

Effects of precautionary principle on risk perception about cell phone radiation

by

Yang Yang

A thesis submitted to the graduate faculty

in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

Major: Journalism and Mass Communication

Program of Study Committee:
Michael Dahlstrom, Major Professor
Eric Abbott
Dan Krier

Iowa State University

Ames, Iowa

2016

Copyright © Yang Yang, 2016. All rights reserved.

TABLE OF CONTENTS

	Page
LIST OF FIGURES	iii
LIST OF TABLES	vi
ACKNOWLEDGMENTS	vii
ABSTRACT	vi
CHAPTER I INTRODUCTION	1
CHAPTER II LITERATURE REVIEW	6
Cell Phone EMF	6
The Precautionary Principle	7
Risk Perceptions.....	11
Study Objectives	15
CHAPTER III STUDY 1 – METHODS	18
CHAPTER IV STUDY 1 – RESULTS AND DISCCUSION	23
Study 1 - Discussion	27
CHAPTER V STUDY 2 – STUDY OBJECTIVES AND METHODS	29
CHAPTER VI STUDY 2 – RESULTS AND DISCCUSION	32
Study 2 - Discussion	35
CHAPTER VII GENERAL DISCUSSION	41
REFERENCES	47
APPENDIX A: IRB APPROVAL LETTER	53
APPENDIX B: QUESTIONNAIRE FOR PRE AND POST TEST.....	54
APPENDIX C: STIMULUS SAMPLE FROM STUDY 1	62
APPENDIX D: STIMULIUS SAMPLE FROM STUDY 2	66

LIST OF FIGURES

	Page
Figure 1 The predicted relationships of perceived benefits of cell phones and message effects	16
Figure 2 The relationships of perceived benefits of cell phones and message effects	25
Figure 3 The relationships of perceived benefits of cell phones and message effects for U.S. and Chinese participants	35

LIST OF TABLES

	Page
Table 1 Means, Standard Deviation and Reliabilities for Study 1	23
Table 2 Results of H4 for Study 1	26
Table 3 Results of H5 for Study 1	26
Table 4 Results of H6 & H7 for Study 1	28
Table 5 Means, Standard Deviation and Reliabilities for Study 2	32
Table 6 Results of H4 for Study 2	36
Table 7 Results of H5 for Study 2	37
Table 8.1 Results of H6 & H7 for Study 2	39
Table 8.2 Results of H6 & H7 for Study 2	39

ACKNOWLEDGMENTS

I would like to thank my major professor, Dr. Michael Dahlstrom, for his continuous help and encouragement. I would like to thank my committee members, Dr. Eric Abbott and Dr. Dan Krier, for their guidance and support throughout the course of this research.

In addition, I would also like to thank my parents and my boyfriend for their all-out support, they are the most important people in my entire school life. Without them, I would not have achieved my goals and earned the master's degree. I want to also offer my appreciation to those who were willing to participate in my surveys, without whom this thesis would not have been possible.

ABSTRACT

Cell phones represent a technology associated with uncertain risks, yet one that has already been accepted as a normalized part of society. A pair of online experiments examined how individuals cognitively process uncertain risks associated with previously accepted technology when confronted with precautionary information. The second study expanded the initial results by comparing the effects between U.S. and Chinese students. Results suggest that individuals who initially perceived greater benefits from their cell phone showed less change in perceived risk after reading the precautionary message. Perceived risk also had a significant positive relationship with intentions to engage in protective behaviors. The Chinese participants in general displayed more relationships and larger effects than the U.S. participants. An additional line of inquiry explored if messages addressing perceived social norms and self-efficacy would influence dissonance reduction strategies, yet no effects were found in either participant groups.

CHAPTER I

INTRODUCTION

Science-based risk analysis has been used by government agencies as the foundation for resource allocation, regulation and other risk management decisions. So do private industries, which either follow or lead the government to make more frequent and widespread use of risk analysis. “Risk” is often conceptualized as a measure of probability and consequence of uncertain future events and a chance of undesirable outcomes, which could be loss or potential gain that is not realized. Risk analysis works as a process for decision making under uncertainty. It consists of three tasks – risk management, risk assessment, and risk communication. Separately, in these tasks, “risk assessors address uncertainty in the assessment of risks; risk managers address it in their decision making; and risk communicators convey its significance to interested parties as appropriate.” (Yoe, 2011, p. 6) By addressing all of these is to draw a simple conclusion -- that uncertainty is the reason for risk analysis. (Yoe, 2011)

With the apparent benefits brought by the development of new technology, large amounts of unpredictable and more complex risks arise simultaneously. This means that more “scientific uncertainties” of risks are coming out constantly, especially some issues that have been debated continuously for years, including climate change (Augustsson, Filipsson, Öberg & Bergbäck, 2011), genetically modified organisms (GMOs) (Aslaksen & Myhr, 2007) and nanotechnology (Stokes, 2013). These issues share the common characteristic that they all involve unknown risks. According to National Research Council (2009), uncertainties can be sorted into two distinct sources of not knowing: natural variability and knowledge uncertainty. The difference between these two is that “knowledge uncertainty can

be reduced with more and better information through such means as research, data collection, better modeling and measurement, filling gaps in information and updating out-of-date information, and correcting faulty assumptions” (p. 29) while natural variability cannot be reduced by the same way. The issues mentioned above currently involve large components of knowledge uncertainty. Risk assessors, risk managers and risk communicators have a responsibility to explore specific types of risk and then apply a precise approach when dealing with certain problems (Yoe, 2001). One of these approaches is the precautionary principle.

The precautionary principle emerged in European environmental policies in the late 1970s (Foster, Vecchia & Repacholi, 2000). The increasingly uncertain, unpredictable and unquantifiable but possibly catastrophic risks, such as those associated with climate change or GMOs has confronted societies with the need to develop a anticipatory model (pre-damage control) rather than the old model (the post-damage control) to protect humans and the environment against uncertain risks (COMEST, 2005). On this condition, the precautionary principle was raised and widely applied in decision-making processes when facing risks without adequate data or sufficient information. The precautionary principle emphasizes an awareness of scientific uncertainty about potential adverse effects resulting from a product, phenomenon or process (Freestone & Hey, 1996) and has been raised frequently in risk management situations in an attempt to assure the public under scientific-uncertain situations. The precautionary principle provides a general approach to environmental and health protection (CEC, 2000). There are several versions of the principle ranging from risk-adverse to risk-taking positions, and from ecocentric to anthropocentric. While the precautionary principle has been applied into new technology and environmental

issues, for instance, climate change (Borsuk, Tomassini, 2005), genetically modified organisms (Myhr, 2010) and nanotechnology (Weckert, Moor, 2006), there is no standard version of the precautionary principle used for its implementation (Myhr, Traavik, 2002). Sandin (2004) makes the distinction between prescriptive and argumentative versions of the principle. The argumentative version of the precautionary principle often focuses on narrow utilitarian ethics, and its application involves evaluation of the cost-effective nature of protection of the environment or risk-benefit analyses of environmental risk.

Most mechanisms underlying today's complex technologies are unfamiliar and incomprehensible to the public, and the harmful consequences of them are rare and often delayed. Under this situation, risk assessment is designed to aid in identifying, characterizing, and quantifying risk. However, risk assessment is an approach employed by sophisticated analysts to evaluate hazards -- for the majority of citizens, they prefer to rely on intuitive risk judgments, typically called "risk perception" (Slovic, 1987, p. 280). Generally, these people get their "experience" of hazards from indirect sources, often from the news media, which have report on threats and risks daily.

Therefore, research into risk perception investigates these judgments people make to evaluate and characterize risk activities and technologies. The psychometric paradigm is one framework describing how people form attitudes and perceptions towards a risk. Within it, studies find that judgments of risk and judgments of benefit, while separate constructs, are generally linked in an inversely relationship across diverse hazards. For instance, DDT is a classic case of the dilemmas faced in risk perception as it possesses both high risks and benefits, but perceptions often focus on one to the detriment of the other. On one hand, DDT is a cheap and effective pesticide that works to reduce malaria and has save millions of lives

in many countries. However, DDT has been involved in the decline of a number of raptors and was suspected as a factor in promoting various human cancers and other disorders (Goklany, 2001). Alhakami & Slovic (1994) found that DDT, as well as smoking and asbestos were seen as having of low benefit and high risk, while vaccinations, solar power and computer display were perceived as being high benefit and low risk.

Risk related to cell phone radiation is an emerging topic. Some studies claim potential negative effects to the human body from exposure to cell phones, yet there is no sufficient consensus from scientists yet. However, cell phones are a technology that have already been accepted by society and are widely used around the world. This distinct characteristic makes cell phone technology unique from many other technologies where the uncertainties could play a role in the public's acceptance or rejection of the technology. Although there is some research on the application of the precautionary principle to EMF fields in general and a few on mobile phones in particular, none have taken into account the pre-existing wide spread social acceptance as a factor within examinations of the precautionary principle.

Thus, a new situation should be considered, one in which the fear of unknown risks conflicts with an accepted technology and socially expected behavior. In this case, cognitive dissonance theory would represent an appropriate approach. The basic idea of cognitive dissonance is that "if an person knows various things that are not psychologically consistent with one another, he will, in a variety of ways, try to make them more consistent" (Festinger, 1962, p. 93). Cognitive dissonance theory has been used in risk communication area, such as in the perceived risk of smoking (McMaster & Lee, 1991; Tagliacozzo, 1979). The cognitive conflict many smokers hold are between the known health concerns and the addiction and often-positive social norms of smoking within the individual's social circles. This

inconsistent relationship between cognitions produces a state of dissonance that is psychologically uncomfortable and will act as a motivator for the person to reduce the dissonant state (McMaster & Lee, 1991).

Few studies have explored the influence of the precautionary principle on risk perception and even fewer have done so with respect to cell phone usage. One study found that the precautionary principle increased public concerns and amplified risk perception with regard to EMF fields in general (Wiedemann & Schütz, 2005). Yet, when it comes to cell phones, a unique case with widespread social acceptance, cognitive dissonance may work as a key factor to influence the effects of precautionary information on risk perception. Also of interest is the behavioral intention changes resultant from any of these changes in risk perception. To more realistically model these behavioral intentions, variables from the theory of planned behavior, specifically social norms and self-efficacy, will also be explored.

In sum, this research will examine the effects of precautionary recommendations about cell phone radiation on risk perceptions, and the process by which individuals reduce their cognitive dissonance relative to cell phone usage. Two studies will be conducted to explore these questions. The first will use U.S. participants and the second will compare U.S. and Chinese participants while using a more extreme stimulus. The results of this research will help to better understand how individuals cognitively process unknown risks associated with previously accepted technology when confronted with precautionary information.

CHAPTER II

LITERATURE REVIEW

Cell phone EMF

According to the World Health Organization (WHO) handbook named “Establishing Dialogue on Risk from Electromagnetic Fields” (2002), the potential health effects of man-made EMF have been a topic of scientific interest since the late 1800s and have received particular attention during the last 30 years.

Broadly speaking, electromagnetic fields (EMF) can be divided into two types: static or low frequency electronic magnetic fields and high frequency radiofrequency fields (RF). The common sources of the former include household electronic appliances, computers and power lines, while the main sources of RF include radio and television broadcast facilities, radar, mobile phones and their base stations. RF was classified by the International Agency for Research on Cancer as “possibly carcinogenic to humans” (Cogliano et al., 2011). In recent years, the health hazards of RF field exposure from mobile phones has been an increasing concern of public and scientists have initiated numerous studies on the possible adverse consequences on human health (Aly, Deris & Zaki, 2011). According to Nielsen et al. (2010), a range of diagnoses and symptoms had been examined in studies on possible adverse health effects following exposure to radiation from mobile phones, including cancer (e.g., brain tumors, acoustic neuroma, leukemia, and testicular cancer), headache, and sleep disturbance. (Johansen, 2004; Schreier, Huss & Rösli, 2006; Takebayashi et al., 2006, 2008; Hardell et al., 2007; Sadetzki et al., 2007). The falling cost of mobile phones is contributing to an increasing number of users, especially in developing countries, and the WHO notes that

any adverse health effect will become a global concern. Thus, even a small impact on health could have a major public health consequence. (Repacholi, 2001).

The World Health Organization Electromagnetic Fields Project (WHO EMF-Project), the International Commission on Non-Ionizing Radiation Protection (ICNIRP) and the International Committee on Electromagnetic Safety (ICES) currently assures users that the present safety standards of radiation emitted by cell phones protect all users and there is no proven health risk exist so far. Nevertheless, some claim that the methodological and research design limitations that are intrinsic to different types of studies (human volunteers, animal, epidemiology, and in vitro studies), is still insufficient to support the “safe” claims (Leszczynski & Xu, 2010, Kristiansen, Elstein, Gyrd-Hansen, Kildemoes, & Nielsen, 2009).

To exemplify this uncertainty, a report published by the UK Independent Expert Group on Mobile Phones concludes that cell phones are unlikely to cause cancer or any other disease. However, a co-author of the report, Colin Blackmore, disagreed and indicated, “RF (radio frequency) radiation below guideline thresholds has a demonstrable effect on cells and tissues and this suggests that a precautionary approach is warranted.” He advised that, “although there is no definite evidence of a health risk, we wanted to give a clear message to the industry that they should not continue to market mobile phones specifically to young children until more research is done,” He also suggests that, at the moment, with the “patchy and confused” published data, further individual studies will not help, and more epidemiological research is needed.

