ABSTRACT

SMITH, JEFFREY JOHN. On-product Warnings as Reminders: Compliance to Product Manual Warnings based upon Presence and Content of On-product Warning. (Under the direction of Michael S. Wogalter.)

Warnings have two well-established purposes. First, warnings inform users of important safety-related information and thereby enable informed decisions regarding product usage and safety issues. Second, warnings are intended to minimize injuries, illnesses, and property damage. In addition, Wogalter and Laughery (2006) suggested that warnings may function as reminders, where their presence cues information in long-term memory and, consequently, facilitates awareness of a particular hazard. For the most part, past research has not evaluated the effectiveness of warnings as reminders.

The present study examined how compliance to product manual warnings was influenced by the presence and content of on-product warnings during a memory installation task involving an electrostatic discharge hazard. Analyses showed that both the presence of an ANSI-compliant label and longer manual exposure were associated with increased compliance. This additive effect reinforces the importance of on-product warnings as not only a first exposure to safety-related information, but also supports the suggestion that warnings may act as reminders, increasing the likelihood of compliance even when one is already aware of a hazard. Analyses also showed that the presence of an explicit ANSI-compliant warning was associated with greater compliance than a general warning, regardless of manual condition. Critiques of the present research and suggestions for future research involving warnings as reminders are discussed.

On-product Warnings as Reminders: Compliance to Product Manual Warnings based upon Presence and Content of On-product Warning

by
Jeffrey John Smith

A thesis submitted to the Graduate Faculty of
North Carolina State University
in partial fulfillment of the
requirements for the Degree of
Master of Science

Psychology

Raleigh, North Carolina

2010

APPROVED BY:

_____ _____

Christopher B. Mayhorn, PhD Sharolyn A. Lane, PhD

_____

Michael S. Wogalter, PhD
Chair of Committee

DEDICATION

I have had many excellent relationships in my life, personal, academic, and professional, but I would like to mention a few individuals instrumental to any success I've had as a dedication: my brother, who personifies authenticity and principle, my mother, with her love and compassion, and my father, who embodies courage and resilience. My entire life has been blessed with thoughtful consideration and questioning rather than discouragement from many individuals, but these three have been there for my entire lifetime, ensuring that I never lacked the capacity for aspiration and hope through their consistent love and support.

BIOGRAPHY

Jeffrey Smith is a 2003 alumnus of Wheeling Jesuit University who majored in Philosophy and Psychology. After attending Duquesne University School of Law for a year on an academic scholarship and working as a clerk for the Allegheny County Juvenile Court Project, Jeff elected to leave law school after learning the practice of law did not fulfill his desire to combine his creativity and passion for critical thinking.

After a year as a researcher for the NASA-sponsored Classroom of the Future, Jeff accepted a teaching assistantship in the Human Factors and Ergonomics program within the Psychology department of North Carolina State University. Jeff quickly discovered that the art and science of human factors - that is, the management of constraints to optimize any human activity - would not only provide novel intellectual challenges, but also require design creativity and applied psychological insights. At NCSU, his academic research focus became risk communication, specifically the design and evaluation of print warnings; he completed his MS in 2010 and plans to continue pursuing his PhD.

Jeff began his career with International Business Machines Corporation in May of 2006 as a Human Factors Scientist and has been identifying opportunities to simplify interactions with IBM hardware ever since. Jeff was recently named a Master Inventor by IBM and the USPTO issued Jeff's first patent in February 2009. A passionate advocate for importance of human factors for business, design, and engineering, Jeff is a member of the NCSU, Carolina, and national Chapters of the Human Factors and Ergonomics Society as well as the Research Triangle Park and national chapters of the Usability Professionals Association.

ACKNOWLEDGEMENTS

Many other individuals have influenced my academic development at the university and graduate levels: Dr. Bryan Raudenbush, my undergraduate advisor, who introduced me to application of psychological insights to human performance, the power of statistics, and, most importantly, the joys of “Superlab” research; Koon, a fellow student researcher and fantastic number “1.5”; Becky, a “shadow” of whose success I am so proud; Dr. Tom Michaud and Dr. Peter Pagan, who demonstrated the connectedness of philosophy and psychology during my undergraduate studies.

At the graduate level, I must first thank Dave Windell, who introduced me to all of the opportunities associated with NCSU. Special thanks especially to Dr. Mike Wogalter and Dr. Shari Lane for their valuable guidance, support, and advice as I discovered my passion for human factors psychology.

TABLE OF CONTENTS

LIST OF TABLES

Introduction

Warnings are a form of safety communication, intended to inform persons at risk about hazards and minimize undesirable consequences of interactions with circumstances that may result in illness, injury, or property damage (e.g., Wogalter & Dingus, 1999; Wogalter & Laughery, 2006). According to Wogalter and Laughery (2006), warnings have several established purposes. First, warnings are a means for conveying important safety-related information to users, allowing them to make well-informed decisions regarding product usage. Second, warnings attempt to minimize injuries, illnesses, and property damage associated with product usage. In addition, these authors suggest that a warning can act as a reminder, cuing information that is stored in long-term memory and prompting awareness of a particular hazard.

Although, ideally, consumers could be protected from hazards without the use of warnings, many hazards cannot be removed during the design and manufacturing process. Accordingly, a well-known hierarchy of hazard no warning exists: (1) design out the hazard, (2) guard against the hazard, and (3) provide adequate warnings for both proper use and reasonably foreseeable misuses (Sanders & McCormick, 1993). Within this hierarchical structure, when hazards cannot be designed out of products and environments or guarded against, manufacturers should place warnings appropriately, whether in the product manual, on the product itself, or both.

Warnings should not be considered a substitute for designing out and guarding against hazards; that is, manufacturers should not assume that the mere presence of an on-product warning will eliminate hazards (Lehto & Salvendy, 1995). Many additional factors affect whether a warning will be perceived, noticed, understood, and complied with. According to the Communications-Human Information Processing (C-HIP) model, which

describes the stages of communication relevant to risk communication and warnings, the effectiveness of warnings is affected by various factors such as attention, comprehension, attitudes/beliefs, and motivation (Wogalter, DeJoy, & Laughery, 1999). Each element of the C-HIP model is influenced by a variety of factors. Comprehension, for example, concerns one's ability to understand the meaning of a warning; the comprehensibility of a warning can be affected by hazard connotation, receiver competence, message content, explicitness, the use of pictorials, etc. (see Wogalter & Laughery, 2006, for a review).

Effectively designed warnings can reduce or eliminate unsafe acts associated with hazardous circumstances (Wogalter, Godfrey, Fontanelle, Desaulniers, Rothstein, & Laughery, 1987). A substantial amount of empirical research related to warning design and evaluation has been developed over the past two decades (see Wogalter, Conzola, & Smith-Jackson, 2002, for a review). For example, effective warnings should include information about a potential hazard, its consequences, and instructions for avoiding risk (e.g., Wogalter & Laughery, 2006), be placed physically and temporally close to the hazard (Frantz & Rhodes, 1993; Wogalter, Barlow, & Murphy, 1995), and from a source that individuals perceive as credible (Wogalter, Kalsher, & Rashid, 1999).

Additional recommendations, guidelines, and methods for designing effective warnings have been provided by the American National Standards Institute (ANSI, 2002), FMC Corporation (1985), the International Organization for Standardization (ISO, 2002) and various researchers (e.g., Laughery & Wogalter, 1994; Human Factors and Ergonomics Society, 2001; Wogalter & Laughery, 2006; Wogalter, 2006).

The Legal Duty to Warn

Manufacturers have a legal responsibility to apprise the purchasers of their products of safety information and limit the exposure of unsuspecting users to hazards associated

with their products. In fact, product manufacturers may be liable for damages caused by a product free of both design and manufacturing defects, if the damages are the result of inadequate warnings regarding use or the lack of instructions describing safe use (*Conti v. Ford Motor Co.*, 1984; *Ragsdale Bros., Inc. v. Magro,* 1985). According to the Restatement of Torts (2nd) and to the Theory of Strict Liability, a product whose reasonably foreseeable risks necessitate the presence of a warning is considered defective if the warning is not present or inappropriate (Madden, 1999). Madden (2006) indicates that a court's perception of the adequacy of warnings is based on the intensity of the warnings' words and symbols, as well as the size and location of the warning. These factors must make clear the nature and extent of hazards associated with a product (*Hubbard-Hall Chem. Co. v. Silverman*, 1965). Further, warnings or instructions must minimize the reasonably foreseeable risk(s) of harm for both intended and reasonably foreseeable uses (and misuses) if followed (Madden, 1987).

According to comment *k* of the Restatement of Torts (2nd), §388 (1965), potential harm that is not easily apparent to a reasonable person and the absence of effective instructions and warnings are essential elements for product liability. In other words, if a hazard is considered "open and obvious," no duty to warn exists and a warning need not be placed within a manual or on the product itself. The sharpness of a knife, for example, is considered "open and obvious." The concept of "open and obvious" also encompasses information that is common knowledge to a particular group of individuals, such as physicians or operators (Madden, 1999).

In addition, consideration is also given to familiarity and expertise related to a hazardous product and its use. This is reflected in the "consumer-contemplation" test of strict liability that reflects the expectations of the "ordinary consumer" (Madden, 2006). The

“consumer-contemplation” test involves the determination of whether a product is dangerous to an extent beyond that which would be contemplated by the ordinary consumer who purchases it, with the ordinary knowledge of its characteristics that are common to the community. This test assumes that expertise and familiarity among a community of purchasers entails both an increased awareness and likelihood of avoidance of risks and hazards associated with a particular product.

However, even individuals that have knowledge about a particular hazard may not be cognizant of the hazard’s potential danger at a particular time. This phenomenon explains how many individuals are injured by hazards that seem obvious and avoidable. For example, Resnick (2006) argues that various contextual elements and their additive effects can increase the likelihood that individuals are injured by hazards that otherwise would be “apparently obvious.” Within his human factors analysis of an injury involving a worker and a fabric roller, he identifies work history, training, attention focus, workplace layout, machine design, materials, peer behavior, and warnings as contextual factors that can obscure the danger of a seemingly evident hazard. In other words, the “totality” of circumstances surrounding a so-called “open and obvious” hazard may eliminate the security provided by its obviousness, even for users familiar with a particular product and, presumably, its hazards.

Warnings intended to be reminders may increase the likelihood that users are mindful of “open and obvious” hazards, even when these individuals are attending to a variety of other stimuli. Tulving and Pearlstone (1966) demonstrated that some information that could not be recalled in noncued (i.e., free recall) conditions could be called to mind in the presence of cues (i.e., hints). This suggests that the presence of a reminder could potentially cue awareness of hazards and safety-related information that would otherwise

not be accessed at the time it is necessary for correct performance of a particular task. Again, both the noticeability of a cue and its ability to prompt information previously stored in long-term memory are centrally important for warnings intended as reminders.

