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EFFECTS OF TEXT ORGANIZATION AND LAYOUT ON THE COMMUNICATION AND EFFECTIVENESS OF PRODUCT WARNINGS

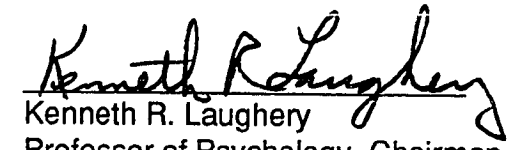
by

DAVID R. DESAULNIERS

A THESIS SUBMITTED
IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE

MASTER OF ARTS

APPROVED, THESIS COMMITTEE:



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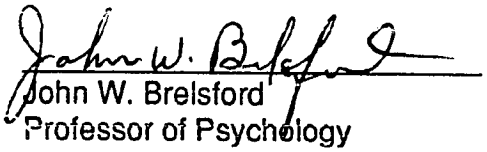

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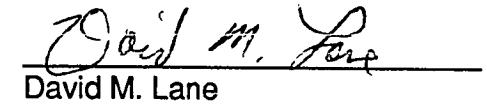

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THE EFFECTS OF TEXT ORGANIZATION AND LAYOUT ON THE COMMUNICATION AND EFFECTIVENESS OF PRODUCT WARNINGS

David R. Desaulniers

Abstract

Four experiments are presented which explore the effects of warning layout (spatial structure) and organization (semantic structure) on the ability to recall and the tendency to read warning information. Warnings were either presented in paragraph layout or in a meaningfully indented "outline layout". Warning information was organized by hazard, type of warning statement, or randomly. Experiment 1 results indicate that layout and organization reliably influenced perceptions of warning eye appeal, ease of processing, and effectiveness. However, a test of recall in Experiment 2 did not reflect the effects of these variables. In Experiments 3 and 4 warnings were presented to subjects in an incidental warning paradigm. The results of these experiments indicate that warnings in outline layout elicited less variability in reading rates, were more likely to be read, and were more likely to elicit warning compliance. Implications for warning design and future research are discussed.

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Finally I would like to thank my wife, Lorna. There are no statistics that I know which can express the magnitude or significance of her love, support, and understanding.

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INTRODUCTION

Warnings can be communicated in a variety of ways. Speech, flashing lights, sirens, buzzers, and pictures are but a few examples. In a typical day we are likely to encounter numerous warnings in each of these forms. Imagine a drive to the local supermarket. As you enter the car a buzzer signals that the door is open and a bell indicates that you have yet to fasten your seat belt. While you drive there are numerous signs and lights to direct your driving activities. When you park the car a small sign in the parking lot reminds you to lock your door and set your parking brake, and as you enter the store a sign indicates that the floor is wet. Of the items that you purchase, several will likely have warnings on the packaging. Finally, at the checkout, different tones will indicate if the bar code has been identified by the electronic scanner.

Of all the warnings we encounter each day, perhaps the most prevalent are the written warnings. In fact we are presented with so many written warnings that is likely we will not process some portion of this information. Some warnings we will fail to notice. Others we will fail to remember and others yet we will simply choose not to read. The focus of this paper concerns the latter issues. Given that a warning is seen and recognized as a warning, what are the factors which influence whether or not it is read and remembered?

People may choose not to read a warning because they believe that they already know what it states. Alternatively, the decision may be the product of an informal utility analysis, the perceived effort to read the warning is judged to outweigh the benefit the warning information affords in enabling them to reduce their risk. The latter hypothesis suggests the potential for tipping the scale in favor of a warning being read by decreasing the perceived effort to read it.

A considerable amount of research has been conducted to investigate the factors which influence the comprehensibility, legibility, and readability of written communications. The results of these studies have provided the basis for the development of numerous guidelines (e.g. specific font characteristics) which have been applied rather widely in warning design. However, two text

characteristics, layout and organization, have received very little consideration in research or application in the warnings context. Layout, the spatial structure of the warning, and organization, the semantic structure of the warning, are two features likely to influence an individuals propensity to read and ability to remember the warning.

The literature review which follows presents research findings on the effects of layout and organization on the readability of text and performance on memory and comprehension measures. Sections 2 and 3 cover the research on layout and organization respectively. Section 4 contains a summary of the issues and the implications for warnings research are discussed. Section 5 describes the plan and objectives of the four experiments which were conducted.

