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**THE EFFECTIVENESS OF WARNINGS ON
PERSONAL IDENTITY DISCLOSURE**

by

PAYTON BROWN

A THESIS

**Submitted in partial fulfillment of the requirements
For the degree of Master of Arts
in
The Department of Psychology
to
The School of Graduate Studies
of
The University of Alabama in Huntsville**

HUNTSVILLE, ALABAMA

2015

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THESIS APPROVAL FORM


Submitted by Payton Brown in partial fulfillment of the requirements for the degree of Master of Arts in Psychology and accepted on behalf of the Faculty of the School of Graduate Studies by the thesis committee.


We, the undersigned members of the Graduate Faculty of The University of Alabama in Huntsville, certify that we have advised and/or supervised the candidate on the work described in this thesis. We further certify that we have reviewed the thesis manuscript and approve it in partial fulfillment of the requirements for the degree of Master of Arts in Psychology.


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(Date)

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ABSTRACT

The School of Graduate Studies
The University of Alabama in Huntsville

Degree Master of Arts College/ Dept. Liberal Arts/Psychology

Name of Candidate Payton Brown

Title The Effectiveness of Warnings on Personal Identity Disclosure

Studies have shown 87% of people in the United States can be uniquely identified by only their zip code, gender, and date of birth. These three personal identity elements are not typically considered sensitive information by the general public. The purpose of this study was to develop a method to stop individuals from disclosing personal information that they deem unimportant by using warning messages and subliminal signals to influence their decisions. Warnings have been studied rigorously in real-world situations, but little research has been conducted on warnings in an online context. The use of a subliminal signal with a supraliminal warning may help people comply with the warning message without habituating, and make safer decisions about disclosing personal identity information online. In the present experiment, we compared how warnings affected disclosure rates of personal identity elements when individuals attempted to apply online for an automobile insurance quote. We targeted three personal identity elements that people believe to be safe to disclose, zip code, gender, and date of birth. We also attempted to identify whether subliminal signals could be used to enhance the effectiveness of the supraliminal warning. Unfortunately, we were unable to measure the effectiveness of subliminal signals because of technical limitations of the implementation

methods. We did not find that warnings were effective at reducing disclosure rates for any of the three personal identity elements. There were several factors which may have influenced participants' decision to disclose personal identity element.

Abstract Approval: Committee Chair



Department Chair



Graduate Dean



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CHAPTER I

INTRODUCTION

Economist Latanya Sweeney conducted a study on United States census data and determined that 87% of Americans can be uniquely identified by their date of birth, zip code, and gender (Sweeney, 2000). Unfortunately, research has shown that people do not consider these three identifiers as sensitive personal identity elements (Zhu, Carpenter, & Kulkarni, 2012). The intent of the current experiment is to develop a new method designed to help individuals make safer decisions about disclosing personal information online. In the world of cyber security, the human element is often the weakest link (Ollmann, 2004). To prevent phishing and social engineering attacks in everyday activities, people need to be persuaded to make better choices.

Phishing Attacks

“Phishing” is a term coined in the mid 1990’s which refers to a method of collecting personal information from individuals by criminals online (Ollmann, 2004). Originally, the purpose of the scam was to steal American Online (AOL) account passwords to provide free internet access for hackers. These hackers would employ a scheme in which random users are targeted with “lure” emails designed to “phish” passwords and other sensitive information. Often the hackers would pose as an authority

organization or trusted source to obtain the user's information. Today, phishing has evolved into an illegal industry which affects over 3.5 million Americans. The mindless divulging of personal information results in an estimated loss of \$2 billion annually (Moore & Clayton, 2007). The criminals utilizing the phishing technique currently are called "phishers." Personal information refers to passwords, email addresses, zip code, driver's license number, social security number, and any other data which can identify an individual or assist in accessing their financial accounts. Phishing is not only designed to steal users' identity and financial information but may also infect users' personal computers with malware. Presently, one of the most common methods of protecting users from potentially harmful cyber-attacks is the use of warnings.

General Warnings

A warning is a message, symbol, or image that must attract attention and provide adequate information for the user to make an informed decision to comply (Laughery, 2006). A warning's purpose is to communicate safety information that will be remembered and recalled. Before the 1980's, little formal research had been conducted on a warning's effectiveness. Warning systems are difficult to study for several reasons. Studying the effects of warning in a naturalistic setting can be both time and resource intensive, and generally serious events are uncommon and irregular (Wogalter & Laughery, 1996). Studying warnings in a laboratory situation could potentially be unethical because it may require placing the participants in dangerous situations. Laboratory experiments can also reduce the believability of the risk in a situation for participants. Consequently, it can also be challenging to generalize the results of a controlled study on warnings. Fortunately, an online environment is advantageous for

designing and testing warning designs by introducing warning methods which may be implemented without detrimental effects to the user.