Familiarity and Warnings as Reminders

A variety of studies have suggested that individuals familiar with a product are less likely to look for, notice, or read a warning. Godfrey, Allender, Laughery, and Smith (1983) had participants rate the hazardousness of various household products as well as their familiarity with each product. For products rated as having only slight hazards (e.g., dishwashing detergent), a significant negative correlation ($r = -.50$) between product familiarity and likelihood to look for a warning message. However, the correlation between product familiarity and likelihood to look for a warning message was not significant for highly hazardous products, such as pesticides and turpentine. Godfrey and Laughery (1984) studied the usefulness of on-product warnings regarding toxic shock syndrome (TSS); results showed that participants who had previously used tampons were less likely to notice the on-product TSS warning than participants who were unfamiliar with the product.

LaRue and Cohen (1987) had 35 participants rate 12 products on 5 warning-related dimensions, including familiarity. Results showed a significant negative correlation ($r = -.66$) between ratings of familiarity and likelihood of reading a warning. Otsubo (1988) examined the effects of warning design and user perceptions on participants' likelihood of noticing, reading, recalling, and complying with power tool warnings by manipulating the warning on a high- and low-danger tool. This study showed that participants who chose to read the warning were less likely to have prior experience with the tool.

Goldhaber and deTurck (1988) investigated participants' awareness of warnings signs placed near swimming pools. Participants who had owned pools for the longest time

were less likely to notice the sign and more likely to express uncertainty about its presence. Wright, Creighton, and Threlfall (1982) had participants indicate the likelihood of reading the instructions for 60 consumer products and rate the products on familiarity, safety, simplicity, price, and use experience. Results showed that products for which participants indicated they would read “None” of the instructions received higher ratings for familiarity and frequency of prior use than products which they indicated they would read “All” instructions. Furthermore, Celuch, Lust, and Showers (1992) found that users with greater reported experience are less likely to consult product manuals than inexperienced users and that prior experience and time considerations were the most important factors differentiating readers from non-readers.

Johnson (1992) explored the effectiveness of warnings labels directing users to read safety guidelines before using or assembling a scaffold. The number of times a person had worked on a scaffold was negatively correlated with the perceived likelihood of reading safety information. However, Wogalter, Brelsford, Desaulniers, and Laughery (1991) found that, while familiarity was negatively correlated to willingness to read warnings, perceived hazard was found to be the primary factor determining whether product warnings will be read.

In summary, more experience with a product appears to be associated with a reduced likelihood to read warnings and instructions. Although some experienced users may neglect to read instructions and warnings because they possess more knowledge regarding the product and associated safety-related information, expert users are still susceptible to injuries related to forgetfulness and lack of awareness at the time of injury. This suggests a need for warnings acting as reminders, even for experienced users, to prompt knowledge already contained in long-term memory and potentially decrease lack of

awareness and forgetting. Since warnings intended as reminders are primarily acting as triggers for information in long-term memory rather than the source of the information itself, noticing (i.e., attending to) the warning and enabling the cue is of primary importance. The presence of warnings intended as reminders may also prompt the recall of safety-related information by acting as a cue, even though they are not consciously 'noticed.'

On-Product Placement of Warnings

Manufacturers often place warnings both within product manuals and on the products themselves. Since space is often limited on the products themselves, some warnings are only placed within the product's manual (Mehlenbacher, Wogalter, & Laughery, 2002). However, some research suggests that many users do not read owner's manuals and, therefore, may not be exposed to information about hazards (Rettig, 1991; Schriver, 1997). For example, Mehlenbacher et al. (2002) found that only 59% of 365 respondents reported reading the owner's manual for the vehicle they drive most frequently and, of those claiming to read the owners manual, they reported reading only about 53% of the total text.

Other research has demonstrated the effectiveness of placing the warning proximate to the task and on the product itself. Wogalter, Barlow, and Murphy (1995) found that compliance was greater when warnings were placed on the product itself compared to on the product box or manual; indeed it was the only way to alert more expert users. Frantz and Rhoades (1993) suggested that compliance was greater when warnings were placed so they interfered with the task compared to when the warnings were merely placed on an object. These findings suggest that placement of a warning intended as a reminder in a conspicuous location on a product itself may not only increase the likelihood that the safety-

related information to which one has been exposed is cued and then recalled, but also encourage compliance.

Recommended Contents of Warnings

ANSI (2002) is a standard for warnings that says that each warning should include a signal word panel along with a message panel, a symbol, or both, when appropriate. The signal word panel for hazardous product or environments includes the signal word (DANGER, WARNING, or CAUTION), its corresponding background color, and the safety alert symbol (ANSI, 2002). ANSI Z535.4 (2002) defines the three hazard-connoting signal words as follows:

> DANGER (white letters on a red background): Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. This signal word is to be limited to the most extreme situations.
>
> WARNING (black letters on an orange background): Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.
>
> CAUTION (black letters on a yellow background): Indicates a potentially hazardous situation, which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

The signal word and background color redundantly code the level of hazard. The message panel should communicate the nature of the hazard, the consequences of not avoiding the hazard, and how to avoid the hazard. Symbols may be used in conjunction with or in lieu of the word message in the message panel, according to the Z535.4 standard's 2002 revision.

Although research has not yet investigated the use of various elements of a warning consistent with the ANSI Z535.4 standard as reminders, ANSI-compliant warnings have been rated more likely to be noticed, read, understood, and obeyed compared to warnings inconsistent with the standard (Laughery, Paige, Laughery, Wogalter, Kalsher, & Leonard, 2002; Young, Frantz, Rhoades, & Darnell, 2002). The enhancement of noticeability is

particularly valuable for warnings intended as reminders, whose fundamental purpose is cuing information already stored in long-term memory of users. In addition, consistent use of ANSI-compliant warnings may build associations between the common elements, such as the previously-mentioned signal words, and safety-related information, facilitating assimilation into long-term memory and improving the quality of the reminder. On the other hand, some researchers have suggested that, while ANSI compliant labels received higher ratings for predicted noticeability and compliance, actual behavior did not reflect increased compliance in the small selection of studies they reviewed (Young et al., 2002).

Pictorial Symbols and Warnings as Reminders

Various researchers have suggested that pictorial symbols are useful for capturing attention (e.g., Bzostek & Wogalter, 1999; Jaynes & Bolas, 1990; Kalsher et al., 1996; Laughery et al., 1993; Young & Wogalter, 1990). Research has also shown that the presence of a pictorial can increase compliance, comprehension, and recall. Jaynes and Boles (1990) examined the utility of using text alone, symbols alone, or combined text and symbol warnings for encouraging use of protective gear during a chemistry experiment. The highest compliance rate occurred with the combined symbol warning and the addition symbols facilitated compliance. Young and Wogalter (1990) found that better comprehension and recall of warnings in manuals for a gas-powered electric generator and a natural-gas oven were found with larger-print, the use of color, and the inclusion of symbols. Furthermore, Young, Wogalter, Laughery, Magurno, and Lovvoll (1995) and Kalsher et al. (1996) found that individuals prefer warnings that include a pictorial symbol to warnings that do not include pictorials.

A pictorial symbol may be a useful reminder that a particular action or set of actions is necessary to minimize the likelihood of illness, injury, or property damage when

interacting with a particular product because pictorial symbols are useful for attracting attention. Attending to the reminder, it would seem, may bring about recollection of information already stored in long-term memory from previous exposures to the safety-related information for a particular product (i.e., assuming habituation has not occurred).

Evaluating On-Product Warnings as Reminders

According to Wogalter and Laughery (2006), warnings have several well-known purposes. First, warnings are a means for informing users of important safety-related information and thereby enabling users to make more informed decisions regarding product usage and safety issues. Second, warnings are intended to minimize injuries, illnesses, and property damage associated with product usage. Lastly, these authors suggest that warnings can function as reminders, where their presence cues information in long-term memory and, consequently, facilitates awareness of a particular hazard.

Since consumers may not always have the manual available when encountering a hazard, warnings should facilitate both initial comprehension and later recall of a hazard and appropriate steps for avoidance. For the most part, past research has not evaluated the effectiveness of warnings as reminders. However, Young and Wogalter (1990) found that both comprehension and recall of warning information are improved when print is conspicuous and icons are present. In addition, these authors found that exposure to an icons-present warning produced significantly higher memorial recall compared to exposure to warning without icons when icons were present during recall.

When warnings are intended to serve as reminders, their presence is presumably intended to generate awareness of a particular hazard by summoning information from long-term memory into working memory. Working memory refers to the processes used for temporarily storing and manipulating a limited amount of information during rehearsal,

reasoning, and other mental procedures (Baddeley, 1986). Long-term memory refers to the more permanent storage system from which information can be retrieved and utilized within working memory. In other words, working memory allows individuals to consciously attend to and use a limited amount of information stored in long-term memory for making decisions and selecting appropriate actions.

Prospective memory is remembering to execute an action that cannot be executed when the intention to execute is formed. Generally, prospective memory refers to the entire process of realizing a delayed intention (McDaniel & Einstein, 2007). Prospective memory involves an intention to execute an action at some later time when circumstances permit, a delay between forming the intention and executing the action, typically involving activities not related to the deferred action, and the absence of an explicit prompt indicating that it is time to execute the delayed intention, requiring the individual to “remember to remember” (Brandimonte, Einstein, & McDaniel, 1996; McDaniel, Guynn, Einstein, & Breneiser, 2004).

Although prospective memory is a relatively new topic for cognitive psychologists, McDaniel and Einstein (2007) suggest five research-based parameters for prospective memory tasks. First, the execution of the intended action does not immediately follow the formation of the intention to complete the particular action. Second, the prospective memory task is part of another ongoing activity, during which cues (stimuli) appear naturally. Third, the appropriate timing for response initiation is constrained. Fourth, there is a clear end to the time frame during which a response can be completed appropriately. Lastly, a conscious intention to complete a particular action must be formed.

Cues can sometimes be used to initiate retrieval of deferred intentions during a time when execution is appropriate and/or necessary. A series of studies performed by Tulving and others has demonstrated the effectiveness of cued recall compared to noncued (i.e.,

free) recall. Tulving and Pearlstone (1966) showed that some items which were not retrieved from long-term memory during noncued recall conditions were recalled when a cue was present. Tulving and Osler (1968) suggest that the effectiveness of retrieval cues depends on the degree to which the cue and the information to-be-remembered relate at the time of encoding. Recall of to-be-remembered information was also higher in cued versus noncued conditions in Thomson and Tulving (1970). McDaniel and Einstein (1993) found that the use of a salient, distinct cue was associated with 100% execution of the prospective memory task, compared to 31% for a less conspicuous cue.

