cognitive resources to events that demand attention in order to generate survival contingent behaviors. An important component of the *emotional intelligence* perspective is that some people are better at employing emotional heuristics than others.

This study supports the idea that anxiety is a key component of emotional intelligence and can be driven by news media-like stimuli, such as crime alerts. It can be argued that the crime alerts triggered or activated an anxiety heuristic, increasing allocation of subject's attentional resources to the messages. The idea of emotional intelligence or emotional learning comes in to play when subjects with a genetic disposition and/or a history of anxiety responded to the alerts faster and did better on memory tests than those who did not have such a history.

The Gender Bias

Generally, subject gender had an effect on subjects' anxiety reported upon alert receipt regardless of victim gender. Women were more anxious about these alerts than men, supporting the idea that women are more emotionally sensitive and experience

emotions more vividly than men (Fujita, Diener, & Sandvik, 1991; Thayer & Johnsen, 2000).

This study also detected a “gender bias” in the subjects’ emotional reaction to the alerts. The interaction between subject gender and victim gender was strong and robust for self-reported anxiety, valence, and arousal upon alert receipt. Female subjects tended to report higher anxiety and arousal and more negative valence upon alert receipt when crime victim was female, while male subjects tended to report higher anxiety and arousal and more negative valence upon alert receipt when crime victim was male.

The examination of the interaction between subject gender and crime severity showed that women and men tended to have large difference in valence and memory when crime severity was low. However, when crime severity was high, the difference in valence and memory between women and men disappeared or narrowed. This result confirms findings in earlier studies that women and men tend to show more emotional difference when stimuli arousal level was low, but a highly arousing, negative stimuli create a “ceiling effect” across gender (Knight, Guthrie, Page, & Fabes, 2002; Zillmann, 1983).

Cultivation Effect and Interface Proximity

Cultivation theory has provided numerous examples of how images of violence on a television screen can alter a viewer’s perception of crimes in the real world (Gerbner, Gross, Morgan, & Signorielli, 1980), and this study extends the cultivation research to emerging mobile communication technologies.

As the cultivation hypothesis predicts, subjects felt less safe walking on campus alone at night at the end of the study than at the beginning of the study. The crime alerts

also increased their estimates of the likelihood of being beaten-up, being threatened by a weapon for property, and being sexually assaulted. Subjects' estimates of the rates of house break-ins, forcible rapes and thefts also increased after the study. In addition, subjects' felt anxiety and arousal significantly increased at the end of the study compared with at the beginning of the study, providing more evidence for Newhagen and Lewenstein's (1992) findings that emotion plays an important role in the cultivation effect.

These results should be qualified to point out that media platform did not predict subjects' estimates of the crime rates and the likelihood of being a crime victim.

Theoretical Implications

Proximity is the mainspring of human information processing. The idea is that the nearer an event takes place in time and space, and the greater its psychological salience, the more important it is. Stated simply, humans have been psychologically conditioned to pay close attention to things that are big, near, loud, bright, and that move around a lot because chances are they are dangerous. That principal stands behind a great deal of functional evolution and its roots are deep. While the essentials of being *big, near, loud, bright, and moving around a lot* might have become more abstract through the course of history, the foundation has not changed. Proximate events compel human attention. As collective human society became more complex, the need to know about the proximity between the events grew and the communication technologies to transmit news to users developed.

A special category of messages that we call news appeared. News messages have taken on different forms as media technologies have advanced. Some advances have been

incremental, such as the transition from black and white television to color television, while others have represented truly revolutionary changes, such as the advent of newspapers, television, and the Internet. This study focused on hand-held wireless devices. One important theoretical challenge was to determine if these hand-held devices represent an incremental change in the context of Internet, or if their mobility, driven by ubiquity, qualifies them as a truly revolutionary leap forward. An examination of the evolution of proximity may help answer that question.

McLuhan (1964/1994) once said: “Electronic technology is directly related to our central nervous systems” (p. 68). The extant dominant communication technology when McLuhan made his comment some 50 years ago was “old” television, that is, large apparatuses housing bulky “picture tubes” that displayed low-quality images. Sound quality was no better. While early television may seem primitive by today’s standards, delivering streaming audio and video into most everyone’s living room was astonishing at the time.

Not only did television qualify as a true revolution in communication technology, it had a special impact on the news genre in particular. Television included time as a dimension of proximity, even though McLuhan fell short of describing it in exactly those terms.

Proximity was recognized as *the* defining feature of news as early as the 1930s and emerged with mass circulation newspapers known as the *penny press*. The most telling limitation of newspapers can be seen in the way proximity came to be conceptualized. The idea of proximity described a physical or geographic distance. The importance of time was broken out of the concept to stand alone as “timeliness,” and the

psychological dimension may have been implicitly recognized, but was not well understood. A close look reveals that for roughly a century, newspapers did well at collecting information from a distance, thus validating the role of physical distance in the concept of proximity. Timeliness was acknowledged as a key ingredient of newsworthiness, stood outside proximity, and represented somewhat of a conundrum. Though gathering news from far away was still slow, newspapers had to be fast. Despite advances in telegraphy and even wireless radio, newspapers news could still be hours or even days behind the actual occurrence of a “breaking” news story. One anecdote describes how one news agency “beat” its completion in reporting the assassination of President Lincoln in 1865 by using a system of semaphore flags to contact a ship bearing the news before it docked in London. A three-hour “beat” brought the wire service acclaim although the actual event happened three days earlier. The idea was that time was not isomorphic with physical distance and it became disconnected from the concept of proximity.

McLuhan (1964/1994) understood what a dramatic shift television represented when he proclaimed that “the medium is the message,” but stopped just short of fully understanding what that message was. Auslander (1999) describes what he calls the “ideology” of television as “liveness.” Viewers have the sense that television can “go at any moment. An important caveat to journalism in this context is that, the answer to the question of “go live to what?” is a breaking newsworthy event. Baudrillard (1983) extended this discussion by pointing out that television was not just as good as “real,” it was better, or what he call *hyper-real*. This stream of thought suggests that television accomplished what newspapers had not; it embraced time, space, and psychological

salience as three isomorphic dimensions, all residing in the concept of proximity. But the upshot of that convergence is that the metric values on all three dimensions of proximity becomes *functionally zero*, or right here, right now. At that point the idea of proximity as a distance from the event to the viewer loses meaning in a number of important ways. Ask someone if they “saw” the commercial airlines crash into the World Trade Center on Sept. 11, 2001. The answer will invariably be “yes,” even though they might have been in Denver at the time.