The Communication-Human Information Processing (C-HIP) model was developed (Conzola & Wogalter, 2001; Smith-Jackson & Wogalter, 2011) for understanding how individuals interpret warnings. The model is divided into four major components: the source, channel, receiver, and behavior (Figure 1.1).

The source of warnings is the entity that is transmitting the warning to the receivers, or individuals. Sources can be government organizations (e.g., US Food and Drug Administration), companies (e.g., Google), or other individuals (e.g., safety inspector at a construction site).

The channel is the method or medium by which the warning is transmitted to an individual. Channels which are typically related to human senses and perception may be a

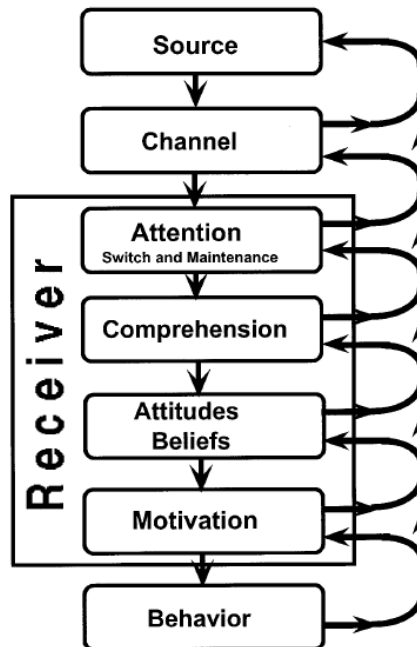


Figure 1.1 The Communication-Human Information Processing (C-HIP) model. A model created to visual represent how a warning source results in a behavior change.

printed sign (e.g., warning on a hazardous chemical), an auditory alarm (e.g., fire alarm), a particular smell (e.g., natural gas or propane), or even a tactile change (e.g., textured crosswalks for the vision impaired). The channel occurs when the warning message reaches the receiver, the individual intended to receive the warning.

The receiver processes the information in four stages: attention switching and maintenance, comprehension, attitudes or beliefs, and motivation. Attention switching and maintenance requires gaining the attention of the targeted individual and holding attention for an undetermined duration. Comprehension is defined as whether a warning is being attended to by the individual receiving the warning, and whether the individual understands and remembers the message. Attitudes or beliefs of the individual receiving the warning determine how the individual interprets the warning. The individual also must be motivated to adhere to the warning in an appropriate manner.

The last process requires a modification to the individual's behavior. At this point in the model, the individual receiving the warning must physically or mentally change their actions to follow the warning's instructions.

Interactive warnings have been shown to influence participants' compliance levels over passive warnings (Duffy, Klasher, & Wogalter, 1993). Interactive warnings are messages in which an individual must physically cooperate with a warning prior to finishing a task. An example may be a modal warning on a computer that requires an individual to make a physical decision to move forward before they can resume their task by choosing an appropriate command button. Passive warnings merely display the warning but do not require the user to interact with the warning. However, interactive warnings have the potential to annoy individuals because the physical interaction may be

disruptive to the individual's current task. Irritation with warnings may lead to the warning message being disregarded. The warning used in the current study is a hybrid of interactive and passive warnings. The warning does not incorporate the modality of a typical interactive warning, but the abrupt appearance on screen is purposefully designed to draw the users' attention. The aesthetic construction and design of a warning has been tested extensively. For example, warnings with thick red borders have been shown to increase warning salience (Rashid & Wogalter, 1997) over all other colors, and upper case letters have been shown to be easier to read than lower case letters (Arditi & Cho, 2007).

The signal words in the warning are critical for attracting attention, retaining the attention of the user, and the promotion of future compliance. Research conducted by Wogalter, Kalsher, and Rashid (1999) examined how perception of a word's credibility influenced the likelihood of participants compliance with the warning. It was shown the longer the prefix before the signal word (e.g., "Warning" versus "U.S. Federal Government Warning") the more participants perceived the warning as having credibility and increased their chance of compliance. There was no difference found between the authority sources supporting the warning. In other words, participants perceived government issued warnings to have the same credibility as scientific or professional groups (Wogalter et al., 1999). The current study will use the signal word, "Hazard," because it has been shown to be effective for warnings in an online context (Carpenter, Zhu, & Kolimi, 2013).