Accordingly, Wogalter and Laughery (2006) speculate that warnings intended as reminders will be especially valuable when (1) a non-obvious hazard is encountered infrequently; (2) distractions occur during a potentially hazardous situation, and (3) mental workload and demands on attention are high. These situations share a common element: previously-acquired knowledge stored within long-term memory that likely has not been activated within working memory, exposing users to hazards that could be attended to and avoided if the appropriate information was present in working memory.

Since the primary function of warnings intended as reminders is enabling the retrieval of information already stored in long-term memory, attracting the attention of users is fundamentally important. Since pictorial symbols are useful for capturing attention (e.g., Bzostek & Wogalter, 1999; Jaynes & Boles, 1990; Kalsher et al., 1996; Laughery et al., 1993; Young & Wogalter, 1990), a pictorial symbol could serve as a reminder that a particular action or set of actions is necessary to minimize risk. In other words, the presence of a familiar pictorial on a product itself could increase the likelihood of user awareness for risks already stored within long-term memory from product manuals, prior experience, etc.

For optimal effectiveness, memory cues should be present during encoding as well as retrieval (e.g., Thomson & Tulving, 1970; Tulving & Thomson, 1973). Accordingly, systematic manipulations of the on-product warning should include the elements of a warning that were present during the encoding. The degree to which the cue relates to the encoded cue should also influence its effectiveness as a means for prompting the recall of safety-related information. This may suggest that warnings placed in product manuals share the same features (e.g., formatting, symbols) as the warnings intended as reminders that are placed on the products themselves.

The present study examined the effects of using various elements of an ANSI-compliant warning label as a reminder on both behavioral compliance and information acquisition. One of the primary measures of warning effectiveness is behavioral compliance; that is, effective warnings will not only be observed and comprehended, but also obeyed (Wogalter & Dingus, 1999). Since the setup of realistic scenarios involving risk can be difficult, time-consuming, and too dangerous to conduct, self-reported user intentions are often utilized as a surrogate for compliance research. Because the present task presents a risk to the equipment and no additional risk to the participants, actual behavioral compliance was observed.

An ANSI-compliant warning label was included amongst the instructions in the product manual given to participants during the ‘encoding’ process (Appendix A). This label included a yellow signal word panel containing the alert symbol and the word “CAUTION,” a symbol depicting the electrostatic discharge hazard, and a pictorial symbol next to each instruction listed on the label (Appendix B). Participants were exposed to the product manual including the instructions and warnings for 15 seconds or 300 seconds to establish low and high levels of familiarity with the instructions and ANSI-compliant warning

(Freeman, 2003). Freeman (2003) also suggests that, for this particular task, compliance will be higher with the presence of an ANSI-compliant warning on the system than in the absence of a warning during the task.

During the installation (i.e., the 'retrieval' phase), the entire ANSI-compliant warning label, a blurred version of this ANSI-compliant label, or a general 'warning' label was presented to determine whether the presence and content of reminder cue affected compliance rates. The blurred version was expected to affect compliance because the formatting of the warning was the same as the ANSI-compliant warning. The general 'warning' label is expected to be less effective than the explicit ANSI-compliant warning because the warning text is specific to the task and hazard. During the no warning condition, no label was present on the machine.

There is limited formal research on the utilization of on-product warnings as reminders. Previous research using a similar method as well as a specific measure of information acquisition suggests that, for this particular task, 15 seconds with a product manual will not allow participants enough time to locate warning information and that 300 seconds will provide ample time for locating and reviewing warning information (Freeman, 2003). Accordingly, scores for behavioral compliance with the warning and safety-related information acquisition were expected to be higher in the 300 second manual exposure condition than the 15 second exposure condition.

Generally, individuals in the short manual-exposure time were expected to have lower levels of behavior compliance compared to the long manual-exposure condition because their level of knowledge related to the hazard and appropriate steps for avoidance will be lower, based upon results found by Freeman (2003) using a similar method. The presence of the ANSI label is expected to have the most pronounced effect on recall and

behavioral compliance because the warning information in its entirety will be placed onto the product itself (Freeman, 2003). The presence of a cue in the general warning and blurred warning was expected to increase levels of behavioral compliance compared to the no warning condition for individuals by varying degrees (e.g., Tulving & Pearlstone, 1966). Participants in the long manual-exposure condition who are also exposed to the complete ANSI-compliant warning were expected to show the highest levels of compliance.

Method

Participants

In exchange for credit in their introductory psychology class, 207 students from a North Carolina State University undergraduate psychology course participated in this study. The first 20 participated in the pilot experiment. The remaining 187 participants (M = 18.7 years, SD = 2.19; 52.2% female) were randomly assigned to one of the eight conditions for the primary experiment. Every participant reported owning a computer.

To help ensure lack of familiarity with the task and associated risk, the study's purpose was described as "investigating the effects of branding on the selection and use of consumer products" on Experimetrix, an online research participant pool management system used by NCSU's Department of Psychology. The average reported level of familiarity with the task of installing RAM into a computer was below "somewhat experienced" (M = 1.66, SD = 2.42), on a 9-point scale ranging from "not at all experienced (0)" to "extremely experienced (8)." The average reported perception of how hazardous the memory installation task was between "somewhat hazardous" and "hazardous" (M = 2.79, SD = 2.35) on a 9-point scale ranging from "not at all hazardous (0)" to "Extremely hazardous (8)."

Materials

Participants were given selected pages from an Apple Macintosh 7500 product manual, specifically the pages regarding the installation of additional memory. The memory installation process is described as follows in the manual:

> *Please follow the steps below to avoid injury or damage to the equipment when adding a memory chip to your computer:*
>
> *1. Disconnect the power cord from the back of the computer.*
> *- To open the main cover, the cord must first be removed from the machine*
>
> *2. Flip the support foot out until it locks in place.*
> *- After opening the machine, the main cover must rest on the support foot.*
>
> *3. Wrap the tether around your wrist or hand and clip it to a metal component inside the machine. The tether is used to discharge static electricity.*

Appendix A contains the instructions as they originally appear in the product manual.

Freeman (2003) created a warning label containing the above information based upon the ANSI Z535.4 (1993) design guidelines (Appendix B). This warning label was placed in the product manual given to participants. This label included a yellow signal word panel containing the alert symbol and ANSI-compliant signal word, “CAUTION.” In addition, a pictorial symbol appeared next to each instruction listed on the label.

The pictorial that appeared next to “Disconnect the power cord from the machine” depicted the removal of the power cord by showing the power cord connection into the rear of the machine and included an arrow to show the removal director of the unplugging action. The pictorial that appeared next to “Flip the support foot out until it locks into place” showed the support foot in its appropriate position at the end of the intended manipulation with an arrow depicting the appropriate motion during manipulation. The pictorial that appeared next to “Wrap tether around your wrist or hand” showed the wrist tether appropriately wrapped around one’s wrist and attached to the system with a hand holding a component.

This label was also conspicuously placed on the product itself, in a location likely to have been used by the product manufacturer, to be viewed during the memory installation task. In the other experimental conditions, a version of the ANSI-compliant label blurred using the blur tool in Adobe Photoshop (Appendix B) or a general warning label (Appendix B) was placed in the same location. The blurred label included the same formatting as the ANSI-compliant label; however, the pictorials and text instructions are illegible due to the blurring. The general warning label included the yellow signal word panel and the general warning text, “Incorrect installation can damage your computer.” During the no warning condition, no label was present on the machine.

Behavioral Compliance: Research Design

The experimental design for the primary experiment was a between-subject, 2 (manual exposure time: 15 seconds vs. 300 seconds) x 4 [presence of warning: (1) no warning, (2) general warning label, (3) blurred ANSI label (4) ANSI label] factorial design.

Procedure

The memory DIMM installation task was selected because previous research (Freeman, 2003) showed that the task was unfamiliar to participants. It was also selected based upon the assumption that individuals could be motivated to comply with the warning to avoid damaging the equipment or receiving a minor static shock, even though the personal risk is illusory. To ensure a consistent experience across participants, a script was used for the various instructions given by the experiment (Appendix C). The participants were given a selected portion of a product manual for a computer, which included warnings and instructions related to the installation of a memory DIMM (Appendix D). A brief manual-exposure condition instead of the absence of the manual was used to ensure consistency

between manual exposure conditions. After exposure to the product manual for the requisite amount of time (i.e., 15 seconds or 5 minutes), the individual completed a ten-minute distracter task unrelated to the completion of the experimental task to decrease rehearsal of the information related to the task and assimilation of the information into long-term memory (e.g., Baddeley, 1986). The distracter task initially involved selecting a computer, printer, and digital camera from four advertising flyers; however, this distracter task was modified to involve only selecting a laptop computer that cost $1000 or less following piloting of participants. After ten minutes, participants were asked by the experimenter which laptop was chosen. Participants were then asked to complete the installation task without access to the product manual.

The participants were led into an adjacent room where the computer was located. The outer cover of the computer was partially removed from the computer because the cover itself was difficult to remove and not the focus of this experiment. The end of the power cord was plugged into a surge protector that was visible to participants; however, the surge protector power cord was hidden behind a nearby table out of participant view and not plugged into an outlet for safety reasons.

While the content of warning information placed upon the product varied, the location of the warning remained constant. The ANSI compliant, blurred ANSI label, and general warning label were adhered to the power supply, located conspicuously where individuals were to install the memory DIMM during their respective conditions (Appendix B). All pilot participants exposed to a condition where a warning was present indicated that they noticed the warning. In the no warning condition, no warning appeared near the DIMM.

The memory DIMM and wrist tether were located next to each other to the right of the machine; the wrist tether was clearly visible to participants as they retrieved the memory

to complete the installation task once the machine was open. The wrist tether is a device that is used to prevent product damage resulting from electrostatic discharge. One end of the tether is intended to be placed around one's wrist or palm and includes a plastic loop; the other end of the tether should be adhered to a metal component while handling and installing a component (e.g., memory).

During the installation attempt, the experimenter was located approximately 5 feet to the right of the participant in a position that allowed viewing of participant action. After notifying the participant that that top cover was partially removed, the experimenter asked the participant to install the memory DIMM and to notify him when the participant thought the memory installation was completed or when the participant was unable to continue any further. The experimenter recorded whether each step in the process was successfully completed. In addition, the experimenter demonstrated the proper method for unplugging the power cord if either a participant made five unsuccessful attempts to rotate the internal component tray or indicated that they could progress no further in the task prior to unplugging the cord.

After completing the installation task, individuals completed a knowledge test including items about both the memory installation task and the distracter task (Appendix D). The knowledge test included the following open-ended item related to the installation task: In the blanks, list the important things that need to be done before and during the installation of memory (RAM) in the computer. Individuals then completed a demographic questionnaire, which included items related to age, gender, educational level, and experience with the memory installation task (Appendix E).

