CALIFORNIA STATE UNIVERSITY, NORTHRIDGE

**THE INFLUENCE OF POSITION, HIGHLIGHTING, AND IMBEDDING
ON WARNING EFFECTIVENESS**

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ABSTRACT

THE INFLUENCE OF POSITION, HIGHLIGHTING, AND IMBEDDING ON WARNING EFFECTIVENESS

by

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Master of Arts in Psychology

Warnings on consumer products are typically the only devices used to elicit safe product use. Manufacturers have a legal duty to warn about predictable product dangers, and currently the legal system heavily emphasizes the importance of such written product warnings in determining product liability issues. The legal system's reliance on such warnings rests on the assumption that these warnings are effective in influencing user behavior. An experiment was conducted to provide behavioral data pertaining to the effectiveness of such warnings; by investigating the effects of position, highlighting, and imbedding warnings on detection, recall and compliance with warnings through actual user behavior.

Three warning positions (top, middle, and bottom) were varied on the label of a consumer product, as were two warning highlighting conditions (inverted and not inverted) and two warning imbeddedness conditions. The imbeddedness consisted of beginning the Warning section with either the critical warning information (the unimbedded condition) or a superfluous warning statement followed by the critical information (the imbedded condition). An additional "control" group condition was used in which the critical safety information was included in the Directions section on the label, with no formal Warning section appearing at all.

In the experiment each of 195 subjects was given a product and a situation in which they had to actually use it. Through direct user observation the influence of

the warning on user behavior was directly measured and follow-up questions provided insights into the underlying factors involved. The follow-up questions were specifically focused to determine if the user 1) noticed the warning, 2) then read it, and 3) followed it. The purpose being to find out where along this three step process people dropped out (if at all) and more importantly, if they did drop out, why.

The results showed a consistent decline over all experimental conditions in terms of the number of people who first noticed, read and then complied with the warning. Surprisingly, the only variable to have a differential effect on warning compliance was that of imbedding. Imbedding the critical warning information significantly reduced warning compliance, as subjects stopped reading the warning prior to reaching the critical safety information. A further unanticipated finding was that placing the critical safety information within a separate Warning section, as opposed to placing it within the Directions, dramatically reduced the number of subjects who read and fully recalled the warning yet failed to comply with the warning because of forgetting. This suggests that the utility of a Warning section may be that if the material is read, it becomes more salient and less forgettable to the user. Even in the best condition, however, warning compliance was only 37%; this suggests that steps beyond just warning a user, such as designing the potentially dangerous aspects out of the system to begin with, are needed.

INTRODUCTION

A warning, as pertains to consumer products, is a cautionary statement or set of statements used to alert the user to a potential danger. A warning should not only supply the user with information about the severity of the danger, but also provide information on the nature of the hazard and instructions on how to avoid the danger.

Consumer product warnings are put on products to modify the users' behavior in relationship to the product so as to reduce and, hopefully, eliminate product-related accidents. The effective use of warning messages hinges on three assumptions: 1) That human behavior is a critical factor in determining the safe use of products (McCarthy, Robinson, Finnegan and Taylor, 1982) and, conversely, that human behavior is a critical factor in the misuse of products and accidents; 2) That human behavior can be altered to increase safe use of products, and to reduce the likelihood of misusing products and of injury; and 3) That warning messages are an effective means of modifying behavior in the use of consumer products.

X *Dependent Variables*
The effectiveness of a warning on a consumer product label depends on whether it is actually detected by the user, *(detection)* whether the user is able to interpret the warning, *(recall)* and finally, whether the user modifies his or her behavior as a result of having read the warning. X *(Compliance)*

While it is widely held that warnings are an important means of informing the user of potential dangers related to the use of products, the specific characteristics of effective warnings are not as widely known or agreed upon. With the recent emergence and prominence of product liability cases, many articles on the effective uses of warnings have been written. Most of these articles, however, simply state guidelines, with little or no experimental support to serve as a basis for their assertions or suggestions (Dorris & Purswell, 1978; Ross, 1981; McCarthy et al., 1982; and Peters, 1984).

Many report the findings of surveys based upon hypothetical responses and behaviors (Dorris & Tabrizi, 1978; Cochran, Riley & Douglas, 1981; Wright, Creighton & Threlfall, 1982; and Wogalter, Desautniers & Godfrey, 1983a).

Far fewer in number are the articles reporting the results of experimental studies conducted with warnings. A few areas such as highlighting to differentiate the warning from the rest of the product (Loewenthal & Riley, 1980; and Zlotnik, 1982) and the position of a warning on a product (Easterby, Hakiel & Graydon, 1980) have been experimentally investigated.

A major problem with most of the research regarding consumer product warnings is the lack of behavioral studies involving people actually using products containing warnings. Only through experimentation involving actual product-user-warning interaction can conclusive evidence regarding the critical features and components of effective warnings be obtained.

INDEPENDENT VARIABLES

The present study was designed to investigate the effects of position, highlighting and imbedding on the detection, recall and compliance with warnings, through observation of actual user behavior. The specific warning studied was contained on the back label of a "house-hold" size consumer product.

Position. The position of the warning refers to it's position on the label in relationship to the rest of the information. The present study examined the relative effectiveness of warnings when placed at the top, middle or end of the information label.

Highlighting. The highlighting technique used to distinguish the warning section of the label from all others was that of inversion, that is, while the rest of the label was printed with black lettering on a white background, the warning section had white lettering printed on a black background. This inversion highlighting

condition, and the absence of inversion, were the two levels of highlighting used.

Imbedding. The imbedding utilized in the study refers to "hiding" written information within a written passage. For the purposes of this study, the imbedding consisted of a sentence "non-essential" to the warning being included in the warning section and directly proceeding the "critical" warning. The unimbedded version contained the same overall information, but the "non-essential" sentence followed the "essential" warning within the warning section, thus no longer serving as an imbedding agent. X

X Dependent Variables

Detection. Many features of a warning can affect its detection; among these are its highlighting, and its placement. Of the limited amount of literature available on warnings, much of it deals with detection, in as much as detection affects perception, and without perception there is failure to warn.

After Zlotnik (1982) used a procedural task to investigate the effects of eight different highlighting conditions, which consisted of combinations of cross hatching, shadowing, and blocking of the signal word and of the entire warning.

Highlighting indeed proved to be more effective than no highlighting, but no differences were found in the effectiveness of one highlighting condition over any other. Bresnahan and Bryk (1975) similarly found color coding to be effective in eliciting differential hazard associations.

Cochran et al. (1981) included the location of the warning as being one of three factors that are critical in attracting user attention and therefore affecting conspicuity. Warnings buried within a manual or label, or buried within other text (i.e., imbedded) are of little effective use (Peters, 1984).

Zlotnik (1982) determined that placing the warning directly before the procedural step to which it applied was more effective than placing the warning

action within the step. In a similar procedural task, Wogalter, Fontenelle, and Laughery (1985b) found that placing the warning before the instructions was superior, in terms of compliance, to placing it after the instructions. Easterby et al. (1980), determined that the placement of warnings on packages was critical in determining detection. Their results showed that the top right corner on packages is optimal for detection, while the lower left corner is the least effective in terms of detection.

Recall. To the extent that with repeated use, warnings are less likely to be noticed and subsequently read (Godfrey & Laughery, 1984), the ability of users to recall or remember the critical warning message of a product will determine, in part, the extent to which the warning is effective. Whereas much of the warning literature deals with the variables that affect detection, unfortunately few studies examine the qualities that affect recall of warnings.

Dorris and Purswell (1978), as well as Peters (1983), discussed the effects of wording and message length, which affect recall. Highly technical words and the use of long or grammatically complex phrasing will hinder not only the users' understanding but also his or her retention of the warning information. Rothstein (1985) varied message length, serial position, message format, and pre-questioning, and analyzed the effects on three different recall measures. Her findings indicated that message length, format and pre-questioning did affect subsequent recall.

Compliance. The data on warning compliance (i.e., the extent to which behavior is modified) is mixed. It appears that the effectiveness of warnings (in terms of eliciting warning compliance) is situation specific. For example, Godfrey, Rothstein and Laughery (1985) found warnings to be effective in the various environmental situations in which they placed the warnings. Zlotnik (1982) concluded that the presence of warning messages shortened task completion times and reduced error rates with his proceduralized task. Wogalter et al. (1985b), in a

similar experiment, concluded that the presence of warning messages significantly increased the desired user behavior, as compared to the nonwarning condition.

Tokuhata (1976), however, reported no significant differences in injury rates between subjects who did or didn't read the instructions on product labels. McCarthy et al. (1982) concluded that "people commonly fail to take action in response to warnings, even when they read or hear them, and it seems they often fail to notice warnings." Indeed, McCarthy, Finnegan, Krumm-Scott and McCarthy (1984) concluded, on the basis of their literature review, that "there is not enough scientific evidence found to support the contention that on-product warning labels measurably increase the safety of any product."