Compliance to warnings is directly related to individuals' habituation level to a warning. Wogalter, Barlow, and Murphy (1995) discovered a trend in redundant

instructions which were used to increase warning compliance, although the results were not statistically significant. However, compliance did increase significantly in conditions where the supplemental directives, or additional instructions, were placed in close proximity to the warning. The study found that novice users were more likely to comply with warnings in comparison to expert users. Individuals who do not require additional information to complete a task are more susceptible to warning habituation. Habituation to warnings occurs when an individual is overexposed to a warning (Kim & Wogalter, 2009). It has been shown attention to the warning drops significantly after repeated exposure to the same warning. Failure to attend to a warning, even for expert users, can lead to negative consequences. There are currently several methods which are widely employed to reduce individuals' habituation to warning and increase compliance. General modifications to the warning can help reduce the habituation effect. Adjustments to the aesthetics, moving the warning's location, or even changes to the medium of delivery for warnings are all potential solutions to habituation (Kim & Wogalter, 2009). Requiring individuals to interact with the warning has been shown to increase warning compliance, therefore reducing user habituation to the warning (Duffy et al., 1993).

Subliminal Priming

In 1957, advertiser James Vicary claimed he could increase the sales of popcorn and Coke in movie theaters by flashing the text, "Drink Coke," and, "Eat Popcorn," for fractions of a second. The concept initially sparked panic in the American public. It was feared that if an individual can be subliminally primed to purchase a product, then what else could people unknowingly be influenced to do? Researchers quickly attempted to replicate the results of the study. Eventually, Vicary was revealed to be a fraud, but the

stunt inspired a desire to understand the effects of subliminal priming as a persuasive technique throughout the scientific community (Pratkanis, 1992).

Since the hoax of James Vicary, others have attempted to utilize subliminal priming through various methods to influence individuals' behaviors. Another well-known scheme is the use of subliminal messages via self-help audio tape recordings. The recordings promised to increase a person's self-esteem, improve memory, induce weight loss, or even stop people from smoking (Moore, 1988). Unfortunately, all of these claims have since been debunked by empirical research (Greenwald et al., 1991; Moore, 1988). The only effect from the audio tape recordings resulted from a placebo effect. Users of the tapes satisfied a self-fulfilling prophecy by changing an aspect of their life willingly, similar to hypnosis. However, there is no statistically significant evidence to support the use of subliminal priming through auditory media. Although unconscious auditory messages typically have no effect on individuals, visual subliminal primes have been shown to influence the behavior of people in a variety of ways.

In recent years, research on subliminal priming as a persuasive technique has expanded. An important methodological aspect to consider when incorporating subliminal priming into the design is the administration of the stimulus. Current liquid crystal display (LCD) monitors refresh at a rate of 60 hertz a second or 16 milliseconds. It is imperative that the prime appears simultaneous to the refresh rate. Otherwise, the timing of the prime's appearance will vary greatly between each instance. Inconsistent priming times create a variable which cannot be controlled by experimenters.

Research by Strahan, Spencer, and Zanna (2002) helped to establish subliminal priming by attempting to identify several key factors of semantic priming methodology.

They found that participants who were motivated towards a particular goal were more likely to be influenced by a subliminal prime. In their work, individuals who were thirsty prior to participation in the experiment were more affected when subliminally primed by words like “thirst” over neutral words such as “won.” The findings show a potential possibility of enhancing persuasion techniques through unconsciously received text. Other supporting evidence has shown subliminal priming can even influence participants’ choice between beverage brands if the participants were thirsty prior to the priming (Karrenmans, Stroebe, & Claus, 2006). Deprivation has also been shown as a motivator when employing subliminal priming (Weltkamp, Aarts, & Custers, 2007). Participants who were more dehydrated before being subliminally primed were not only influenced more by the prime, but also ingested more fluids. The findings suggest subliminal priming can alter an individual’s behavior at a physical level. However, studies by Veltkamp, Custers, and Aarts (2011) reject the necessity of motivators for subliminal priming to have an unconscious effect on participants. Their research suggests individuals do not require a particular goal for subliminal priming to have an effect on individuals’ behavior. Semantic priming is not the only method of unconsciously manipulating individuals’ behavior. Images have also been successfully used as persuasive subliminal primes.

Graphical primes are useful when testing across a diverse sample because images can be culturally agnostic symbols. Research has shown that faces are effective stimuli for influencing individuals’ purchasing habits. Sad faces can motivate participants to actively seek methods to restore their mood (Strahan, Spencer, & Zanna, 2002). Other studies have shown participants subliminally primed with images of dark faces reacted

with more hostility than participants primed with light faces, regardless of the participants' attitudes and beliefs towards race.