RESULTS

Behavioral compliance scores were established by observing whether particular steps (i.e., unplugging system, use of support foot, use of tether) were properly performed while participants completed the memory installation task. Properly performing a particular step was coded as “1”; failure to perform a particular step was coded as “0.” Similar scoring was used for information acquisition. That is, mentioning a particular step was coded as “1” and failure to mention a particular step was coded as “0.” Means for behavioral compliance (Table 2) and information acquisition (Table 2) are provided below. “Overall” within the manual column is a combination of the participants from the “15 seconds condition” and the “300 seconds” condition. The “All Conditions” row is a combination of participants from the ANSI-compliant warning, blurred warning, general warning, and no warning conditions.

Table 1. Percentages for Behavioral Compliance as a Function of Manual-exposure and Presence and Content of On-Product Warning.

Manual	Label	Unplugged (%)	Support Foot (%)	Tether (%)
	None	22.2	22.2	5.6
15 seconds	General	23.1	15.4	0.0
	Blurred	18.5	29.6	7.4
	ANSI	64.7	47.1	17.6
	All Conditions	*32.1*	*28.6*	*7.7*
	None	63.0	66.7	29.6
300 seconds	General	34.8	69.6	17.4
	Blurred	77.8	81.5	25.9
	ANSI	95.7	91.3	52.2
	All Conditions	*67.8*	*77.3*	*31.3*
	None	42.6	44.4	17.6
Overall	General	28.9	42.5	8.7
	Blurred	48.1	55.6	16.7
	ANSI	80.2	69.2	34.9
	All Conditions	*50.0*	*52.9*	*19.5*

Table 2. Percentages for Information Acquisition as a Function of Manual-exposure and Presence and Content of On-Product Warning.

Manual	Label	Unplugged (%)	Support Foot (%)	Tether (%)
	None	61.1	0.0	5.6
15 seconds	General	38.5	15.4	11.5
	Blurred	51.9	25.9	22.2
	ANSI	88.2	35.3	29.4
	All Conditions	*59.9*	*19.2*	*17.2*
	None	70.4	22.2	33.3
300 seconds	General	63.6	27.3	27.3
	Blurred	77.8	25.9	33.3
	ANSI	78.3	30.4	34.8
	All Conditions	*72.5*	*26.5*	*32.1*
	None	65.7	11.1	19.4
Overall	General	51.0	21.3	19.4
	Blurred	64.8	25.9	27.8
	ANSI	83.2	32.9	32.1
	All Conditions	*66.2*	*22.8*	*24.7*

Total Behavioral Compliance

A 'Total Behavioral Compliance' score was computed for each condition by averaging the sums of the three steps completed by each participant in that condition (i.e., unplugging system, use of support foot, use of tether). An ANOVA using manual exposure (15 or 300 seconds) presence and content of on-product warning (no warning, general, blurred, ANSI) yielded significant main effects for manual exposure, $F(1, 187) = 74.7$, $p < .001$, and presence and content of on-product warning, $F(3, 187) = 11.7$, $p < .001$. Total compliance was significantly higher for the 300 second manual exposure condition ($M = 1.76$) than the 15 second manual condition ($M = 0.68$). The interaction between manual exposure and presence and type of on-product warning was not significant, $F(3, 187) = 0.65$, $p = 0.59$. Post hoc comparisons were conducted using Tukey's Honestly Significant Difference (HSD) and showed that the ANSI exposure ($M = 1.84$) was higher than in no warning ($M = 1.04$), general ($M = 0.80$), and blurred ($M = 1.20$) conditions, $p < .001$. It was also noted that the difference between the blurred ($M = 1.20$) and general ($M = 0.80$) conditions approached significance, $p = .053$. Means for total behavioral compliance are provided in Table 3.

Table 3. Total Behavioral Compliance as a Function of Manual-exposure and Presence and Content of On-Product Warning.

Label	Total Compliance Score (0-3) 15 seconds	300 seconds	Mean
None	0.50	1.59	1.05
General	0.39	1.22	0.80
Blurred	0.56	1.85	1.20
ANSI	1.29	2.39	1.84
Mean	0.68	1.76	

Nonparametric Analyses: **Chi Square**

A series of 6 chi-square analyses were performed to examine the relationship between manual exposure (2: 15 and 300 seconds) and presence and type of on-product warning (4: no warning, general warning, blurred ANSI warning, and ANSI warning) with regard to behavioral compliance and information acquisition (6: behavioral compliance: unplugged system, used support foot, properly used tether; information acquisition: unplug, support foot, tether). Reported mean percentages are intended to provide an overview of patterns within the data and do not imply any specific paired comparisons or differences.

Behavioral Compliance

Unplugging Power Cord. The relationship between manual exposure, presence and content of on-product warning, and unplugging the power cord from the rear of the system was significant, X^2 (3, N = 187) = 15.36, $p < .05$. A higher percentage of participants properly unplugged the power cord in the 300 second manual exposure condition (67.8%) than in the 15 second condition (32.1%). Participants exposed to the ANSI label (95.7%) complied more than in the no warning (63.0%), general warning (34.8%), or blurred warning

(77.8%) conditions. Participants exposed to the manual for 300 seconds and the ANSI-compliant label complied most frequently (95.7%).

Flipping out the Support Foot. The relationship between manual exposure, presence and content of on-product warning, and flipping out the support foot before opening the system was not statistically significant at the conventional probability level, X^2 (3, N = 187) = 7.07, $p > .05$. However, it was noted that a higher percentage of participants properly manipulated the support foot in the 300 second manual exposure condition (77.3%), more frequently than in the 15 second condition (28.6%). Participants exposed to the ANSI label (69.2%) complied at a higher percentage level than in the no warning (44.4%), general warning (42.5%), or blurred warning (55.6%) conditions. Participants exposed to the manual for 300 seconds and the ANSI-compliant label complied most frequently (91.3%).

Wearing the Wrist Tether. The relationship between manual exposure, presence and content of on-product warning, and wearing the wrist tether was not statistically significant at conventional levels, X^2 (3, N = 187) = 6.08, $p > .05$. A higher percentage of participants utilized the wrist tether in the 300 second manual exposure condition (31.3%) than in the 15 second condition (7.7%). Participants exposed to the ANSI label (34.9%) complied more than in the no warning (17.6%), general warning (8.7%), or blurred warning (16.7%) conditions. Participants exposed to the manual for 300 seconds and the ANSI-compliant label complied most frequently (52.2%).

Information Acquisition

Unplugging Power Cord. The relationship between manual exposure, presence and content of on-product warning, and reporting unplugging the power cord from the rear of the system as a requirement to prevent product damage was significant, X^2 (3, N = 187) = 7.87,

$p < .05$. Participants exposed to the manual for 15 seconds and the ANSI-compliant label properly reported the task most frequently (88.2%).

Flipping Out the Support Foot. The relationship between manual exposure, presence and content of on-product warning, and reporting flipping out the support foot before opening the system as a requirement to prevent product damage was significant, X^2 (3, N = 187) = 21.77, $p < .001$. Participants exposed to the manual for 15 seconds and the ANSI-compliant label properly reported the task most frequently (35.3%).

Wearing the Wrist Tether. The relationship between manual exposure, presence and content of on-product warning, and reporting wearing the wrist tether as a requirement to prevent product damage was significant, X^2 (3, N = 187) = 11.67, $p < .05$. Participants exposed to the manual for 300 seconds and the ANSI-compliant label properly reported the task most frequently (34.8%).

Nonparametric Analyses: Kruskal-Wallis and Mann Whitney

Behavioral Compliance. Statistical analyses using Kruskal-Wallis tests revealed significant differences between the conditions for all three behavior compliance measures: unplugging power cord ($\chi^2(7, N = 187) = 56.4$, $p < .001$), flipping out the support foot ($\chi^2(7, N = 187) = 54.5$, $p < .001$), and wearing the wrist tether ($\chi^2(7, N = 188) = 28.9$, $p < .001$).

Post hoc paired comparisons were made using Mann-Whitney to analyze the following: (1) the presence of the ANSI-compliant warning regardless of manual condition to examine the effect of the label alone, (2) exposure to the manual in the no warning condition to examine effect of manual alone, (3) the presence of the ANSI-compliant warning and exposure to the manual to examine the effect of the manual and label together, (4) the

effects of general warning label versus an explicit (i.e., ANSI-compliant) warning label to examine the effect of explicitness, (5) the effects of a general warning label versus the no warning regardless of manual condition, (6) blurred warning versus general warning to examine the effects of ANSI formatting versus general warning content, and (7) the presence of an ANSI-compliant warning versus a general warning in the longer exposure condition. See Table 1 for mean percentages.

1. Presence of ANSI-compliant warning versus No warning condition. Compliance for unplugging the power cord ($U(N = 85) = 577.5$, $p < .01$) and flipping out the support foot ($U(N = 85) = 687.5$, $p < .05$) were significantly higher in the ANSI-compliant warning condition than in the no warning condition. The difference for wearing the wrist tether ($U(N = 85) = 742.5$, $p = .08$) was not statistically significant at conventional levels.

2. Manual Exposure in the No warning condition. Compliance for unplugging the power cord ($U(N = 45) = 144.0$, $p < .01$), flipping out the support foot ($U(N = 45) = 135.0$, $p < .01$), and wearing the wrist tether ($U(N = 45) = 184.5$, $p = .05$) were significantly higher in the 300 second, no warning condition than in the 15 second, no warning condition.

3. Presence of ANSI-compliant warning and 300 second manual exposure versus No warning condition and 15 second manual exposure. Compliance for unplugging the power cord ($U(N = 41) = 55.0$, $p < .001$), flipping out the support foot ($U(N = 41) = 64.0$, $p < .001$), and wearing the wrist tether ($U(N = 41) = 110.5$, $p < .01$) were significantly higher with the presence of the ANSI-compliant warning and 300 second manual exposure compared to the no warning (i.e., no warning) condition and 15 second manual exposure.

4. Presence of ANSI-compliant warning versus General warning. Compliance for unplugging the power cord ($U(N = 89) = 451.5$, $p < .001$), flipping out the support foot

($U(N = 89) = 669.5$, $p < .01$), and wearing the wrist tether ($U(N = 89) = 692.5$, $p < .01$) was higher in the ANSI-compliant conditions than in the general warning conditions.

5. Presence of the General warning versus the no warning condition. Compliance for unplugging the power cord ($U(N = 94) = 451.5$, $p = .071$), flipping out the support foot ($U(N = 94) = 64.0$, $p = .434$), and wearing the wrist tether ($U(N = 94) = 972.0$, $p = .099$) was not significantly higher in the general warning condition than in in the ANSI-compliant

6. Presence of Blurred warning versus General warning. Compliance for unplugging the power cord ($U(N = 103) = 1064.5$, $p < .05$) was significantly higher in the blurred warning condition than in the general warning condition, regardless of manual exposure. Flipping out the support foot ($U(N = 103) = 1128.0$, $p = .137$) and wearing the wrist tether ($U(N = 103) = 1210.5$, $p = .197$) were not statistically significant at conventional levels.