This idea has manifested within the current revolutionary communication technology, the Internet, and is articulated by the phases of “virtual space,” and “virtual time.” Psychological proximity is sometimes described as “presence.” This is important to think about when considering the distance between user and communication interface. While desktop computers represent a revolution in communication technology that exceed even television in importance, they are large, bulky and stationary, and, not unlike television, the user has to seek them out. Laptop computers offer the hope of mobility but are still somewhat cumbersome. While wireless connection to the Internet has made them more mobile, short battery life keeps users “tethered” to an electric wall outlet.

But advances in communication technology in the 21st century have been breathtaking. Engineering advances have enabled users to access a vast interconnected network through small, lightweight, interactive interface devices anywhere, anytime. In temporal, spatial, and psychological terms, the interface has come closer to our central nervous system. This project extends the concept of proximity to include the distance between “information processors” and the interface, connecting them to the larger network. Ubiquitous mobile hand-held devices bring the electronic technology McLuhan

alluded to as close to the human nervous system as it is likely to get outside science fiction. Now, not only is the proximity of the user to the event functionally zero, but so is the proximity of the user to the interface itself. Each advance in technology brings these devices closer and closer to being transparent skins immersing users in their reality.

However utopian a picture this might have seemed to early adopting zealots like Rheingold (2000), the dystopian warnings of critics such as Winner (1978) must also be considered. Of course we can expect to hear about the benefits of these powerful devices, such as Apple[®] new iPhone[®]. This study, however, looks at possible unintended or unanticipated effects of the technology, especially the possibility that their use could generate anxiety, a dysfunctional inhibitory emotional state that has already had an epidemic proportion in some segments of our society.

This new conceptualization of proximity used for this study breaks new ground by expanding the concept to explicitly include time and psychological salience as well as physical distance. But an even more important distinction is made, shifting the locus of proximity from the distance between the message receiver and the news event to the distance between the user and the communication interface. This shift is ontologically important because it reflects the shift from the “designer center” to the “user center” in the design of technology interface, an important concept proposed by human-computer interaction (HCI) research in recent years (Shneiderman, 2003).

In the context of HCI research, hand-held devices are limited with annotating the physical and cultural reality that surrounding the user. An intriguing comment made by virtually everyone consulted in the course of the development of this project, professional journalists included, is that the crime alerts used as stimuli represent “news” in the fullest

sense. Yet the alerts are not the product of journalistic process. Thus, just with the ontological shift in HCI research, this conceptualization of proximity shifts the definition of news from being “production centered,” to being “user centered.” The implications of that shift for professional journalism may be staggering.

The study also breaks new ground in the study of emotion and media. Anxiety, called “the defining character of our time” by Spielberg (1966) has been little studied by communication scholars. Although a few studies have explored the impact of anxiety on the processing of health information, and blog writing (Liu, 2008), studies of anxiety in communication are still very rare. This study shows that the proximity of the media platform to the user affects anxiety at all three tiers of the multi-faceted model that take into account genetic predispositions, earlier life experience, and the immediate stressing trigger message.

The study also detected difference in anxiety levels for subject gender, the gender of victim depicted in the alert messages, and their interaction. A careful look at the results shows that the concept of “severity” does not transcend gender. Some “severe” messages contained a report of a rape, and it should not be a surprise that female subjects reported heightened anxiety for those alerts. Other “severe” messages contained reports of a male victim being set upon by a gang, thrown to the ground, beaten and kicked severely enough to require emergency aid at a hospital. Those messages also were associated with heightened anxiety, regardless of gender. However, one thing that is especially clear is that the respective curves, crossing victim gender with subject gender, are not symmetrical. Stated simply, rape represents a special status in its severity for women not experienced by men.

Practical Implications

Virginia Tech administrators have been criticized for not implementing an emergency alert system prior to the tragedy that university suffered, but, in hindsight, it would have been hard to prepare for such an event. In the tragedy's wake, other universities quickly put alert system in place. This study took place two years after the Virginia Tech tragedy, and it seems appropriate to study the full the impact of such an emergency alert system. The question of what is the best design for such a system has to go beyond issues of technical efficiency and take into account human factors as well. This study has practical implications for such systems on at least three aspects.

First, this study found that subjects responded to the crime alerts on the hand-held devices much faster than on the laptop and the desktop computers, suggesting they paid more attention to their mobile devices. Thus the hand-held devices will be a more effective way to disseminate the information to the students and faculty in an emergency.

Second, this study shows that the crime alerts increased students' anxiety and arousal, making them feel less safe walking on campus, and increasing their estimates of the crime rates on campus. Although the crime alerts help to increase students' awareness of their own safety, university administrators should also pay attention to the emotional and the psychological impacts of the crime alerts on the students, especially those who have a genetic vulnerability to anxiety and family history of depression and anxiety.

Third, this study detected a cognitive overload in the processing of crime alerts among students, especially among mobile device users at the end of the study, reflected as their anxiety, valence and arousal were stable and lower on the second day than on the first day. However, according to Hebb's (1955) theory of the relationship between

information intensity and cognitive performance, people's cognitive performance will improve as more information comes in and arousal increases, but only to a point. Beyond that point, people's cognitive performance will decrease. Thus, the university police might need to consider the frequency and the number of the crime alerts they will send to the students to keep their arousal at an ideal level.

Limitations

One limitation to this study was that it was not conducted in a laboratory, where external factors might have been controlled. This poses a threat to the validity and generalizability of the results of this study. However, the ecological validity of this study was strengthened by approximating the real-life situation under which these devices are actually used. While not fully conducted, subjects replied to the e-mails as what they would normally in their everyday life. The often-criticized artificial setting of experimental research was thus reduced in this study.

A central proposition of cultivation theory is that the portrayal of crimes and violence will influence people's behavior by shaping their beliefs (DeFleur & Ball-Rokeach, 1989). However, this study only lasted two days due to the financial and time limits, which made it only a loose approximation of the long-term effects of the crime alerts on the students' anxiety. But even in that brief time, the study detected effects on subjects' estimates of crime rates and perception of personal safety.