In sections 6 through 9 four studies are reported which address the effect of layout and organization in the domain of consumer product warnings. Specific perceptions of warnings, warning recall, reading rate, compliance, and tendancy to read are all examined as a function of warning layout and organization. Different methods and dependent measures are employed across the four experiments in order to provide convergent data on the influence of layout and organization on the likelihood that a warning will be read and remembered.

Text Layout Literature

Layout and Space

Layout, was defined in the introduction as the spatial structure of the text. The definition implies that space is medium through which one manipulates layout. However, space is perhaps most often thought of in terms of the limitation it imposes on the amount of information that can be presented in the warning. Clearly this is often the case for warnings on small consumer product. One might recall instances in which a warning was printed in type so small that it sacrificed readability for the sake of including the necessary warning

information. Perhaps worse are cases in which warning information is omitted or abbreviated to a non-comprehensible level.

Alternatively, it is possible that rather than being viewed as a limiting factor, space can also be considered as a tool in warning design. Proper use of space may effectively "declutter" a warning, resulting in a more appealing and readable warning design. For example, research on text design has provided the basis for guidelines which recommend that to ensure maximum readabilty, spacing between characters be, at minimum, equal to one stroke width. Similarly, the space between characters and a surrounding border can also influence the readability of the display (Caplan, Lucas, & Murphy, 1983).

Research on specific spatial characteristics of text such as line length, line spacing, and type of margins are typically discussed under the rubrics of format (e.g. Frase,1969), typography (e.g. Carver,1970; Hartley, 1981) and layout (e.g. Caplan, Lucas, & Murphy, 1983). These terms appear to refer to similar groups of variables, consequently they are often used interchangeably. However, Schoff and Robinson (1984) state that, "Strictly speaking, *format* refers to the mechanical specifications of the page - page size, column width, type size, etc. - and *layout* refers to the placement of actual text (copy) and visuals (art) on the page" (p. 62). The definition of layout provided by Schoff and Robinson will be used in this discussion of the literature. The variables encompassed by the term layout will be those affecting the relative placement of warning information within the warning itself, as opposed to warning placement within the environment, and excludes typographical variables such as font style, font size, underlining, and color.

For purposes of discussion, layout variables might be divided into those which influence the readabilty or comprehensibility of the text. Alternatively, layout considerations might be divided according to the unit of text being manipulated. An example of the latter type of categorization appears in a review of factors influencing the written communication process by Caplan, Lucas, & Murphy (1983). They identify layout and space as two variables

influencing the readability of written communications. Although it is not entirely clear how these to variables differ, it would appear that layout is simply space at the macro level. The elements involved in layout design are the larger components of written communication, such as pictures, phrases, sentences or paragraghs, as opposed to letters or numbers. Although the definition of layout used in the present discussion does not differentiate between space and layout, the discussion will be focused at the macro-level; the arrangement of phrases, sentences, and paragraphs.

Typography

By way of introduction, the statement was made that very little research has been done on the layout of warnings. There is, however, a body of literature which concerns the layout of instructional text. Hartley (1981) provides a compilation of guidelines, based upon typographic research, for the effective presentation of instructional text. Since instructions on the appropriate behavior in the hazard environment are a basic component of warnings, it seems fair to say that warnings are a special type of instructional text. However, warnings are considerably briefer than most of the extended discourse Hartley considers. Such a difference suggests caution in generalizing findings on extended discourse to product warnings.

Among the numerous considerations and guidelines which Hartley notes, there are several issues discussed regarding the use of space in the layout of text. His comments are similar to those cited earlier in this paper, they concern clarity in text and how it contributes to reader comprehension. "Clarity in text is largely a function of the layout, or how the material is spaced." (Hartley, 1981, p.23). Whereas the argument was previously made that clarity is largely a function of text organization, Hartley expresses the parallel opinion, clarity is largely a function of layout. Indeed, we may find that clarity is a function of the interaction of these two variables.

The unit of text being manipulated is one criterion by which layout variables can be categorized. Hartley addresses layout in terms of spacing

between lines, words, clauses, sentences, paragraphs, and sections. Each of these will now be considered in turn.