7. Presence of the ANSI-Compliant warning versus General warning in the 300 second manual exposure condition. For individuals in the longer manual exposure condition, compliance for unplugging the power cord ($U(N = 46) = 103.5$, $p < .001$) and wearing the wrist tether ($U(N = 46) = 172.5$, $p = .014$) were significantly higher in the ASNI-compliant warning condition than in the general warning condition. Flipping out the support foot ($U(N = 46) = 207.0$, $p = .07$)) was not statistically significant at conventional levels.

DISCUSSION

The present study examined the effects of manual exposure and presence and content of an on-product warning as a reminder on behavioral compliance and information acquisition. One of the primary measures of warning effectiveness is behavioral compliance; that is, effective warnings will not only be observed and comprehended, but also obeyed (Wogalter & Dingus, 1999). Rather than relying on self-reported intentions as a

substitute, the present study involved observation of behavioral compliance, as well as examination of reported appropriate actions to reduce risk of product damage.

As predicted and supported by Freeman (2003), the presence of the ANSI-compliant label resulted in higher compliance for properly unplugging the power cord and flipping out the support foot versus than the absence of any on-product warning; in addition, proper use of the wrist tether was higher in the ANSI-compliant condition than the no warning conditions, although not significant at conventional levels. This underlines the importance of providing explicit safety-related instructions that comply with warning standards on products whenever possible. Furthermore, the general warning condition did not yield significant improvement in behavioral compliance versus the absence of a warning label for this particular hazard and task. This reinforces the value of explicit on-product warnings, especially for the most important hazards. A focus on the most important hazards helps manage the cost of providing on-product labels and may reduce the likelihood of habituation.

As predicted and supported by Freeman (2003), both behavioral compliance and information acquisition scores were notably higher for the longer manual exposure condition than for the lower manual exposure condition. This reinforces the importance of making safety-related information easy to access and locate, both within product manuals and through other media such as websites to maximize the likelihood of a user finding, reading, and utilizing the information.

Also, as predicted, longer exposure to the product manual combined with the presence of the ANSI-compliant label resulted in a higher percentage of compliance for each of the precursor tasks. Furthermore, the presence of the ANSI-compliant warning resulted in the highest levels of compliance within the shorter manual exposure condition.

This additive effect reinforces the importance of on-product warnings as not only a first exposure to safety-related information, but also supports Wogalter and Laughery's (2006) suggestion that warnings are important reminders even for known hazards. While warnings within a product's owner's manual may increase the likelihood of compliant behavior if located and thoroughly reviewed, warnings on the product itself can supplement the placement of warning information within a manual. This is especially important for experienced users, as past warnings research has shown that familiarity decreases the reported likelihood of reading product manuals. Consequently, the warning information should be positioned in such a way that it not only interrupts an experienced user's learned sequence of behaviors and attracts attention, but also attracts attention from the inexperienced user in order to provide a first exposure to information, especially in use scenarios where exposure to a manual is unlikely (e.g., secondhand products, products less likely to become obsolescent).

Wogalter and Laughery's (2006) suggestion regarding the importance of warnings as reminders is supported by the significantly higher compliance for unplugging the power cord and wearing the wrist tether by participants given the opportunity to encode the warning information in the longer exposure condition and exposed to the ANSI-compliant warning rather than the general warning during the task. This may further supported by the performance of participants in the longer-exposure condition who were exposed to the blurred ANSI warning. Although significant differences were not always found for this comparison, participants in the blurred ANSI warning were more likely to successfully comply than the general warning for each task. These findings suggest that using identically or similarly formatted information within the product manual may increase the effectiveness of a reminder warning and the likelihood of compliance, even when the content of the

warning is not presented on the product itself. This may have important implications for the way product warnings and warning information are designed, given that lists of safety-related instructions are often presented in manuals using formatting that does not match on-product information.

Similar findings were found for information acquisition, although the differences between the shorter and longer exposure conditions were less pronounced. Exposure to the ANSI-compliant warning resulted in the highest reported information acquisition for each task. Because participants were asked the information acquisition question following their attempt at the memory exposure task, some participants may have thought reporting the information unnecessary after demonstrating their knowledge through successful compliance. Another possible explanation for the difference between compliance and acquisition is question's request for listing the important precursors to the memory installation acting as an unintended, yet unavoidable, cue for the safety-related information.

Critique of Present Research

While the unfamiliarity with the memory installation task and associated electrostatic discharge hazard was useful for isolating the effects of the manual exposure and presence and type of on-product warning, this unfamiliarity may have contributed to low perceived hazard and reduced the likelihood of compliance. In other words, the use of a wrist tether is not as familiar to participants as, for example, use of gloves to protect against chemical or other dangerous substances. This may have also reduced the likelihood that the wrist tether itself acted as a cue even for participants who noticed it. Further, the cost of compliance associated with the proper use of a wrist tether – that is, wrapping around one's wrist and attaching appropriately to establish grounding – is more complicated than using gloves.

For future studies involving this task, modern computer equipment that matches the participants' perceptions of personal computing should be used. Many participants remarked that they doubted the equipment even "worked" anymore due to its age and appearance; these comments could indicate that participants felt that causing product damage was irrelevant (since the machine was not in use) and reduce the likelihood of compliance with the warning. Furthermore, since the equipment was not 'owned' by the participants or used before or after the installation task, they may have felt less motivated to avoid product damage and ensure proper installation. Future experimental uses of this task could perhaps involve powering down the system in the presence of the participants prior to completing the activity to demonstrate that it is in working condition. However, the aged equipment did provide certain advantages. For example, the lack of affordances in the product design and absence of on-product instructions ensured that the task was difficult; in addition, the exposed sheet metal provided a conspicuous location for attaching the wrist tether to the machine.

Two fundamental differences between the method of the present study and Freeman (2003) are the location and size of the on-product warning label. In the present study, in order to improve external validity, the warning label was placed within the machine in a location that may have been used by the manufacturer (i.e., on the power supply) and appropriately sized to fit the power supply. In Freeman (2003), the label was larger (15.5 cm (wide) X 11.0 cm (long)) and placed conspicuously on top of the machine, which already had the cover removed, to increase the salience of the warning and ensure noticeability; while this size and location likely contributed to higher percentages of compliance than the present study, it likely induced a ceiling effect as well. Researchers should consider the

advantages and disadvantages of these two methods when designing and evaluating the utility of warnings in experimental settings.

One potential flaw exists in the warning label design for both the present study and Freeman (2003): the warnings, while ANSI-compliant from a formatting perspective, may include too much informational “noise” beyond the necessary hazard-related information. In other words, the likelihood of complying with the warning with regard to proper use of the wrist tether may be compromised by the additional instructional information not related to the electrostatic discharge hazard (i.e., support foot). In addition, a real-world memory manufacturer would likely conspicuously locate the warning label on or within the electrostatic bag in an attempt to associate the warning label with the memory.

The quality of the pre-experiment deception and distracter task used in the present study also may have contributed to the information acquisition and behavioral compliance scores in the present study. Many participants provided unprompted, detailed explanations for decisions and decision-making processes regarding the deception task both immediately following the task and at the end of experiment. This may indicate that the distraction task was not only too engaging, but also interrupted and interfered with recalling warning information to a greater intent than intended and severely reducing the likelihood of compliance (see McDaniel & Einstein, 2007).

Perhaps most importantly, in order to increase the external validity of studies using a similar task, researchers should consider allowing access to the manual during the task and/or providing detailed installation information on the product and/or in the electrostatic bag in which the part is distributed. This may more closely replicate a real-world situation where an individual is installing a memory module into a personal computer or laptop.

Future Research

Future research regarding warnings as reminders and prospective memory could involve experimentally manipulating the formation of one's intention to comply with the safety-related instructions, the amount of stimuli and level of distractedness during the ongoing activity between the intention formation and appropriate response initiation window, the modality and salience of the cue, the duration between formation and appropriate response initiation window, and the cost of compliance and noncompliance for the appropriate safety-related action (See McDaniel & Einstein, 2007). In addition, future research could investigate the effectiveness of using dynamic warnings to prevent habituation, which could decrease the ability of a cue to increase the likelihood of compliance as one's familiarity with the action and hazard increase.

Researchers could also manipulate the perception of the risk associated with the hazard to ascertain whether perceived hazard affects the likelihood of "remembering to remember", as well as whether an interaction exists perceived hazard and cue characteristics such as salience and level of instruction. For example, a hazard with an extremely high perceived risk may require a less detailed or salient cue, or perhaps no cue whatsoever, to remind one of the appropriate action. Findings indicating that higher or more realistic perceptions of likelihood and severity of consequences of a hazard would reinforce the importance of ensuring proper risk communication through a variety of channels to realize the value of warnings as reminders, including product manuals and on-product warnings.

Since the presence of a general warning was not shown to influence compliance, additional research is also necessary to further evaluate the use of general warnings as reminders. Although this research suggests that general warnings are less effective than

ANSI-compliant and similarly formatting warning labels, many general warning labels are available from companies such as Clarion (www.safetylabels.com). The likelihood of these warnings to generate increase compliance could be evaluated in a variety of contexts by manipulating variables such as task complexity, familiarity, cost of compliance, and stress.

References

American National Standards Institute. (2002), *ANSI Z535.4: American National Standard for Product Safety Signs and Labels*. New York: ANSI.

Baddeley, A. (1986). *Working memory.* Oxford: Claredon Press.

Brandimonte, M., Einstein, G.O., & McDaniel, M.A. (1996). *Prospective Memory: Theory and Applications*, Mahwah, NJ: Lawrence Erlbaum.

Bzostek, J.A., & Wogalter, M.S. (1999). Measuring visual search time for a product warning label as a function of icon, color, column, and vertical placement. *Proceedings of the Human Factors and Ergonomics Society*, *43*, 888-892.

Conti v. Ford Motor Co., 743 F.2d 195 (3d. Cir. 1984). In M.S. Madden (2006). The duty to warn in products liability. In M.S. Wogalter (Ed.), *Handbook of Warnings*. (pp. 583-588). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Celuch, K.G., Lust, J.A., & Showers, L.S. (1992). Product owner manuals: an exploratory study of nonreaders versus readers. *Journal of Applied Social Psychology*, *22 (6),* 492-507.

FMC Corporation (1985), *Product Safety Sign and Label System*. FMC Corporation, Santa Clara, CA.

Frantz, J.P., & Rhoades, T.P. (1993). A task analytic approach to the temporal placement of product warnings. *Human Factors*, *35*, 719-730.

Freeman, K. (2003). The influence of consumer product manual warnings and on-product warnings on information retrieval and behavioral compliance. Unpublished Master's Thesis. North Carolina State University Retrieved 26 January 2007 from http://www.lib.ncsu.edu/theses/available/etd-07162003-191217/

Godfrey, S.S., & Laughery, K.R. (1984). The biasing effect of familiarity on consumer's awareness of hazard. *Proceedings of the Human Factors Society*, *28*, 483-486.