Thirdly, the desktop group and the laptop group received the alerts on computers through e-mails, and the hand-held group received the alerts through text messages due to the small amount of people using hand-held devices to receive e-mails. This problem is not new to communication research. Cross-platform differences have been a nagging

problem for research comparing news in newspapers to news on television. The very nature of the effects of a media technology on content makes stimulus equivalence problematic. Still, questions that arise from cross-platform differences are penetrating and probably transcend epistemological concerns. In this particular case, while there may have been differences in the appearance of the messages in terms of size and formatting, the stimuli were solely text with exactly the same content. However, there is little existing literature showing that the different layouts of text will influence subjects' emotion and cognition, especially in regards to the core dependent variable in this study, anxiety. Some research on television screen size indicates bigger is better, in the sense large screens are associated with stronger emotional responses. That was not the case in this study however. One option might be to replicate the experiment using only hand-held devices with different presentational affordances.

A methodological limitation is that this study relies on self-reported subjective-based emotion measures of valence, arousal, and anxiety, which may bring bias (Davies, Stankov, & Roberts, 1998). Self-report measures usually assume that respondents are clearly aware of their emotional experiences and are accurate in their observations of their own behavior (Heimber, Turk, & Mennin, 2004). However, differences in anxiety scores may arise due to other external factors such as a stressful situation, or differences in the degree to which people recognize their own emotions (Spielberger & Sarason, 1991). Therefore, more objective measures of emotion, such as the psycho-physiological measures including heart rate and skin conductance. Equipment to capture that data are, however intrusive and could only be used within a laboratory setting.

Future Research

There are several directions that future research can explore. This experiment replicated the current state of the emergency warning systems based on only text messages. However, if the research were to study a broader spectrum of news, the stimuli would have to include still images and streaming video and audio. Real time images of plane crashes and terrorist bomb attacks on subways have already made their way straight from the event site to the Internet. Earlier studies have shown that negative compelling images of human death and suffering affect viewer attention and memory (Newhagen & Reeves, 1992; Lang, Newhagen, & Reeves, 1996). However, that research was limited to television. Bringing that work to the study of the mobile communication technologies may be one of the more fertile areas in journalism and communication research.

Some of the findings in this study pose more questions than they answer. One of the interesting results is that the desktop and the laptop users reported anxiety, valence, and arousal upon alert receipt increased to the highest level at the end of the study, while the hand-held users levels were stable across the second day and dropped to the lowest point at the end of the study. Although the “cognitive overload” might be an explanation, the cognitive processing of the crime alerts of the hand-held group, at the end of the study is still an unveiled “black box.” Future studies can combine experiment and other research methods, such as the in-depth interviews to reveal the reason behind the significant decrease in anxiety and the two dimensions of emotion among the mobile device users.

One confound might be a mismatch between the time reported in the crime alerts and the time the subjects read them. For example, if the subjects receive a crime alert at

night, they might feel more anxious about the crime happening at midnight than the same crime happening in the daytime. Similarly, an alert about a car crash in early morning may seem more threatening than a car crash at night for people who read it on their way to work. While stimulus randomization should have prevented misleading interpretation of results in this study, future studies could systematically vary the time when the crimes happen and the time when the subjects read them to examine the main effect of crime time and the interaction between crime time and receipt time.

This study demonstrated how personality traits, such as trait anxiety, affect the cognitive process associated with media effects. This point is relevant not simply to cultivation research, but could be extended to other theoretical approaches to the study of media effects, such as social cognitive theory, agenda-setting, or framing. Future media research could consider how the personality traits might affect message perception and interpretation as well as meaning construction.

Hawkins and Pingree (1981) and Potter (1991) thought that mass media have first- and second-order cultivation effects and they are not interchangeable. Heavy TV viewers, according to them, always overestimate the incidence of crime in society, which is called the first-order effect. Gerbner et al. (1980) contended that overemphasis of violence in television and the distorted picture television presents can create an over-reactive fear of the world; that is, television “cultivates” a misconception of an overly dangerous social reality. This is called the second-order effect of cultivation (Rössler & Brosius, 2001). Although this study found that subjects felt less safe to walk on campus at night and increased their estimates of crime rates, as the first-order cultivation effect has predicted, it did not examine the second-order effect on subjects’ beliefs and

Future research could conduct longitudinal studies to examine the long-term effects of the crime alerts. A related research direction might be the cross-sectional studies, which compare the effects of the emergency system in different cultures and societies, or among different age groups.

As an exploratory study, this experiment also found that regardless of subject gender, memory for the low severity crimes was significantly better than that for the high severity crimes, a result that has been rarely discussed in current literature. Newhagen and Reeves (1992) found both proactive and retroactive effects for compelling negative television news images. Because memory is such an important variable in this stream of research, it would make sense to focus more on a design looking specifically at that issue in future studies.

Conclusions

Journalism has experienced significant transitions in the 20th century. Internet was introduced in the early 1970s and gained the status of a mass medium with unprecedented speed (Morris & Ogan, 1996). It changed a century-old routine of reading a newspaper virtually overnight. Television has irrevocably been changed by its presence as well. Fitzgerald's (1996) prediction that "virtual newspapers will become a competitive displacement for printed newspapers" is, in 2009, a reality.

This study further explores the use of new and emerging mobile communication technologies as a vehicle for news by using emergency alerts. The alerts used in this study were sent to the students in a timely fashion, like news, and disseminated information about potential danger, just as news does. Thus, these alerts are performing the informing function of communication of news described by Lasswell (1948) and

McQuail (2005). Furthermore, the messages altered students' perception of personal safety on campus and increased their estimates of crime rates after the study, suggesting that these alerts could induce the short-term cultivation effects.

Interface proximity of communication technologies was conceptualized at three levels of operational functionality; stationary, portable, and ubiquitous. Those levels correspond to three electronic devices, desktop computers, laptop computers, and hand-held devices. Interface proximity was found to be a source generating anxiety among their users.