Spacing of Lines. The guidelines for the spacing between lines suggest that the distance between the baseline for one line and the baseline for the next line should be at least approximately 1.25 to 1.5 time the type size. Additionally, spacing between lines should always remain constant throughout the text. These guidelines are designed to optimize the legibility of the text. As the present concerns are primarily with readability and comprehension, the issue of line spacing will not be considered further.

Spacing of Words. Although the spacing between words is critical for legibility and readability, recent research on the spacing between words has primarily focused on whether or not the spacing is regular. Text with ragged right margins, such as this, maintains equal spacing between words. In contrast, justified text has uneven spacing between words in order to obtain even right and left margins.

In the debate over the advantages and disadvantages of justified text, a primary issue is the question of whether readability is impaired by the varied spacing that is produced in order to obtain fixed line lengths. Hartley (1981) contends that there is very little difference between reading speed or comprehension obtained with the two different types of text. However, there appears to be some advantage for less able readers with unjustified text (Gregory & Poulton 1970, Zachrisson, 1965). Note that this paragragh has been set as justified text. As a result it is possible to see rivers of space running through the text. Hartley notes that this can give the text the appearance of moving about on the page.

Although there are other pratical differences between justified and unjustified text that will not be discussed in this paper (e.g expense of typesetting), there is one other point that deserves mention. With justified text it is generally possible to get a few more words on the page. This is because the white space remaining on the ragged right hand margin of unjustified text is

used in justified text. Considering on-product labeling, where space is most often at a premium, the more spatially efficient justified text would appear to be the preferable mode. There are however other factors to be discussed which suggest that there might be more to be gained by not using the white space.

Goldfarb (1982), Saunders (1982) and Schoff and Robinson (1984) have presented guidelines for the layout of procedures. Each of these authors make suggestions concerning the use of "white space" on the page. Saunders suggests using lots of white space when presenting safety precautions. Goldfarb also supports the liberal use of white space. The rationale is that users are discouraged when pages of text are "monotonously loaded". Goldfarb notes that although the use of white space will make the document longer, the user will be more likely to read the document completely. Similarly, Schoff and Robinson believe the amount of white space on a page can influence one's assessment of how difficult the material is to read. If this is true, the likelihood of the material being read will probably be affected. Unfortunately, none of these authors cite research to support their recommendations.

Schoff and Robinson also indicate that a benefit of white space is that it provides needed rest breaks for the eyes, thereby providing the mind with time to assimilate information. The authors note that reading is not accomplished in a word by word fashion, but rather in chunks, adding phrases and sometimes whole sentences together to form a thought. They suggest that space can be used to help the reader perceive the information in chunks and also to recognize the structure of the piece of writing. Research which addresses this interpretation of the advantages of white space is presented in the following sections.

Spacing of Clauses. The effect of the spacing between clauses has been the subject of research since the early 1950's. North & Jenkins (1951) measured reading performance with conventional text and with two forms of text which were spaced according to what they referred to as "thought units". The text spaced according to thought units was either in an arrangement

referred to as "square span", as shown below:

This is	of the	style of
an example	square span	presentation.

or in a style referred to as "spaced unit", as in this example:

This is an example of the spaced unit style of presentation.

Square span was first proposed by Andrews (1949) and was designed to effectively use both the horizontal and the vertical visual span as well as group the text into thought units. The results obtained by North & Jenkins indicate that the spaced unit typography is superior to square span and standard typography in terms of reading speed comprehension.

Carver (1970) further investigated the effect of spaced unit typography, although he referred to it as "chunked" typography. His research followed the lead of Epstein (1967) and Anglin & Miller (1968). These researchers had found that chunking of text facilitated free recall and rote memorization of the sentences respectively.

Carver compared five experimental versions of chunked typography with standard typography. The primary differences in the chunked typography were the nature of the paragraph indentation, the size of the chunk, and whether the chunks were arranged horizontally or vertically. The results of the three experiments conducted showed no statistical difference between chunked typography and standard text layout on measures of reading rate and comprehension. However, one format was clearly superior to the others in terms of a consistent ranked preference.

This is an example
of the type of format
which was clearly superior
according to ranked preference.