In light of these mixed and varied results, the present study attempted (through varying the position, highlighting and imbeddedness), to determine the effects of warnings with regard to detection, recall, and compliance.

These three independent measures of position, highlighting and imbeddedness, are of particular practical interest given the reluctance of manufacturers to put prominent warnings on packages. It often seems that not only are warnings imbedded deeply within passages and unhighlighted, but also are placed in easily over-looked areas of the package. All of this is done in an attempt to minimally comply with legal warning requirements while at the same time trying to minimize the conspicuity of the warning. This is done in an attempt to not "scare-off" any potential purchasing consumers.

Manufacturers have a legal duty to warn users about any reasonably foreseeable dangers involved in using their product, resulting from inherent properties of the product or from missuse (Moll, 1976). Currently, the legal system heavily emphasizes the importance of written product warnings in determining product liability issues. The legal system's reliance on written warnings rests on the assumption that written warnings are effective in influencing user behavior. Up

until recently, there has been no behavioral data available to either support or refute this assumption. Therefore it is critical that imperical behavioral data be obtained on the effectiveness, or lack there of, of written product warnings.

One company, Liquid Paper Inc., evidently thought that inverting the warning message to set it apart from the rest of the label would increase at least its conspicuity, as evidenced by their recent product repackaging. After several deaths resulted from product misuse within one year's time, they have turned to what they hope will be a more effective highlighting technique in the form of reversing the figure/ground contrast of their warning message. Clearly, then, empirical information regarding warning conspicuity, comprehension and effectiveness is needed.

The premise of the task in the present study is that subjects initially read the label of a household product for non-warning related information. Once this has been completed the product is to be used. Since the warning is crucial to the safe use of the product, the subject should then, in theory, read the warning also. Based on the results of a pilot study, it was hypothesized that the effect of highlighting the warning section would be the most powerful independent variable on detection.

There should be, therefore, no position or imbeddedness effects when the warning is highlighted, because the effect of the highlighting should be so strong that people will notice the warning regardless of its position or imbedded state. Similarly, it was hypothesized that with the effect of highlighting removed, the next most powerful effect would be that of position; with the top position being the best, followed by the middle position and finally the bottom position. Additionally, highlighting by position effects were hypothesized to occur.

Much of the existing literature (primarily the survey literature), implies that once warnings are noticed, then the users will read and subsequently adhere to the warning (Dorris & Purswell, 1978; McGuinness, 1977; Wright et al., 1982). These

findings provided the rationale for hypothesizing that the imbeddedness dimension would be the least effective in terms of subjects reading the warning. In effect, since it was hypothesized that once people noticed the warning they would read it, it doesn't matter if the critical warning information is presented at the beginning of the warning section or at the end. Highlighting and position placement should play the greatest roles in getting the warning section as a whole noticed, and therefore once the warning section is noticed, people should read it regardless of where the critical information is placed.

Additionally, based on the results of the existing literature (which assumes that once the subject notices the warning, the chain of events continues through the execution stage), this then also becomes the rationale for hypothesizing that the effects of highlighting, position, and imbedding will be similar across the dimensions of noticing, reading, and following the warning.

Conclusion X
In addition to investigating the effectiveness of highlighting, imbedding, and positioning of the warning, the effects of placing the critical warning information within the directions section of the package label (and eliminating a separate warning section) were assessed. The operative action of the warning message used could logically be considered a direction statement. Because this warning action lent itself so readily to being included in the directions section, this condition was added to the experiment. This was done to determine if this placement would be more effective in getting subjects to notice, read, recall and follow the warning than when the information was set aside in a separate warning section.

It was hypothesized that this control condition, of sorts, would result in more subjects reading and therefore following the warning than in the other conditions, due to the heavy emphasis placed on using the product in the experimental task. X

METHOD

Design

The independent variables tested were warning position (top, center, and bottom in relationship to the other constant features of the product label), the typographical highlighting applied to the warning (an inverted message/background condition and a non-inverted condition), and finally, the position of the "essential" warning statement within the warning section (either immediately prior to the "non-essential" warning statement or immediately following it).

X The study was conducted to investigate the effects of the independent variables in relationship to warning detection, warning recall, and warning compliance. To test these, the following six dependent variables were measured: the percentages of subjects who noticed the warning, read the warning, and responded to the warning, plus the amount of information subjects could recall pertaining specifically to the cause of the danger, the nature of the danger, and the prevention of the danger. X

The experiment was a 2X2X3 between-subjects design, where each subject was tested on only one warning position/highlighting/intra-warning order (imbeddedness) combination. Fifteen subjects were used within each of the 12 experimental cells.

An additional control group was also included. In this condition the critical warning information was incorporated within the Directions section of the package label, and no separate warning section was therefore included. Fifteen subjects were also used in this control condition.

Subjects

A total of 195 subjects were run in the experiment, based on 15 subjects per

each of the 12 experimental cells, plus an additional 15 subjects used in the control condition cell. The subjects were undergraduate psychology students from C.S.U.N., who received class credits for participating in psychological experiments.

Stimulus Materials

A 12 ounce bottle of "glue" and two substances to be hypothetically glued together were used. The bottle of glue displayed a front panel showing the name of the product and its logo. The back panel contained 5 sections; a warning message, a promotional paragraph, a paragraph containing directions for use, a paragraph denoting the uses of the glue, and finally a paragraph listing the ingredients. (Refer to Appendix A, pages 47-51, for examples of label designs).

The structure of the information label was dependent upon the fact that single spacing was used throughout. Single spacing was utilized to mimic the actual appearance of the majority of labels on the market. The final line of any section was approximately 1/4 of the length of the fully justified lines before it. Therefore, the white space following the last line of each section served as a visual cue that a new section was beginning.

Within the warning section of the label, the imbedded sentence used was of a configuration so that the start of the "essential" warning, as triggered by the signal word "DANGER" was positioned at the end of a sentence. By restricting the location of the imbedded signal word away from the left margin of the warning section, the signal word would not be identified as a section heading, which would nullify the imbedding effect. Placing the signal word after the "non-essential" sentence so that the signal word starts the next line would nullify the imbedding effect because it would appear as if the warning section began with the signal word and not the "non-essential" sentence (this would certainly be the case in the unhighlighted

condition, and even to a certain extent in the highlighted condition).

By placing the warning signal word at the start of a new sentence, whether it follows the imbedding sentence or not, would result in its position alone acting as a visual cue to denote a new section, due to the nature of visual scanning and search patterns. This left margin position effect of the signal word was thought to serve as a more powerful cue than the white space cue for indicating new sections, particularly since the form used throughout the label was that new sections begin on new lines, and compounded by the fact that single spacing was used throughout. Because of this, the "essential" warning began at the end of a line in the imbedded condition. The numerous products on the market found with the signal word imbedded in this manner attests to the realism of this experimental placement.

"Danger" was chosen as the signal word because the nature of the hazard used in this study (severe burns) is immediate. There is agreement among the two most widely used standards in industry (the American National Standard Institute's "Specifications for Accident Prevention Signs" (Z35.1-1973), and FMC Corporation's "Product Safety Sign and Label System," 1980) that "Danger" denotes an immediate hazard which will result in severe personal injury or death. Indeed, subjects were found to rate "Danger" as being more hazardous than "Caution" (Bresnahan & Bryk, 1975), indicating that this distinction is practical and not merely technical in nature.

With the exception of the warning message, all of the other sections on the product label were identical in not only form but in length. Since evidence has shown that "long" warnings tend not to be read (Dorris & Purswell, 1978; Peters, 1984), the warning tested here was kept in length to a minimum (to promote subjects to read it), while preserving a complete sentence structure. Additionally, the wording of the various sections of the label (with the necessary exception of the ingredients section) was kept to a non-technical level, which was shown in the pilot study to be well within the reading capabilities of college students.

The warning was designed to include four key informational features: 1) The nature of the danger; 2) The severity of the danger; 3) The cause of the danger; and 4) Information/instructions on how to avoid the danger, (refer to Appendix A, pages 47-51).

The warning message was designed to present an easily identifiable and immediately harmful substance (i.e., acid), an easily defined and immediately forthcoming injury (i.e., burns), and an easy to perform, (and also easy for the experimenter to observe), solution to the potential hazard (i.e., shaking the bottle).

The two items used as gluing props were both substances listed on the label as being appropriate to use the glue on. One item was a piece of fabric, while the other item was a small piece of plastic. Both items were readily identifiable, in terms of their composition, by all of the subjects run in the experiment.