Subliminally primed images have even been shown to influence the gambling behavior of individuals by increasing participants' confidence in winning. Gibson and Zielaskowski (2013) showed that participants bet more frequently when they receive exposure to subliminal priming of dollar signs from computerized gambling machines in comparison to participants who did not receive the subliminal prime. The seriousness of the findings resulted in a seizure of 87 slot machines from Ontario, Canada gambling establishments. The study also found the effect of the subliminal prime was shown to drastically reduce five minutes after exposure. These results support the use of subliminal signals as warning devices because the habituation, or over exposure, to warnings may be only limited to a short time frame. However, studies have also shown the effect of subliminal priming can last several days (Lowery et al., 2007) indicating that the targeted behavior does matter. The variability of subliminal priming information is one of the key factors for defining the parameters of the construct. The subliminal warning in the current experiment is an International Organization of Standardization (ISO) prohibition symbol. As warning signals pictorials are perceived as more noticeable and preferred over just text (Kalsher et al., 1994).

Fortunately, the effects of subliminal priming can be controlled by individuals who are warned not to be influenced (Verwijmeren et al., 2013). These findings propose a possible solution to avoiding the persuasive effects of subliminal priming which are used maliciously. The use of a subliminal prime as a warning is more akin to signal words used in the warning literature. Therefore, "subliminal signal" better describes the prime used in

the current experiment. The goal of this experiment was to determine not only the effect of warnings on personal identity element disclosure, but also determine whether subliminal signals can enhance the effectiveness of the warning.

Design

The study used a 2 (subliminal signal: present or absent) X 2 (warning: present or absent) X 3 (personal identify elements: date of birth, gender, or zip code) between-subject design.

Hypotheses

The intent of the experiment was to determine whether a warning could reduce disclosure of identity elements that people deem are safe to disclose, and use a subliminal signal to enhance the effectiveness of the warning. We predicted:

1. Participants who received both the subliminal signal and supraliminal warning would be the least likely to disclose personal identity elements in comparison to participants who did not receive the subliminal signal or supraliminal warning.
2. That participants who received only the supraliminal warning would be less likely to disclose personal identity elements compared to those that did not receive the supraliminal warning.
3. That participants would be least likely to disclose their zip code in comparison to disclosing date of birth and gender.

CHAPTER II

METHOD

Participants

The participants were undergraduates from The University of Alabama in Huntsville (UAH) and employees of a software development company in Huntsville, Alabama, $N=101$, (54 male, 47 female, $M_{\text{age}}=25.6$ years, age range: 19-64 years, 75 university, 26 company). However, the subliminal signal conditions were removed due to methodological problems described in the results and discussion. The total number of participants for the remaining conditions was $N=57$. Due to data collection methods which did not account for removal of conditions, additional demographic information cannot be provided. Psychology student participants received one experimental point for their participation. Employees of the software development company were asked to volunteer their time. Participants were not paid for their participation. Participants had to be able to read text from a computer monitor without assistance from others. All APA ethical guidelines were followed (Appendix A).

Materials

The experiment required computers which have LCD monitors with a standard refresh rate of 60 hertz per second. The standardization was necessary because of the implementation restrictions of the subliminal signal display. The refresh rate of 60 hertz per second is equivalent to 16 milliseconds which is taken into account by the subliminal signal application. Participants used Mozilla's Firefox (version 31.0) web browser or higher and had a version of Windows 7 installed as the operating system (OS). Other combinations of web browsers and operating systems were not used because they may have unknown compatibility issues.

A passive text-based warning was used in the experiment's warning conditions. The warning consisted of a white rectangular box bordered by a red line. The text of the warning box read, "*HAZARD! FBI: Disclosing this information may be dangerous to your identity privacy.*" The language of the warning was similar to the warning text used by Zhu and colleagues (2013) (Figure 2.1).

The subliminal signal was an 18 X 18 pixel image of an International Organization of Standardization (ISO) general prohibition symbol (Figure 2.2). The image was selected for universal recognition across cultures.



Figure 2.1 Supraliminal warning. Warning employing signal word "Hazard", government organization initials, message intent, and red border used in the study.



Figure 2.2 Subliminal signal. International Organization for Standardization (ISO) Prohibition Symbol 18x18 pixels used in the study.