Relative to the other experimental formats, the prefered format has a greater vertical orientation and medium line length. Additionally, the body of the text is indented, rather than the first line, which contrasts with conventional paragraph formats. Carver's results suggest that there is a preference for information to be presented in medium size chunks in a vertical format. Although reliable differences in performance were not obtained, the preferences were consistent with performance data of prior research.

Frase and Schwartz (1979) conducted research in which spacing was used to break down sentences into meaningful elements. In addition, their research examined the influence of indentation in conjunction with the text segmentation. Their results indicate that readers can read text and answer questions more quickly when the text is spatially separated into meaningful elements. Meaningful elements in this research corresponded rather closely to the phrases and clauses of sentences. Meaningfully segmented and indented text resulted in 14%-18% faster response times. Although both segmentation and indentation significantly reduced response time, the effect of indentation added little once the text had been segmented. It is important to note that the above results were obtained using text with highly technical content. The questions remains as to whether similar results would be obtained with a less technical text such as a consumer product warning.

More recently, research on text chunking has been conducted at Bell Laboratories by Keenan (1984). The study was designed to investigate the effect of chunked versus standard format typography on various conditions of task, text difficulty, and presentation mode. Accuracy in performance was emphasized and reading speed was the dependent measure. Based upon her review of the literature, Keenan predicted that there would be a speed advantage for the chunked typography. Contrary to these expectations, the chunked format resulted in a 16% reduction in reading speed relative to the standard typography.

Based upon a post hoc review of her data, as well as those of Frase &

Schwartz (1979) and Carver (1970), Keenan concluded that the data in these three studies can be accounted for by a three factor theory consisting of chunking, line length, and line length variability. High line length variability results when each chunk occupies a separate line. Whereas text chunking, and medium length lines are likely to facilitate reading, high line length variabiltiy is thought to interfere with ease of reading. Specifically, highly variable line lengths are hypothesized to interfere with the rhythm of eye movements thereby decreasing reading ease. She posited that any advantage of chunking in her experiments were offset by high line length variability.

Although prior research had not investigated the effect of line length variability, the effect of line length has received a considerabe amount of attention. Marcus (1982) notes that long lines have been shown to slow down reading and that most typographers recommend 40-60 characters per line as does Chadbourne (1977). It would seem likely that line lengths exceeding these guidelines would increase the likelihood of doubling, reading the same line twice, consequently resulting in reduced reading speeds.

It is perhaps worthwhile noting that while lines that are too long can have the effect of slowing down reading rates, the same might be said of line lengths that are too short. Coleman and Hahn (1966) have taken this concept to the extreme and have investigated reading rates for vertical typography, read from top to bottom, as opposed to conventional horizontal typography. Earlier work, Coleman and Kim (1961) and Tinker (1955), had found that although read more slowly when presented in a conventional manner, the vertical typography facilitated the accurate reading of tachistoscopically presented text. The advantage of the vertical typography was attributed to better utilization of the vertical aspect of the eye span. However, a series of three experiments conducted by Coleman and Hahn (1966) failed to find any advantage for vertical typography.

The results obtained by Coleman and Kim, taken together with the guidelines recommended by Chadbourne (1977) and Marcus (1982), suggest

that a line length of greater than one word and less than 60 characters is optimal. One further consideration will be noted. Marcus (1977) and Keenan (1985) have both commented that unequal word spacing, which occurs when text is justified, is most pronounced when line lengths are short.

Spacing of Paragraphs and References. The use of space in the layout of paragraphs has also received some attention. Horn (1976) has devised a technique, referred to as information mapping, which is a method for organizing and spacing the text so that its content and structure are clearer to the reader. Thus far, the application of this technique has been primarily limited to reference and technical manuals. Jewett (1972) has developed a method similar to that of Horn's in which the pararaphs of the text are categorized in terms of their importance to the central ideas of the text. The levels of the text are identified by the degree to which they are indented. Typically three levels are used:

main points of the argument,

explanations and examples,

and incidental materials.

Whereas Jewett has primarily made use of horizontal space to identify the transition from one paragraph to the next, Hartley (1980) has investigated the use of vertical spacing to group related information, as in paragraphs. In such a format there is one line space between paragraphs, one line space below a secondary heading and two above, two line spaces below a major heading and four above. In addition to this use of vertical spacing, this format may also initiate the beginning of each sentece on a new line. Hartley has indicated that this format enhances user preferances (Hartley, 1981) and retrieval speed (Hartley, 1980).