Godfrey, S.S., Allender, L., Laughery, K.R., & Smith, V.L. (1983). Warning messages: Will the consumer bother to look? *Proceedings of the Human Factors Society*, *27*, 29-37.

Goldhaber, G.M., & deTurck, M.A. (1988). Effects of consumer's familiarity with a product on attention and compliance with warnings. *Journal of Products Liability*, *11*, 29-37.

Hubbard-Hall Chem. Co. v. Silverman, 340 F.2d 402 (1st Cir. 1965). In M.S. Madden (2006). The Duty to Warn in Products Liability. In M.S. Wogalter (Ed.), *Handbook of Warnings*. (pp. 583-588). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Human Factors and Ergonomics Society. (2001). *Human Factors Perspectives on Warnings: Selections from Human Factors and Ergonomics Society Annual Meetings, 1994-2000.* Wogalter, M.S., Laughery, K.R., & Young, S.L. (Eds.) Reston, VA: American Society of Civil Engineers.

International Organization for Standardization. (2002). *ISO 9186: 2002. Graphical symbols-Test methods for judged comprehensibility and for comprehension*.

Jaynes, L.S., & Boles, D.B. (1990). The Effects of symbols on warning compliance. *Proceedings of the Human Factors Society*, *34*, 984-987.

Johnson, D. (1992). A warning label for scaffold users. *Proceedings of the Human Factors Society 36th Annual Meeting,* 36, 611-615.

Kalsher, M.J., Wogalter, M.S., & Racicot, B.M. (1996). Pharmeceutical container labels and warnings: preference and perceived readability of alternative designs and pictorials. *International Journal of Industrial Ergonomics*, *18*, 83-90.

LaRue, C., & Cohen, H. (1987). Factors Influencing Consumer's Perceptions of Warning: An examination of the differences between male and female consumers. *Proceedings of the Human Factors Society*, *31*, 610-614.

Laughery, K.R., Paige, D.L., Laughery, B.R., Wogalter, M.S., Kalsher, M.J., & Leonard, S.D. (2002). Guidelines for warnings design: Do they matter? *Proceedings of the Human Factors and Ergonomics Society 46th Annual Meeting*, *46*, 1708-1712.

Laughery, K.R., Vaubel, K.P., Young, S.L., Brelsford, J.W., & Rowe, A.L. (1993), Explicitness of consequence information in warning. *Safety Science*, *1*, 597-613.

Laughery, K.R. & Wogalter, M.S. (1994). *Human Factors Perspectives on Warnings: Selections from Human Factors and Ergonomics Society Annual Meetings, 1980-1993*. Reston, VA: American Society of Civil Engineers.

Lehto, M.R. & Salvendy, G. (1995). Warnings: a supplement not a substitute for other applications to safety. *Ergonomics*, *38*, 2155-2163.

Madden, M.S. (1987). *The Duty to Warn in Products Liability: Contours and Criticism*, 89 W. Va. L. Rev. 221. In M.S. Madden (2006). The Duty to Warn in Products Liability. In M.S. Wogalter (Ed.), *Handbook of Warnings*. (pp. 583-588). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Madden, M.S. (1999). The Law Related to Warnings. In M.S. Wogalter, D.M. DeJoy, and K.R. Laughery, Eds., *Warnings and Risk Communication* (pp. 315-329). London: Taylor & Francis.

Madden, M.S. (2006). The Duty to Warn in Products Liability. In M.S. Wogalter (Ed.), *Handbook of Warnings*. (pp. 583-588). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

McDaniel, M.A., & Einstein, G.O. (1993). The importance of cue familiarity and cue distinctiveness in prospective memory. *Memory*, *1,* 23-41. in McDaniel, M.A., & Einstein, G.O. (2007). prospective memory: An overview and synthesis of an emerging field.

McDaniel, M.A., & Einstein, G.O. (2007). Prospective Memory: An overview and synthesis of an emerging field. Thousand Oaks, CA: Sage Publications, Inc.

McDaniel, M.A, Guynn, M.J., Einstein, G.O., Breneiser, J.A., (2004).Cue-focused and reflexive-associative processes in prospective memory retrieval. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 30(3)*, 605-614.

Mehlenbacher, B., Wogalter, M.S., & Laughery, K.R. (2002). On the reading of product owner's

manuals: Perceptions and product complexity. *Proceedings of the Human Factors Society 46th Annual Meeting*, *46*, 730-734.

Otsubo, S.M. (1988). A behavioral study of warning labels for consumer products: perceived danger and user of pictographs. *Proceedings of the Human Factors Society*, *32*, 536-540.

Ragsdale Bros., Inc. v. Magro, 693 S.W.2d 530 (Tex. Civ. App. 1985). In M.S. Madden (2006). The Duty to Warn in Products Liability. In M.S. Wogalter (Ed.), *Handbook of Warnings*. (pp. 583-588). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Resnick, M.L. (2006). When Open and Obvious is Neither: The importance of context in human factors forensics. *Proceedings of the Human Factors and Ergonomics Society*, *50,* 843-846.

Restatement of Torts (2nd) §388; *id*. at cmt *k*. 1965.

Rettig, M. (1991). Nobody reads documentation. *Communications of the ACM*, *34* (7), 19-24.

Sanders, S.M., & McCormick, J.E. (1993). *Human Factors in Engineering and Design*, 7th ed., McGraw-Hill, New York.

Schriver, K.A. (1997). *Dynamics in Document Design: Creating Texts for Readers*. New York: John Wiley & Sons.

Thomson, D. M., & Tulving, E. (1970). Associative encoding and retrieval: Weak and strong cues. *Journal of Experimental Psychology*, *86 (2),* 255-262.

Tulving, E. & Osler, S. (1968). Effectiveness of retrieval cues in memory for words. *Journal of Experimental Psychology, 77,* 593-601.

Tulving, E. & Pearlstone, Z. (1966). Availability versus accessibility of information in memory for words. *Journal of Verbal Learning and Verbal Behavior*, *5*, 381-391.

Tulving, E. & Thomson, D.M. (1973). Encoding specificity and retrieval processes in episodic memory. *Psychological Review*, *80*, 352-373.

Wogalter, M.S., Barlow, T., & Murphy, S. (1995), Compliance to owner's manual warnings: Influence of familiarity and the task-relevant placement of a supplemental directive. *Ergonomics*, *38*, 1081-1091.

Wogalter, M.S., Brelsford, J.W., Desaulniers, D.R., & Laughery, K.R. (1991), Consumer product warnings: The role of hazard perception. *Journal of Safety Research*, *22*, 71-82.

Wogalter, M.S., Conzola, V.C., & Smith-Jackson, T.L. (2002). Research-based guidelines for warning design and evaluation. *Applied Ergonomics*, *33*, 219-230.

Wogalter, M.S., DeJoy, D.M., & Laughery, K.R. (1999). Organizing framework: A consolidated communication-human information processing (C-HIP) model. In M.S. Wogalter, D.M., DeJoy, & K.R. Laughery (Eds.), *Warnings and risk communication* (pp. 15-24). London: Taylor & Francis.

Wogalter, M.S. & Dingus, T.A. (1999). Methodological techniques for evaluating behaviorial

intentions and compliance. In M.S. Wogalter, D.M. DeJoy, & K.R. Laughery (Eds.), *Warnings and Risk Communication* (pp. 53-81). London: Taylor and Francis.

Wogalter, M.S., Godfrey, S.S., Fontanelle, G.A., Desaulniers, D.R., Rothstein, P.R., & Laughery, K.R. (1987). Effectiveness of warnings. *Human Factors, 29* (5), 599-612.

Wogalter, M.S., Kalsher, M. J., & Rashid, R. (1999). Effect of signal word and source attribution on judgments of warning credibility and compliance likelihood. *International Journal of Industrial Ergonomics*, *24*, 185-192.

Wogalter, M.S. & Laughery, K.R. (2006) Warnings and Hazard Communications. In Salvendy, G., (Ed.), *Handbook of Human Factors and Ergonomics*, 3rd ed. (pp. 889-911), Hoboken, NJ: John Wiley & Sons, Inc.

Wogalter, M.S. (2006). *Handbook of Warnings*. Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Wright, P., Creighton, P., & Threlfall, S.M. (1982). Some factors determining when instructions will be read. *Ergonomics*, *25*, 225-237.

Young, S.L., Frantz, J.P., Rhoades, T.P., & Darnell, K.R. (2002, September). Safety signs and labels: Does compliance with ANSI Z535 increase compliance with warnings? *Professional Safety*, 18-23.

Young, S.L., Wogalter, M.S., Laughery, K.R., Magurno, A., & Lovvoll, D. (1995). Relative order and space allocation of message components in hazard warning signs. *Proceedings of the Human Factors and Ergonomics Society*, *39*, 969-973.

Young, S.L., & Wogalter, M.S. (1990). Comprehension and memory of instruction manual warnings: Conspicuous print and pictorial icons. *Human Factors*, *32*, 637-649.

APPENDICES

Appendix A: Sample Warning and Instructions from Product Manual

Appendix A: Product Owner's Manual Warning

Connecting a SCSI device

Use these general instructions in conjunction with the instructions that came with your SCSI device:

1. **Turn off your Macintosh.**
2. **Make sure the SCSI device is switched off.**

WARNING Do not connect or disconnect any device while the device or your Macintosh is turned on. Doing so could damage the device, your computer, or both.