John Dewey (1931) once predicted that, "the great scientific revolution is still to come. It will ensure when men systematically use scientific procedures for the control of human relationships and the direction of the social effects of our vast technological machinery...The story of the achievement of science in physical control is evidence of the possibility of control in social affairs." Innis (1964) also thought that the new pervasive communications technologies would be adopted for their apparent positive characteristics. However, this study shows that decreasing distance between the user and the technology also increases their emotional arousal and anxiety, an outcome which is different from Innis' optimism. As early as 1978, Winner expressed his concern about the social impact of these technologies. He was worried that despite new technology's incredible power to make a quantum jump at each cycle of innovation, people simply ignored questions about such advances fit into the human community. These are stern warnings for today's researchers, imploring them to also ask the hard questions about the social and cultural implications of ubiquity.

APPENDICES

Appendix A Questionnaire 1

1. Read each statement and then circle the statement to indicate how you feel right now, that is, at this moment. There are not right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I feel tense right now.	a)	b)	c)	d)	e)
I feel strained right now.	a)	b)	c)	d)	e)
I feel upset right now.	a)	b)	c)	d)	e)
I feel nervous right now.	a)	b)	c)	d)	e)
I feel calm now.	a)	b)	c)	d)	e)
I feel secure now.	a)	b)	c)	d)	e)
I am comfortable.	a)	b)	c)	d)	e)
I am relaxed.	a)	b)	c)	d)	e)
I feel steady.	a)	b)	c)	d)	e)
I feel pleasant.	a)	b)	c)	d)	e)

2. How safe do you feel when walking along after dark on campus or in the surrounding areas?
- a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe
3. How anxious are you feeling about becoming crime victims on campus or in the surrounding areas?
- a) Not anxious at all
 - b) Little anxious
 - c) Somewhat anxious
 - d) Quite anxious
 - e) Extremely anxious

In your opinion, how safe from crime (theft, assault, etc.) are each of the following areas on campus?

- 4. Library**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 5. Hallways and stairs**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 6. Campus sidewalks and roads**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 7. Parking lots and garages**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 8. Empty classroom**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 9. Bus stops**
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 10. How much do you agree with the statement that I generally feel safe on campus?**

- a) Strongly disagree
- b) Somewhat disagree
- c) Neutral
- d) Somewhat agree
- e) Strongly agree

In your opinion, what is the likelihood that you will become a victim of the following crimes?

11. Being threatened with a weapon for money or valuables

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

12. Having something taken from you by force

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

13. Being attacked by a stranger

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

14. Having someone break into your residence

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

15. Having your car or bike stolen

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

16. Having your property stolen (e.g. your backpack or your laptop computer)

- a) Not at all

- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

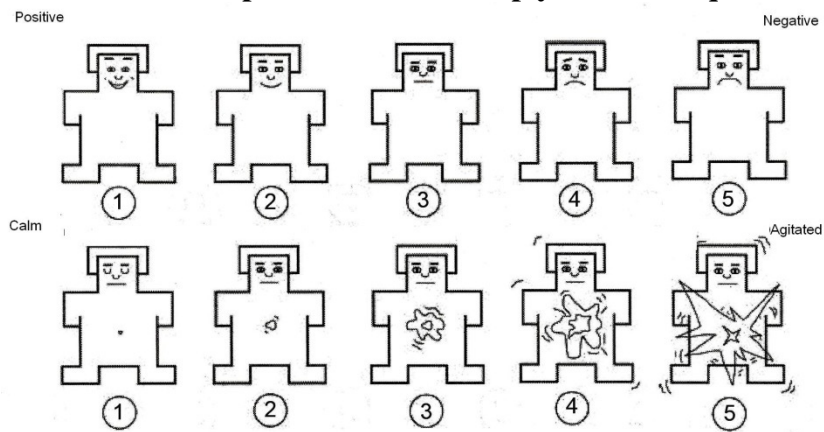
17. Being sexually assaulted

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

18. Being beaten up

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

Please look at the picture below to help you answer questions 19 and 20.



19. How positive are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

20. How calm are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

21. How anxious are you feeling now?

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) Extremely anxious

Please estimate the statistics of the following crimes on campus in the year of 2008.

22. Forcible rape

- a) 0 or 1
- b) Around 5
- c) Around 10
- d) Around 15
- e) More than 20

23. Aggravated assault involving firearms, knife, or other dangerous weapons

- a) Around 5
- b) Around 10
- c) Around 30
- d) Around 50
- e) More than 60

24. House break-in

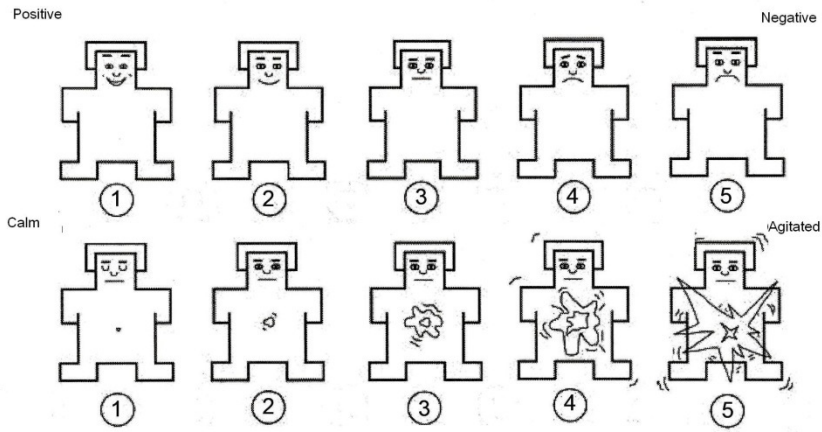
- a) Around 10
- b) Around 50
- c) Around 100
- d) Around 150
- e) More than 200

25. Theft

- a) Around 50
- b) Around 150
- c) Around 300
- d) Around 500
- e) More than 500

Appendix B Questionnaire 2

Please look at the picture below to help you answer questions 1 and 2.