The Precautionary Principle

The Precautionary Principle emphasizes an awareness of scientific uncertainty about potential adverse effects resulting from a product, phenomenon or process (Freestone & Hey,

1996) and originates as the German principle of “Vorsorge”, or foresight. This idea of “Vorsorgeprinzip” can be traced back to a 1970 in a bill aimed at securing clean air and is often defined as taking action before possible danger of severe damage occurs to protect human health and the environment. In 1984, the precautionary principle was introduced at the First International Conference on Protection of the North Sea and it has been added into many international agreements and conventions, such as the Bergen declaration on sustainable development, the Barcelona Convention, the Maastricht Treaty on the European Union, and the Global Climate Change Convention (Tickner, Raffensperger, & Myers, 1999). Among many definitions of the precautionary principle, one of the first and well-recognized expressions of the precautionary principle is from the 1993 United Nations Conference Environment and Development in the Rio Declaration (Tickner et al, 1999):

In order to protect the environment, the precautionary approach shall be widely applied by States according to their capabilities. Where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation. (UNCED, 1993)

Sandin (2004) explored and recast the precautionary principle into several dimensions. He makes the distinction between argumentative versions and prescriptive versions of the principle. The argumentative version of precautionary principle often focuses on narrow utilitarian ethics, and “it is not a principle prescribing actions, but a principle for what arguments are valid” (Sandin, 2004, p. 470). The prescriptive version, however, does “prescribe actions.” One example of the prescriptive version of the principle is the Wingspread Statement (Tickner et al, 1999, p. 353-354):

When an activity raises threats of harm to human health or the environment, precautionary measures should be taken even if some cause-and-effect relationships are not fully established scientifically.

The precautionary principle has been raised frequently in risk management situations in an attempt to assure the public under scientific-uncertain situations. Specifically, according to World Commission on the Ethics of Scientific Knowledge and Technology's report, the precautionary principle applies to problems within certain classes characterized by "(1) complexity in the natural and social systems that govern the causal relationships between human activities and their consequences and (2) unquantifiable scientific uncertainty in the characterization and assessment of hazards and risks" (COMEST, 2005, p. 25). So far, the precautionary principle has been applied to a host of recent technology and environmental issues, such as climate change (Borsuk, Tomassini, 2005), genetically modified organisms (Myhr, 2010) and nanotechnology (Weckert, Moor, 2006). Goklany mentioned that the use of DDT is classic case where policymakers had to use the Precautionary Principle to balance between the environmental and public health. He also notes the precautionary principle has been invoked to solve such dilemmas as "a restatement of a Hippocratic oath, 'first do no harm.'" (Goklany, 2001, p. 1-2)

Studies that have examined the precautionary principle have explored how it can help policy makers to balance potential harm and good within environmental risk assessment (Goklany, 2001) as well as analyzing the effects of precautionary principle on trade barriers in the European Community (Goldstein & Carruth, 2004). Few studies focus on the influence of precautionary information on perceived risk of the public (Wiedemann et al, 2013). Goldstein & Carruth (2004) note that whether risk perception should be seen as a trigger for

invoking precautionary measures is a complex topic. On one hand, public risk perception should be taken into account within decisions and risk managers should address the concerns by invoking protective measures to assure the public. Pragmatically, according to the trust, confidence, and cooperation model, implementing precautionary measures can raise confidence in risk management of the health authorities, reducing risk perception overall (Earle, Siegrist & Gutscher, 2007). On the other hand, precautionary measures might be a cue that evokes emotional arousals. The public could take the precaution as a warning signal and interpret the information along the lines of, “there is no smoke without fire”, therefore amplifying public risk perception (Wiedeman et al, 2013).

Some research has examined the influence of precautionary measures on RF EMF-related risk perception, with a fewer number exploring specifically mobile phones or base stations. According to Wiedemann et al (2013), public concerns about the possible hazardous health effects of RF EMF exposure from cell phones and base stations are reported from Europe as well as Australia (Sheperd, Jepson, Watterson & Evans, 2012), Taiwan, China (Liao, 2012) and New Zealand (Bond & Wang, 2005). In other nations and area, such as the United States, the RF EMF is a debated topic but has not become a widespread worry (Slesin, 2012). The major findings of Wiedemann et al. show that informing people about implemented precautionary measures aimed at dealing with potential risks of EMF increases public concern (Wiedemann et al., 2013) and amplifies risk perception (Timotijevic & Barnett, 2006; Wiedemann et al., 2013). Other studies found similar results towards perceived risk of base stations after receiving the precautionary principle information (Wiedemann & Schütz, 2005; Barnett, Timotijevic, Shepherd & Senior, 2007; Burgess, 2004; Wiedemann, Thalmann, Grutsch & Schütz, 2006). In a similar study, Cousin and Siegrist

(2011) explored the influence of precautionary measures in risk perception of mobile communication but found conflicting results. After providing precautionary information in the form of booklets, readers' knowledge increased initially, but health concerns decreased after two weeks.

In sum, most epidemiological studies find little to no negative effects to human body from exposure to cell phones, yet there are others who suggest there is not yet sufficient consensus from science and dangers may still exist. Nonetheless, cell phones are a technology that have already been accepted by society and are widely used around the world. This distinct characteristic makes cell phone technology somewhat unique from many other controversial technologies, (e.g. GMO, nanotechnology etc.) where the unknown risks play a role in the public's acceptance or rejection of the technology. Although there is some research on the application of the precautionary principle to EMF fields in general and a few on mobile phones in particular, none have taken into account the pre-existing wide spread social acceptance as a factor within examinations of the precautionary principle.

Thus, a new situation should be considered, one in which the fear of unknown risks conflict with an accepted technology and socially expected behavior. In this case, cognitive dissonance theory would represent an appropriate approach.

Risk perceptions

Research into risk perception investigates the judgments people make to evaluate and characterize risk activities and became a significant concept within policy contexts in the 1960's. Public risk perceptions were seen as a contributing factor in public opposition to technology, and the most notably was to nuclear technology (Martin & Wogalter, 1989). Why does it seem more difficult for people to accept the risk of living close to nuclear

technology rather than the risk of smoking, even though experts identify the latter as the greater risk? Experts critiqued such public perceptions as an impediment to rational decision-making, giving rise to the conflict between public and expert risk perception at the basis of the social dilemmas of risk management (Sjöberg, 1999). Other scholars took up these questions to develop detailed frameworks.

The psychometric paradigm is a framework that uses psychometric scales to make quantitative measures of perceived risk (Slovic, Fischhoff & Liechtenstein, 1980, 1982, 1985; Fischhoff, Slovic, Lichtenstein, Read & Combs, 1978). Hazards are characterized by different attributes that may influence the perception and acceptance towards certain risk, such as newness, dreadfulness, controllability, catastrophic potential, voluntariness and immediacy, etc. It assumes that what individuals subjectively understand as risk may be influenced by a wide array of psychological, social, institutional, and cultural factors. The paradigm assumes that with an appropriate design of the survey instrument, many of these factors and their interrelationships can be quantified and modeled in order to better understand individuals' and society's attitudes toward the hazards they confront (Slovic, 2000).

Within these psychometric studies, judgments of risk and benefit are regularly observed to be inversely related across diverse hazards, such that phenomenon with greater perceived benefits are perceived to have fewer risks and vice versa (Kristiansen *et al*, 2009). Alhakami and Slovic (1994) note that the negative correlations between risk and benefit might contribute to magnifying the “halo effect”, which was first mentioned by Wells (1907) and later named by Thorndike (1920). “Halo occurs when [an] individual judges people, object or thing in term of general attitudes toward them.” (Alhakami & Slovic, 1994, p. 1087)

For example, if a person has a favorable overall impression of another individual, then it is mainly the positive aspects of that individual that the person notices. Several psychological theories including cognitive consistency theories was raised as explanations of halo effect.

Cognitive consistency theories of attitude change suggest that when people sense inconsistencies in their beliefs, they often change some of inconsistent thoughts to restore consistency (Benoit & Benoit, 2008). In the context of attitude towards activity and technology, when an individual considers an activity or technology as having more benefits, to be consistent, he or she will modify her beliefs to also view this activity or technology as having lower risk (Alhakami & Slovic, 1994). Finucane, Alhakami, Slovic, & Johnson (2000) describes an “affect heuristic” model explaining the relationship between perceived risk and benefits. “If a general affective view guides perceptions of risk and benefit, providing information about benefit should change perception of risk and vice versa.” (Slovic, Finucane, Peters, & MacGregor, 2004, p. 315)

Cognitive dissonance is another theory that deals with the relationship between cognitions that are inconsistent. Festinger (1957) argues that there are three possible relationships among cognitions: consonance, dissonance, and irrelevance. Consonance means that two ideas are consistent. For example, “I like Michael Jordan” and “Michael Jordan is the greatest basketball player in the world” are two consistent ideas. Dissonant means that two thoughts are inconsistent, such as “I smoke cigarettes.” and “Cigarettes can kill smokers.” Two thoughts are irrelevant, which means that they are not connected at all. For instance, “Michael Jordan is the greatest basketball player in the world” and “Cigarettes can kill smokers” are two irrelevant thoughts. Cognitive dissonance theory often begins with a behavior, such that a behavior is enacted that afterwards is realized to contradict existing

thoughts or beliefs. Festinger (1957) postulated that this unpleasant psychological state encourages some dissonance reduction strategy, such as attitude change, to achieve consonance, thereby reducing these uncomfortable feelings.

Cognitive dissonance embodies the potential conflict within this mobile phone context. If a person learns about the potential dangers of using a cell phone, but has already accepted the technology and incorporated it into their daily lives, an uncomfortable psychological state might arise. In order to reduce the dissonance, the individual might reduce or stop using their cell phone. However, it might be easier to use other dissonance reduction strategies that continues to permit cell phone use, such as by dismissing the potential risk, assuming a lack of ability to address it, or reducing the importance of health all together. Which dissonance reduction strategy an individual use likely depends on how the potential risks are perceived.

Little research has explored the risk perceptions specifically surrounding mobile phone use. Some that do suggest that acquired knowledge and trust in authorities might be relevant factors (Cousin & Siegrist, 2011). Wiedemann et al. (2013) found that within a mobile phone context, “Higher perceived personal benefits is associated with lower perceived risk, and positive attitudes toward science and technology are associated with lower perceived risk” (Wiedemann et al. 2013, p. 1795). Risk perceptions are also often linked to behaviors, such as when Cousin and Siegrist (2011) found that individuals who were informed about precautionary measures without additional behavioral recommendations (e.g. using a headset or a Bluetooth application, avoiding holding the cell phone close to head etc.) reported less behavioral change than those who was exposed to specific recommendations.

An additional factor that has yet to be explored in this context, yet is strongly related to behavior, is perceived social norms. Social norms are not usually theorized within cognitive dissonance, but instead within the theory of planned behavior, which was built on the theory of reasoned action (Ajzen & Fishbein, 1975). This theory conceptualizes that subjective norms and perceived behavioral control are contributing factors that predict behavioral intention and behavior. Therefore, what individuals believe others are doing and expect from them is known to influence individual behaviors, yet this remains unstudied in a mobile phone context.

Study Objectives

Exposure to precautionary information that calls for changes to cell phone usage will likely lead to cognitive dissonance as cell phones represent a technology that has already been widely accepted. How participants resolve that dissonance is the focus of this study and the following hypotheses predict some possible outcomes.

The first possible dissonance reduction strategy in this context includes (1) perception of the message as not trustworthy and retaining the original risk perceptions and behaviors toward cell phone usage. In this case, perceived trustworthiness of the article would be low, as would acceptance of the risk perceptions and behaviors espoused in the precautionary principle message. Because the psychometric paradigm finds that perceptions of benefits will inversely be correlated with perceptions of risks, this first dissonance reduction strategy would be more likely to be used in the case of high initial perceptions of benefits regarding cell phone use. However, individuals who do accept the message as trustworthy will more likely accept the risk perceptions and behaviors espoused in the precautionary principle message. Likewise, greater acceptance of risk perceptions should also relate to increased

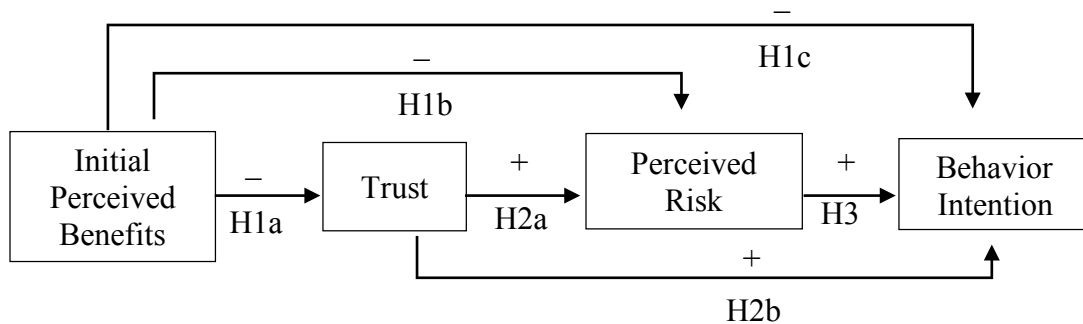
acceptance of the proposed protective behaviors. These predictions are described in the following hypothesis and are present visually in Figure 1.

H1. Greater initial perceived benefits of cell phone usage will relate with lower (H1a) trustworthiness of the message as well as more negative (H1b) risk perceptions and (H1c) behaviors proposed by the argument within the precautionary principle message.

H2. Higher perceived trustworthiness of the message will correlate with increased acceptance of the (H2a) risk perceptions and (H2b) behaviors proposed by the argument within the precautionary principle message.

H3. Higher risk perceptions will relate to increased acceptance of the behaviors proposed by the argument within the precautionary principle message.

Figure 1. The predicted relationships of perceived benefits of cell phones and message effects



However, this link between perceived risk and behavior change demands more scrutiny. More complex interactions with self-efficacy and social norms as alternate reduction strategies are also possible to maintain original behaviors toward cell phone usage while still accepting the risk perceptions. Specifically, this leads to three more possibilities of dissonance reduction strategies that do not lead to behavior change, (2) acceptance of the argument, but no subsequent behavior changes due to lack of perceived self-efficacy, (3) acceptance of the argument, but no subsequent behavior change due to perceived pressure

from social norms to avoid change and (4) acceptance of the argument, but no subsequent behavior change due to both lack of self-efficacy and social norms pressure. The following hypotheses explore these possibilities.