3. **Use a SCSI cable to connect the device either to the computer's SCSI port or to the last SCSI device already in the chain.**

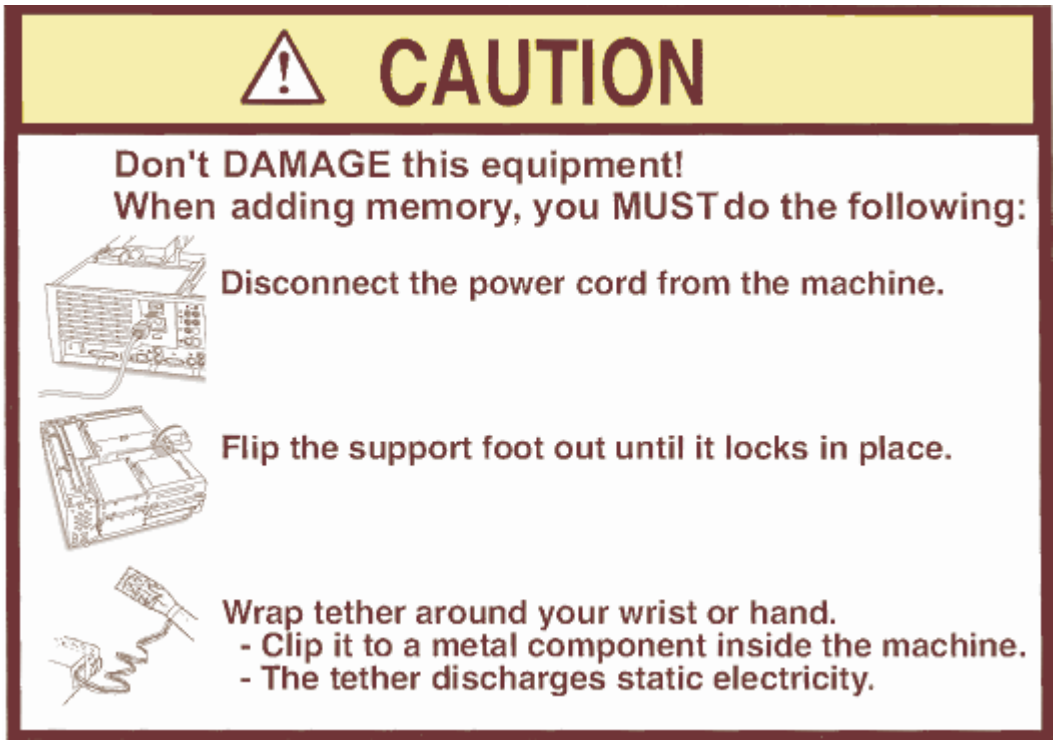
Adding memory (RAM)

Please follow the steps below before adding a memory chip to your computer:

1. Disconnect the power cord from the back of the computer.
   - To open up the main cover, the cord must first be removed from the machine.
2. Flip the support foot out until it snaps into its locked position.
   - After opening the machine, the main cover must rest on the support foot.
3. Wrap the tether around your wrist or hand and clip it to a metal component inside the machine. The tether is used to discharge static electricity.

Appendix B: Labels

ANSI-compliant Label



Blurred Label

General Warning Label

Appendix C: Experiment Script

Pre-Consent
"Hi, I'm Jeff Smith. Thanks for taking the time to participate in my experiment. Have you ever participated in a psychology experiment before? This is a consent form. It provides some more details about the experiment you are about to participate in. Please read through it carefully and let me know if you have any questions before you sign it at the bottom. (Questions.) Thank you."

Pre-Manual Exposure Task
"I would like to you imagine that you are going to install a memory DIMM into your personal computer. A memory DIMM is an internal component and the procedure for installation is described within this manual. You will have 15 seconds (or 5 minutes) to review the procedure before I take away the manual. You will not have access to the manual while installing the DIMM. Any questions? (Questions.) Please begin."

Pre-Computer Purchase Task
"You have decided to purchase a new laptop computer. You have a personal budget of $1000 for the new laptop. Please take a look at these brochures and select the laptop you feel is the best value. I'll give you about ten minutes to complete the task and let you know when you need to make a final selection. Any questions? (Questions.) Please begin."

Pre-Installation Task
"This is Apple's Power Macintosh 7500. The top cover has been partially removed. Please install this memory DIMM. You have as much time as you need to install the DIMM. Please let me know when you have completed the DIMM installation or cannot go any further."

Post-Installation Task
"Do you feel like you installed the DIMM correctly? Please return to where you were sitting to complete the experiment."

Pre-Surveys
"Please complete these surveys. The first page asks you questions about the tasks you performed. The second page asks for information related to you and your experiences with some different things."

Post-Surveys
"Thank you again for your participation. Do you have any questions before you leave? (Questions.)

Have a good night."

Appendix D: Knowledge Test

Follow-up questions

1. Laptop Brand _____ **Store** _____

2. Did you feel that $1000 was enough money to purchase a new laptop? YES _____ NO _____

3. Did you have any difficulty deciding which laptop to pick?
YES _____ NO _____

4. Where else would you have looked for a laptop?

5. Where else might you have shopped if you were actually making the purchases?

_____

_____

6. In the blanks, list the important things that need to be done before and during the installation of the memory (RAM) in the computer.

_____

_____

_____

_____

_____

Appendix E: Demographic Questionnaire

Participant Survey

Gender: Male Female **Age:** _____

What is your Ethnicity/Race? (Check one that best describes you. You may choose note to answer.)

African-American_____
Asian _____
Caucasian _____
East Indian _____
Latino/Hispanic _____
Native American_____
Middle Eastern _____
Mixed Race _____
Pacific Islander _____
Other _____

Last or highest year of school completed. Please circle a number.

1 2 3 4 5 6 7 8 9 10 11 12
---Grade School-----High School-

1 2 3 4 5 6 7 8 more
---College/University/Technical School---

Are you a full-time student? _____ Yes _____ No
If you are NOT a full-time student, what is your current occupation/profession?
_____

Please indicate how experienced you feel you are with installing memory (RAM) into a computer.

0--------1--------2--------3--------4---------5---------6---------7----------8
Not at all Experienced Somewhat Experienced Experienced Very Experienced Extremely Experienced

Please indicate how hazardous you feel installing memory (RAM) into a computer is.

0--------1--------2--------3--------4---------5---------6---------7----------8
Not at all Hazardous Somewhat Hazardous Hazardous Very Hazardous Extremely Hazardous

Do you own:

	YES	NO
Computer	____	____
Stereo	____	____
DVD player	____	____

Did you setup and learn to use these products yourself or did someone else help you:

	Myself	Had help	Don't own
Computer	____	____	____
Stereo	____	____	____
DVD player	____	____	____

Have you ever helped someone else set up and learn to use these products:

	YES	NO	Number of times
Computer	____	____	_____
Stereo	____	____	_____
DVD player	____	____	_____

Appendix F: Analyzed Participant Data

P#	Participant Number
Manual	Manual Exposure (Short: 15 Seconds; Long: 5 Minutes)
Label	Label Condition: (No: No Warning; Gen: General Warning; Blur: Blurred ANSI; ANSI: ANSI)
S1	Behavioral Compliance Step 1: Unplugging the Power Cord
S2	Behavioral Compliance Step 2: Flipping out the Support Foot
S3	Behavioral Compliance Step 3: Properly Using the Wrist Tether
I:S1	Information Acquisition Step 1: Power Cord
I:S2	Information Acquisition Step 2: Flipping out the Support Foot
I:S3	Information Acquisition Step 3: Wrist Tether
Gen	Gender (1 = Male)
Age	Age
Eth	Ethnicity
RAM	Familiarity with memory installation 9-point scale ranging from “not at all experienced (0)” to “extremely experienced (8).”
Haz	Perception of hazard associated with memory installation 9-point scale ranging from “not at all hazardous (0)” to “Extremely hazardous (8).”
Own	Own a computer? (1=Yes)

P#	Manual	Label	S1	S2	S3	I:S1	I:S2	I:S3	Gen	Age	Eth	RAM	Haz	Own
1	Short	ANSI	1	1	0	1	1	1	2	19	3	4	2	1
2	Long	Gen	1	1	1	1	1	0	1	18	3	8	0	1
3	Short	Gen	0	0	0	0	1	0	1	18	3	3	4	1
4	Short	No	1	0	0	1	0	0	1	19	2	2	4	1
5	Long	Blur	1	1	0	1	0	0	1	18	3	2	0	1
6	Short	Gen	1	0	0	1	0	0	1	19	3	4	2	1
7	Short	ANSI	1	1	1	1	0	0	2	18	3		1	1
8	Short	ANSI	1	1	0	1	1	0	2	19	3	1	6	1
9	Long	Gen	0	0	0	0	0	0	1	18	3	0	2	1
10	Short	ANSI	1	1	0	1	0	1	1	19	1	3	4	1
11	Short	Gen	0	0	0	0	0	0	2	18	3	0	2	1
12	Long	ANSI	1	1	1	1	1	1	1	18	3	2	0	1
13	Short	No	0	1	0	0	0	0	2	18	3	0	5	1
14	Long	No	0	0	0	0	0	0		18	3	8	1	1
15	Long	ANSI	1	1	1	1	0	1	1	18	1	7	0	1
16	Long	No	1	0	1	1	0	1	2	19	3	0	0	1
17	Long	ANSI	1	0	0	1	0	0	2	22	3	0	0	1
18	Long	ANSI	1	1	0	1	1	0	1	18	3	3	0	1
19	Short	No	0	0	0	1	0	0	1	20	14	0	1	1
20	Long	ANSI	1	1	1	1	0	0	1	19	3	0	3	1
21	Short	No	0	0	0	1	0	0	2	19	1	0	2	1
22	Long	No	1	0	0	1	0	0	2	19	3	0	3	1
23	Long	No	0	0	0	0	0	0	1	21	3	1	1	1
24	Long	No	0	0	0	1	0	0	2	20	1	0	8	1
25	Short	No	0	1	0	1	0	0	2	18	1	0	1	1
26	Long	Blur	1	1	0	1	0	0	2	18	3	0	4	1
27	Long	Gen	0	0	0	1	0	0	1	19	3	2	0	1
28	Short	Gen	0	0	0	0	0	0			3	0	6	1
29	Long	Blur	0	0	0	1	0	0	1	21	3	2	0	1
30	Long	No	0	0	0	1	0	0	1	20	1	0	4	1
31	Short	Blur	0	0	0	1	0	0	2	20	3	0	2	1
32	Short	No	1	0	0	1	0	0	1	18	3	6	3	1
33	Long	ANSI	1	1	1	0	0	0	1	19	3	1	5	1
34	Long	Gen	0	1	0	0	0	0	2	18	3	0	2	1
35	Long	No	1	1	1	1	1	1	1	19	3	4	1	1
36	Short	Blur	0	0	0	1	0	0	2	18	3	0	6	1
37	Long	Gen	0	1	0	1	0	0	1	20	3	0	4	1
38	Short	Gen	0	0	0	0	0	0	1	20	3	0	8	1
39	Short	Gen	0	1	0	0	0	0	1	18	3	0	4	1
40	Short	Blur	1	1	0	0	0	0	2	18	3	0	1	1
41	Long	Blur	1	1	0	1	0	0	1	18	3	2	4	1
42	Long	ANSI	1	1	0	1	0	1	1	21	3	8	1	1
43	Long	ANSI	1	0	0	1	0	0	2	19	3	3	2	1
44	Short	Gen	0	0	0	0	0	0	2	17	3	0	0	1
45	Long	ANSI	1	1	1	1	1	1	1	18	3	8	0	1