1. How positive are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

2. How calm are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

3. How anxious are you feeling now?

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) Extremely anxious

Appendix C Questionnaire 3

1. Read each statement and then circle the statement to indicate how you feel right now, that is, at this moment. There are not right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I feel tense right now.	a)	b)	c)	d)	e)
I feel strained right now.	a)	b)	c)	d)	e)
I feel upset right now.	a)	b)	c)	d)	e)
I feel nervous right now.	a)	b)	c)	d)	e)
I feel calm now.	a)	b)	c)	d)	e)
I feel secure now.	a)	b)	c)	d)	e)
I am comfortable.	a)	b)	c)	d)	e)
I am relaxed.	a)	b)	c)	d)	e)
I feel steady.	a)	b)	c)	d)	e)
I feel pleasant.	a)	b)	c)	d)	e)

2. How safe do you feel when walking along after dark on campus or in the surrounding areas?
- a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

In your opinion, how safe from crime (theft, assault, etc.) are each of the following areas on campus?

- 3. Library
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

- 4. Hallways and stairs
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

5. Campus sidewalks and roads
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

6. Parking lots and garages
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

7. Empty classroom
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

8. Bus stops
 - a) Very unsafe
 - b) Somewhat unsafe
 - c) Neither unsafe nor safe
 - d) Somewhat safe
 - e) Very safe

9. How much do you agree with the statement that I generally feel safe on campus?
 - a) Strongly disagree
 - b) Somewhat disagree
 - c) Neutral
 - d) Somewhat agree
 - e) Strongly agree

In your opinion, what is the likelihood that you will become a victim of the following crimes?

10. Being threatened with a weapon for money or valuables
 - a) Not at all
 - b) Very little
 - c) Neutral
 - d) Somewhat
 - e) To a great extent

11. Having something taken from you by force

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

12. Being attacked by a stranger

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

13. Having someone break into your residence

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

14. Having your car or bike stolen

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

15. Having your property stolen (e.g. your backpack or your laptop computer)

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

16. Being sexually assaulted

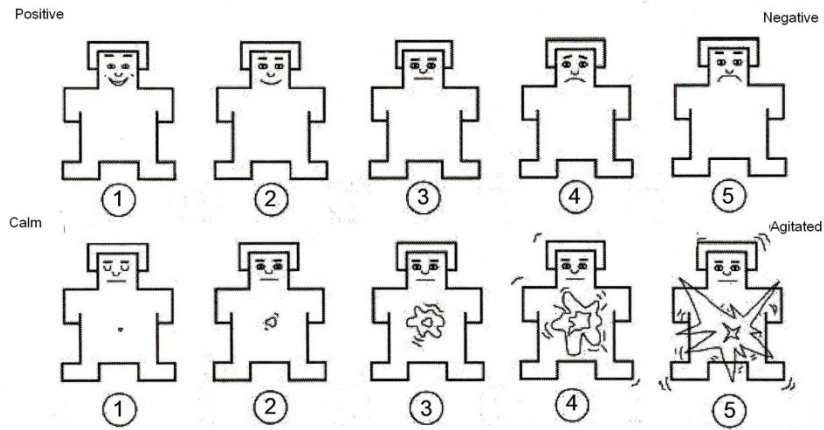
- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) To a great extent

17. Being beaten up

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat

e) To a great extent

Please look at the picture below to help you answer questions 18 and 19.



18. How positive are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

19. How calm are you feeling now?

- a) 1
- b) 2
- c) 3
- d) 4
- e) 5

20. How anxious are you feeling now?

- a) Not at all
- b) Very little
- c) Neutral
- d) Somewhat
- e) Extremely anxious

Please estimate the statistics of the following crimes on campus in the year of 2008.

21. Forcible rape

- a) 0 or 1
- b) Around 5
- c) Around 10
- d) Around 15
- e) More than 20

22. Aggravated assault involving firearms, knife, or other dangerous weapons

- a) Around 5
- b) Around 10
- c) Around 30
- d) Around 50
- e) More than 60

23. House break-in
- a) Around 10
 - b) Around 50
 - c) Around 100
 - d) Around 150
 - e) More than 200

24. Theft
- a) Around 50
 - b) Around 150
 - c) Around 300
 - d) Around 500
 - e) More than 500

25. Where did you grow up?
- a) Rural area
 - b) Suburban
 - c) Metropolitan city

26. Think of the place you lived prior to coming to UMD. In your opinion, how much of a problem was crime there?
- a) Not a problem
 - b) A little problem
 - c) A large problem

27. How much alcohol do you consume per week?
- a) None
 - b) 1-5 drinks
 - c) 6-10 drinks
 - d) 11-15 drinks
 - e) More than 15 drinks

28. How much alcohol does your father consume per week?
- a) None
 - b) 1-5 drinks
 - c) 6-10 drinks
 - d) 11-15 drinks
 - e) More than 15 drinks
 - f) I don't know

29. How much alcohol does your mother consume per week?
- a) None
 - b) 1-5 drinks
 - c) 6-10 drinks
 - d) 11-15 drinks
 - e) More than 15 drinks
 - f) I don't know
30. Have you ever seen someone about mood anxiety or depression?
- a) Never
 - b) Rarely
 - c) Occasionally
 - d) Frequently
 - e) Very frequently
31. Has either of your parents ever seen someone about mood anxiety or depression?
- a) Never
 - b) Rarely
 - c) Occasionally
 - d) Frequently
 - e) Very frequently
 - f) I don't know
32. How much print newspaper did you read about 2007 Virginia Tech campus massacre in the first week after the event?
- a) A lot less than usual
 - b) Somewhat less than usual
 - c) Almost the same as usual
 - d) A bit more than usual
 - e) A great amount more than usual
33. How much TV did you watch about 2007 Virginia Tech campus massacre in the first week after the event?
- a) A lot less than usual
 - b) Somewhat less than usual
 - c) Almost the same as usual
 - d) A bit more than usual
 - e) A great amount more than usual
34. Read each statement and then choose the right of the statement to indicate you generally feel.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I am a pleasant person.	a)	b)	c)	d)	e)
I am a nervous person	a)	b)	c)	d)	e)

I am easy to be satisfied.	a)	b)	c)	d)	e)
I wish I could be happy as others.	a)	b)	c)	d)	e)
I worry too much over something that really doesn't matter.	a)	b)	c)	d)	e)
I am a steady person.	a)	b)	c)	d)	e)
I am in a state of tension.	a)	b)	c)	d)	e)
I am a rested person.	a)	b)	c)	d)	e)
I always feel secure.	a)	b)	c)	d)	e)
I am a calm person.	a)	b)	c)	d)	e)

Here are some questions about the messages you have received in the past two days. Please DON'T look at those messages and answer them as soon as you can.