First, it is likely that content within the precautionary principle message itself could address the self-efficacy and social norms concerns by alleviating self-efficacy and social norms fears.

H4. Participants exposed to precautionary principle messages that portray self-efficacy as high will result in greater perceived self-efficacy.

H5. Participants exposed to precautionary principle messages that address social norms to change behavior as high will result in greater perceived social norms toward cell phone reduction.

These changes in perceived self-efficacy and social norms could, in effect, block those dissonance reduction strategies and increase the chances for behavioral change.

H6. Within the individuals who show risk perception change aligned with the precautionary principle, participants exposed to a treatment countering a single dissonance reduction strategy (either self-efficacy or social norms) will exhibit greater behavior intentions aligned with the precautionary principle than the treatment addressing no dissonance reduction strategies.

H7. Participants exposed to precautionary principle messages that address both response efficacy and social norms will exhibit the greatest proportion of behavior change intentions aligned with the precautionary principle message.

CHAPTER III

STUDY 1 – METHODS

Sample

The participants were undergraduate students who enrolled in a large communication class and received extra credit for their participation. The initial sample contained 271 participants. Participants who didn't finish the survey or spent less than 20 seconds reading the stimulus were removed. This resulted a final sample of 260 participants. Subjects were predominantly female (72%), with a median age of 21.

Protocol

Data was collected during two weeks in December 2015. After consenting to participate in a study about how risk issues were presented in the media, participants were asked to complete a pretest capturing their perceived benefits, risk perceptions, perceived subjective norms and self-efficacy, as well as behavioral intentions about cell phone. The survey then informed participants that they would read a news story about cell phone radiation that was published by a trustworthy scientific source. Random assignment then exposed participants to one of four version of a precautionary principle news story that differed by the presence of paragraphs explicitly addressing self-efficacy and social norms about the issue. Finally, participants were asked to fill out a final questionnaire capturing most of the same variables as in the pre-test to permit the calculation of change caused by the treatment. Participants were thanked, told that parts of the stimuli they read were fictionalized for the purpose of this study, and encouraged to visit the World Health Organization's website for more information about the potential risks of cell phone radiation.

Stimuli

The stimuli consisted of a news story describing the scientific uncertainty about the risks of mobile phone radiation and arguing that users should engage in precautionary behaviors to protect themselves from these uncertain risks. The content of news story was modified from the stimuli used in the Wiedemann and Schütz (2005, 2013) studies of precautionary information within an EMF context. The news story began by describing the uncertainties of cell phone risk, the possible ways such radiation harms human health and then suggested specific behaviors that users should adopt to continue using cell phones while protecting themselves. Accompanying the story was an image portraying an illustrated x-ray of a person talking on a cell phone with rings of radiation penetrating the person's skull.

Manipulations

Four versions of stimulus were created for manipulations: precautionary principle information only; precautionary principle with self-efficacy information; precautionary principle with social norms information and precautionary principle with both self-efficacy and social norms information. The precautionary principle information treatment represented the base stimulus as described above. The self-efficacy manipulation included an additional paragraph emphasizing how enacting many of the recommended behaviors were simple and fit into everyday uses of cell phones. The social norms manipulation included an additional paragraph describing a recent survey that finds that a large proportion of the public is concerned about cell phone radiation and more than sixty percent of them are engaging in at least one protective action to reduce their potential risk. This paragraph continued to claim that these protective actions are especially growing among high school and university students. For the treatment with both self-efficacy and social norms, both of these additional paragraphs were included. The length of each treatment was 663 words (precautionary

principle only), 778 words (with the self-efficacy manipulation only), 758 words (with the social norms manipulation only) and 873 words (with both manipulations). The stimulus with both manipulations is included in Appendix C.

Variables

Perceived benefits

To measure the perceived benefits of cell phone use, questions were drawn from previous research on perceived benefits and perceived risk (Fischhoff et al., 1987; Slovic et al., 1991). Respondents were asked, “In general, how beneficial do you consider cell phones to be for yourself?” and, “In general how beneficial do you consider cell phones to be for society as a whole?” (1 = not at all; 7 = very beneficial). These measures of perceived benefits were collected both in the pre- and post-survey. The responses to these two questions were averaged to form the pre and post perceived benefits of cell phone use (pre: $M=5.62$, $SD=1.12$, $\rho=.92$; post: $M=5.68$, $SD=1.14$, $\rho=.95$).

Actual cell phone use was also collected in the pre-test by asking participants “About how many hours per day do you use your cell phone for making calls, receiving calls, or text messaging?” on a Likert scale (1=none, 7=more than 8 hours) (White et al., 2007). These categorical answers were recoded to approximate a continuous variable of hours for further analysis (1-2 hours became 1.5, etc.) ($M=3.54$, $SD=2.32$).

Trustworthiness

Meyer’s five-item credibility index (West, 1994) was used to measure the trustworthiness of information provided in the news story. Participants were asked if they thought the preceding news article was (1) unfair/fair, (2) biased/unbiased, (3) don’t tell the whole story/tell the whole story, (4) inaccurate/accurate, (5) can’t be trusted/can be trusted,

each on a 1 to 5 Likert scale with greater values representing greater perceived trustworthiness ($M=3.42$, $SD=.62$, $\alpha=.83$).

Perceived risk

Perceived risk of cell phone use was measured through the psychometric paradigm's concept of "severity", "vulnerability" and "worry." Participants were asked how they perceive each of the three factors relative to cell phone radiation for both themselves and for society as a whole on a scale from 1 to 7 with greater values representing greater risk perceptions. This measure was captured at both pre and post conditions and responses at each time point were averaged (pre: $M=4.29$, $SD=.96$, $\alpha=.92$; post: $M=3.79$, $SD=1.49$, $\alpha=.95$). A difference score was constructed by subtracting the pre-test score from the post-test score ($M = -.49$, $SD = 1.17$).

Behaviors

In the pretest, participants were asked to select from six possible self-protective behaviors whether they had already taken any actions to reduce the potential health hazards from exposure of cell phone radiation. These behaviors came from Cousin and Siegrist's study (2011), and were also the specific behaviors suggested in the stimuli. For instance, "I use a headset and Bluetooth application in order to reduce the radiation passed to my head." In the posttest, participants were asked to answer the likelihood of continuing or adopting any of the same behaviors. The total pre and post behavior measure was calculated by summing the number of behaviors the respondent checked (pre: $M=.96$, $SD=1.07$; post: $M=1.90$, $SD=1.69$). As a second behavioral measure, the participants were asked about the frequency with which they try to protect themselves from the potential effects of cell phone radiation (in the pre-test) or their intention in the future (in the post-test) on a scale from 1

(less than once a month) to 7 (Daily) (pre: $M=2.10$, $SD=1.81$; post: $M=3.25$, $SD=2.08$).

Difference scores were constructed by subtracting the pre-test score from the post-test score, for both the specific behavior variable ($M=.94$, $SD=1.45$) and frequency of protection ($M=1.15$, $SD=1.85$).

Self-efficacy

The self-efficacy of each of the six protective behaviors was measured by asking “How easy do you think it would be for you to apply the following risk prevention behaviors into the way you currently use your cell phone?” each on a 1-100 slider bars, as suggested by Bandura (2006). Self-efficacy was measured in both pre and post test and all self-efficacy measures at each time point were averaged (pre: $M=47.40$, $SD=19.13$, $\alpha=.72$; post: $M=51.22$, $SD=21.83$, $\alpha=.82$). The change of self-efficacy was also calculated by subtracting the pre from the post scores ($M = 3.82$, $SD = 11.02$).

Social norms

Social norms were measured by asking participants four questions modeled after Mackie et al. (2012), including “How much do you think the average person worries about cell phone radiation?” (1 = none; 7 = almost everyone) and “How many people in general do you think actually engage in some of these risk reduction behaviors?” (1 = not at all; 7 = worry about it very much). Same questions were also asked about how the participants think about ISU students. Social norms were measured for both pre and post time points. All responses at each time point were averaged (pre: $M=3.47$, $SD=1.31$, $\alpha=.81$; post: $M=2.58$, $SD=1.00$, $\alpha=.85$). Similar with the previous variables, a difference score was created by subtracting the pre from the post score ($M = -.89$, $SD = .95$).

All measured variables for Study 1 are reported in Table 1.

Table 1. Means, Standard Deviation and Reliabilities for Study 1

Variable	Pre-test			Post test			Change
	M	SD	p / α	M	SD	p / α	M
Perceived benefits	5.62	1.12	0.92	5.68	1.14	0.95	0.06
Perceived risk	4.29	0.96	0.92	3.79	1.49	0.95	-.05
Cell phone use time	3.54	2.32					
Protective behaviors	0.96	1.07		1.90	1.69		0.94
Time spent on behaviors	2.10	1.81		3.25	2.08		1.15
Trustworthiness				3.42	0.62	0.83	
Self-efficacy	47.40	19.13	0.72	51.22	21.83	0.82	3.82
Social norms	3.47	1.31	0.81	2.58	1.00	0.85	-0.89

Note: M = mean, SD = standard deviation, p / α = Spearman-Brown split-half / Cronbach's Alpha coefficients.

CHAPTER IV

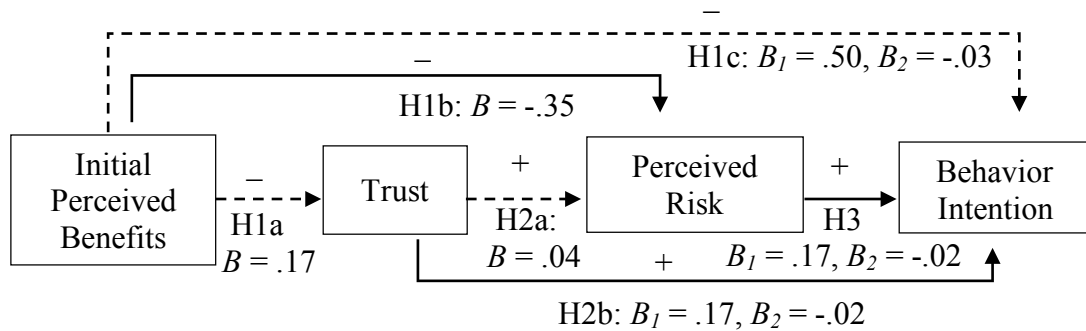
STUDY 1 – RESULTS AND DISCUSSION

Because the hypotheses predict directional relationships, all tests are one-tailed. H1 predicted that greater initial perceived benefits of cell phone usage would relate with lower levels of the (H1a) trustworthiness of the message and subsequent lower (H1b) risk perceptions and (H1c) behavioral intentions as proposed by the argument within the precautionary principle message. A hierarchical regression analysis was used to explore this relationship. In block one, the demographics of age and gender were entered. Trustworthiness of the message was entered in block 2. The change of perceived risk was entered in block three and the change in both behavioral variables were entered in block four. The results show that initial perceived benefits of cell phone usage has a significant negative relationship with risk perceptions ($B = -.35, p < .001$) but not with the trustworthiness of the message ($B = .17, p = .16$), the protective behaviors proposed by the argument ($B = .05, p = .41$) or the time spent on behaviors ($B = -.03, p = .35$).

H2 predicted that higher perceived trustworthiness of the message would relate with higher acceptance of the (H2a) risk perceptions and (H2b) behaviors proposed by the argument within the precautionary principle message. A similar hierarchical regression analysis was used to explore this relationship replacing the dependent variable with trustworthiness of the message and removing the second regression block. The results found that trust did not have a significant relationship with risk perception ($B = .04, p = .080$), but did with both protective behaviors ($B = .17, p < .001$) and the amount of time spent on these behaviors ($B = -.02, p = .004$).

H3 completed the model by predicting that higher risk perceptions would relate to increased acceptance of the behaviors proposed by the argument within the precautionary principle message. Again, a similar hierarchical regression analysis was used replacing the dependent variable with change in risk perceptions. Results found that there is a positive relationship between perceived risk and the acceptance of the protective behaviors ($B = .50$, $p < .001$), but not between risk perception and the amount of time spent on these behaviors ($B = -.03$, $p = .10$). The results from all three hypotheses are portrayed visually in Figure 2.

Figure 2. The relationships of perceived benefits of cell phones and message effects



Note: B_1 = beta coefficient related to protective behaviors, B_2 = beta coefficient related to time spent on these behaviors.

H4 predicted that participants exposed to precautionary principle messages that address self-efficacy will result in a greater change in perceived self-efficacy. An ANOVA test found no significant difference between any of the treatments on change in perceived self-efficacy: precautionary principle only ($M = 2.56$, $SD = 11.56$); self-efficacy manipulation only ($M = 3.05$, $SD = 13.10$); social norms manipulation only ($M = 5.47$, $SD = 10.83$); both manipulations ($M = 3.79$, $SD = 8.28$; $F(245) = .83$, $p = .48$, $\eta_p^2 = .01$). Therefore, H4 was not supported. Detailed results are reported in Table 2.

Table 2. Results of H4 for Study 1

Manipulation	Perceived self-efficacy		Compared treatment	Sig.
	M	SD		
Precautionary principle only	2.56	11.56		
Self-efficacy	3.05	13.10	Precautionary principle only	0.41
Social norms	5.47	10.83	Precautionary principle only	0.07
			Self-efficacy	0.11
Self-efficacy & social norms	3.79	8.28	Self-efficacy	0.15
			Precautionary principle only	0.27
			Social norms	0.20

* $p < 0.01$

Note: N = 245, M = Mean, SD = Standard Deviation

H5 predicted that participants exposed to precautionary principle messages that address social norms would result in a greater change in perceived response social norms and behavior change intentions. An ANOVA test followed by pairwise comparisons confirmed that the social norms manipulation only ($M = -.60$, $SD = .84$) was significantly greater than precautionary principle only ($M = -.93$, $SD = .86$) and self-efficacy manipulation only ($M = -1.11$, $SD = .85$; $F(245) = 4.17$, $p = .01$, $\eta_p^2 = .05$). As shown in Table 2, there was no difference between the social norms manipulation only and the treatment with both manipulations ($M = -.71$, $SD = .98$; $F(245) = 4.17$, $p = .48$, $\eta_p^2 = .05$). Thus H5 is partially supported.