The glue containers used were consistent across the different experimental conditions. Additionally, they were of a nature and shape so that they were not readily identifiable. Familiarity of objects has been shown to be inversely proportional to the reading of warnings (Wright et al., 1982), so non-familiar appearing glue containers, in addition to calling the product "Liquid Adhesive," were used to reduce the familiarity aspect involved in normal glue use.

Procedure

A pilot study was conducted to determine what problems, if any, would arise as a result of the experimental design, stimulus materials, etc. The experimental conditions were identical to those used in the actual experiment. The experiment ran smoothly, with the subjects revealing no problems in understanding either the task, the wording, or the warning. As a result of the pilot study, no changes were necessitated in the experimental procedure.

Subjects were tested individually in the experiment. During an experimental

session, each subject was given an instruction sheet, which was read aloud by the experimenter as the subject read along. The subject was told to imagine being in the hypothetical condition described in the instruction sheet.

Subjects were to imagine that they were on the way out of their house, carrying a child's game. In their haste they dropped the game and two pieces of it broke off. They were directed to the two pieces in question, which had been placed in front of them on the table where they were seated. The instructions further stated that the only available glue in the house was the bottle of liquid adhesive that had also been placed on the table in front of them. They were then instructed to determine whether this liquid adhesive was appropriate to use to glue these two items back together, based on what these two pieces were made out of and what the label on the bottle indicated that this liquid adhesive would adhere to.

If the subject determined that this liquid adhesive was indeed capable of gluing these two items together, they were instructed to then proceed to glue the items together anyway they wish, just so long as they were in fact glued together. If the subject determined that the glue was not appropriate to use, based on the two items to be glued, the subject was instructed to tell the experimenter, who would then direct him or her as to their next action. (See Appendix B, pages 52 and 53, for an example of the instruction sheet).

Once the instructions had been read, the experimenter then allowed the subject to carry out the task. The experimenter, who was seated behind the subject and out of the subject's line of vision (to be as unobtrusive as possible), observed the subject's behavior while the subject proceeded with the task. Because the warning on the label indicated a specific, easily identifiable action which must take place prior to the opening of the glue bottle lid (i.e., shaking the bottle), it was readily apparent to the experimenter whether the subject complied with the warning. Once the subject opened the lid of the glue, regardless of whether the warning was followed or not, the

examiner stopped the subject.

The experimenter then verbally gave the subject a 10 point questionnaire to gauge the subject's understanding and recall of the warning message (see Appendix C, pages 54-56, for the experimental and the control group questionnaires). After subjects completed the questionnaire, the experimenter recorded their comments and explanations about their performance. The order of question presentation was not randomized, due to the sequential nature of the information sought. The bottle of liquid adhesive was not available for the subjects to reference while answering the experimenter's questions.

All subjects received the same two items to glue together, which were readily identifiable as being among the group of items that were appropriate for use with this liquid adhesive (one item was a piece of fabric, the other was plastic). Therefore, it was hypothesized that all subjects should attempt to glue the pieces of the game together. In the event that a subject reported that the liquid adhesive was not appropriate to use, they would not have been included in the experiment (basically because they would not have yielded a result for actually following the warning, since they would not have attempted to glue the items together). This problem was never encountered in the actual experiment.

Once the questionnaire had been filled out, and the subject's comments recorded, a debriefing sheet was given to the subject.

RESULTS

To facilitate interpretation of the multiple analyses used, the results will be presented and organized in terms of the three independent variables of imbeddedness, highlighting and position. In this manner, each independent variable will be discussed separately, while incorporating information about the dependent variables and the statistical analyses performed. Unless specifically stated, the analyses discussed will pertain to the non-control group data.

The dichotomous data obtained from the experiment will be discussed first. The data analyzed here consist of the effects of the three independent variables on the percentage of people who noticed, read, and followed the warning, plus the percentage of people who could specifically recall the nature of the danger indicated in the warning, its cause, and its remedy. These data will be presented by main effects and interactions.

The warning recall data, in addition to being analyzed in a dichotomous manner, will then be analyzed utilizing the continuous nature of the data. These data will be presented by main effects and interactions.

Supplementary analyses, not directly pertaining to the main focus of the experiment, will then be explained and discussed. Refer to Appendix D, pages 57-59, for the complete set of data.

Overview

Analyzing the experimental results in their totality, across all experimental conditions (excluding the control condition), it was found that 91% of all the subjects noticed the warning on the product label. Seventy-seven percent of all of the subjects reported having read the warning, while only 37% of all subjects actually followed the warning. (The percentages across the conditions on which these totals

are based are displayed in Figure 1.) A test of the differences between proportions showed that the percentage of people who noticed the warning was significantly greater than both the percentage of people who read ($z = 3.62$, $N = 360$, $p < .05$) and the percentage of people who followed the warning ($z = 10.8$, $N = 360$, $p < .05$). Additionally, the number of people who read the warning was significantly greater than the number who followed it ($z = 7.69$, $N = 360$, $p < .05$). X

Comparing these findings to those obtained from the control group (in which critical user information was included not in a warning section, but was supplied instead within the direction section of the package label), shows consistently similar proportions: 100% of the subjects noticed the section of the label containing the warning instruction (here, the direction section), 100% of the subjects read the section, while only 33% of all subjects actually followed the warning instructions, as shown in Figure 2.

X An analysis of the differences between proportions revealed that only the percentages of subjects who read the section (i.e., the Warning section in the experimental conditions, and the Directions in the control condition) were significantly different from one another, ($z = 2.11$, $N = 195$). Therefore, the percentages of people who noticed and subsequently followed the warning directive (i.e., shaking the bottle) was effectively the same regardless of where the statement was located. Therefore, the same dramatic sequential drop-off of subjects from the Noticed and Read stages down to the Execute stage of the experiment are exhibited whether the critical information is presented within it's own section (i.e., the warning section) or logically included with other directions for usage (i.e., in the Directions section). X

Figure 1. Overall percentages of Imbeddedness, Positioning, and Highlighting across the dependent measures of Noticing, Reading, and Complying with the Warning.

Figure 2. Overall experimental group percentages and control group percentages across the dependent measures of Noticing, Reading, and Complying with the Warning.

DICHOTOMOUS DATA

Chi squared statistical analyses were used to test for the main effects of the dichotomous data. Interactions among the independent variables as well as their main effects were assessed using Chi squared analyses in which the marginal proportions (as opposed to theoretical proportions) were used to compute the Chi squared expected values (Winer, 1962).

The data from questions number 1, 3, and 6 were used to analyze the effects of the three independent variables on the percentage of people who noticed, read and followed the warning. The data from questions number 8, 9, and 10 were used to analyze the effects of the three independent variables on the percentage of people who recalled what the danger was, what caused the danger, and how to avoid the danger. These warning recall items on the questionnaire (numbers 8, 9, and 10) were scored utilizing a 3-point scale: a score of 0 indicating a totally incorrect response; a score of 1 indicating a partially correct answer; and a score of 2 indicating a correct answer. To analyze these data in a dichotomous manner, partially and totally correct responses were combined (i.e., scores of 1 and 2), thus yielding a correct vs. not correct measure. Figure 3 shows the overall totals of this recall data, when scored dichotomously. Tests to determine the significance between proportions showed that the number of people who recalled acid was significantly larger than the number of people who recalled shake ($z = 2.89$, $N = 278$, $p < .05$) and the number of people who recalled burn ($z = 2.24$, $N = 278$, $p < .05$).

A series of 2-way and complex chi squares was performed on the data, using the Imbedded/Unimbedded, Highlighted/Unhighlighted, and Top/Middle/Bottom Position dimensions as independent variables. The six dependent variables were the dimensions of Noticed, Read, and Shake (noticing the warning, reading the warning, and following the warning) plus the specific warning recall dimensions of the danger, cause and the remedy (burning being the danger, acid causing the danger,

Figure 3. Overall recall percentages of subjects across the recall dimensions of Acid, Shake, and Burn.

and shaking being the preventative action). Phi coefficients (ϕ) and contingency coefficients (C, for complex chi squares) are reported along with the Chi squares, to indicate the degree of the relationship between the two variables indicated.

Two and 3-way Chi squared interactions were analyzed, but no significant interactions were detected among any of the three independent variables.

Imbeddedness. The data for the effect of imbedding the critical warning information within the warning section, as seen in Figure 4, shows a steady drop-off of subjects throughout the three dependent variable stages of the experiment: noticing the warning, reading the warning and following the warning.

In addition to the sequential drop-off of subjects across these three stages being very pronounced, it is also evident that imbedding the critical warning information consistently reduced these numbers across the three stages even further, when compared to the non-imbedded condition.