35. A ____ student was strongly robbed at a gunpoint in front of the apartment at Graduate Hills.
a) Male
b) Female
36. A ____ student reported her/his car parked at 1300 Block University Blvd. was robbed at 10:00pm.
a) Female
b) Male
37. Two male students were walking in the area between Annapolis Hall and Frederick Hall when a group of 5 suspects confronted them. The suspects ____ and fled.
a) Took away his wallet
b) Knocked them to the ground and kicked them
c) Produced a strong robbery with a knife
38. A graduate female student ____ in Tydings Hall at around 9:00pm.
a) Was strongly robbed in the elevator
b) Lost her wallet
39. A ____ student was approached by an unknown man at College Ave. and demanded wallet.
a) Male
b) Female
40. A female UMD student _____ at about 1:30 a.m. The suspect went through the window and entered her room.
a) Had her house broken in
b) Was killed in a robbery

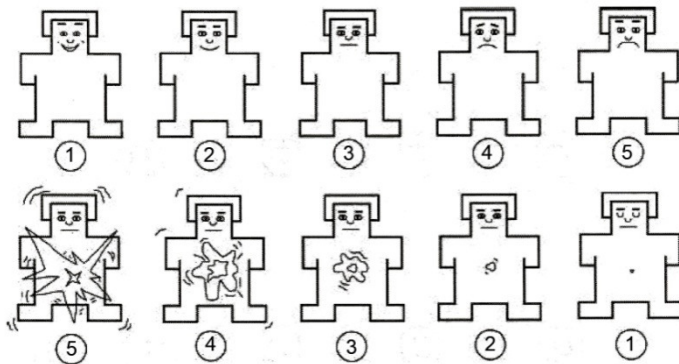
- c) Was sexually assaulted
41. A male student was confronted with two suspects who borrowed his cell phone to make a call. Then he was ____ and demanded money.
- a) threatened with a knife
 - b) threatened with a handgun
 - c) punched in the face with a closed fist and kicked
42. A ____ student heard some noises outside the bedroom window and found the suspect looking into it.
- a) Male
 - b) Female
43. Where are you living?
- a) On campus
 - b) Off campus (within walking distance)
 - c) Commuter
44. Your gender:
- a) Male
 - b) Female
45. Your age:
46. Which year are you at UMD?
- a) Freshman
 - b) Sophomore
 - c) Junior
 - d) Senior
 - e) Graduate student

Appendix D Sample of Stimuli Selection

THIS MESSAGE IS PART OF THE CRIME ALERT STUDY
CRIME ALERT-FROM THE PRINCE GEORGES COUNTY POLICE

A female UMD student was sexually assaulted at about 1:30 a.m. when she was asleep at her residence. The suspect entered her residence through a window and went to the victim's room. The victim was too frightened to give a detailed description of her assailant who fled the scene after the attack and is still at large.

1. How *positive/negative* and *calm/excited* does this message make you feel? Please circle the following picture:



2. How *anxious* does this message make you feel?

- ① Not at all ② Very little ③ Neutral
④ Somewhat ⑤ Extremely so

Appendix E Mean Scores and Standard Deviations of Stimuli Messages

Conditions	Messages	Mean	SD
A. Female Victim, Low Crime	A1. A graduate female student lost her wallet in her office in Tydings Hall on campus around 9:00pm. She left the door open when she went to the bathroom and found her wallet missing after she came back.	1.00	.00
	A2. A UMD female student heard a noise outside her bedroom window at approximately 11:00p.m. and called police. Subsequent investigation by the police officers revealed that a suspect stood on the stacked furniture, reaching the window and looking in, but fled after being detected.	1.78	.78
	A3. Two men threatened a female and demanded her property at around 8:45p.m. The woman was walking in the area of Rhode Island and College Avenues when the suspects approached her and demanded money. After she gave her purse, they fled.	1.75	.50
	A4. A female student lost her purse in her car parked at on University Blvd. at about 8:00 p.m. The thief broke a window and took away her laptop and purse, according to the policeman.	2.00	.00
B. Female Victim, Strong Crime	B1. A UMD female staff employee was robbed at gunpoint on campus at around 7:15pm, according to a police spokesperson. The victim was in an elevator in the Plant Sciences Building. While the elevator was moving, the suspect, also in the elevator with her, grabbed the victim by her shirt, took her University ID card and keys, and then fled the building. The victim stated that the suspect was a male about 35 years old.	3.75	.50
	B2. A female UMD student was sexually assaulted at about 1:30 a.m. when she was asleep at her residence. The suspect entered her residence through a window and went to the victim's room. The victim was too frightened to give a detailed description of her assailant who fled the scene after the attack and is still at large.	3.50	.72
	B3. A female student was robbed at gunpoint at around 10:30p.m. when she was returning to her apartment at Graduate Hills, police said. The student had her key in the front door of her apartment on the first floor when a man came up to her, brandished a silver handgun to her and demanded money. She described the assailant as a six-foot-tall young male, who pushed her on the ground and	3.50	.58