The results of hypothesis 5 are reported in Table 3.

Table 3. Results of H5 for Study 1

Manipulation	Perceived social norms		Compared treatment	Sig.
	M	SD		
Precautionary principle only	-0.93	0.86		
Self-efficacy	-1.11	0.85	Precautionary principle	0.14
Social norms	-0.60	0.84	Precautionary principle	0.20
			Self-efficacy	0.01*
Self-efficacy & social norms	-0.71	-0.98	Precautionary principle	0.09
			Self-efficacy	0.01*
			Social norms	0.26

* $p < 0.01$

Note: N = 245, M = Mean, SD = Standard Deviation

The remaining hypotheses only concern those individuals who exhibited an increase in risk perceptions after exposure to the stimulus. Therefore, the following results are based on this subset of 66 participants out of the total, or 27%. This subset of participants was predominantly female (73%), with a median age of 19.

H6 predicted that these participants exposed to a treatment countering a single dissonance reduction strategy (either self-efficacy or social norms) would exhibit a greater change in behavior intentions aligned with the precautionary principle than the treatment addressing no dissonance reduction strategies. ANOVA tests followed by pairwise comparisons were used to explore both the relationships on protective behaviors as well as time spent on behaviors. For change in behaviors, the precautionary principle only treatment ($M = 1.93$, $SD = 1.64$) was significantly greater than the self-efficacy manipulation only ($M = .56$, $SD = 1.46$; $F = (66)$, $p = .02$, $\eta_p^2 = .13$) and the social norms manipulation only ($M = .54$, $SD = .42$; $F = (66)$, $p = .02$, $\eta_p^2 = .13$). This is opposite of what was expected.

Regarding change in time spent on behaviors, an ANOVA test found no significant difference between any of the relevant treatments: precautionary principle only ($M = 1.00$, $SD = 1.52$); self-efficacy manipulation only ($M = .75$, $SD = 2.20$); social norms manipulation only ($M = 1.08$, $SD = 1.98$; $F = (66)$, $p = .39$, $\eta_p^2 = .05$).

H7 predicted that participants exposed to precautionary principle messages that address both response efficacy and social norms will exhibit the greatest behavior change intentions aligned with the precautionary principle message. From the previous ANOVA analyses, there was no significant difference in the change in behaviors of participants exposed to the message with both self-efficacy and social norms ($M = 1.18$, $SD = 1.60$) with

any of the other three stimuli groups. No significant relationship was found in regard to change in time spent on behaviors ($M=1.23$, $SD=1.95$). Thus H7 is not supported.

The detailed results of H6 and H7 are displayed in Table 4.

Table 4. Results of H6 & H7 for Study 1

Manipulation	Behaviors		Sig.
	M	SD	
Precautionary principle only	1.93	1.64	
Self-efficacy	0.56	1.46	Precautionary principle only 0.01
Social norms	0.54	0.84	Precautionary principle only 0.01
			Self-efficacy 0.50
Self-efficacy & social norms	1.18	1.60	Precautionary principle only 0.22
			Self-efficacy 0.03
			Social norms 0.04
Manipulation	Time spent on behaviors		Sig.
	M	SD	
Precautionary principle only	1.00	1.52	
Self-efficacy	0.75	2.20	Precautionary principle only 0.37
Social norms	1.08	1.98	Precautionary principle only 0.46
			Self-efficacy 0.33
Self-efficacy & social norms	1.23	1.95	Precautionary principle only 0.12
			Self-efficacy 0.06
			Social norms 0.15

* $p < 0.01$

Note: N = 66, M = Mean, SD = Standard Deviation

STUDY 1 – DISCUSSION

This study examined two sets of hypotheses, the first predicting from the psychometric paradigm that greater initial perceived benefits of a technology would relate to less perceived trust in the information. Exploring a model that also incorporated trust in the message and behavioral intentions, results confirm that greater perceived benefits did relate in less perceived risk which had a significant relationship with subsequent behavior intentions. Perceived benefits did not relate to trust or have a direct relationship to behaviors, but trust itself did have a positive relationship with change in behavior intentions.

This second set of hypotheses explored this link between change in risk perceptions and change in behavioral intentions through a cognitive dissonance framework. However, the manipulation checks failed to indicate that the stimuli designed to influence dissonance reduction strategies regarding self-efficacy worked as intended. Likely as such, none of the following hypotheses were supported.

The number of respondents who exhibited a change in risk perceptions aligned with the stimuli were also lower than expected, adding another explanation of sample size as to why the dissonance hypotheses were not supported. To address these shortcomings, a second study was designed and conducted.

CHAPTER V

STUDY 2 – STUDY OBJECTIVES AND METHODS

The second study replicated the previous experiment but made two major modifications to better explore if the lack of previous findings were due to methodological artifacts or a true lack of effects. The first modification was to alter the stimulus to emphasize the possible threat and danger of cell phone use. Because the first study was limited by the proportion of participants who exhibited positive change in risk perceptions, this modification aims to make this risk more salient and increase this subset of the total sample to use in the dissonance analyses. Other smaller changes were also made to the stimulus to emphasize content of interest.

The second modification concerned the sample itself. The potential risk of cell phone radiation is not a common concern within the U.S. However, the risk of cell phone radiation is a common topic among internet and mainstream media in China (Yan, Zeng & Shi, 2009). Many Chinese citizens are actively worried about the potential health issues of cell phone use and some are convinced that probably unrelated healthy issue are caused by cell phone radiation. Therefore, this study will use two samples: (1) a replication of the U.S. sample to see if a more salient risk message and larger subsample the appropriate change in risk perceptions changes any of the previous results and (2) a new sample of Chinese citizens.

Therefore, the hypotheses of Study 2 will be same as Study 1 with one addition:

H8: Chinese participants will exhibit larger effects relative to the previous hypotheses as compared to U.S. participants.

Sample

Participants were U.S. undergraduate students enrolled in a communication class and Chinese students officially registered in the same university during 2016. Subjects who enrolled in the communication class received extra credit for their participation. For the Chinese students, ten were randomly selected to receive a \$10 gift card for their participation.

The initial sample contained 347 participants (93 Chinese and 254 U.S. students). Participants who didn't finish the survey or who spent less than 20 seconds reading the survey were removed. This resulted a final sample of 315 participants (84 Chinese and 231 U.S. students). American subjects were predominantly female (63.6%), with a median age of 20 years. Chinese subjects were predominantly male (57.1%) with a median age of 24 years.

Protocol

Data was collected during two weeks in February 2016. The same protocol from study 1 was followed.

Stimuli

The stimuli from Study 1 were modified to strengthen the possible dangers of cell phone radiation, changing the headline and including more vivid descriptions of the potential harm. Comparing the perceived risk between the two studies suggests that these modifications did result in greater perceived risk in Study 2. The average perceived risk declined in Study 1 where the perceived risk in Study 2 increased one point for the U.S. sample and almost two points for the Chinese sample. The protective behaviors were also displayed in bullet points to further emphasize them from the main body text. The stimulus with both manipulations from Study 2 is included in Appendix D.

Variables

All variables were measured the same as in Study 1 and are reported in Table 5.

Table 5. Means, Standard Deviation and Reliabilities for Study 2

Variable	U.S.							China						
	Pre-test			Post test			Change	Pre-test			Post test			Change
	M	SD	p/α	M	SD	p/α		M	SD	p/α	M	SD	p/α	M
Perceived benefits	5.67	1.09	0.84	5.69	1.09	0.95	0.02	5.48	0.80	0.86	3.98	1.09	1.14	-1.50
Perceived risk	3.14	1.30	0.84	3.78	1.47	0.95	0.64	2.69	1.03	0.86	4.63	1.01	0.92	1.94
Cell phone use time	4.07	2.49						4.14	1.94					
Protective behaviors	0.99	1.56		2.01	1.54		1.02	1.01	0.92		3.69	1.31		2.68
Time spent on behaviors	1.98	1.59		3.42	2.04		1.44	2.62	1.41		4.14	1.24		1.52
Trustworthiness				3.39	1.30	0.83					4.21	0.48	0.76	
Self-efficacy	45.97	23.84	0.72	52.67	19.86	0.78	6.70	19.13	19.46	0.92	41.25	18.61	0.90	22.12
Social norms	2.25	2.51	0.80	2.63	4.08	0.88	0.38	2.51	0.87	0.39	4.08	1.16	0.90	1.57

Note: M = mean, SD = standard deviation, p/α = Spearman-Brown split-half / Cronbach's Alpha coefficients.

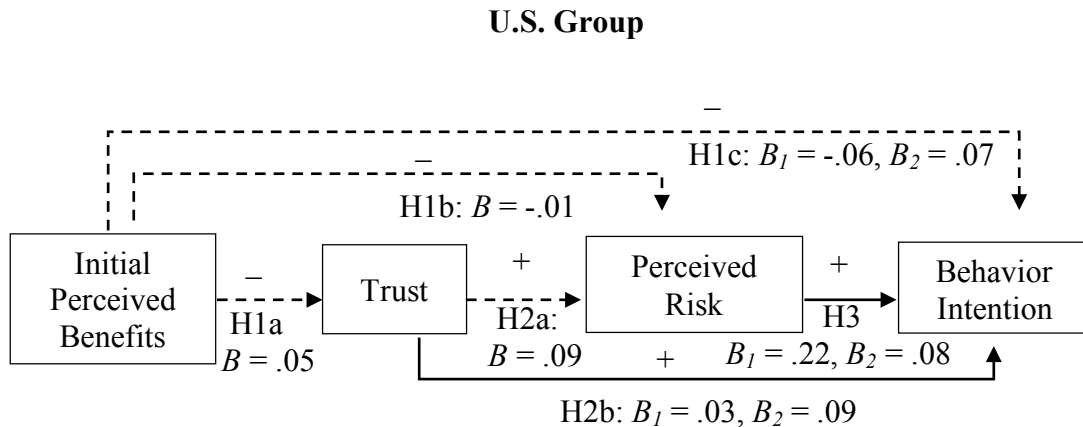
CHAPTER VI

STUDY 2 – RESULTS AND DISCUSSION

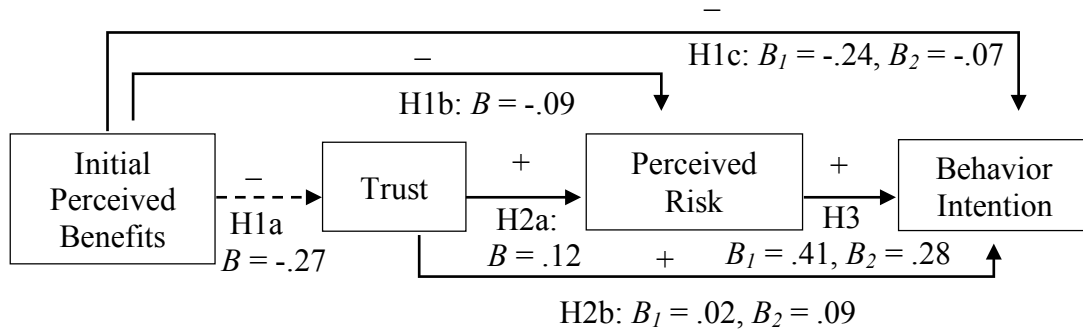
Because the hypotheses predict directional relationships, all tests again are one-tailed. H1 predicted that greater initial perceived benefits of cell phone usage will relate with lower (H1a) trustworthiness of the message and subsequent lower (H1b) risk perceptions and (H1c) behaviors proposed by the argument within the precautionary principle message. Hierarchical regression analysis was used to explore this relationship. In block one, the demographics of age and gender were entered. Trustworthiness of the message was entered in block 2. The change of perceived risk was entered in block three and the change in both behavioral variables were entered in block four. A separate hierarchical regression was conducted for both the U.S. and Chinese groups.

For the Chinese group, greater initial perceived benefits of cell phone usage had significant negative relationships with change in risk perceptions ($F(84) = 3.31, B = -.09, p = .001$), protective behaviors ($F(84) = 4.74, B = -.24, p < .001$) and time spent on behaviors ($F(84) = 4.74, B = -.07, p = .001$). For the U.S. group, these relationships were not significant: change in perceived risk ($F(230) = .22, B = -.01, p = .43$), change in protective behaviors ($F(230) = .54, B = -.06, p = .48$) and change in time spent on behaviors ($F(230) = .54, B = .07, p = .08$). There was no relationship between initial perceived benefits and trust of the message for either group (U.S.: $F(230) = .29, B = .22, p = .16$; Chinese: $F(84) = 1.54, B = -.27, p = .34$). Thus, H1 is partially supported.

H2 predicted that increased perceived trustworthiness of the message would relate with increased acceptance of the (H2a) risk perceptions and (H2b) behaviors proposed by the argument within the precautionary principle message. Similar hierarchical regression



Chinese Group



Note: B_1 = beta coefficient related to protective behaviors, B_2 = beta coefficient related to time spent on these behaviors.

H4 predicted that participants exposed to precautionary principle messages that address self-efficacy would result in greater change in perceived self-efficacy. An ANOVA test followed by pairwise comparisons confirmed that in the Chinese group, the self-efficacy manipulation ($M=24.60$, $SD=14.54$) and the self-efficacy and social norms manipulation ($M=26.42$, $SD=10.01$) had significantly greater change in perceived self-efficacy than the precautionary principle only ($M=8.22$, $SD=10.01$) and social norms manipulation ($M=10.46$, $SD=7.39$; $F(84) = 11.19$, $p < .001$, $\eta_p^2 = .30$).