A significant relationship was found between the imbedded dimension and the specific recall of Shake as the desired action, $\chi^2(1, N = 180) = 9.12, p < .01, \phi = 0.22$. A significant relationship was found between imbeddedness and correctly following the warning (i.e., shaking the product), $\chi^2(1, N = 180) = 4.58, p < .05, \phi = 0.16$. Additionally, a significant relationship was found between imbeddedness and Acid (as the causal agent) recall, $\chi^2(1, N = 180) = 4.36, p < .05$, with $\phi = 0.16$. No significant relationships were found to exist between the imbedded dimension and Burn recall, Noticing and Reading the data.

The imbedded/unimbedded dimension appears, therefore, to be an important factor in influencing not only the recall of the specific dangerous agent involved and the specific action required to avoid the danger, but is also critical in affecting whether the warning is actually followed. If the critical warning information is imbedded within the warning section, subjects are significantly less likely to remember what is causing the danger (i.e., acid), how to avoid the danger (i.e.,

Figure 4. Percentages of subjects in the Imbedded and Unimbedded conditions who Noticed, Read, and Complied with the Warning.

shake), and subsequently less likely to followed the warning, than if this information was presented at the beginning of the section.

Highlighting. As was shown with the data for imbeddedness, Figure 5 reveals how the data for the effects of highlighting the warning section (by inverting the figure-ground contrast) demonstrates the same steady drop-off of subjects throughout the three dependent variable stages of the experiment.

Highlighting the warning section in this manner can be seen to increase the number of subjects who first of all notice and then subsequently read the warning. Paradoxically, however, the raw data (although not statistically significant) suggests that performance, in terms of following the warning, is actually less likely when the highlighting is used.

A 2-way Chi squared analysis performed on the data revealed a significant relationship between the highlighting dimension and reading the warning, $\chi^2(1, N = 180) = 3.82, p < .05, \phi = 0.15$. No significant relationships were found to exist between the highlighting dimension and noticing the warning, following the warning, or any of the three warning recall measures. Highlighting the warning section therefore appears to exert its effect only in terms of getting the subject to read the warning more so than he or she would if it were not highlighted.

Position. Following the trend shown to exist among the previous independent variables of Imbeddedness and Highlighting, Figure 6 demonstrates how the data for the effects of the position of the warning section on the package label show a steady drop in the number of subjects who progress through the dependent variable stages of noticing the warning, reading the warning, to following the warning.

The trends that are evident from these raw data suggest that the middle position retains the greatest number of subjects throughout the three stages, followed by the top position, while the bottom placement position results in the fewest number of subjects progressing through these stages.

Figure 5. Percentages of subjects in the Highlighted and Unhighlighted conditions who Noticed, Read, and Executed the Warning.

Figure 6. Percentages of subjects in the Top, Middle, and Bottom positions who Noticed, Read, and Complied with the Warning.

A complex Chi squared analysis performed on the effectiveness of the three placement positions of the warning revealed a significant relationship between position and subject's ability to recall what the specific danger was (i.e., being burned), $\chi^2(2, N = 180) = 6.19, p < .05, C = 0.18$. Simple Chi squares analyses revealed that a significant difference exists only between the middle and bottom positions in terms of burn recall $\chi^2(1, N = 120) = 5.83, p < .025, \phi = 0.22$.

Nonsignificant relationships were found to exist between the position effect and noticing, reading and following the warning, and additionally with recalling what caused the danger and how to avoid it. The only position effect was that placing the warning in the middle position relative to the rest of the label information resulted in better burn recall than placing it in the bottom position.

Recall Data

The recall data (questions 8, 9, and 10) were also analyzed separately, the analyses chosen reflecting the continuous nature of the 3-point data. Each of these three questions could result in a score of 0, 1, or 2, and therefore the combined score for any given subject on this recall data as a whole could range from 0-6. Each subject who read the warning received such an overall recall score in this manner, and it is these recall scores that are used in analyzing these data.

The data that comprise this recall measure deserve special note. At this point in the experiment, the experimental cells no longer contain equal sample sizes. This is because these data on warning recall are necessarily based only upon the number of subjects who indeed read the warning. Passing through the stages of first noticing the warning, and then reading the warning acts as a filtering agent, where subjects may drop out anywhere along the way. Therefore, to the extent that not all subjects will notice the warning or then read it, the recall data is inherently based on unequal experimental cell sizes.

T-tests were performed on the data from the Imbeddedness and Highlighting independent variables, in order to determine whether performance differed significantly within each of the groups. Similarly, a one factor analysis of variance was performed on the position independent variable data, to determine whether the performance difference between the three groups was significant. These analyses were utilized based on the fact that they could be conducted with unequal sample sizes. Therefore, all of the recall data were used in these analyses.

A 3-way factorial analysis of variance was performed on the recall data in an attempt to determine the interactive effects of the three independent variables in combination with each other. While significant main effects were found, no two or 3-way interactions were significant. This factorial analysis required equal cell sizes and therefore, data was randomly deleted from experimental cells until equal subject sizes were obtained. The total number of scores deleted in this manner were 31 (out of a total of 180 scores). The maximum number of scores dropped per cell were six, with the resulting analysis being based on nine scores per cell. Refer to Appendix E, pages 60 and 61, for the contingency table for this analysis.

Imbeddedness. A t-test performed on the recall data for imbeddedness yielded a significant result, $t(137) = 2.02$, $p < .05$. When the critical warning information was imbedded within the warning section, overall recall was significantly worse ($M = 2.89$) than when the critical warning information was presented at the beginning of the warning section ($M = 3.68$). This result is consistent with the Chi square findings that imbedding the warning significantly reduces recall of the agent causing the danger and how to avoid the danger.

X Highlighting. A t-test performed on the recall data for the effects of highlighting revealed a nonsignificant result. Highlighting the warning section as a whole ($M = 3.09$) was not found to significantly improve recall of the warning over that obtained when the section was not highlighted ($M = 3.56$).

Thus, there is consistency among the Chi squared and t-tests in showing that there is no significantly differential recall of warning information whether the entire section is highlighted by figure-ground inversion, or whether it is not highlighted at all.

Position. A one-factor analysis of variance performed on the recall data for the effectiveness of the three placement positions of the warning section resulted in nonsignificance. In terms of recalling the critical components of the warning, even though no significant difference was found between the three positions, the middle position yielded a higher score ($\bar{M}=3.75$) than did the top position ($\bar{M}=3.24$), while the bottom position resulted in the lowest warning recall score ($\bar{M}=2.86$).

Although no significance was found at $\alpha=.05$, there was significance at a less stringent alpha level ($\alpha=.2$). Indeed, by dichotomizing the data, as was done to calculate the Chi squared recall data, significance was found between the middle and bottom positions on recall of what exactly the imminent danger was (i.e., being burned).

Control Group Data

Eighty-seven percent of the subjects tested in the control group condition were able to correctly recall that the message of "shake well before opening" was included in the label Directions.

Supplementary Analysis

Four items on the experimental questionnaire (numbers 2, 4, 5, and 7) were included to tap supplementary information pertaining to how the subjects approached the experiment.

Question number 2 was included to help guard against any demand characteristics possibly involved if subjects were asked outright if they had seen a

warning. Instead, subjects were asked to recall as many of the five sections of the label as they could. Of the subjects who later reported noticing the warning, the percentages of those who were able to recall having seen the warning in this free recall fashion ranged from 93% to 54%, depending upon the experimental condition. No discernable patterns could be found across the experimental groups to account for these differences, and based on the comments and subsequent responses given by subjects, it appears that no significant patterns can be read into these results. Subjects who initially couldn't freely recall the warning section, but subsequently did when directly asked, appeared simply to have genuinely initially forgotten it. Of the five sections on the label, the warning seemed to be the most difficult to recall unaided.

The corollary to this question was asked to the control group; in this case, if they mentioned the directions when recalling the four sections of the label. Sixty percent recalled it, which falls within the range reported for the experimental group's questionnaire.

Questions number 4 and 5 were asked to ascertain how much information subjects retained about the physical appearance of the warning. Question number 4 asked subjects to report the location of the warning (if they had noted it). There were almost universally correct answers to this question, with 99% of the subjects getting it correct.

Question number 5 asked subjects whether the warning was highlighted, and if so, how. While there were practically no incorrect answers pertaining to correctly reporting highlighting (the average correct response - 96%), variability did occur with reference to the specific type of highlighting used. Although the vast majority of subjects did correctly identify the method of highlighting used (87% correct), incorrect answers such as the warning having been printed in different colors (e.g., red, yellow, and blue), underlined or boldfaced were commonly given. These results

were similar to those obtained by Zlotnik (1982), in which many of his subjects could not accurately recall the highlighting condition they had received.