The signal appeared on screen for 40 milliseconds after participants clicked inside the input field of their assigned condition. The time interval of the subliminal signal, 40 milliseconds, was chosen because it was the most appropriate, stable time within the constraints of the technology used to render the image. During the manipulation check, the subliminal signal was followed by a 102 milliseconds mask (Strahan, Spencer, & Zanna, 2002). The mask consisted of three hash tags in the exact prior location of the subliminal signal. The purpose of the mask was to avoid any residual effects from the subliminal signal which could inadvertently have caused the image to be recognized above the threshold of awareness.

The experiment was conducted online for logistical purposes. The website, myautoneeds.com, was a simulated insurance site for a mock company called Expedite Auto Insurance. The website asked participants a variety of questions about their personal information. The three identity elements used for the study were not co-located to avoid priming effects (Figure 2.3). After obtaining the auto insurance quote, the subliminal signal manipulation check was presented. The manipulation check page included detailed instructions and a text box. The instructions stated: *Please read these instructions before continuing! While staring at the text box below, please click anywhere inside the text box.* When the participant clicked inside the text box the subliminal signal appeared for 40 milliseconds followed by the mask for 102 milliseconds. Afterwards, another text instructions appeared below with the instructions: *Please describe what image, if any, you saw appear before the ###.* The purpose of the manipulation check was to ensure the subliminal signal is not appearing supraliminal more than 50% of the time during the

experiment. All participants received the manipulation check regardless of their assigned condition.

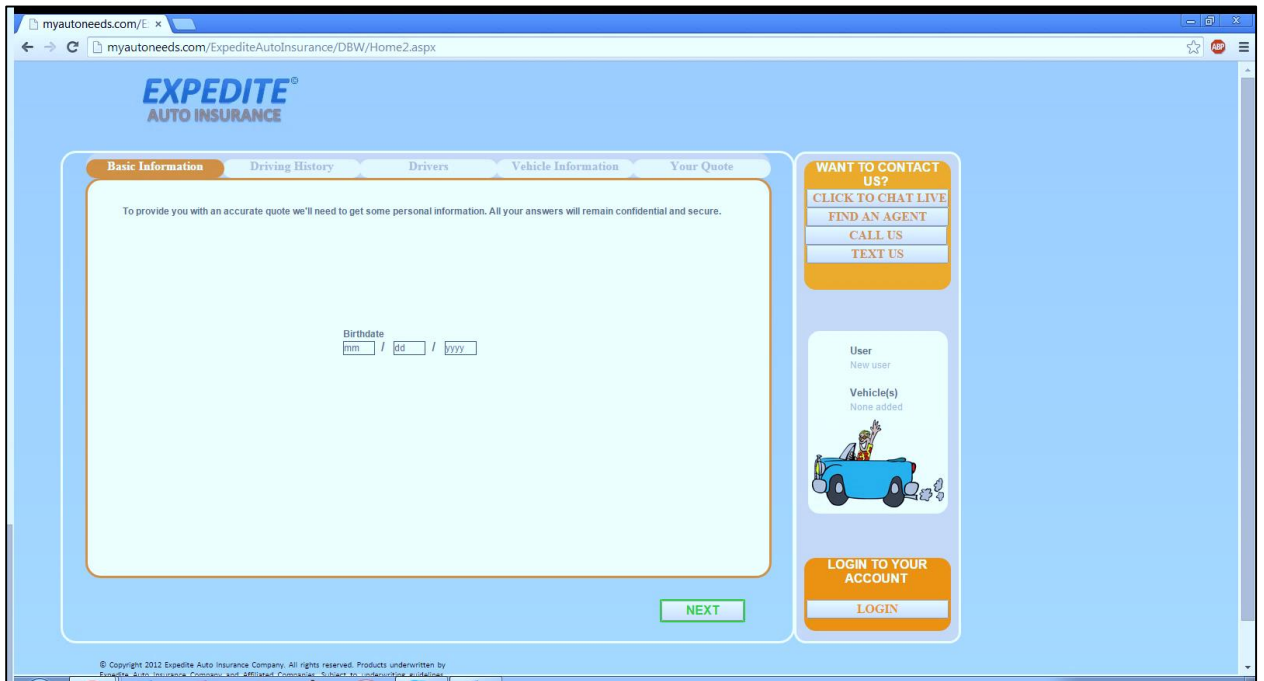


Figure 2.3 Experiment website.

The example screenshot shows a series of text fields asking for the participant's date of birth.