However, the U.S. group showed no significant differences in change in perceived self-efficacy between any of the treatments: precautionary principle only ($M = 4.16$, $SD = 11.33$); self-efficacy manipulation ($M = 8.19$, $SD = 13.51$); social norms manipulation ($M = 5.47$, $SD = 10.83$); both manipulations ($M = 5.06$, $SD = 11.54$; $F(231) = 1.30$, $p = .28$, $\eta_p^2 = .02$). Thus, H4 is partially supported. The results are shown in Table 6.

Table 6. Results of H4 for Study 2

Manipulation	U.S.				China			
	Perceived self-efficacy		Compared treatment	Sig.	Perceived self-efficacy		Compared treatment	Sig.
	M	SD			M	SD		
Precautionary principle only	4.16	11.33			8.22	10.01		
Self-efficacy	8.19	13.51	Precautionary principle only	0.06	24.60	14.54	Precautionary principle only	0.00*
Social norms	5.47	10.83	Precautionary principle only	0.53	10.46	7.39	Precautionary principle only	0.57
			Self-efficacy	0.22			Self-efficacy	0.01*
Self-efficacy & social norms	5.06	11.54	Precautionary principle only	0.67	26.42	10.01	Precautionary principle only	0.00*
			Self-efficacy	0.15			Self-efficacy	0.65
			Social norms	0.84			Social norms	0.00*

* $p < 0.01$

Note: N(U.S.) = 231, N(China) = 84, M = Mean, SD = Standard Deviation

H5 predicted that participants exposed to precautionary principle messages that address social norms will result in a greater change in perceived social norms. Similar with the previous results, an ANOVA test followed by pairwise comparisons found that in the Chinese group, the social norms manipulation ($M=1.94$, $SD=1.71$) and the self-efficacy and social norms manipulation ($M=2.54$, $SD=1.54$) had significantly greater change in perceived social norms than the precautionary principle only ($M=1.02$, $SD=.89$) and the self-efficacy manipulation ($M=.84$, $SD=.92$; $F(84) = 7.68$, $p < .001$, $\eta_p^2 = .22$). However, the U.S. group again showed no significant differences on change in perceived social norms: precautionary principle only ($M = .25$, $SD = .73$); self-efficacy manipulation only ($M = .41$, $SD = .64$); social norms manipulation only ($M = .52$, $SD = 1.03$); both manipulations ($M = .37$, $SD = .98$; $F(231) = .93$, $p = .45$, $\eta_p^2 = .01$). Thus, H5 is partially supported.

The results of H5 are reported in Table 7.

Table 7. Results of H5 for Study 2

Manipulation	U.S.				China			
	Perceived social norms		Compared treatment	Sig.	Perceived social norms		Compared treatment	Sig.
	M	SD			M	SD		
Precautionary principle only	0.25	0.73			1.02	0.89		
Self-efficacy	0.41	0.64	Precautionary principle only	0.34	0.84	0.92	Precautionary principle only	0.65
Social norms	0.52	1.03	Precautionary principle only	0.10	1.94	1.71	Precautionary principle only	0.03
			Self-efficacy	0.49			Self-efficacy	0.01*
Self-efficacy & social norms	0.37	0.98	Precautionary principle only	0.46	2.54	1.54	Precautionary principle only	0.00*
			Self-efficacy	0.83			Self-efficacy	0.00*
			Social norms	0.36			Social norms	0.15

* $p < 0.01$

Note: N(U.S.) = 231, N(China) = 84, M = Mean, SD = Standard Deviation

The remaining hypotheses only concern those individuals who exhibited an increase in risk perceptions after exposure to the stimulus. Therefore, the following results are based on this subset of 76 participants for the Chinese sample and 152 participants for the U.S. sample, or 33% and 67% respectively. For the Chinese sample, this subset of participants was predominantly male (57%), with a median age of 24. For the U.S. sample, this subset of participants was predominantly female (67%), with a median age of 19.

H6 predicted that these participants exposed to a treatment countering a single dissonance reduction strategy (either self-efficacy or social norms) would exhibit greater change in behavior intentions aligned with the precautionary principle than the treatment addressing no dissonance reduction strategies. A pair of ANOVA tests followed by pairwise comparisons were used to explore both the relationships on change in protective behaviors as well as change in time spent on behaviors. For protective behaviors, no significant difference

was found between any of the treatments among either the Chinese or U.S. groups:

precautionary principle only (Chinese: $M = 1.88$, $SD = 1.13$; U.S.: $M = 1.28$, $SD = 1.15$);

self-efficacy manipulation only (Chinese: $M = 2.42$, $SD = 1.07$; U.S.: $M = 1.32$, $SD = 1.38$);

social norms manipulation only (Chinese: $M = 1.94$, $SD = 1.30$; U.S.: $M = 1.55$, $SD = 1.50$);

both manipulations (Chinese: $M = 2.65$, $SD = 1.46$; $F(76) = .35$, $p = .79$, $\eta_p^2 = .02$; U.S.: $M = 1.06$, $SD = 1.33$; $F(152) = .83$, $p = .48$, $\eta_p^2 = .07$).

Regarding the time spent on behaviors, again no significant difference between any of the treatments among either the Chinese or U.S. groups: precautionary principle only (Chinese: $M = 1.39$, $SD = .30$; U.S.: $M = 1.75$, $SD = 1.75$); self-efficacy manipulation only (Chinese: $M = 1.81$, $SD = .98$; U.S.: $M = 2.05$, $SD = 2.09$); social norms manipulation only (Chinese: $M = 1.59$, $SD = 1.12$; U.S.: $M = 1.64$, $SD = 2.25$); both manipulations (Chinese: $M = 1.90$, $SD = 1.41$; $F(76) = .75$, $p = .53$, $\eta_p^2 = .03$; U.S.: $M = 1.64$, $SD = 1.87$; $F(152) = .35$, $p = .79$, $\eta_p^2 = .01$). Therefore, hypothesis 6 was not supported.

H7 predicted that participants exposed to precautionary principle messages that address both response efficacy and social norms will exhibit the greatest proportion of behavior change intentions aligned with the precautionary principle message. From the previous ANOVA analysis, neither the Chinese or U.S. groups exposed to both self-efficacy and social norms message exhibited a different change in protective behaviors from any of the other treatments (Chinese: $M = 2.65$, $SD = 1.46$; U.S.: $M = 1.02$, $SD = 1.37$). In regard to time spent on behaviors, no significant difference was also found for either group (Chinese: $M = 1.43$, $SD = 1.78$; U.S.: $M = 1.90$, $SD = 1.41$). Thus H7 is not supported.

The results of hypothesis 6 and hypothesis 7 are reported in Table 8.1 and Table 8.2.

Table 8.1. Results of H6 & H7 in Study 2

Manipulation	Protective behaviors		Compared treatment	Sig.
	U.S.			
	M	SD		
Precautionary principle only	1.28	1.15		
Self-efficacy	1.32	1.38	Precautionary principle only	0.44
Social norms	1.55	1.50	Precautionary principle only	0.18
			Self-efficacy	0.23
Self-efficacy & social norms	1.06	1.33	Precautionary principle only	0.25
			Self-efficacy	0.21
			Social norms	0.06
China				
	M	SD		
Precautionary principle only	1.88	1.13		
Self-efficacy	2.42	1.07	Precautionary principle only	0.09
Social norms	1.94	1.03	Precautionary principle only	0.45
			Self-efficacy	0.12
Self-efficacy & social norms	2.65	1.46	Precautionary principle only	0.04
			Self-efficacy	0.29
			Social norms	0.05

* $p < 0.01$

Note: N(U.S.) = 152, N(China) = 76, M = Mean, SD = Standard Deviation

Table 8.2. Results of H6 & H7 for Study 2

Manipulation	Time spent on behaviors		Compared treatment	Sig.
	U.S.			
	M	SD		
Precautionary principle only	1.75	1.75		
Self-efficacy	2.05	2.09	Precautionary principle only	0.26
Social norms	1.64	2.25	Precautionary principle only	0.41
			Self-efficacy	0.18
Self-efficacy & social norms	1.64	1.87	Precautionary principle only	0.41
			Self-efficacy	0.20
			Social norms	0.50
	China			
	M	SD		
Precautionary principle only	1.39	0.30		
Self-efficacy	1.81	0.98	Precautionary principle only	0.13
Social norms	1.59	1.12	Precautionary principle only	0.31
			Self-efficacy	0.28
Self-efficacy & social norms	1.90	1.41	Precautionary principle only	0.09
			Self-efficacy	0.40
			Social norms	0.21

* $p < 0.01$

Note: N(U.S.) = 152, N(China) = 76, M = Mean, SD = Standard Deviation

H8 predicted that Chinese participants would exhibit larger effects relative to the previous hypotheses as compared to U.S. participants. H8 was partially supported. Among the first three hypotheses, the Chinese participants exhibited stronger relationships between most of the relationships regarding initial perceived benefits, trust, perceived risk and behaviors intentions. The Chinese participants also strongly responded to the manipulation checks in the stimuli as expected whereas the U.S. participants did not. However, the final hypotheses regarding dissonance reduction strategies were no different between the Chinese and U.S. participant pools.

STUDY 2 – DISCUSSION

Study 2 replicated the previous study with two modifications. The first was to alter the stimulus to emphasize the possible threat and danger of cell phone use. This appears to have been successful as the change in risk perceptions were more aligned with the stimulus material as compared to Study 1 and the proportion of participants who exhibited positive change in risk perceptions increased significantly. This increase allows a comparison between the U.S. sample from Study 2 and the results from Study 1 to see what previous results may have been dependent upon sample size. However, there were no meaningful differences -- the U.S. participants continued in Study 2 continued the same pattern of showing no influence due to the manipulated stimuli.

The second modification was to add a Chinese sample and this decision appears to have born more fruit. The Chinese participants showed significantly greater relationships between the factors within the first three hypotheses. Specifically, initial perceived benefits had significant negative relationships with the downstream factors of perceived risk and behavioral intentions whereas the U.S. sample did not. Likewise, trust had a significant

positive relationship with perceived risk in the Chinese sample that was absent in the U.S. sample. Both groups exhibited positive relationships connecting both trust and risk perceptions to behavior intentions. Likewise, the Chinese sample strongly responded as expected to the stimulus manipulations where the U.S sample did not. This suggests that the latter hypotheses regarding dissonance strategies can finally be tested with this Chinese sample. Yet, results failed to show even in this Chinese sample that modifying perceptions of self-efficacy or social norms has any influence on behaviors. Thus, there is now at least better evidence that these hypotheses are false.

CHAPTER VII

GENERAL DISCUSSION

This research examined how individuals cognitively process uncertain risks associated with previously accepted technology when confronted with precautionary information. While the results differed across studies and samples, some common effects emerged. Aligning with the psychometric paradigm that states perceived risks and benefits are perceived on a continuum, individuals who initially perceived greater benefits from their cell phone showed less increase in perceived risk after reading the precautionary message. And in all cases, perceived risk had a significant positive relationship with intentions to engage in behaviors to protect. This impact of initial perceived benefits serves to limit the influence of the precautionary message, and within the Chinese sample, these relationships grow in magnitude. This suggests that the potential effects of precautionary messages are limited when individuals already perceive high benefits.

Perceived benefit was predicted to also influence the trust of the message, but this was not found in any of the analyses. However, trust in the message seems to exert a separate influence on these relationships, consistently related to greater change in behavioral intentions. Combined with the previous finding, increasing the trustworthiness of a precautionary message may serve to somewhat counter the lack of influence related to initial perceived benefits of the technology. Again, the Chinese sample exhibited this relationship along with an additional positive link between trust and change in perceived risk.

Compared to the U.S. samples, the Chinese participants showed stronger relationships among almost all analyses. There are several possibilities to explain these differences. First, China is the largest and fastest developing country in the world. Chinese lifestyles have

changed at a tremendous pace following the Chinese Economic Reform in 1978. The rapid growth of cell phone base stations in cities has raised the question of uncertainties about cell phones without the time for society to discuss and consider the outcomes.

Another reason could be what is called the "shanzhai" cell phone phenomenon. In Chinese cellphone markets, "shanzhai" refers to "Chinese imitation and pirated brands and goods, particularly electronics" (Ding & Pan, 2014, p. 101). In recent years, shanzhai cell phone have grown in the mobile market (Ding & Pan, 2014). Most of the firms who produce these "shanzhai" cell phones are small firms without proper production check systems and can not guarantee the safety of their products. The prevalence of these products likely decrease people's trust in cell phone manufactures and amplify worries about cell phone radiation to the whole market.

Health issues caused by defective or deceptive products have also become a recurring and salient worry for consumers and is covered often in Chinese media and the internet. After several influential public food safety crises, Chinese consumers have grown anxious about safety issues regarding their living environment and purchased products. Cell phones and Internet routers are often considered dangerous to children and pregnant women. Some elders believe cell phones and their base station cause sleep problem. These cultural fears and common media coverage may also partially explain why the Chinese sample in particular showed greater influence from the precautionary messages.

Interestingly, it was only the Chinese sample that responded as expected to the stimuli that manipulated self-efficacy and social norms perceptions. It may be that this sample, due to the reasons offered above, was just more attentive to the entire content of the precautionary message and therefore more influenced by the manipulation. The U.S. group,

possibly already discounting the risk, did not internalize the content and the manipulations had little effect, even in the second study where the modification to the stimuli increased the perception of the risk.