Question number 7 was a precaution included to ensure that any effects, or lack thereof, were not due to any language or comprehension difficulties attributable to the wording or understanding of the warning or experimental task. This was also included in the control group questionnaire, and in both cases 100% of the subjects reported having fully understood the task, and the warning.

DISCUSSION

Noticing The Warning

Surprisingly, no significant differences were found to be attributable to imbedding, positioning, or highlighting of the warning, with regard to subjects noticing it. Nor were there any differences across the three manipulated conditions. The percentages of people who noticed the warnings were all consistent around 91% (see Figure 1), with there being no significant difference in the number of people who noticed the Warning section (in the experimental condition) or the Directions (in the control condition). (Refer to Figure 2, page 17.)

It had been hypothesized that highlighting and the position of the warning would affect its noticeability, or conspicuity. The possibility of a position by highlighting effect was also hypothesized, but not found, to affect noticeability.

Comments from the subjects revealed no clear pattern of answers to explain the absence of these expected results. Subjects who noticed the warning when it was unhighlighted and at the bottom (the condition hypothesized to be the least noticable) reported noticing it there because "that's where warnings go." On the other hand, subjects who didn't notice the warning in this unhighlighted bottom position reported not to have noticed it because they "didn't read that far." Indeed, it was a common finding that subjects who didn't notice the warning at the bottom did so because they felt their task was only to find the uses section, and they quit reading after they had found it.

Subjects who noticed the warning in the middle position reported to have done so due to its proximity to the targeted Uses section, while subjects who noticed the warning at the top noticed it because it was the first thing they saw. In other words, almost all of the subjects saw the warning and had an explanation for why they saw it in their particular experimental condition.

Similarly, highlighting had no differential effect on noticability, which was

the area in which it was hypothesized to have the greatest effect. Most people noticed the warning section regardless of highlighting, which indicates a possible ceiling effect.

The result that imbeddedness had no differential effect on noticing the warning is not as surprising, because imbedding doesn't effect the entire warning section, which is what the noticing dimension refers to. It seems reasonable to assume that the warning section as a whole would be recognizable, as such, regardless of the order of the various components within it.

The high percentage of people who noticed the warning (i.e., 91%) regardless of the main effects or interactive effects of position, highlighting, or imbeddedness, suggests that a ceiling effect of some sort exists. This could be caused by the nature of the experimental task, the warning size, or any other feature of the experiment that could be causing the warnings to be noticed regardless of the experimental conditions tested. The question to be considered next is, given that warnings are noticed, do people read them?

Reading The Warning.

Although there was no difference in the overall reading percentages across the three experimental conditions (all averaged 77%; see Figure 1, page 16), there was a significant difference in reading between the highlighted and unhighlighted conditions, and a suspected difference due to imbedding.

As hypothesized, when the warning was highlighted significantly more people read the warning than when it was not highlighted. In terms of imbedding the warning, even though the percentages of people who read the warning in the imbedded and unimbedded conditions were not significantly different, comments given by the subjects revealed that in the imbedded condition subjects were less likely to read onward past the first sentence of the warning section than in the

unimbedded condition. Since the first section in the imbedded condition was superfluous, these subjects never got to the critical warning information. Indeed, the subjects who made this observation, when asked to recall what the warning said, typically responded with information from the superfluous first sentence only (i.e., information about the non-harmful and non-flammable status of the product) and made no mention of any of the critical warning points.

The result, then, that imbeddedness had no differential effect on getting subjects to read the warning is a misleading one, since there was no methodological measure to determine what exactly "reading the warning" meant. That is, there was no measure to determine specifically which parts of the warning were read, although this information can be inferred from the nature of the answers subjects gave to the warning recall questions, (which will be discussed in a subsequent section).

Specific comments from subjects indicated that once they read "Non-harmful" on the warning (in the imbedded condition), they tended not to read further, even though they could see that there was more information in the section. The reason for this seems to be, based on the subjects' comments, that if the subject perceives the initial information to be noncritical (i.e., not directly and immediately relating to their personal well being), then they will read no further. The sentiment among 75% of the subjects was that if you don't immediately prove to the subject that it's worth their while to read the section, then they will not read it. Therefore, subjects were of the opinion that if initial information was not immediately relevant, then they wouldn't waste their time reading it. It is interesting to note that in this experimental case, that meant the refusal to read only one sentence further.

This same insensitivity of reading measurement is responsible for obscuring the possibility of some interesting highlighting by position interactive effects. About 35% of the subjects reported that once they had read far enough into the warning section to realize that it was indeed the warning section, they stopped

reading it. These subjects perceived their task to be one of a search task; searching for the uses section of the label. Even though the ultimate task was that of actually using the product (which is where reading the warning comes into play, since it affects using the product), many subjects did not perceive that reading the warning was necessary. Therefore, as they read through the various sections on the label, once they determined that a given section didn't contain information about the uses of the product, they discontinued reading that section.

X Precisely because the highlighting technique was so effective in delineating the parameters of the warning section, is why it probably had an interactive effect with the top and middle positions in terms of how much of the warning was read: once many subjects realized that they had encountered the warning section, it was very easy for them to skip the rest of this section and go onto the next section. Highlighting formed a convenient cognitive unit which it was easy for subjects to discount, in their search for the uses section. Therefore the distinction needs to be made as to exactly what parts of the warning are read by users in the various conditions.

It should be pointed out that this effect, in all probability, is not restricted to the highlighting technique of inversion, but applies to any technique used to highlight an entire section (i.e., that makes it stand out as a cognitive whole). When in the top position, this phenomenon of using the highlighting to form a cognitive unit to be bypassed was the most pronounced, although again, no highlighting by imbeddedness interactions were found. Not only did subjects report passing over the remainder of the warning section before they completed reading the entire section, but a surprisingly large number of subjects (6 out of the 26 who read it) reported that they started to read the package label at the point just under the highlighted section (i.e., they began to read at the start of the second section, bypassing the highlighted warning section altogether!)

The number of people who read the warning directive (when comparing the experimental conditions to that of the control group) was significantly higher when it was located in the Directions, as opposed to putting it in the Warning section. This confirmed the experimental hypothesis that more people would see it in the Directions, based on the assumption that people will initially read Directions more so than Warnings. In all probability, the nature of both the product used (i.e., liquid adhesive) and the experimental task was influential in getting users to read the Directions. The users' ultimate task was to glue the two items together, and in attempting to do this correctly, most users were concerned with the specifics of the liquid adhesive application, which was supplied in the Directions.

Generally speaking, where a separate warning section was used, once people noticed the warning, the position apparently had no further influence on whether or not the warning was then read, nor were any interactive effects among the variables found to influence the ability of the warning to attract the user to read it. Only by highlighting (and in all probability by beginning the warning with the critical information), was the number of subjects who advanced from noticing the warning to reading the warning maximized.

Therefore, the factors critical in getting people to read warnings are (a) putting the warning directive in the Directions, or (b) if a separate Warning section is used, highlight the section and make sure that the critical information is presented first and not imbedded within the warning section.

Warning Compliance

In terms of following the warning directive, imbeddedness was the only variable to have an influence. Therefore, the imbedded dimension was found to be the most critical in actually influencing user behavior. By imbedding the critical information, significantly fewer subjects actually followed the warning directive.

Again, the subjects who failed to follow the warning when it was imbedded (although they reported having read it), for the most part said that they failed to read beyond the first sentence (which was superfluous).

It was surprising to find that highlighting had no differential effect on the execution of the warning, considering that it had an effect on the number of people who read the warning. Similarly, no differential effects were found on the basis of the warning position. Subjects' comments revealed no clear understanding for the lack of influence that positioning, and especially highlighting, had on warning execution.

It was an unexpected finding to note that while all the subjects who executed the warning directive correspondingly were able to correctly remember the directive action (i.e., shake) in the recall test, there were also subjects who were able to recall the warning directive yet failed to carry it out. Indeed, more than half a dozen subjects in the experimental conditions, and an overwhelming 77% of subjects in the control group, correctly recalled all three major elements of the warning (i.e., the cause, the danger and the remedy), yet failed to follow the warning. When this was pointed out to them during the questioning and they were asked about why they neglected to act on the warning, the unanimous response was one of having forgotten. Between the time it took them to read the label and open the bottle top, they forgot to carry out the warning. Notice, however, that they didn't forget what the warning said (as evidenced by the fact that the recall questions were asked after they had attempted to open the bottle, and were correctly answered). Subjects simply forgot to do it.

For these subjects, the time frame in question (from reading to opening the bottle) was, in general, no more than approximately 10 seconds (and often it was a matter of only a few seconds). This means that within a few seconds, even though subjects knew what to do, they forgot to do it. Each of these subjects expressed great

surprise at their oversight, and said that it hadn't been an intentional one at all.