Participants then filled out a survey based on their interaction with the www.myautoneeds.com. The survey was used to determine how and why participants responded to the text fields on the website. Participants self-reported whether or not the website asked for information about all three personal identity elements. Participants who recalled questions related to the personal identity elements were then be asked to report how they responded. The survey then asked whether or not the participant saw a warning on the website. Participants who received or recalled the warning were then asked to restate the warning, describe what the warning meant, and define the level of risk the warning conveyed. Finally, participants were asked to provide demographic information and rate 11 personal identity elements by how important those elements were to keep private.

Procedure

Each session of the experiment required 30 minutes to complete. After informed consent was provided, the participants were randomly assigned to one of the twelve conditions. The experiment administrators followed the script provided verbatim (Appendix B). The experiment was conducted by undergraduate research assistants at UAH and by a graduate student at a local software development company.

The participants started by opening the auto insurance website link. The first page was a login screen which prompted the participant to provide their first and last names. The second page of the website was a mock disclaimer which informed the participants that the insurance website information would be used for market analysis by a third party. Participants then selected the radio button, *I have read the disclaimer and know that UAHuntsville is not responsible for any information I give to Autoneeds Insurance website*, before continuing to the next page. Previous research has shown, that participants trust universities to not disclose or misappropriate their personal identity elements, which can cause a ceiling effect. The use of a 3rd party disclaimer was designed to reduce this effect.

The third page of the website opened the first page of the Expedite Auto Insurance site. The website was designed to mimic an existing automotive insurance site. Each page within the site had the phrase, *To provide you with an accurate quote we'll need to get some personal information. All your answers will remain confidential and secure*, at the top of the screen. The first text fields were for the participant to provide their legal name. The fourth, fifth and sixth pages of the website all asked for one of the three identity elements, date of birth, gender or zip code targeted for the study. It is

important to note participants were not required to respond to the personal identity elements, regardless of their assigned condition. The website simply tracked whether or not participants clicked within the text boxes associated with each identity element. The subliminal signal and warning were triggered by the participant clicking inside the associated text boxes.

When the participant selected the text field for one of the three identity elements, in the subliminal signal present conditions, the subliminal signal appeared in the text box for 40 milliseconds. The passive warning then appeared, in the “warning present” conditions, on the bottom half of the webpage. The subliminal signal and/or warning did not appear in every identity element textbox, but only appeared in the personal identity element text box associated with a participant’s assigned condition. The website implemented did not record what data was entered into any of the text fields on the website, but did record *whether* data was entered into the text fields. This method allowed information to be provided by participants without the risk of compromising the participant’s actual personal information.

The next webpage, page seven, asked the participant to provide their email address. Following, page eight asked the participant whether they currently have auto insurance, to name their current or previous insurance company, and to select what type of license the participant currently possesses. The ninth page of the website asked the participant to provide their driver’s license number. The tenth page provided the participant with a false insurance quote. The quote was the same for all conditions.

The last page of the website was a manipulation check to determine the threshold level of the subliminal signal. The participants were asked to stare at an empty text box

and to report what was seen after they clicked inside the empty text box. At this point the subliminal signal was shown for 40 milliseconds, followed by the 3 hash tag priming mask for 102 milliseconds. The participants were then prompted to describe what was displayed prior to the 3 hash tag priming mask. All participants received the manipulation check regardless of the participant's assigned condition. Participants then closed out the website and took the survey at an online website.

CHAPTER III

RESULTS

Unfortunately, due to technical issues we were unable to confirm whether or not the subliminal signal was correctly displayed to the designated participants. Manual testing of the website revealed the subliminal signal did not always appear in the conditions associated with the subliminal signal when it was supposed to appear. Only four out of the original 101 participants were able to identify or describe the subliminal signal after the manipulation check. Subliminal by definition means below the threshold of consciousness, but by directing participants' attention to a target location with specific instructions that indicate an expected change will occur it is possible to consciously see an image. Therefore, we removed the subliminal signal from the analyses, and cannot determine any conclusion about our first hypothesis.

We used binomial logistic regression for the analysis of the warning conditions, a method of statistically modeling and predicting categorical data. The classification table (Table 3.1) shows the accuracy of the model when participants disclose identity elements. The overall percentage indicates that without any predictive variables there is a 78.9% classification accuracy, or the percentage in which the dependent variable, disclosure,

correctly predicted the model. The classification table is commonly referred to as the “null” model because it does not include any predictive variables.