Nonetheless, this difference did little to influence the change in behaviors due to addressing different dissonance reduction strategies. Regardless of the stimulus viewed, there was no evidence that dissonance reduction strategies were altered. Cognitive dissonance is a difficult state to measure. A primary condition for dissonance is that the participant feels some level of discomfort, worry or concern about the difference between one of their behaviors and contradictory information. This affective component was not measured, and even if it was, it is likely to dissipate once the individual has adopted a dissonance reduction strategy. It is possible that conceptualizing dissonance as an individual who uses a technology but exhibited an increase in perceived risk regarding that technology was not an accurate way to capture this phenomenon. Even if this conceptualization has merit, the consistency with which this effect was not found across three replications lends support that the theoretical interpretations are lacking and future studies should reinterpret how to influence possible dissonance reduction strategies.

Other limitations deserve mention. While differing in nationality, all participants were college students from one university. Cell phones, especially smart phones, are widely accepted and extremely popular among this group. Cell phones are not only a communication tool but also a necessary device to function social in everyday life. The benefits this group perceives about cell phones are likely greater than other possible samples.

Similarly, the Chinese sample represents Chinese students attending a U.S. university. This group is already unrepresentative of Chinese citizens in general, but may also differ due

to influence from living within an American culture. The specific Chinese students who participated also represent a small response rate, further implying a selection bias. More than 1,500 emails were sent to all ISU Chinese students, but only 90 completed the survey. This is a response rate of only 6%. Considering the stimuli are relatively long and written in English, this could have further biased the type of participant included under the Chinese label.

Yet another difference between the U.S. and Chinese samples is in how they were recruited. Festinger and Carlsmith's early research into cognitive dissonance asked college students to write an essay in support of actions by the New Haven police department, which had just violently suppressed student protests, and this task was expected to arouse considerable cognitive dissonance. Results from one participant pool showed that writing the essay did not change attitudes toward the New Haven police department because the students rationalized that it was just a class assignment and were therefore free to write about things they disagreed with without it impacting their actual beliefs (Festinger & Carlsmith, 1959).

In the current research, the U.S. sample was recruited from an undergraduate course that were told that they would get extra credit as rewards for participating in this experiment. These students could easily rationalize that they were just doing classwork and completed the study for extra points with no real impact of attitudes required. On the other hand, the Chinese participants were recruited of their own free will and may have not had the option of divorcing their actions from their actual beliefs.

Additionally, social norms play different roles between U.S. and Chinese societies. Future research should measure social conformity as a trait variable to account for which participants, as well as which participant pools, are more or less susceptible to norms.

Even though the stimulus material was modified in study 2 to emphasize the potential threats of cell phone use, the U.S. participants who read the self-efficacy and social norms manipulations did not result in greater perceived self-efficacy and social norms. Future studies could continue to emphasize (or even exaggerate) the risks of cell phone use in an attempt to catch the attention of U.S. samples. Techniques like adding examples or providing more statistics or diagrams could enhance the effectiveness of the stimuli. Another possibility is to shift the risk from health to something that U.S. audiences may find more threatening. Since smart phones can connect to wireless network, concerns about privacy or unwanted access of personal data may serve to increase cognitive dissonance to a greater degree. Future studies should continue to expand this conception of risk to explore how precautionary principle messages interact with cognitive dissonance. The stimulus used in present research may have still been too ambivalent to create dissonance. Future studies could strengthen the risky consequences of the behaviors by not only showing text, but adding more photos and video.

REFERENCES

- Ajzen, I., & Fishbein, M. (1975). A Bayesian analysis of attribution processes. *Psychological Bulletin*, 82(2), 261-277. doi: 10.1037/h0076477
- Alhakami, A. S. & Slovic, P. (1994). A psychological study of the inverse relationship between perceived risk and perceived benefit. *Risk Analysis*, 14, 1085–1096. doi: 10.1111/j.1539-6924.1994.tb00080.x
- Aly, S. Deris & N. Zaki, (2011). The effects on cells mobility due to exposure to EMF radiation. *Advanced Computing: An International Journal*, 2(4), 1. doi: 10.5121/acij.2011.2401
- Aslaksen, L., & Myhr, AI. (2007). The worth of a wildflower: Precautionary perspectives on the environmental risk of GMOs. *Ecological Economics*, 60(3), 489-497. doi: 10.1016/j.ecolecon.2006.07.021
- Augustsson, A., Filipsson, M., Öberg, T., & Bergbäck, B. (2011). Climate change: An uncertainty factor in risk analysis of contaminated land. *Science of the Total Environment*, 409(22), 4693-4700. doi: 10.1016/j.scitotenv.2011.07.051
- Barnett, J., Timotijevic, L., Shepherd, R. & Senior, V. (2007). Public responses to precautionary information from the Department of Health (UK) about possible health risks from mobile phones. *Health Policy*, 82, 240–250. doi: 10.1016/j.healthpol.2006.10.002
- Benoit, W. L., & Benoit P. J. (2008). *Persuasive messages: The process of influence*. Malden, MA; Oxford: Blackwell Pub.
- Bond, S., & Wang, KK. (2005). The impact of cell phone towers on house prices in residential neighborhoods. *Appraisal Journal*, 73(3), 256–265. Retrieved from: <http://oem.bmj.com/content/63/12/802.full.pdf+html>
- Borsuk, M. E., & Tomassini, L. (2005). Uncertainty, imprecision, and the precautionary principle in climate change assessment. *Water science and technology: A journal of the International Association on Water Pollution Research*, 52(6), 213-25. Retrieved from: <http://wst.iwaponline.com/content/52/6/213.full.pdf>
- Burgess, A. (2004). *Cellular phones, public fears and a culture of precaution*. New York: Cambridge University Press.
- CEC. (2000). *Toxics in your community newsletter: A publication of Citizens Environmental Coalition*. Albany, N.Y.: Citizens Environmental Coalition.
- Cogliano, V. J., Baan, R., Straif, K., Grosse, Y., Lauby-Secretan, B., El Ghissassi, F., Bouvard, V., Benbrahim-Tallaa, L., Guha, N., Freeman, C., Galichet, L., & Wild, C.

- P. (2011). Preventable exposures associated with human cancers. *Journal of the National Cancer Institute*, 103(24), 1827-39. doi: 10.1093/jnci/djr483
- COMEST. (2005). The Precautionary Principle. UNESCO, Paris. Retrieved from: <http://unesdoc.unesco.org/images/0013/001395/139578e.pdf>
- Cousin, M. & Siegrist, M. (2011). Cell phones and health concerns: Impact of knowledge and voluntary precautionary recommendations. *Risk analysis*. 31(2), 301-11. doi: 10.1111/j.1539-6924.2010.01498.x
- Ding, K., & Pan, J. (2014). The shanzhai cell phone: platforms and small business dynamics. *The Disintegration of Production: Firm Strategy and Industrial Development in China*, 101. Retrieved from: <http://www.elgaronline.com/view/9781783476411.00010.xml>
- Earle, T., Siegrist, M., & Gutscher, H. (2007). Trust in cooperative risk management, 1-49.
- Festinger, L. (1957). A Theory of cognitive dissonance. *British Journal of Psychiatry*, 207(4), 2112-2114. <http://library.perbanas.ac.id/images/book/PHKI11/a%20theory%20of%20cognitive%20dissonance.pdf>
- Festinger, L. & Carlsmith, J.M. (1959). Cognitive consequences of forced compliance. *Journal of Abnormal Psychology*, 58(2), 203-210.
- Festinger, L. (1962). A theory of cognitive dissonance. Stanford, Calif.: Stanford University Press.
- Finucane, M. L., Alhakami, A., Slovic, P., & Johnson, S. M. (2000). The affect heuristic in judgments of risks and benefits. *Journal of Behavioral Decision Making*, 13(1), 1-17. doi: 10.1002/(SICI)1099-0771(200001/03)13:1<1::AID-BDM333>3.0.CO;2-S
- Fischhoff, B., Slovic, P., Lichtenstein, S., Read, S., & Combs, B. (1978). How safe is safe enough? A psychometric study of attitudes towards technological risks and benefits. *Policy Sciences*, 9, 127-152. doi: 10.1007/BF00143739
- Fischhoff, B., Slovic, P., & Lichtenstein, S. (1982). Lay foibles and expert fables in judgments about risk. *American Statistician*, 36(3), 240-255. doi: 10.2307/2683835
- Foster, K. R., Vecchia, P., & Repacholi, M. H. (2000). Risk management. Science and the precautionary principle. *Science*. 288(5468). 979-81. doi: 10.1126/science.288.5468.9
- Freestone, D., & Hey, E. (1996). The precautionary principle and international law: The challenge of implementation. *American Journal of International Law*, 91(1). doi: 10.1017/S0020589300060620

- Goklany, IM. (2001). The precautionary principle: a critical appraisal of environmental risk assessment. Washington, D.C.: CATO Institute.
- Goldstein, B., & Carruth, R. S. (2004). The precautionary principle and/or risk assessment in World Trade Organization decisions: A possible role for risk perception. *Risk Analysis*, 24(2), 491-499. doi: 10.1111/j.0272-4332.2004.00452.x
- Hardell, L., Carlberg, M., Ohlson, C. G., Westberg, H., Eriksson, M., & Hansson Mild K. (2007). Use of cellular and cordless telephones and risk of testicular cancer. *International Journal of Andrology*, 30(2), 115–122. doi: 10.1111/j.1365-2605.2006.00721.x
- International Commission on Non-Ionizing Radiation Protection (ICNIRP). (2009). Statement on the "Guidelines for limiting exposure to time-varying electric, magnetic and electromagnetic fields (up to 300 GHz)".
- Johansen, C. (2004). Electromagnetic fields and health effects: Epidemiologic studies of cancer, diseases of the central nervous system and arrhythmia-related heart disease. *Scand J Work Environ Health*, 30, 1–30. Retrieved from: <http://www.jstor.org/stable/40967524>
- Kristiansen, I. S., Elstein, A. S., Gyrð-Hansen, D., Kildemoes, H. W., & Nielsen, J. B. (2009). Radiation from mobile phone systems: Is it perceived as a threat to people's health? *Bioelectromagnetics*, 30(5), 393-401. doi: 10.1002/bem.20484
- Leszczynski, D., & Xu, Z. (2010). Mobile phone radiation health risk controversy: The reliability and sufficiency of science behind the safety standards. *Health Research Policy and Systems*, 8, 2-2. doi: 10.1186/1478-4505-8-2
- Liao, CH. (2012). Public attitude toward mobile base station siting: more than nimby. Available at: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1553672. Accessed on August 12, 2012.
- Mackie, G., Moneti, G., Derry, E. and Shakya, G. (2012) What are social norms? how are they measured? New York: UNICEF/UCSD Centre on Global Justice.
- Martin, E. G., & Wogalter, M. S. (1989). Risk Perception and Precautionary Intent for Common Consumer Products. *Proceedings of the Human Factors and Ergonomics Society Annual Meeting*, 33(15), 931-935. <http://dx.doi.org/10.1177/154193128903301507>
- McMaster, C., & Lee, C. (1991). Cognitive dissonance in tobacco smokers, *Addictive Behaviors*, 16(5), 349-353. doi: 10.1016/0306-4603(91)90028-G

- Myhr, A. & Traavik, T. (2002). The precautionary principle: scientific uncertainty and omitted research in the context of GMO Use and release source. *Journal of Agricultural and Environmental Ethics*, 15(1), 73-86. doi: 10.1023/A:1013814108502
- Myhr, A. (2010). A precautionary approach to genetically modified organisms: challenges and implications for policy and science source. *Journal of Agricultural and Environmental Ethics*. 23(6), 501 -525. doi: 10.1007/s10806-010-9234-x
- National Research Council (US) Committee on improving risk analysis approaches used by the U.S. (2009). science and decisions: advancing risk assessment. *Risk Analysis*, 30(7), 1028–1036. doi: 10.1111/j.1539-6924.2010.01426.x
- Repacholi, M. (2001). Health risks from the use of mobile phones. *Toxicology Letters*, 120(1), 323-331. doi: 10.1016/S0378-4274(01)00285-5
- Sadetzki, S., Chetrit, A., Jarus-Hakak, A., Cardis, E., Deutch, Y., Duvdevani, S., Zultan, A., Novikov, I., Freedman, L., & Wolf, M. (2007). Cellular phone use and risk of benign and malignant parotid gland tumors—A nationwide case-control study. *Am J Epidemiol*, 167(4), 457–467. doi: 10.1093/aje/kwm325
- Sandin, P. (2004). The Precautionary principle and the concept of precaution. *Environmental values*, 13(4), 461-475. doi: <http://dx.doi.org/10.3197/0963271042772613>
- Sheperd A., Jepson, R., Watterson A., & Evans JMM. (2012). Risk perceptions of environmental hazards and human reproduction: A community based survey. *ISRN Public Health*, 2012. doi: 10.5402/2012/748080
- Sjöberg, L. (1999). Risk perception by the public and by experts: A dilemma in risk management. *Human Ecology Review*, 6(2), 1-9. Retrieved from: <http://www.humanecologyreview.org/pastissues/her62/62sjoberg.pdf>
- Slesin, L. (2012). Public concerns over microwave radiation in the U.S.: Comparing the perceived health risks of phones and towers. Retrieved from: [http://www.salzburg.gv.at/Proceedings\(26\)Slesin.pdf](http://www.salzburg.gv.at/Proceedings(26)Slesin.pdf)
- Slovic, P., Fischhoff, B., & Lichtenstein, S. (1980). Facts and fears: Understanding perceived risk. Societal risk assessment: How safe is safe enough? New York: Plenum Press, 181-216.
- Slovic, P., Fischhoff, B., & Lichteinstein, S. (1985). Characterizing perceived risk. Kates, R. W., Hohenemser, C. & Kasperson, J. X. (eds.), *Perilous Progress: Managing the Hazards of Technology*, 91-125. Retrieved from: http://papers.ssrn.com/sol3/papers.cfm?abstract_id=2185557
- Slovic, P. (1987). Perception of risk. *Science*, 236(4799), 280-285. doi: 10.1126/science.3563507