The format described above has been applied to the layout of journal references and studied to determine user preferances (Hartley, Trueman, and Burnhill, 1980). References were formatted in six different styles including the typical British and American run-on entry, vertical layout as prescribed by the

guidelines above, and hybrids of the vertical with the traditional styles. The use of italics was also crossed with the formats to yield 12 different styles of references. Ratings by both American and British judges indicated that there was a significant preference for the vertical layouts as opposed to the run-on type. There was also a significant preference for formats which used italics as opposed to those that did not.

Summary of Text Layout Literature

For purposes of summary, the major studies discussed thus far are presented in Table 1. The columns from left to right indicate the authors of the reseach, the main variables manipulated, the major findings, and this author's interpretation of possible factors contributing to the results obtained. The last column has been provided as an attempt to integrate the various results and therefore does not necessarily reflect the interpretation of the original authors.

As can be seen from a quick review of the last column, it would appear that much of the data can be discussed in terms of the predictability and encodeability of the text. Text justification affects the efficiency of eye movement in finding the beginning of the words in the text. In search tasks, text chunking and beginning a new sentence on a new line, facilitates the identification of individual idea units by making their beginning more predictable. Text chunking, either by clauses, or as sentences (Hartley, 1980), would appear to facilitate the comprehension and recall of the text by spatially arranging the text into easily encodeable units. As Keenan (1985) has suggested, those instances in which researches failed to find a facilitation of reading rate with chunked text may be due to the inhibitory effect of the low predictability of the text.

There is one additional factor, mentioned in the guidelines of Goldfarb (1982), Saunders (1982), and Schoff and Robinson (1984) which may substantially influence the readability of text. These authors suggest the use of white space in text presentation. Although none of these authors cite research to support their suggestions, the guidelines appear congruent with the research

Table 2. Summary of Text Layout Literature Review.

RESEARCHER(S)	VARIABLES	RESULTS	EXPLANATION
Hartley (1981)	line spacing	should be constant	predictability
Gregory & Poulton (1970)	unjustified text	advantage for less able readers	predictable spacing
Goldfarb (1982)	white space	motivates reading (not researched)	perceived shorter
Saunders (1982)	"	"	"
Schoff et al (1984)	"	"	inc. perc. of encodeability
North & Jenkins (1951)	spaced unit typography	inc. reading rate inc. comprehension	encodeability
Epstein (1967)	"	inc. free recall	"
Anglin et al. (1968)	"	inc. rote memory	"
Carver (1970)	"	prefer vertical	?
Frase & Schwartz (1979)	"	faster response time	encodeability
Keenan (1984)	"	reduced reading rate	line length unpredictable
Marcus (1982)	line length	best under 60 char.	decreases doubling
Chadbourne (1977)	"	"	"
Hartley (1980)	new line for new sentence	inc. retrieval speed	predictability

discussed thus far. Guidelines for minimum line spacing, maximum line lengths, unjustified typography, spaced unit typograhy, and vertical layouts all have the same basic affect on text. They all serve to increase the amount of white space on the page. In addition to the actual increase in white space which results from unjustified typograhy, Marcus (1982) states that in unjustified typography, the effective visual length is shorter.

Although Saunders seems to imply that white space has attention getting characteristics, Goldfarb suggests that breaking up the text with white space has a motivational affect and reduces the readers resistance to reading solid pages of text. Schoff and Robinson note that white space provides rest places for the eyes, allowing the mind time to assimilate the information that has been read. As suggested by other areas of research, they also note that white space provides the reader with information about the structure of the text.

Recent research by Tullis (1983) also adds to the plausibility of white space in text providing indirect benifits. Tullis (1983) investigated the effects of several characteristics of display design on the performance of CRT operators in a look-up task of airline reservations and hotel accomodations. He found that measures of layout complexity, the predictability of text, display density were predictive of preference for various display types.

One might argue that a search task on a computer generated display is qualitatively different from reading text and therefore these variables may have little influence on a subject's preference for text layout. However, layout complexity and display density were not the measures which were most predictive of search time in the look-up task. This would seem to indicate that the display appeal was not entirely task related and that subjects were possibly responding to a more global impression of the display itself. The apparent independance of task performance and display preference has also been noted in the prior research of Carver (1970) and Hartley, Timson, and Burnhill (1973).