Table 3.1
Logistic Regression Classification Accuracy

<u>Observed</u>	<u>Non-Disclosure</u>	<u>Disclosure</u>	<u>Percentage Correct</u>
Non-disclosure	0	12	0
Disclosure	0	45	100
Overall Percentage			78.9

The null model was rejected because there was a statistically significant difference found between the dependent variables, non-disclosure and disclosure, indicated by the Wald Chi-Square test (Table 3.2). The odds ratio, Exp (B) (Table 3.2), shows participants were 3.75 times more likely to disclose personal identity elements than to not disclose.

Table 3.2
Logistic Regression Null Model for Disclosure and Non-Disclosure

<u>Constant</u>	<u>B</u>	<u>Se</u>	<u>Wald</u>	<u>Sig.</u>	<u>Exp(B)</u>
	1.322	.325	16.551	.000	3.750

The Score test (Table 3.3) predicted whether any of the independent variables were significant in the model. None of the independent variables, date of birth, gender, or zip code, were statistically significant in the model. Therefore, we cannot support the second hypothesis that the supraliminal warning will effect disclosure rates of non-sensitive personal identity elements. The overall statistics (Table 3.3) indicates the result of including all of the predictor variables in the model. The overall statistics was not statistically significant and unsupportive of our third hypothesis. Zip codes did not have a significantly lower disclosure rate in comparison to date of birth and gender. The

frequency of disclosure (Table 3.4) indicates the disclosure versus non-disclosure rates for participants who only received the supraliminal warning condition or no supraliminal warning condition.

Table 3.3

Significance Values of Predictor Variables Effect on the Logistic Regression Model

<u>Independent Variables</u>	<u>Score</u>	<u>Sig.</u>
Control	1.322	.325
Date of Birth	.957	.328
Gender	.002	.968
Zip Code	.730	.393
Overall Statistics	1.287	.732

Table 3.4

Frequency of Disclosure and Non-disclosure in Each Condition

<u>Independent variable</u>	<u>Disclosure</u>	<u>Non-disclosure</u>	<u><i>n</i></u>
Control	12	3	15
Date of Birth	9	4	13
Gender	11	3	14
Zip Code	13	2	15

CHAPTER IV

DISCUSSION

We encountered an unexpected issue with the display of the subliminal signal, and were unable to support the prediction that subliminal signals may enhance the effectiveness of supraliminal warnings on disclosure rates for non-sensitive personal identity elements. The study was conducted using a website hosted online which may have contributed to the inconsistent display of the subliminal signal. It became unclear whether the subliminal signal was appearing for the correct duration of time or even appearing at all. These issues, as mentioned previously, resulted in the removal of the subliminal conditions from the experiment. Future experiments may benefit from a native desktop application which resembles a website versus a live, hosted website. A desktop application would reduce the variance between each session by eliminating technical variables like network latency and browser caching. Therefore, we focused only on the identity elements and whether or not supraliminal warnings had an effect on disclosure rates for participants.

We were unable to find a significant difference between disclosure rates for the three identity elements. The warning did not affect participant's decision on whether or not to disclose personal information. We were also unable to determine that zip codes

were less likely to be disclosed than date of birth or gender because none of identity elements had a significant effect on disclosure rates. There were a few problems with the methodology which may have influenced participants to disclose their personal information.

There are a few changes which would help to improve the experiment in general. Warnings in a laboratory setting may not be effective because participants cannot be placed in a potentially dangerous situation, and therefore may not respond to the warning in the same manner as the real world (Wogalter & Laughery, 1996). This was a known problem prior to conducting the experiment, but research suggested laboratory studies are possible with more sensitive personal identity elements (Zhu et al., 2012). However, the personal identity elements chosen for this study were specifically picked because date of birth, gender, and zip code are considered non-sensitive identity elements. The use of a fully interactive warning may reduce the chance of participants overlooking or ignoring the message in future studies. A modal dialog box would require user input to move forward in the process and demand participants to attend to the warning message. Forcing participants to attend to the warning message by stopping the system progress may help to reduce disclosure rates of non-sensitive identity elements like zip code, date of birth, and gender.

The website design itself may have contributed to a lack realism in the study. Low quality websites are considered less trustworthy and would decrease disclosure rates (Gregg & Walczak, 2010). However, changing the aesthetics of the site may be beneficial for creating a more realistic experience for the participants. Incorporating more standard web user interface elements would help to reduce this issue by increasing the padding

around elements, opting for higher resolution images, and especially increase the content of the pages to reflect a more believable representation of an automobile insurance website.