- Slovic, P. (2000). *The perception of risk*. London; Sterling, VA: Earthscan Publications.
- Slovic, P., Finucane, M. L., Peters, E., & MacGregor, D. G. (2004). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk, and rationality. *Risk Analysis*, 24(2), 311-322. doi: 10.1111/j.0272-4332.2004.00433.x
- Stokes, E. (2013). Demand for command: Responding to technological risks and scientific uncertainties. *Medical Law Review*. 21(1), 11-38. doi: 10.1093/medlaw/fws042
- Takebayashi, T., Akiba, S., Kikuchi, Y., Taki, M., Wake, K., Watanabe, S. & Yamaguchi, N. (2006). Mobile phone use and acoustic neuroma risk in Japan. *J Occup Environ Med*, 63(12), 802-807. doi: 10.1136/oem.2006.028308
- Takebayashi, T., Varsier, N., Kikuchi, Y., Wake, K., Taki, M., Watanabe, S., Akiba, S., & Yamaguchi, N. (2008). Mobile phone use, exposure to radiofrequency electromagnetic field, and brain tumour: a case-control study. *British Journal of Cancer*, 98(3), 652. doi: 10.1038/sj.bjc.6604214
- Thorndike, E.L. (1920). A constant error in psychological ratings. *Journal of Applied Psychology*, 4(1), pp25-29. doi: 10.1037/h0071663
- Timotijevic, L. & Barnett, J. (2006) Managing the possible health risks of mobile telecommunications: Public understandings of pre- cautionary action and advice. *Health, Risk & Society*, 8(2), 143-164. doi: <http://dx.doi.org/10.1080/13698570600677324>
- Tagliacozzo, R. (1979). Smokers' self-categorization and the reduction of cognitive dissonance, *Addictive Behaviors*, 4(4), 393-399. doi: 10.1016/0306-4603(79)90010-8
- Tickner, J., Raffensperger, C., & Myers, N. (1999). *The precautionary principle in action: A handbook* (Science and Environmental Health Network). Retrieved from: <http://www.calepa.ca.gov/envjustice/Documents/2003/Appendices/AppendixI.pdf>
- UNCED (1993). *The earth summit: The United Nations Conference on Environment and Development* (1992: Rio De Janeiro). Introduction and commentary by Stanley P. Johnson.
- United Nations Conference on Environment and Development. (1992). *Final Declaration, Principle, 15*. Rio De Janeiro.
- Weckert, J., & Moor, J. (2006). The precautionary principle in nanotechnology. *International Journal of Applied Philosophy*, 20(2), 191-204. doi: <http://dx.doi.org/10.5840/ijap200620214>

- Wells, F. L. (1907). A statistical study of literary merit: with remarks on some new phrases of the method. New York: The Science press.
- West, M. D. (1994). Validating a scale for the measurement of credibility: A covariance structure approach. *Journalism Quarterly*, 71, 159-168. Retrieved from: <http://crawl.prod.proquest.com.s3.amazonaws.com/fpcache/42ee0bdb63419d3ffb9719a8dc64019a.pdf?AWSAccessKeyId=AKIAJF7V7KNV2KKY2NUQ&Expires=1467992892&Signature=w8JvGd6PVLVRaCOZL9LW07ohXgg%3D>
- WHO (World Health Organization). (2002). Establishing a dialogue on risks from electromagnetic fields. Retrieved from http://www.who.int/peh-emf/publications/EMF_Risk_ALL.pdf
- Wiedemann, P. M., & Schutz, H. (2005). The precautionary principle and risk perception: Experimental studies in the EMF area. *Environmental Health Perspectives*, 113(4), 402-405. Retrieved from: <http://www.jstor.org/stable/3436152>
- Wiedemann, P. M., Thalmann, A. T., Grutsch, M. A. & Schütz, H. (2006). The impacts of precautionary measures and the disclosure of scientific uncertainty on EMF risk perception and trust. *Journal of Risk Research*, 9, 361–372. Retrieved from: <http://www.tandfonline.com/doi/pdf/10.1080/13669870600802111>
- Wiedemann, P. M., Schuetz, H., Boerner, F., Clauberg, M., Croft, R., Shukla, R., Kikkawa, T., Kemp, R., Gutteling, J. M., de Villiers, B., Medeiros, FND. & Barnett, J. (2013). When Precaution Creates Misunderstandings: The Unintended Effects of Precautionary Information on Perceived Risks, the EMF Case. *Risk Analysis*, 33(10), 1788-1801. doi: 10.1111/risa.12034
- Yan, Y., Zeng J., & Shi, L. (2009). Knowledge, attitudes and practice on cell phone radiation among college freshmen and sophomores. *Chinese Journal of School Health*, 2013-07, 23-25. Retrieved from: http://en.cnki.com.cn/Article_en/CJFDTOTAL-XIWS201307015.htm
- Yoe, C. (2011). Primer on risk analysis decision making under uncertainty. Boca Raton, FL: CRC Press.

APPENDIX A

IRB APPROVAL LETTER

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515-294-4366
FAX 515-294-4267

Date: 11/24/2015

To: Yang Yang
205 S. 5th Street #903
Ames, IA 50010

CC: Dr. Michael Dahlstrom
215 Hamilton Hall

From: Office for Responsible Research

Title: Effects of precautionary information about cell phone usage

IRB ID: 15-446

Study Review Date: 11/23/2015

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
 - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
 - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed**. For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**

Please don't hesitate to contact us if you have questions or concerns at 515-294-4566 or IRB@iastate.edu.

APPENDIX B

QUESTIONNAIRE FOR PRE-TEST

First, we would like to ask you a few questions about your cell phone use.

1. About how many hours per day do you use your cell phone for making calls, receiving calls, or text messaging?

- ☐ None
- ☐ Less than 1 hour
- ☐ 1 - 2 hours
- ☐ 3 - 4 hours
- ☐ 5 - 6 hours
- ☐ 7 - 8 hours
- ☐ More than 8 hours

2. How beneficial do you consider cell phones to be for society as a whole?

- | | | | | | | | | |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Not at
all | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very
beneficial |

3. How beneficial do you consider cell phones to be in your own life?

- | | | | | | | | | |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Not at
all | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very
beneficial |

Some people worry that cell phones may be harmful because using them introduces radiation into the brain. Scientific evidence is not clear if this risk exists or not. What do you think about this?

4. How severe do you think the effects cell phone radiation are in general?

- | | | | | | | | | |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Not at
all | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very severe |

5. How severe do you think the effects of cell phone radiation are to your own body?

- | | | | | | | | | |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Not at
all | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very severe |

6. How vulnerable do you think society as a whole is to the possible effects of cell phone radiation?

- | | | | | | | | | |
|---------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|--------------------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | |
| Not at
all | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | Very
vulnerable |

7. How vulnerable do you think you are to the possible effects of cell phone radiation?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very vulnerable

8. How much do you worry about the effects of cell phone radiation for society as a whole?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Worry about it very much

9. How much do you personally worry about the effects of cell phone radiation on your own body?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Worry about it very much

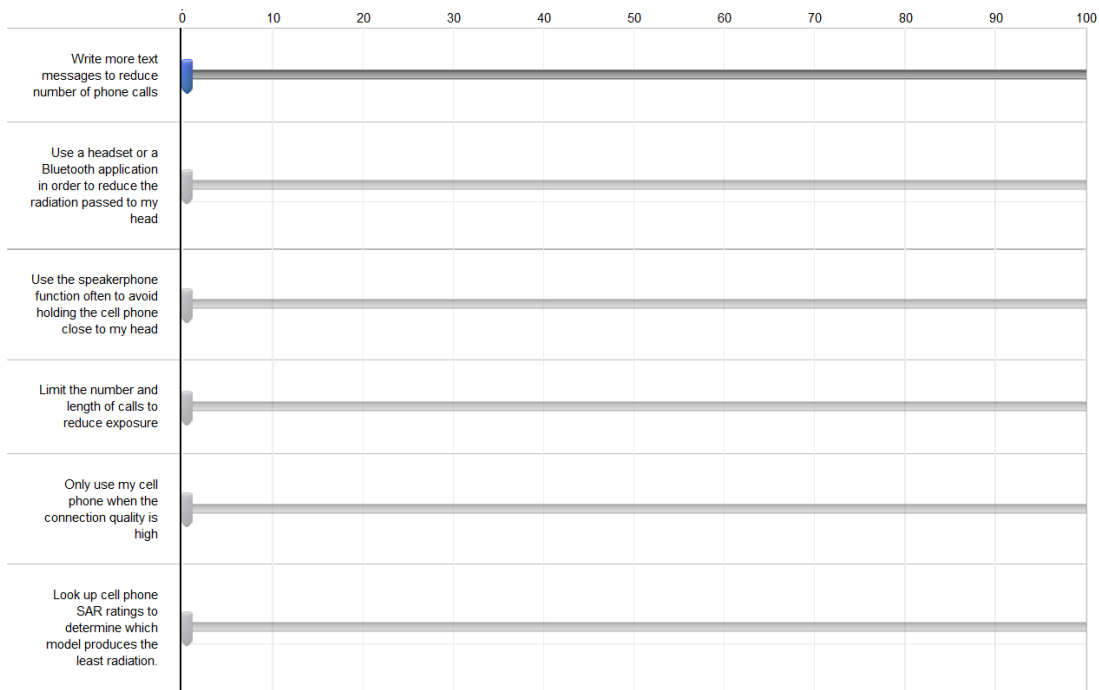
10. For people who do worry about the possible effects of cell phone radiation, there are numerous protective behaviors they can do and still use their cell phone. Please select if you have done any of the following protective behaviors. (You can select more than one answer)

- ☐ I try to write more text messages to reduce my cell phone calls.
- ☐ I use a headset or a Bluetooth application in order to reduce the radiation passed to my head.
- ☐ I use the speakerphone function often to avoid holding the cell phone close to my head.
- ☐ I limit the number and length of calls to reduce exposure.
- ☐ I try to only use my cell phone when the connection quality is high.
- ☐ I look up cell phone SAR ratings to determine which model produces the least radiation.
- ☐ None of above.

11. Regardless of which preventative action you may use, how often do you actively try to protect yourself from the potential effects of cell phone radiation?

- ☐ Never
- ☐ Less than Once a Month
- ☐ Once a Month
- ☐ 2-3 Times a Month
- ☐ Once a Week
- ☐ 2-3 Times a Week
- ☐ Daily

12. For each of these preventative actions, please drag the slider between 1 and 100 to show how easy you feel it is, or would be, to incorporate that behavior into the way you currently use your cell phone. Higher values represent an easier behavior to enact.



13. How much do you think the average person worries about cell phone radiation?

Not at all 1 2 3 4 5 6 7 Worry about it very much

○ ○ ○ ○ ○ ○ ○ ○

14. How many people in general do you think actually engage in some of these risk reduction behaviors?

- ☐ None
- ☐ Only a little
- ☐ Less than half
- ☐ Half
- ☐ More than half
- ☐ A large number
- ☐ Almost everyone

15. How much do you think other ISU students worry about cell phone radiation?

Not at all 1 2 3 4 5 6 7 Worry about it very much

○ ○ ○ ○ ○ ○ ○ ○

16. How many ISU students do you think actually engage in some of these risk reduction behaviors?

- ☐ None
- ☐ Only a little
- ☐ Less than half
- ☐ Half
- ☐ More than half
- ☐ A large number
- ☐ Almost everyone

The Independent Expert Group on Mobile Phones (IEGMP) is a frequent source for news stories that discuss the potential risk of cell phone radiation. On the next page you will find a recent news article that interviews the IEGMP to describe the current scientific understanding of this potential risk. Please read the story and afterwards answer a few questions about your opinions.

QUESTIONNAIRE FOR POST TEST

Now that you have read the news story, some of your previous thoughts may have changed. Please answer the following questions to tell us how you feel now.

1. Please select the number between the pair of words that best describes your feelings about the information you just read in the news article.

	1	2	3	4	5	
Is unfair	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Is fair
Is biased	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Is unbiased
Don't tell the whole story	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Tell the whole story
Is inaccurate	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Is accurate
Can't be trusted	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Can be trusted

2. Please select your agreement or disagreement with the following statement: After reading the previous news article, my thoughts about the perceived risk of cell phone radiation have increased.