	produced a gun robbery.		
	B4. A female UMD freshman was sexually assaulted between 2 a.m. and 3 a.m. by two men who had gained entry to her apartment through an unlocked window, said the police. The student, who was at home alone, was seriously injured and then was sent to the nearest hospital.	3.50	.82
C. Male Victim, Low Crime	C1. A male UMD student reported he was confronted by a man who began arguing with him at approximately 12:10 a.m. The suspect then demanded the victims the wallet and fled on foot. No injuries were reported.	1.50	.58
	C2. A male student reported his car parked at 1300 Block University Blvd had been robbed at 10:00 p.m. The thief broke a window and took his laptop computer, according to the policeman.	1.75	.85
	C3. A male student reported he was approached by an unknown man while he was walking on College Avenue. The suspect followed him and demanded the victim's wallet. The victim took out his wallet and threw it on the ground. The suspect then fled. No injuries were reported.	2.00	.00
	C4. A male student walking home from a friend's house near the intersection of College Avenue and Rhode Island Avenue told the police he noticed two unknown males who appeared to be following him at about midnight. They trailed him for a short distance before one of the suspects confronted him and demanded money. The victim replied that he did not have any and fled. No injuries were reported.	2.00	.82
D. Male Victim, Strong Crime	D1. A UMD male student was approached by two suspects at approximately 8:30 p.m. in front of Annapolis Hall. One of the suspects asked him to use his cell phone. When the suspect completed the call, he punched the student in the face with a closed fist. The student then fell to the ground. The other suspect began to kick him and demanded money. The student suffered severe injuries and was sent to the nearest hospital. The suspects are still at large.	3.75	.50
	D2. Police reported a first-degree assault with a dangerous weapon taking place after a man was stabbed just outside of the entrance of the campus at 9:00pm. The male student was involved in an argument with two men when one produced a knife and cut his forearm, according to the police. A friend of the victim was cut in the thigh after attempted to stop the assault. The suspects then fled in a car on Route one. Police said the second stabbing victim received life-threatening injuries and both victims were transported to the nearest hospital.	3.75	.50
	D3. Three men broke in a male student's apartment	3.50	.58

	<p>confronting him with a handgun at 10:30 at p.m. One held him at bay with the gun while the other two ransacked the apartment, overturning and breaking furniture and other belongings. They fled with his computer, camera and money. The victim was taken to a local hospital for treatment of abrasions resulting from the scuffle.</p>		
	<p>D4. Two male students reported walking in the area between Annapolis and Frederick Halls on campus when a group of 5 suspects confronted them and knocked them to the ground without warning. The suspects then began to kick the victims, pointing handguns to their heads and demanded money. The police, who classified the incident as strong robbery, said the assailants were still at large.</p>	3.50	.85

Appendix F Online Consent Form

Welcome to the Electronic News Experiment!

This is a dissertation research project conducted by PhD. student Wenjing Xie under the supervision of Dr. John E. Newhagen in the College of Journalism at the University of Maryland, College Park. I am inviting you to participate in this research project because your experience of using new media will help to provide key information and insights for the research topic.

Purposes: The purpose of this project is to understand how young people are using new media to read news.

Procedures: You will receive four news messages in your e-mail/text messages every day for two days continuously. You will be asked to fill out an online questionnaire before, during and after the study.

Confidentiality: We will do our best to keep your personal information confidential. To help protect your confidentiality, I will not include your name in my dissertation. If we write a report or article about this research project, your identity will be protected to the maximum extent possible. Your information may be shared with representatives of the University of Maryland, College Park or government authorities if you or someone else is in danger or if we are required to do so by law.

Risks: There are no known risks associated with participating in this research project.

Benefits: This research is not designed to help you personally, but the results may help the investigator to learn more about new media.

Do I have to be in this research? May I stop participating at any time? Your participation in this research is completely voluntary. You may choose not to take part at all. If you decide to participate in this research, you may stop participating at any time. If you decide not to participate in this study or if you stop participating at any time, you will not be penalized or lose any benefit that you otherwise will get.

Questions and Contact: If you have any questions about the research study itself, please contact Wenjing Xie at wxie@jmail.umd.edu or 240 – 338 – 9194 or 1117 Journalism Building, University of Maryland, College Park, MD 20742. Or you may contact Professor John E. Newhagen: jnewhagen@jmail.umd.edu or 301 – 405 – 2417. If you have questions about your rights as a research subject or wish to report a research-related injury, please contact: Institutional Review Board Office, University of Maryland, College Park, Maryland, 20742; (e-mail) irb@deans.umd.edu; (telephone) 301-405-0678. This research has been reviewed according to the University of Maryland, College Park IRB procedures for research involving human subjects.

I will be grateful if you would sign this form to indicate that: you are at least 18 years of age; the research has been explained to you; your questions have been fully answered; and you freely and voluntarily choose to participate in this research project.

Signature:

Date:

Appendix G Exit Page of the Third Online Questionnaire after the Study

Thanks for participating in the study!

This study was designed to understand how new media, especially mobile devices, can be a source of anxiety for their users. Participants received alert messages dealing with crime on or near campus through one of the three devices: desktop, laptop, and hand-held devices for two days, and were asked to reply as soon as they read the messages. Anxiety level then was compared based on different devices.

If you have any questions or are interested in the study's results please contact with Wenjing Xie at wxie@jmail.umd.edu or Prof. John Newhagen at jnewhagen@jmail.umd.edu.

I greatly appreciate your help!

Appendix H State-Trait Anxiety Inventory Form 1 (State Anxiety Inventory)

DIRECTIONS:

A number of statements that people have used to describe themselves are given below.

Read each statement and then circle the statement to indicate how you feel *right* now, that

is, *at this moment*. There are no right or wrong answers. Do not spend too much time on

any one statement but give the answer which seems to describe your present feelings

best.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I feel tense right now.	a)	b)	c)	d)	e)
I feel strained right now.	a)	b)	c)	d)	e)
I feel upset right now.	a)	b)	c)	d)	e)
I feel nervous right now.	a)	b)	c)	d)	e)
I feel calm now.	a)	b)	c)	d)	e)
I feel secure now.	a)	b)	c)	d)	e)
I feel at ease.	a)	b)	c)	d)	e)
I am presently worrying about future misfortunes.	a)	b)	c)	d)	e)
I feel satisfied.	a)	b)	c)	d)	e)
I feel frightened.	a)	b)	c)	d)	e)
I am comfortable.	a)	b)	c)	d)	e)
I feel confident.	a)	b)	c)	d)	e)
I am jittery.	a)	b)	c)	d)	e)
I am indecisive.	a)	b)	c)	d)	e)
I am relaxed.	a)	b)	c)	d)	e)
I feel content.	a)	b)	c)	d)	e)
I am worried.	a)	b)	c)	d)	e)
I am confused.	a)	b)	c)	d)	e)
I feel steady.	a)	b)	c)	d)	e)
I feel pleasant.	a)	b)	c)	d)	e)

Appendix I State-Trait Anxiety Inventory Form 2 (Trait Anxiety Inventory)

DIRECTIONS:

A number of statements that people have used to describe themselves are given below.