This may be indicative of the true value of warnings, since the inclusion of the critical safety information in a separate warning section dramatically reduced the number of subjects who read and fully recalled yet failed to follow the warning due to forgetting, as compared to the number of subjects who forgot when this information was presented within the Directions. It appears that by presenting this information in the context of a "warning" this information is less likely to be forgotten, once it has been read.

Whereas placing the warning directive in the Directions significantly increased the amount of users who read it, there was no difference due to this placement (as opposed to putting it in a separate Warning section), in terms of the number of users who actually following the warning. This curious finding tends to confirm the sentiment of those such as McCarthy et al. (1984), who have concluded that, in general, warnings are simply not followed.

Recall

The recall data show no clear pattern of results, other than to further testify to the detrimental effects posed by imbedding. Figure 3, page 19, illustrated patterns of recency and primacy effects, as a result of the wording order within the warning. The only significant difference found (i.e., between Acid and Burn recall, and between Acid and Shake recall), however, supports a primacy effect. Interestingly enough, where as in this experiment the cause of the danger (i.e., Acid) was remembered the most, Rothstein (1985) found that how to avoid the danger (i.e., in this case Shaking) was recalled the most by subjects, as a result of varying message length. Additionally, she found no recency or primacy effects, which means that no clear patterns can be formulated from these results in terms of what components of warnings, either placement-wise or compositionally, tend to be remembered most

often by users.

The only variable shown to affect Burn recall was that of positioning. While the top and middle positions were equally effective, the bottom position was found to be significantly worse in terms of facilitating the recall of the bodily danger. This finding is consistent with the results obtained by Zlotnik (1982) and Wogalter et al. (1985b), where they found that placing the warning prior to the targeted section was superior, in terms of influencing behavior, to placing it after the targeted section.

It is not clear why a position effect was found for only one of the recall measures, nor were subjects' comments particularly insightful in determining its significance. It is possible, however, that a differential reading effect exists for position (in terms of the specific areas of the warning read), which is being hidden by the reading measure used. If such an effect exists, it may well explain these recall results for positioning.

In the control group, 87% of the subjects were able to recall the warning directive, but as previously noted, only 23% of these subjects actually followed the warning directive. Subjects were unable to give any reasons for their noncompliance, other than to say that they were so caught-up in the task at hand that they simply forgot. In light of these findings, a subsequent step may be to consider this from the viewpoint of division of attention. It is possible that there are really two tasks in operation here: 1) those actions necessary to use the glue, and 2) another set of actions needed to ensure safety. It may be that the subjects didn't "forget," but simply focused their attention on the "primary" task, i.e., the task with the highest priority. The task instructions placed a great deal of importance on using the glue. Another set of instructions placing some emphasis on safety might well produce different results.

The only experimental variable affecting the recall of the dangerous agent (i.e., Acid) and the preventative action (i.e., Shaking) was that of imbeddedness.

Again, imbedding this critical information significantly impaired the recall of the causal agent and the prevention, which directly affected compliance with the warning. Neither highlighting nor positioning had any influence on this measure.

When the critical information was not imbedded, subjects responded with critical and noncritical information when asked to freely recall the warning, as opposed to the imbedded condition, in which subjects typically only recalled the information contained in the first (i.e., noncritical warning information) sentence. Beginning the warning section, then, with the critical information served to encourage subjects to not only read more of the warning, but to more often follow the warning than when this information was imbedded within the section.

The effect that imbedding has on recall supports the contention that differential amounts of the warning section are read when the warning begins with the critical information as opposed to the noncritical information.

Generalization

The experimental situation used was designed to yield high external validity. The design of the experiment was purposely chosen to be as indicative as possible of real life use of such products. Because glues or adhesives are notorious for their selective applications, the experimental premise (i.e., of having subjects read through the label to determine whether the liquid adhesive was sufficient to suit their needs) was representative of precisely the behavioral patterns exhibited by first time users of such products. Additionally, the actual user behavior was assessed, as opposed to merely asking the user about his or her probable behavior with reference to the product.

Not only was the experimental situation realistic, great pains were taken to make the package information as "readable" as possible. For example, the warning information was designed to be as brief and concise as possible. This was done to

further encourage subjects to read it, since lengthy written messages discouraged people from reading them (Dorris & Purswell, 1978; Peters, 1984). The nature of the danger (i.e., severe burns) was purposely designed to be easily identifiable as an immediate and severe physical threat to the user. This was done to further attract, and hopefully sustain, the attention of the user. Another example of how the stimulus materials were designed to accommodate subjects was the deliberate effort made to keep the wording as clear and uncomplicated as possible.

To the extent that such great pains were made to make the experimental situation in general, and the warning section in particular, as accommodating as possible, the results obtained from this study may be viewed as being based on an ideal situation. That is, most informational labels lend themselves less readily to easy interpretation; as a function of having longer, more complicated warnings, or any number of other complicating features. Warnings specifically tend to become long as the manufacturers try to include enough information to meet their legal requirements. To the extent that other warning conditions are less accommodating than the one used in this study, and to the extent that with repeated use warnings are increasingly less effective (Godfrey & Laughery, 1984), the percentages of subjects who notice, read and subsequently follow the warnings will be less than the percentages obtained here. Taking this into consideration, it is indeed disheartening to realize that probably in most real life situations the percentage of subjects who execute the warning instructions is actually lower than the 37% value obtained in this study.

The reason why the experimental situation used was specifically equated to first time product use (in reference to its high expected external validity), is because it is doubtful that the effects found here would generalize to the repetitive use of products. This is hypothesized due to the nature of the product involved, and due to the fact that with repetitive use of products the reading of and adherence to

warnings sharply drops (Godfrey & Laughery, 1984). Although, as previously stated, glues and adhesives realistically require that the product information labels be read for successful use, glues are considered such common, and more importantly, nonhazardous substances that it is highly probable that for this type of product, warnings would not be read at all (Wright et al., 1982).

Both the nature of the product and the size of the container (12 oz.) were chosen to be representative of household consumer products. Given that household products are smaller by nature than products for industrial use, it is unclear how these experimental results would generalize to this market. These results may therefore only be applicable to small products.

Limitations

The order of the three components incorporated within the critical warning sentence (i.e., the cause, the physical danger, and the prevention) were static across all experimental conditions. Because of this it is possible that the effects obtained were due to the serial positioning of these components within the warning. The possibility of primacy and or recency effects cannot, therefore, be ruled out. Rothstein (1985), however, analyzed serial position effects with warnings, in relationship to three recall items highly similar to those investigated in this study, and her findings showed no significant effects of serial positioning for any of the recall measures.

The warning direction chosen (i.e., of having subjects shake the product) may have contributed to poor warning recall and execution. This may be the case since shaking was chosen primarily because it is an easily identifiable action for the experimenter to recognize. Shaking an item may not be, however, intuitively the first precaution that comes to mind when confronted with a chemical burn. Shaking was, however, considered to be within the logical realm of solutions, considering that

mixing chemical compositions or suspensions often changes their reactive properties. A positive aspect involved in using an initially nonintuitive measure is that it precludes the possibility of subjects successfully guessing the correct answer. Indeed, when subjects couldn't remember what the warning directive was, they guessed with immediately obvious remedies for the situation. Had the experiment been conducted with exclusively chemistry students, rather than psychology students, more care would have been taken in making the warning more chemically feasible.

As was previously mentioned, there was no measure to determine which parts of the warning were read, when subjects reported having read the warning. Although this information can be inferred, to some extent, by the nature of the warning recall responses, a more precise and indepth measure would yield more information that could add to the understanding of subjects' selectivity when reading warnings.

Conclusions

The steady decline in the number of subjects who first noticed, then read, and finally followed the warning was exhibited by each of the three independent variables tested. This steady drop-off, in terms of the number of subjects who advanced through these three stages, underscores the point that, contrary to previous assertions (by Dorris & Purswell, 1978; McGuinness, 1977; Wright et al., 1982), even if people notice a warning, this is certainly no guarantee that they will even read it, let alone execute it. Clearly, then, the conspicuity of a warning is not singularly sufficient in persuading users to follow warnings. Therefore, there must be other factors that affect whether or not users will attend to, and ultimately adhere to, warnings.

Based on the comments of the subjects, the attitude taken with warnings should be one of persuasion. Users apparently must be convinced that (a) it is worth their while to take the time to read the warning, and (b) that it is worth their while to follow the warning. This is why the imbedded condition was so detrimental to performance: the initial information didn't hold the users' attention and therefore they didn't bother to read any further, to where the critical information was. Without reading the critical information they had no knowledge of the danger, or remedy, and consequently failed to carry out the warning directive. In the imbedded condition, it appeared that only the people who normally tend to read warnings proceeded to read through to the critical information. Users seemingly must be convinced that the danger is immediately relevant before they will read further.