1 2 3 4 5 6 7

Disagree ○ ○ ○ ○ ○ ○ ○ Agree

3. How beneficial do you consider cell phones to be in your own life?

[illegible]

4. How beneficial do you consider cell phones to be for society as a whole?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very beneficial

5. How severe do you think the effects of cell phone radiation to the society as a whole?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very severe

6. How severe do you think the effects of cell phone radiation may be to your own body?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very severe

7. How vulnerable do you think society as a whole is to the possible effects of cell phone radiation?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very vulnerable

8. How vulnerable do you think you are to the possible effects of cell phone radiation?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very vulnerable

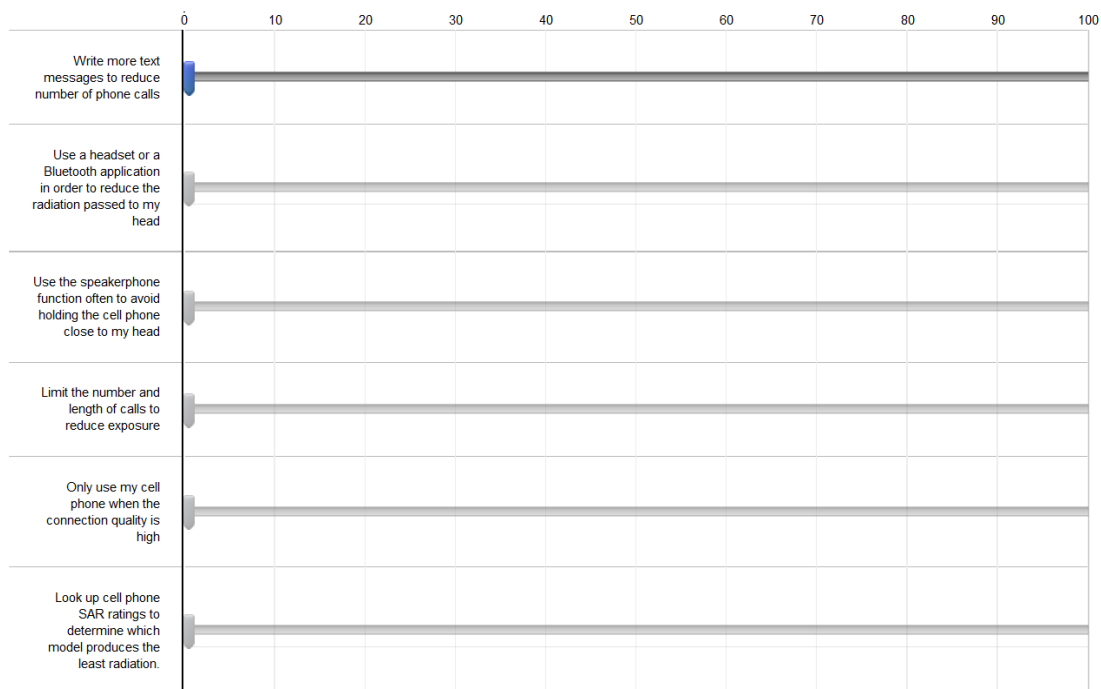
9. How much do you worry about the effects of cell phone radiation for society as a whole?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Worry about it very much

10. How much do you personally worry about the effects of cell phone radiation on your own body?

	1	2	3	4	5	6	7	
Not at all	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Worry about it very much

11. For each of these preventative actions, please drag the slider between 1 and 100 to show how easy you feel it is, or would be, to incorporate that behavior into the way you currently use your cell phone. Higher values represent an easier behavior to



12. How much do you think the average person worries about cell phone radiation?

Not at all 1 2 3 4 5 6 7 Worry about it very much
 ○ ○ ○ ○ ○ ○ ○

13. How many people in general do you think actually engage in some of these risk reduction behaviors?

- ☐ Never
- ☐ Only a little
- ☐ Less than half
- ☐ Half
- ☐ More than half
- ☐ A large number
- ☐ Almost everyone

14. How much do you think other ISU students worry about cell phone radiation?

Not at all 1 2 3 4 5 6 7 Worry about it very much
 ○ ○ ○ ○ ○ ○ ○

15. How many ISU students do you think actually engage in some of these risk reduction behaviors?

- ☐ None
- ☐ Only a little
- ☐ Less than half
- ☐ Half
- ☐ More than half
- ☐ A large number
- ☐ Almost everyone

16. Based on your new understanding of the potential risks of cell phone use, you may now be considering to try some of these protective behaviors. Please select which of the following protective behaviors you intend to continue, or intend to begin, in the future. (You can select more than one answer)

- ☐ I try to write more text messages to reduce my cell phone calls.
- ☐ I use a headset or a Bluetooth application in order to reduce the radiation passed to my head.
- ☐ I use the speakerphone function often to avoid holding the cell phone close to my head.
- ☐ I limit the number and length of calls to reduce exposure.
- ☐ I try to only use my cell phone when the connection quality is high.
- ☐ I look up cell phone SAR ratings to determine which model produces the least radiation.
- ☐ None of above

17. Regardless of which preventative action you may use, how often do you intend to actively protect yourself from the potential effects of cell phone radiation in the future?

- ☐ Never
- ☐ Less than Once a Month
- ☐ Once a Month
- ☐ 2-3 Times a Month
- ☐ Once a Week
- ☐ 2-3 Times a Week
- ☐ Daily

18. What is your gender?

- ☐ Male
- ☐ Female

19. What is your age?

20. What is your nationality?

- ☐ U.S. Citizen
- ☐ International student from China
- ☐ International student from a country other than China

APPENDIX C

STIMULUS SAMPLE FROM STUDY 1

Cell phone radiation? Better safe than sorry

While current research does not suggest any consistent evidence of adverse health effects from exposure to cell phone radiation, IEGMP (Independent Expert Group on Mobile Phones) warn that uncertainties still remain and recommend that people take precautions when using their cell phones.

Cell or cellular phones are now an integral part of modern telecommunications. In many countries, over half the population use cell phones and the market is growing rapidly. In 2014, there is an estimated 6.9 billion subscriptions globally. In some parts of the world, cell phones are the most reliable or the only phones available.

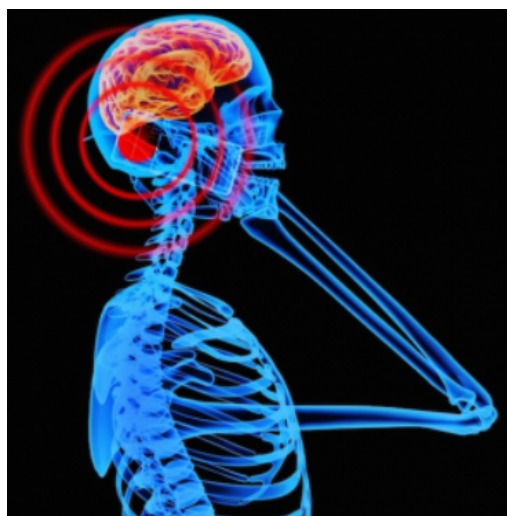
Tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body. At the frequencies used by cell phones, the skin and other superficial tissues, resulting in negligible temperature rise in the brain or any other organs of the body, absorb most of the energy.

Epidemiological research examining potential long-term risks from radiofrequency exposure has mostly looked for an association between brain tumors and cell phone use. However, because many cancers are not detectable until many years after the interactions that led to the tumor, and since cell phones were not widely used until the early 1990s, epidemiological studies at present can only assess those cancers that become evident within shorter time periods.

IEGMP conclude that it is not possible at present to say that exposure to RF radiation, even at levels below national guidelines, is totally without potential adverse health effects,

and that the gaps in knowledge are sufficient to justify a precautionary approach. However, the group recommends that a precautionary approach to the use of cell phone technologies be adopted until much more detailed and scientifically robust information on any health effects becomes available. They also suggest that there are some behavioral changes that individuals can adopt if they are worried about the uncertainties surrounding cell phone radiation.

Cell phones are low-powered radiofrequency transmitters, operating at frequencies between 450 and 2700 MHz with peak powers in the range of 0.1 to 2 watts. The handset only transmits power when it is turned on. The power (and hence the radiofrequency exposure to a user) falls off rapidly with increasing distance from the handset. A person



using a cell phone 30–40 cm away from their body – for example when text messaging, accessing the Internet, or using a “hands free” device – will therefore have a much lower exposure to radiofrequency fields than someone holding the handset against their head.

In addition to using “hands-free” devices, which keep cell phones away from the head and body during phone calls, exposure is also reduced by limiting the number and length of calls. Using the phone in areas of good reception also decreases exposure as it allows the phone to transmit at reduced power. The use of commercial devices for reducing radiofrequency field exposure has not been shown to be effective.

Radiofrequency exposure limits for cell phone users are given in terms of Specific Absorption Rate (SAR) – the rate of radiofrequency energy absorption per unit mass of the

body. Currently, two international bodies (ICNIRP, 2009; IEEE, 2005) have developed exposure guidelines for workers and for the general public, except patients undergoing medical diagnosis or treatment. These guidelines are based on a detailed assessment of the available scientific evidence. Concerned individuals can contact their cellular provider to ask about the SAR rating for their particular cell phone or inquire about SAR ratings when deciding on purchasing a new cell phone.

Stimulus with self-efficacy manipulation:

(IEGMP notes that while many of these behaviors represent a change to how most people use their cell phones, they are simple and can fit easily into current lifestyles. Reducing cell phone calls by writing more text messages may be the easiest choice, while using the speakerphone function also keeps the phone away from the head while in use. Other methods like limiting the number and length of calls or waiting to make calls until there is high connection quality may impact the convenience of cell phone use, but still achievable with little effort. Individuals who are especially concerned about cell phone radiation can check the publically available SAR ratings before purchasing a cell phone.)

Stimulus with social norms manipulation:

(A recent survey by IEGMP suggests that while some individuals do not engage in these protective actions because they think that no one else is doing so, the same survey finds that over 80% of the public is concerned about cell phone radiation and almost 60% are engaging in at least one protective action to reduce the potential risk. This preventative action is especially growing among high school and university students, which also had the greatest proportion of people noting that they think others who always have a phone to their head are unnecessarily risky.)

IEGMP reiterate the uncertainty of RF radiation from cell phone in current scientific knowledge. The group considers that a precautionary approach would be an essential way at this early stage in our understanding of mobile phone technology and its potential to impact on biological systems and on human health. Some cell phone users find these behavioral recommendations to be inconvenient or are not worried because other people are unconcerned, however IEGMP recommends taking a precautionary approach for concerned cell phone users to minimize the exposure to such radiation.

APPENDIX D**STIMULUS SAMPLE FROM 2****Is cell phone radiation dangerous? Better safe than sorry**

The Independent Expert Group on Mobile Phones (IEGMP) released a warning stating that consumers should take precautions when using their cell phones because the health effects of cell phone radiation remain uncertain and potentially dangerous. Cell phones are an integral part of modern telecommunications. In many countries, over half the population use cell phones and the market is growing. In 2014, there was an estimated 6.9 billion subscriptions globally. In some parts of the world, cell phones are the most reliable or the only phones available.

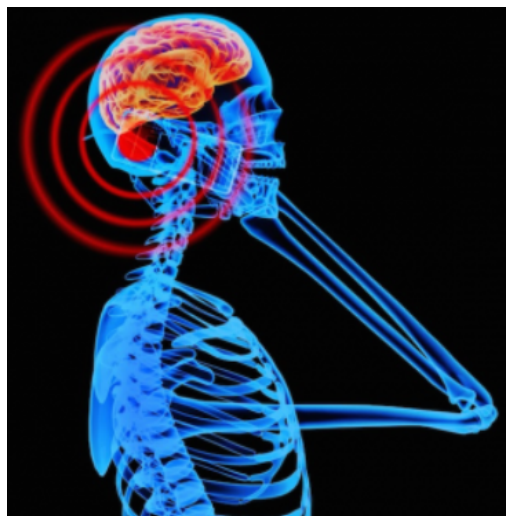
Yet, the effects of cell phone radiation on human tissue remain uncertain. Epidemiological research examining potential long-term risks from exposure to cell phone radiation has mostly looked for an association between brain tumors and cell phone use. However, because many cancers are not detectable until many years after the interactions that led to the tumor, and since cell phones were not widely used until the early 1990s, epidemiological studies at present can only assess those cancers that become evident within shorter time periods.

However, some alarming evidence has surfaced in recent years. Researchers from Sweden found that tumors are more likely to occur on the side of the head that the cell handset is used and concluded that cell phones are not safe for long-term exposure. A meta-analysis of 23 studies on mobile phone use and tumor risk found that "there is possible evidence" that mobile phone use causes an increased risk of tumors. In 2011, the World Health Organization's International Agency for Research on Cancer announced it was

classifying electromagnetic fields from mobile phones and other sources as "possibly carcinogenic to humans".

Tissue heating is the principal mechanism of interaction between radiofrequency energy and the human body. At the frequencies used by cell phones, the skin and other superficial tissues absorb most of the energy, resulting in negligible temperature rise in the brain or any other organs within range.

Cell phones are low-powered radiofrequency transmitters, operating at frequencies between 450 and 2700 MHz with peak powers in the range of 0.1 to 2 watts. The handset only transmits power when it is turned on. The power (and hence the radiofrequency exposure to a user) falls off rapidly with



increasing distance from the handset. A person using a cell phone 30 ~ 40 cm away from their body – for example when text messaging, accessing the Internet, or using a “hands free” device – will therefore have a much lower exposure to radiofrequency fields than someone holding the handset against their head.

Two international bodies have developed exposure guidelines based on a detailed assessment of the available scientific evidence. They recommend certain actions to minimize exposure for cell phone users:

- Write more text messages to reduce number of phone calls.
- Use "hands-free" devices to keep cell phones away from the head and body during phone calls.

- Use the speakerphone function often avoid holding cell phone close to the head.
- Limit the number and length of calls.
- Use the phone in areas of good reception to decrease exposure as it allows the phone to transmit at reduced power.
- Contact your cellular provider to ask about the rate of radiofrequency energy absorption per unit mass of the body, called the phone's SAR rating, when deciding on purchasing a new cell phone.

Stimulus with self-efficacy manipulation:

(The IEGMP notes that while many of these behaviors represent a change to how most people use their cell phones, they are simple and can fit easily into current lifestyles. Reducing cell phone calls by writing more text messages may be the easiest choice, while using the speakerphone function also keeps the phone away from the head while in use. Other methods like limiting the number and length of calls or waiting to make calls until there is high connection quality may impact the convenience of cell phone use, but still achievable with little effort. Individuals who are especially concerned about cell phone radiation can check the publically available SAR ratings before purchasing a cell phone.)

Stimulus with social norms manipulation:

(A recent survey by IEGMP suggests that while some individuals do not engage in these protective actions because they think no one else is worried about cell phone radiation, the same survey finds that over 80% of the public is concerned about cell phone radiation and almost 60% are engaging in at least one protective action to reduce their potential risk. This preventative action is especially growing among high school and university students, which

also had the greatest proportion of people noting that they think others who always have a cell phone to their head are unnecessarily risky.)

The IEGMP emphasizes that until the health effects are better understood, individuals should take a precautionary approach and minimize their exposure to cell phone radiation through these recommended behaviors.