In condensing the findings of the research presented here on text layout,

three factors stand out as determining layouts for optimal readability. 1) Current research would seem to suggest that the predictabilty of the text influences text readability. 2) The results of the studies on text chunking support the notion that comprehension and memory are facilitated when text is presented in easily encoded units. 3) Appropriate use of space may contribute to readabilty and user preference for a text. In short, these factors address the physical, cognitive, and perhaps motivational limitations of the reader.

Text Organization Literature

Guidelines for the design of warnings typically recommend that the warning be composed of four components. The four components are the signal word, statement of the hazard, statement of the consequences, and the instructions (FMC,1980). Although they generally appear in the order given, there has been little published research to determine their optimal order/organization. Furthermore, these guidelines are typically applied to environmental hazards. Text organization is likely to be a greater factor in the comprehension and recall of on-product warnings as there is frequently more than one hazard about which the user must be informed and are most often presented as a prose passage.

When the warning is to present information about more than one hazard, several organizations are possible. Following the signal word, one might present all the hazard statements, then the consequence statements, and then the instruction statements. Such an organization parallels the guidelines presented for the single hazard and has the advantage of presenting all the hazard information "up front" of the text of the warning. Furthermore all like information is grouped together facilitating the search for all consequence information, or all instructions, if a certain type of information is of particular concern.

Alternatively, it is possible that the optimal communication of information concerning several hazards is a sequential presentation of several warning

messages, each consisting of a hazard statement, followed by consequence and instruction statements. Such an organization groups information according to hazards rather than statement type and keeps all the information concerning a particular hazard proximal in the layout.

Although further arguments can be made for the above or other organizations, there is a need for research to be conducted which directly investigates the effectiveness of alternative warning organizations. Following is a review of research that has been conducted on warning organization. As few studies have been conducted in which warning organization was manipulated, research on the organization of other types of text will be presented as well.

Warning Organization

Rothstein (1985) has examined several factors likely to influence whether warning information will be read and remembered. One of the factors investigated was the possibility of a serial position effect for memory of warning information presented in a list format. Research literature in cognitive psychology would suggest that items at the beginning and end of the list would have a higher probability of being remembered. Contrary to her expectations, there was no reliable evidence to support a serial postion effect from the format manipulation.

Strawbridge (1986) manipulated the organization of warnings by changing the position of "critical warning information" within the text of the warning. She found that subjects were less likely to recall and comply with the critical warning text when it was imbedded within (followed) other warning text. Strawbridge (1986) and Wogalter, Fontenelle, and Laughery (1985) also found that the position of warning information relative to usage directions or other constant features of a product label can have a significant influence on whether or not a warning will be read and complied with.

Though the latter results indicating an effect of warning position can not be taken as a direct statement concerning warning organization, these results do suggest that the relative position of information on the label or in instructions

is an important consideration.

Organization of Instructional Text

Despite the paucity of research that has been conducted on the organization of warnings there has been considerable amount interest in the effects of organization in the context of instructional text. Much of that research appears to have important implications for the effective communication of warning information.

Frase (1969) has explored the influence of organization on the ability to recall relationships between the names and attributes of concepts as presented in prose text. In this study, the concepts were chessman and the names of concepts were pawn, knight, bishop, and so on. The attributes of these concepts were, for example, how the chessmen could be moved, their point values, and how many are used in the game.

Forty-eight sentences were formulated from a matrix which had concept names (N) and attributes (A) as the marginals, and the attribute values (V) in the cells. The sentences were then organized according to name, attribute, or organized randomly. Frase hypothesized that subjects in the random condition would need to spend a significant portion of time reorganizing the information, thus reducing the overall learning time and subsequent level of recall.

Results of this study indicated that organized passages led to significantly higher levels of recall than randomly organized passages. The superiority of organized text over randomly organized text in eliciting recall has gained further support by the subsequent research of Friedman and Greitzer (1972); Myers, Pedzek, and Coulson (1973); and Shultz and DiVesta (1972).