While highlighting the warning was effective in attracting users to read the warnings, the next problem then becomes holding the user's attention. It appears, based on the data, that the best way to do this is to begin the warning section with the critical information. The results indicated that subjects in the unimbedded situation read more of the warning and retained more of the warning information than subjects who were in the imbedded condition. Therefore, by presenting the critical information so that it's the first thing that the user sees, user interest is obtained and held throughout the notice/read/comply stages.

Indeed, the need of users to be convinced of the necessity of reading and following warnings is in part responsible for the lower percentage of users who followed the warning in the control group, even though significantly more people read the directive in this condition than in the experimental conditions. In the control group, no explanation was provided explaining why the product should be shaken prior to opening. One subject in this control group summed up her reasons for not following the directive by saying, "If they don't tell me why I should do it, then I don't." Apparently, users must be convinced about the relevance of the

warning before they will comply. Therefore, given that companies must include a multitude of information on the package label to insure that they are not held liable, the critical information (from the user's standpoint) should be mentioned first. In this way, based on these experimental results, more users will be persuaded to not only read the critical information, but to read the entire warning section.

X Even if users notice, read and recall the warning, this is still no guarantee that users will follow the warning. X As was previously mentioned, there were subjects who, after correctly identifying the three major elements of the warning (i.e., the cause, the danger and the remedy), failed to follow the warning. X They reported that this was not a conscious decision to disregard the warning, rather, the subjects simply forgot to do so. What makes this all the more remarkable is that they forgot after only a matter of seconds. X To the extent that these numbers were far fewer when the critical information was presented in a separate section, this argues for the inclusion of an independent Warning section.

This brings up the point that even though users are willing to follow the warning, this fact in and of itself may not even be sufficient to bring it about. To the extent that users don't follow warnings in spite of their own intentions to do so, steps beyond simply warning seem necessary.

X The results of this experiment indicate that regardless of where the information is placed, most subjects don't follow warnings, at least ones with seemingly familiar and "presumably" nondangerous substances. X Given that this is the case, and that manufacturers have a duty toward the users of their products, actions above and beyond warnings must be taken. The ineffectiveness of warnings with familiar household products necessitates that human factors principles be applied to product design; namely fail-safe designs, to prevent the occurrence of undesirable behavior and to force the desired behavior to be exhibited.

In light of the enormous importance that the legal court system places on the

effectiveness of warnings, the importance of these experimental findings (and others, such as McCarthy et al., 1984), showing the ineffectiveness of warnings, cannot be understated. Since it has been shown that warnings are not very effective in these types of situations, the need for fail-safe designs is clearly evident. The use of warnings, in effect, offers the user a choice; they can either comply or not. It has been shown, however, that wanting or intending to comply and actually complying are two different processes. With this and the safety of the user in mind, it is time to weigh the pros and cons of taking the choice of compliance out of the user's hands, in the form of fail-safe designs.

REFERENCES

- American National Standards Institute, "ANSI Specification for Accident Prevention Signs," New York, NY, American National Standards Institute, 1973.
- Bresnahan, T. F., & Bryk, J. (1975). The hazard association values of accident-prevention signs. Professional Safety, January, 17-25.
- Cochran, D. J., Riley, M. W., & Douglass, E. I. (1981). An investigation of shapes for warning labels. Proceedings of the Human Factors Society - 25th Annual Meeting, 1981, 395-399.
- Dorris, A. L., & Purswell, J. L. (1978). Human factors in the design of effective product warnings. Proceedings of the Human Factors Society - 22nd Annual Meeting, 1978, 343-346.
- Dorris, A. L., & Tabrizi, M. F. (1978). An emperical investigation of consumer product perception of product safety. Journal of Products Liability, 2, 155-163.
- Easterby, R. S., Hakiel, S. R., & Graydon, I. R. (1980). Safety sign conspicuity: the effect of sign size and position on detection (AP report 89). Birmingham: University of Aston, Applied Psychology Department.
- FMC Corporation, Product Safety and Label System - 3rd Edition. Santa Clara, CA, FMC Corporation, 1980.
- Godfrey, S. S., & Laughery, K. R. (1984). The biasing effects of familiarity on consumers' awareness of hazard. Proceedings of the Human Factors Society - 28th Annual Meeting, 1984, 483-486.
- Godfrey, S. S., Rothstein, P. R., & Laughery, K. R. (1985). Warnings: Do they make a difference? Proceedings of the Human Factors Society - 29th Annual Meeting, 1985.
- Loewenthal, A., & Riley, M. W. (1980). The effectiveness of warning labels. Proceedings of the Human Factors Society - 24th Annual Meeting, 1980, 389-391.
- McCarthy, R. L., Robinson, J. N., Finnegan, J. P., & Taylor, R. K. (1982). Warnings on consumer products: objective criteria for their use. Proceedings of the Human Factors Society - 26th Annual Meeting, 1982, 389-391.
- McCarthy, R. L., Finnegan, J. P., Krumm-Scott, S., & McCarthy, G. E. (1984). Product information presentation, user behavior, and safety. Proceedings of the Human Factors Society - 28th Annual Meeting, 1984, 81-85.
- McGuinness, J. (1977). Human Factors in Consumer Product Safety. Proceedings of the Human Factors Society - 21st Annual Meeting, 1977, 292-294.
- McGuinness, J. (1977). Human Factors in Consumer Product Safety. Proceedings of the Human Factors Society - 21st Annual Meeting, 1977, 292-294.

- Peters, G. A. (1983). Toward effective warnings for automobiles: A challenge to the trial bar. Trial, 19, 114-139.
- Peters, G. A. (1984). 15 cardinal principles to ensure effectiveness of warning system. Occupational Health & Safety, 5, 76-79.
- Ross, K. (1981). Legal and practical considerations for the creation of warning labels and instruction books. Journal of Products Liability, 4, 29-45.
- Rothstein, P. R. (1985). Designing Warnings to be read and remembered. Proceedings of the Human Factors Society - 29th Annual Meeting, 1985.
- Tokuhata, G., Colflesh, V., Smith, M., Ramaswamy, K., & Digon, E. (1976). Consumer behavior and product injuries. Journal of Safety Research, 8 (3).
- Winer, B. J. (1971). General partition of degrees of freedom in a contingency table. In N. Garnezy, R. L. Solomon, L. V. Jones, & H. W. Stevenson (Eds.), Statistical Principles in Experimental Design (2nd ed.) (pp. 855-859). New York: McGraw-Hill.
- Wogalter, M. S., Desaulniers, D. R., & Godfrey, S. S. (1985). Perceived Effectiveness of Environmental Warnings. Proceedings of the Human Factors Society - 29th Annual Meeting, 1985.
- Wogalter, M. S., Fontenelle, G. A., & Laughery, K. R. (1985). Behavioral Effectiveness of warnings. Proceedings of the Human Factors Society - 29th Annual Meeting, 1985.
- Wright, P., Creighton, P., & Threlfall, S. M. (1982). Some factors determining when instructions will be read. Ergonomics, 25, 225-237.
- Zlotnik, M. A. (1982). The effects of warning message highlighting on novel assembly task performance. Unpublished master's thesis, California State University at Northridge, Northridge, CA.

APPENDIX A
FORMAT EXAMPLES OF
LIQUID ADHESIVE PRODUCT LABELS

The following examples of label formats are provided to demonstrate a cross-section of the various forms of Highlighting, Imbeddedness and Positioning used. An example of each of the highlighting conditions used is shown (i.e., highlighting by inversion, and no highlighting), as well as a representation of each imbeddedness condition (i.e., imbedded and not imbedded), and each of the three warning positions tested (i.e., top, middle, and bottom). Additionally, an example of the label used in the control condition is provided.

TOP POSITION/UNIMBEDDED/HIGHLIGHTED CELL

DANGER: Contains Acid. To avoid severe burns, shake well before opening. Non-harmful and non-flammable if product is used as directed.

Titan Super-Bonding Liquid Adhesive instantly bonds most materials for an ever-lasting hold. It's ideal for industrial or personal use, wherever a super-strength bond is required.

Directions: Use only on dry, clean surfaces. Position the spout over the areas to be permanently bonded, and apply a thin stream of the liquid adhesive. Let the bond dry for 60 seconds.

Titan Super-Bonding Liquid Adhesive may be used to bond a variety of substances. Use it on plastics, synthetics, leathers, nonporous materials, metals, fabrics, glass and any natural woods.

Ingredients: petroleum distillates, pure polyvinyl acetate resin, hydrochloric acid, dichloromethane, magnesium aluminum silicate, hydrolyzed animal protein, D & C yellow number 9.