Pilot testing the subliminal signal and supraliminal warning should have been more extensive before starting the official data collection. The variance between subliminal primes throughout the research showed a lack of definitive parameters for the construct. Technical issues aside, the image and size of the subliminal signal may not have been appropriate. The use of human faces expressing pain (Yamada & Decety, 2009) has been shown to trigger avoidance behavior through subliminal priming, and may be useful for deter individuals from disclosing personal information in future studies. The ISO prohibition symbol may be generally understood, but facial expressions are also universally recognizable. An 18 X 18 pixel image may be difficult to see regardless of whether the image is static or dynamically displayed. Increasing the size of the subliminal signal to a minimum of 48 x 48 pixels may help to improve the effectiveness of the signal. Initially, there was concern a supraliminal warning which was too effective may create a ceiling effect on disclosure rates rendering the subliminal signal unmeasurable. The results of this experiment determined that the warning was not overly effective. In future studies it would be advantageous to create a stronger warning for non-sensitive personal identity elements in comparison to warnings for sensitive personal identity elements.

It would be beneficial to track whether participants disclosed identity information for other personal elements for which they did not receive a warning. By tracking all instances of user input we would be able to determine the effect of the warning across

multiple web pages. Tracking user response across the entire site may show a warning's effective duration. Overall, there are many directions from which future research could branch from the current experiment and help to define effective warning methods in an online environment.

APPENDIX A

IRB Approval Letter



Payton Brown and Dr. Sandra Carpenter
Psychology Department, College of Liberal Arts

January 24, 2014

Dear Payton Brown and Dr. Carpenter,

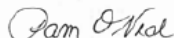
The UAH Institutional Review Board of Human Subjects Committee has reviewed your proposal, *Website Usability 2*, and found it meets the necessary criteria for approval. Your proposal seems to be in compliance with this institutions Federal Wide Assurance (FWA) 00019998 and the DHHS Regulations for the Protection of Human Subjects (45 CFR 46) and has been classified as expedited.

Please note that this approval is good for one year from the date on this letter. If data collection continues past this period, you are responsible for processing a renewal application a minimum of 60 days prior to the expiration date.

No changes are to be made to the approved protocol without prior review and approval from the UAH IRB. All changes (e.g. a change in procedure, number of subjects, personnel, study locations, new recruitment materials, study instruments, etc) must be prospectively reviewed and approved by the IRB before they are implemented. You should report any unanticipated problems involving risks to the participants or others to the IRB Chair.

If you have any questions regarding the IRB's decision, please contact me.

Sincerely,



Pam O'Neal PhD, RN
IRB Chair
Associate Dean for Undergraduate Programs
College of Nursing, University of Alabama in Huntsville,
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APPENDIX B

Script

Introduction

Before the experiment starts, ensure all necessary materials are available:

- Participant number check list (use to track participants)
- Pen
- Designated computer with internet access
- Paper copy of consent form
- Experiment condition(s) website address
- Survey website address

Open the experiment condition and survey website in the Firefox web browser. Do not use other browsers. When the participant arrives introduce yourself. Then, ask for identification to confirm their birthdate and identity. If the participant is under 19 they must bring a signed parental consent form. Participants under 19 cannot legally participate without parental consent. If the participant's identification does not match the person who signed up do not run the participant. Contact the lab manager for more information in this matter.

Experiment

The experiment requires little administrator interaction. Once the participant is seated at the computer please assign them a participant number and say the following lines verbatim:

Thank you for your participation in the 2nd Usability Study. Today you will use an auto insurance website to determine the overall functionality and accessibility of obtaining an insurance quote. Please let me know if you have any questions before we begin.

If the participant asks questions please try to reply as vaguely as possible. Avoid talking unless prompted by the participant. Once the participant has completed the experiment condition website portion, instruct them to complete the survey website.

Closing

When the participant has completed the experiment condition website and survey website please thank them again and debrief the experiment.

Thank you again for your participation. A formal debrief will be issued once the experiment is complete. If you have any questions about the experiment please contact [email redacted]. Thank you and have a great day!

APPENDIX C

Additional Tables

Table C.1

Comparison of Control and Date of Birth Disclosure Rate by Warning Conditions

	<u>Warning Present</u>	<u>Warning Absent</u>
Disclosure	9	12
Non-disclosure	4	3

Table C.2

Comparison of Control and Gender Disclosure Rate by Warning Conditions

	<u>Warning Present</u>	<u>Warning Absent</u>
Disclosure	11	12
Non-disclosure	3	3

Table C.3

Comparison of Control and Zip Code Disclosure Rate by Warning Conditions

	<u>Warning Present</u>	<u>Warning Absent</u>
Disclosure	13	12
Non-disclosure	2	3

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