Read each statement and then circle the statement to indicate you *generally* feel.

	Strongly disagree	Somewhat disagree	Neutral	Somewhat agree	Strongly agree
I am a pleasant person.	a)	b)	c)	d)	e)
I am a nervous person	a)	b)	c)	d)	e)
I am easy to be satisfied.	a)	b)	c)	d)	e)
I wish I could be happy as others.	a)	b)	c)	d)	e)
I am calm, cool, and controlled.	a)	b)	c)	d)	e)
I worry too much over something that really doesn't matter.	a)	b)	c)	d)	e)
I am a steady person.	a)	b)	c)	d)	e)
I feel secure.	a)	b)	c)	d)	e)
I am in a state of tension.	a)	b)	c)	d)	e)
I feel rested.	a)	b)	c)	d)	e)
I take disappointments so keenly that I can't put them out of my mind.	a)	b)	c)	d)	e)
I feel confident.	a)	b)	c)	d)	e)
I have disturbing thoughts	a)	b)	c)	d)	e)
I am content.	a)	b)	c)	d)	e)
I feel inadequate.	a)	b)	c)	d)	e)
I make decisions easily.	a)	b)	c)	d)	e)
I lack self-confidence.	a)	b)	c)	d)	e)
I am a happy person.	a)	b)	c)	d)	e)
I feel difficulties are piling up so that I cannot overcome them.	a)	b)	c)	d)	e)

Appendix J Cutting-off Points of Latency Time for Message Responses

Message	Device	Mean (<i>min</i>)	SD (<i>min</i>)	Cutting-off Point (<i>min</i>)
Message 1	Hand-held	38.89	63.29	102.18
	Laptop	278.00	375.81	653.81
	Desktop	285.04	329.73	614.77
Message 2	Hand-held	56.00	91.96	147.96
	Laptop	191.17	307.59	498.76
	Desktop	206.28	279.88	486.16
Message 3	Hand-held	25.97	36.62	62.59
	Laptop	265.35	375.80	641.15
	Desktop	207.92	288.58	496.10
Message 4	Hand-held	50.97	149.48	200.95
	Laptop	264.61	340.07	604.68
	Desktop	326.04	356.24	682.28
Message 5	Hand-held	73.38	143.54	216.92
	Laptop	235.86	347.18	583.04
	Desktop	301.58	415.53	171.11
Message 6	Hand-held	116.8	216.68	333.48
	Laptop	249.40	311.52	560.92
	Desktop	283.46	343.09	656.55
Message 7	Hand-held	74.81	231.77	306.58
	Laptop	118.50	143.62	262.12
	Desktop	364.77	450.94	815.71
Message 8	Hand-held	51.50	150.20	201.70
	Laptop	255.20	411.40	666.60
	Desktop	287.64	352.45	640.09

Appendix K Fractional Factorial Design

The practice of testing the influence of various factors with multiple levels is not new in communication research. However, as the number of factors in a factorial design increases, the number of runs required for a complete replicate of the design rapidly outgrows the resources of the experiments. The science of experimental design lets people project the impact of many stimuli by testing just a few of their combinations. If the investigator can reasonably assume that certain high-order interactions are negligible, information on the main effects and low-order interactions may be obtained by running only a fraction of the full factorial experiment (Montgomery, 2008). This type of experimental design is the so-called fractional factorial design.

While fractional factorial design has been widely used in business research, few communication studies have used this technique. A major use of fractional factorial design is in screening experiments, which are usually performed in the early stages of a project. The goal of fractional factorial design is to select and test a subset of combinations of variables that represent the complexity of the original variables. For example, in a situation with three factors, two at two levels and one at four levels, a full factorial design will generate $2 \times 2 \times 4 = 16$ treatment combinations (see Table 1a). However, with a one-half fractional factorial design, we only need $2^3 = 8$ combinations. “Fractional” in this situation means we only choose half of the combinations; however, each level of each variable is paired in at least one instance with each level of the other variables (Almquist & Wyner 2001) (see Table 1b).

Table 1a Full-Factorial Experimental Design (example from Almquist & Wyner, 2001)

A	(1)	(1)	(2)	(2)
B	(1)	(2)	(1)	(2)
C (1)	X	X	X	X
C (2)	X	X	X	X
C (3)	X	X	X	X
C (4)	X	X	X	X

Table 1b Fractional- Factorial Experimental Design (example from Almquist & Wyner, 2001)

A	(1)	(1)	(2)	(2)
B	(1)	(2)	(1)	(2)
C (1)	X			X
C (2)		X	X	
C (3)		X	X	
C (4)	X			X

Minitab and BMDP have been good statistical software to generate a fractional factorial design. In recent years, a new type of software, *JMP*, a product of SAS company, was developed and substitutes BMDP as a major tool for fractional factorial design. In this study, a 2 (crime severity) x 2 (victim gender) x 4 (repeated measure) full factorial design totally generated 16 messages. However, what we are interested in is the main effects of *crime severity* and *victim gender* and their interaction effect. The reason we used 4 *repeated measures* of news messages in each condition was that experiments in communication research are different from those in psychological research. For example, in a psychological study of anxiety or fear, the stimuli are single and simple, such as a snake or a spider. However, in communication research, the stimuli, which are usually news stories, are much more complex and contain many variances. Thus, the

purpose to use 4 repeated measures was to suppress the variances of the news stories and reduce the error terms in the whole model.

For the two interesting factors, *crime severity* and *victim gender*, we kept the 2 x 2 full factorial design, which generated 4 message conditions. However, we used the *repeated measure* as a “one-half fractional” factor. This suggests that all of the subjects will see all of the four message conditions, but only see 2 rather than 4 messages in each message condition. Every subject then only saw $2 \times 2 \times 2 = 8$ messages, rather than $2 \times 2 \times 4 = 16$ messages.

We adopted Jennrich, Sampson, and Frane’s (1981) approach and finished this task using SPSS. In the Repeated Measures function under General Linear Model in SPSS, we coded both *crime severity* and *victim gender* as two-level factors. Repeated measures, which were supposed to be four levels, were also coded as a two-level factor. Repeated measure analysis then was able to be run with anxiety scores for each message as the dependent variables and media platform and subject gender as the between-subject factors.

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