MIDDLE POSITION/UNIMBEDDED/UNHIGHLIGHTED CELL

Titan Super-Bonding Liquid Adhesive instantly bonds most materials for an ever-lasting hold. It's ideal for industrial or personal use, wherever a super-strength bond is required.

Directions: Use only on dry, clean surfaces. Position the spout over the areas to be permanently bonded, and apply a thin stream of the liquid adhesive. Let the bond dry for 60 seconds.

DANGER: Contains Acid. To avoid severe burns, shake well before opening. Non-harmful and non-flammable if product is used as directed.

Titan Super-Bonding Liquid Adhesive may be used to bond a variety of substances. Use it on plastics, synthetics, leathers, nonporous materials, metals, fabrics, glass and any natural woods.

Ingredients: petroleum distillates, pure polyvinyl acetate resin, hydrochloric acid, dichloromethane, magnesium aluminum silicate, hydrolyzed animal protein, D & C yellow number 9.

BOTTOM POSITION/IMBEDDED/UNHIGHLIGHTED CELL

Titan Super-Bonding Liquid Adhesive instantly bonds most materials for an ever-lasting hold. It's ideal for industrial or personal use, wherever a super-strength bond is required.

Directions: Use only on dry, clean surfaces. Position the spout over the areas to be permanently bonded, and apply a thin stream of the liquid adhesive. Let the bond dry for 60 seconds.

Titan Super-Bonding Liquid Adhesive may be used to bond a variety of substances. Use it on plastics, synthetics, leathers, nonporous materials, metals, fabrics, glass and any natural woods.

Ingredients: petroleum distillates, pure polyvinyl acetate resin, hydrochloric acid, dichloromethane, magnesium aluminum silicate, hydrolyzed animal protein, D & C yellow number 9.

Non-harmful and non-flammable if product is used as directed. DANGER: Contains Acid. To avoid severe burns, shake well before opening.

CONTROL GROUP CONDITION

Titan Super-Bonding Liquid Adhesive instantly bonds most materials for an ever-lasting hold. It's ideal for industrial or personal use, wherever a super-strength bond is required.

Directions: Use only on dry, clean surfaces. Shake well before opening. Position the spout over the areas to be permanently bonded, and apply a thin stream of the liquid adhesive. Let the bond dry for 60 seconds.

Titan Super-Bonding Liquid Adhesive may be used to bond a variety of substances. Use it on plastics, synthetics, leathers, nonporous materials, metals, fabrics, glass and any natural woods.

Ingredients: petroleum distillates, pure polyvinyl acetate resin, hydrochloric acid, dichloromethane, magnesium aluminum silicate, hydrolyzed animal protein, D & C yellow number 9.

APPENDIX B
EXPERIMENTAL INSTRUCTION SHEET FOR SUBJECTS

Imagine that you're on your way out of the door, carrying a brand new game for your little niece's birthday. But before you can get to the front door, you trip over the dog's squeaky toy and you drop the game. As you bend over to pick it up, you notice that 2 parts of the game have broken off. These are the 2 items in front of you on your left. The only glue in the house you can find is the bottle of Liquid Adhesive on your right. Your task now is to determine based on A) what the 2 game pieces are made out of, and B) what substances this liquid adhesive will glue together, whether you'll be able to glue these 2 pieces together or not, so that you can fix the broken game.

So, figure out, by examining the 2 pieces and by reading the label on the bottle, if this liquid adhesive will glue these 2 things together. If so, go ahead and glue them together, anyway you want (the kid's only 5, so she won't know if you did it right or not!), the important thing is that they are glued together. If you discover, after reading the label, that the liquid adhesive won't glue these 2 things together, just tell me, and I'll instruct you as to what your next action will be.

APPENDIX C
EXPERIMENTAL QUESTIONNAIRES

QUESTIONNAIRE FOR THE EXPERIMENTAL CONDITIONS

1. Did they shake it?

Yes No

*if no AND they read it, find out why.

2. Tell me what general categories of information you remember seeing on the label.

Promo Directions Uses Ingredients Warning

3. Did you notice any sort of warning on the glue bottle label?

Yes No

**Did they shake but not read it? Why?

4. If you noticed it, where was it in relationship to the rest of the information on the back panel of the label?

Top Middle Bottom

@@5. Did the warning "stand-out" in any way from the rest of the label? (that is, was it highlighted to catch your attention?)

Yes No

**If yes, how?

6. If you noticed a warning did you read it?

Yes No

7. If you read the warning did you feel that you understood it/ that it was clear? (That is, what it was trying to warn against, and what you were to do, even if you were not sure why following the warning would help)

Yes No

8. If you understood it, what exactly was the danger? (what would happen to you if you didn't follow the warning?)

0 1 2

---

9. What specifically caused the danger?

0 1 2

---

10. How could you avoid the danger?

0 1 2

**Explore why if read & understood why they didn't shake?

Comments:

QUESTIONNAIRE FOR THE CONTROL GROUP

1. Did they shake it?

Yes   No

**if no AND they read it, find out why.

2. Tell me what general categories of information you remember seeing on the label.

Promo   Directions   Uses   Ingredients

3. Did you notice any sort of directions on the glue bottle label?

Yes   No

**Did they shake but not read it? Why?

6. If you noticed the directions did you read it?

Yes   No

7. If you read the instructions did you feel that you understood them/ that they was clear?

Yes   No

8. What did the instructions say?

Did they mention "shake well"?   Yes   No

Comments:

APPENDIX D

THE EXPERIMENTAL DATA

The results from the experiment are divided into two sections. The first one being the effects of the independent variables on the dependent measure on Noticing, Reading, and Following the warning. The experimental cells are abbreviated and presented in the left-hand column. The abbreviations used are as follows: Bot.-Bottom position; Mid.-Middle position; Imb.-Imbedded; Unimb.-Unimbedded; Hi.-Highlighted; and Unhi.-Unhighlighted.

The scores are presented as fractions, with the number of subjects who carried out the specific measure to be found in the numerator, and the overall number of subjects at this particular point in the experiment to be found in the denominator. The percentage the numerator makes out of the original total number of subjects for each cell (i.e., 15) is also given.

For example, under the "Notice" column, "12/15, 80%" means that 12 subjects out of the 15 in this cell noticed the warning, which means that 80% of all the subjects in this experimental cell noticed the warning. Similarly, under the "Read" column, "9/12, 60%" means that 9 subjects out of the 12 who noticed the warning actually read it, and that only 60% of the total number of subjects in this experimental condition read it.

In this manner it is easy to see how the number of subjects who progress throughout these three dependent variable stages (i.e., noticing, reading and following) drops off within each experimental cell.

The second section shows the recall data for each recall measure. The scoring is as follows: 0-an incorrect recall response; 1-partially correct; and 2-a correct response. Again, the numbers of subjects in each condition, are presented as a fraction of the total number, per experimental cell, that read the warning.

	Notice % Total		Read % Total		Shake % Total	
Bot./Imbed./Hi.	14/15	93%	12/14	80%	3/12	20%
Bot./Unimb./Hi.	12/15	80%	9/12	60%	5/9	33%
Mid./Imb./Hi.	15/15	100%	13/15	87%	4/13	27%
Mid./Unimb./Hi.	15/15	100%	15/15	100%	9/15	60%
Top/Imb./Hi.	13/15	87%	13/13	87%	3/13	20%
Top/Unimb./Hi.	14/15	93%	13/14	87%	6/13	40%
Bot./Imb./Unhi.	11/15	73%	10/11	67%	4/10	27%
Bot./Unimb./Unhi.	14/15	93%	11/14	73%	9/11	60%
Mid./Imb./Unhi.	12/15	80%	9/12	60%	5/9	33%
Mid./Unimb./Unhi.	15/15	100%	14/15	93%	6/14	40%
Top/Imb./Unhi.	14/15	93%	9/14	60%	5/9	33%
Top/Unimb./Unhi.	15/15	100%	11/15	73%	7/11	47%
Control Condition	15/15	100%	15/15	100%	5/15	33%

APPENDIX E
CONTINGENCY TABLE: 3-WAY FACTORIAL
FOR RECALL DATA (REDUCED DATA)

	ss	df	ms	F	p
Total	583.19	107	-	-	-
Position	39.25	2	19.63	3.99	p<.025
Highlighting	7.26	1	7.26	1.48	-
Imbeddedness	27.00	1	27.00	5.49	p<.025
Position by Highlighting	8.57	2	4.29	.87	-
Position by Imbeddedness	8.16	2	4.08	.83	-
Highlighting by Imbeddedness	10.71	1	10.71	2.18	-
3-Way Interaction	10.02	2	5.01	1.02	-
Error	472.22	96	4.92	-	-