46	Long	No	1	1	0	1	0	1	2	22	3	0	2	1
47	Long	No	1	0	1	1	1	1	1	18	3	0	4	1
48	Short	ANSI	0	1	0	0	0	0	2	18	3	0	4	1
49	Short	ANSI	1	0	0	1	0	0	1	18	3	1	5	1
50	Long	Blur	1	1	0	1	1	1	1	18	3	3	1	1
51	Long	ANSI	0	1	0	1	0	0	2	19	3	0	8	1
52	Long	No	0	1	0	1	0	0	1	18	3	1	1	1
53	Short	Blur	0	1	0	0	0	0	1	20	3	1	2	1
54	Long	ANSI	1	1	1	1	1	1	2	18	2	0	8	1
55	Short	No	1	0	1	1	0	1	2	19	3	0	2	1
56	Short	Blur	0	0	0	1	0	0	2	18	3	1	0	1
57	Long	Blur	1	1	0	1	1	1	1	24	3	0	1	1
58	Short	Gen	1	0	0	0	1	1	1	18	3	2	6	1
59	Short	No	0	0	0	0	0	0	2	20	8	0	6	1
60	Long	No	0	0	0	0	0	0	2	18	3	0	1	1
61	Short	Gen	0	0	0	0	0	0	1	18	3	2	4	1
62	Long	Gen	0	1	0	0	0	0	1	21	2	1	2	1
63	Short	No	0	0	0	0	0	0	2	17	3	0	2	1
64	Long	No	0	0	0	1	0	0	2	18	3	0	5	1
65	Long	ANSI	1	1	1	1	1	0	2	19	2	2	4	1
66	Long	Blur	1	1	0	0	0	0	2	18	2	0	1	1
67	Long	Gen	0	1	0	0	0	0	2	18	3	0	4	1
68	Short	Blur	0	0	0	0	0	1	2	18	3	0	4	1
69	Long	No	1	1	0	1	1	1	2	18	3	3	4	1
70	Long	No	1	1	1	1	1	0	2	17	5	3	5	1
71	Short	Blur	1	1	0	1	1	0	1	18	3	0	5	1
72	Long	Blur	1	1	0	0	0	0	2	18	3	0	5	1
73	Short	No	0	0	0	1	0	0	1	18	3	4	0	1
74	Long	Blur	1	1	0	0	0	0	1	18	3	0	2	1
75	Short	ANSI	1	1	0	0	1	1	1	19	3	8	0	1
76	Long	Blur	1	1	0	1	0	0	1	19	3	0	1	1
77	Long	Gen	1	1	0				2	19	1	0	8	1
78	Short	Gen	0	0	0	1	0	0	1	19	3	6	1	1
79	Long	ANSI	1	1	1	1	0	1	1	21	3	4	2	1
80	Short	Blur	0	0	0	1	0	0	2	19	3	0	6	1
81	Short	ANSI	1	0	0	1	0	0	2	18	3	0	8	1
82	Long	Blur	1	1	1	1	1	1	2	18	3	2	5	1
83	Short	Gen	0	0	0	1	0	0	2	19	6	0	2	1
84	Short	Blur	0	0	0	0	0	0	2	18	2	0	2	1
85	Long	No	1	1	0	1	0	0	2	18	1	1	4	1
86	Short	Gen	0	0	0	1	0	0	1	18	3	0	2	1
87	Long	No	1	1	0	0	0	0	2	18	3	0	4	1
88	Long	Gen	0	1	0	1	0	0	2	19	3	2	4	1
89	Long	ANSI	1	1	1	0	0	0	2	18	3	0	8	1
90	Long	ANSI	1	1	1	1	1	1	1	19	3	2	2	1
91	Short	ANSI	0	0	0	1	0	0	1	18	3	8	0	1
92	Short	Blur	0	0	0	1	1	0	2	18	3	2	2	1

93	Long	Blur	1	0	1	1	0	1	2	19	1	2	1	1
94	Long	No	0	1	1	1	1	0	1	18	3	8	0	1
95	Short	Gen	0	1	0	0	0	0	1	18	3	1	2	1
96	Short	Blur	0	0	0	0	0	0	1	18	3	0	2	1
97	Short	Gen	1	0	0	0	0	0	2	19	2	0	8	1
98	Long	Blur	1	1	1	1	0	1	2	18	3	0	4	1
99	Long	ANSI	1	1	0	1	0	0	1	18	3	2	2	1
100	Short	Blur	1	0	0	0	0	0	2	18	1	0	8	1
101	Long	No	0	1	0	1	0	1	1	17	3	7	0	1
102	Long	ANSI	1	1	0	1	0	0	2	18	3	0	2	1
103	Long	Gen	1	1	0	1	0	1	2	18	3	0	4	1
104	Short	No	0	0	0	0	0	0	2	19	3	1	8	1
105	Long	Blur	0	1	0	1	0	0	2	20	3	2	1	1
106	Short	No	0	0	0	1	0	0	1	18	3	2	3	1
107	Short	Blur	0	0	0	1	0	1	1	18	3	3	0	1
108	Long	Gen	0	1	0	0	0	0	1	44	3	0	6	1
109	Short	ANSI	0	0	0	1	1	0	2	18	3	0	1	1
110	Short	Blur	0	0	0	0	0	0	2	20	3	0	6	1
111	Long	No	1	1	0	0	0	0	1	18	3	0	1	1
112	Short	Blur	0	0	0	0	0	0	2	18	3	0	1	1
113	Short	Gen	0	0	0	0	0	0	2	18	1	0	4	1
114	Long	Blur	1	1	0	1	0	0	1	21	3	6	1	1
115	Long	Gen	1	1	1	1	1	1	1	18	3	2	6	1
116	Short	Blur	0	0	0	0	0	0	2	18	3	0	6	1
117	Long	ANSI	1	1	0	1	0	0	1	18	1	0	1	1
118	Short	ANSI	0	0	0	1	1	0	2	19	3	0	1	1
119	Long	ANSI	1	1	1	1	1	1	1	19	3	8	1	1
120	Short	Gen	0	0	0	0	0	0	2	18	3	0	2	1
121	Long	No	1	1	0	1	0	1	1	19	3	5	2	1
122	Short	Gen	0	0	0	0	0	0	1	18	3	6	4	1
123	Long	No	1	1	0	0	0	0	1	18		0	2	1
124	Long	Blur	1	0	1	1	0	1	1	18	3	0	1	1
125	Long	Gen	0	1	0	1	0	0	1	18	3	0	2	1
126	Short	ANSI	1	0	1	1	0	1	2	18	3	0	6	1
127	Short	Blur	1	1	1	1	1	1	1	18	3	3	2	1
128	Long	Gen	1	1	1	1	1	1	2	18	3	1	3	1
129	Short	No	0	0	0	1	0	0	2	19	3	8	1	1
130	Short	No	0	1	0	0	0	0	2	20	3	0	0	1
131	Short	Gen	0	0	0	0	0	0	1	18	3		2	1
132	Long	Blur	0	1	1	1	1	1	2	18	2	3	2	1
133	Long	No	1	1	1	1	0	0	1	19	3	0	6	1
134	Long	Gen	0	1	0	0	0	0	2	18	3	0	0	1
135	Short	No	0	0	0	1	0	0	2	18	8	0	4	1
136	Short	Blur	0	1	1	1	1	1	2	18	7	1	1	1
137	Long	Blur	1	1	0	1	1	1	1	23	5	2	2	1
138	Short	ANSI	0	0	0	1	0	0	2	20	3	0	2	1
139	Short	Gen	0	0	0	0	0	0	1	18	3	0	2	1

140	Long	Blur	0	1	0	1	1	0	1	18	9	0	2	1
141	Short	No	0	0	0	0	0	0	2	18	3	1	2	1
142	Short	Blur	1	0	0	0	0	0	2	19	1	1	1	1
143	Long	Gen	1	1	0	1	1	0	1	18	1	0	2	1
144	Long	ANSI	1	1	0	1	0	0	1	18	3	7	1	1
145	Long	No	1	1	1	1	1	1	2	18	1	1	6	1
146	Long	No	1	1	1	1	0	1	1	18	2	8	0	1
147	Long	Blur	1	1	0	0	0	0	1	24	3	6	2	1
148	Short	Gen	1	1	0	1	1	1	1	17	3	5	2	1
149	Short	No	0	0	0	0	0	0	1	19	9	0	6	1
150	Long	Blur	1	1	1	1	0	1	2	21	3	1	4	1
151	Short	Gen	0	0	0	1	0	0	2	18	3	0	4	1
152	Long	ANSI	1	1	0	0	0	0	2	18	3	0	8	1
153	Short	Blur	0	1	0	1	1	0	1	18	3	8	0	1
154	Short	Gen	0	1	0	0	0	0	2	18	9	0	2	1
155	Short	Blur	0	1	0	1	0	0	2	19	3	0	5	1
156	Short	ANSI	1	1	1	1	1	1	1	19	2	1	3	1
157	Short	ANSI	1	1	0	1	0	0	2	18	3	1	5	1
158	Long	Blur	0	1	0	1	0	0	1	18	3	1	0	1
159	Long	ANSI	1	1	1	0	0	0	2	18	3	1	7	1
160	Long	ANSI	1	1	0	0	0	0	2	17	3	0	4	1
161	Short	Blur	0	0	0	0	0	0	1	18	3	0	1	1
162	Long	Gen	1	0	1	1	0	1	2	19	12	6	1	1
163	Short	Blur	0	1	0	1	0	1	2	18	3	2	4	1
164	Long	Gen	0	1	0	0	0	1	2	18	3	2	0	1
165	Short	Gen	0	0	0	1	0	1	1	19	3	5	2	1
166	Long	Blur	1	0	0	1	0	0	1	18	3	2	1	1
167	Long	Blur	1	1	0	0	0	0	1	19	3	5	1	1
168	Long	Gen	0	0	0	1	1	1	1	19	3	0	7	1
169	Long	No	1	1	0	0	0	0	2	18	3	0	1	1
170	Short	Gen	1	0	0	1	0	0	1	19	3	6	0	1
171	Long	Blur	0	0	0	1	0	0	2	18	3	1	7	1
172	Long	Gen	0	1	0	1	0	0	2	18	3	0	7	1
173	Short	Blur	0	0	0	1	1	1	1	18	3	8	5	1
174	Short	ANSI	1	0	0	1	0	0	1	18	3	2	0	1
175	Short	Gen	0	0	0	1	1	0	2	17	1	2	8	1
176	Short	ANSI	0	0	0	1	0	0	2	19	3	2	0	1
177	Short	Blur	0	0	0	0	0	0	2	19	3	0	1	1
178	Long	Blur	1	1	0	0	0	0	2	18	1	0	1	1
179	Long	No	0	1	0	1	0	0	1	18	3	0	1	1
180	Long	No	1	1	0	0	0	0	2	18	2	0	0	1
181	Long	Blur	1	1	1	1	1	0	2	18	1	0	2	1
182	Short	No	1	1	0	1	0	0	2	18	3	0	2	1
183	Short	Blur	0	0	0	1	1	0	1	19	3	0	0	1
184	Long	Gen	1	0	0	1	1	0	2	18	3	1	1	1
185	Short	Blur	0	0	0	0	0	0						
186	Long	Gen	0	0	0	1	0	0						

187	Short	Gen	1	0	0	1	0	0