Further analyses of recall performance indicated that passages organized by name elicited the highest level of recall relative to attribute and randomly organized passages. One should note that name organization, as manipulated in this study, is essentially a hierarchical organization in which all information about a general concept is presented before presenting the next general concept. Such an approach to information presentation is advocated by Felker

(1980) who believes that people organize information hierarchically in memory and that people understand and retain topic information more than details. Indeed, Frase noted an interaction between presentation organization and subjective organization in recall. The response protocols reflected a tendancy to impose name organization on recall regardless of presentation organization.

Frase (1973) presents further research examining the influence of text organization on recall and comprehension under varying conditions of sentence structure and learning objectives. It was hypothesized that the higher levels of recall elicited by name organized text, relative to attribute organization (Frase,1969), may have been due to sentence syntax favoring name organization. If sentence form influences the salience of attribute and name cues, the compatibilty of sentence form and text organization might affect learning.

In a series of three experiments, sentence structures were varied to have either a N-A-V or an A-V-N organization. As in his prior study, discussed above, paragraph organization was manipulated. Paragraphs were either organized according to names or attributes. The results of these experiments, congruent with the findings of Frase (1969), indicate that name organization is superior to attribute organization in eliciting free recall. Subjects given paragraphs organized by name remembered more and were more accurate in recall. However, the effect of paragraph organization depended on sentence syntax. Confusions were more likely when there were incompatibilties between sentence and paragraph emphasis.

As previously stated, learning objectives were also manipulated in this series of experiments. Learning objectives were varied by listing the names, attributes, both, or neither in the instructions. The expectation was that performance would improve as more items were listed. The results indicated an interaction between learning objectives and paragraph organization. Subjects given learning objectives listing concept names exhibited fewer confusions in recall when the paragraph was organized according to names

than when the paragraph was organized according to attributes. The opposite effect occured when the learning objectives listed attributes.

In addition to measures of recall level and confusions in recall, Frase obtained measures of the ability to answer questions which required the integration of information provided in separate sentences. Frase hypothesized that the way in which descriptive statements are sequenced or organized is preserved in memory and that the ability to relate propositions can be influenced by this pattern. Information that is contiguous in text will be contiguous in the reader's mental representation and consequently more easily integrated.

In experiment 1 the subjects answered questions requiring information integration and their performance was evaluated for the effect of type of organization. Paragraph organization provided the manipulation for the extent to which certain types of information were located proximally in the text. The results indicated a significant effect of organization on the ability of subjects to answer questions requiring text integration. Name organization elicited higher levels of performance on this task relative to the attribute organization condition. Subsequent experiments attributed the relative superiority of name organization to prior semantic associations. However, the contiguity of information, as manipulated through text organization, was found to have a significant influence on ability to answer questions requiring information integration.

The text organization research reviewed thus far has potential implications for warning design and research. The findings, if applicable, suggest that warning designers need to go beyond simply imposing an arbitrary organization on warning information. The research of Frase (1969, 1973) indicates that alternative organizations are likely to differ in their ability to elicit subsequent recall. Furthermore, the objectives of the warning communication may need to be considered in determining an appropriate warning organization. Organizations which present information in sequences

which differ from the user's strategies in learning the warning information may result in confusions in information acquisition and recall. Given the nature of the warning communication, such confusions are likely to have potentially serious consequences.

Knowledge of Text Patterns and Topic Structure.

Hawley, Kryter, Licklider, and Webster (1963) have demonstrated an increase in the intelligibility of speech communication when the message set is limited. With a limited message set the communication is more predictable. Consequently this effect is attributed to the communication conforming to the listener's expectations. Analogous results are suggested in the results of research on instructional text.

Hartley (1981) notes that readers have expectations about the layout and content of different kinds of text and that difficulties arise when these expectations are violated. Similarly, Horowitz (1985a) likens a skilled reader to an expert cab driver. For both the reader and the driver, knowledge of the macro-level and micro-level structure of their environment allows them to arrive at their destination in the most efficient manner. For the reader this may include knowledge of overall text design, chapter formats, substructures within chapters, paragraph structures and so on.

Based upon her review of the literature, Horowitz expresses the opinion that readers use text patterns to facilitate recall without being aware that they are sensitive to these patterns. She dicusses five text patterns in her review. The five patterns are: temporal order (time order), attribution (list structure), adversative (compare-contrast), covariance (cause-effect), and response (problem-solution).

Horowitz notes that unskilled readers at all levels tend to have difficulty with the cause-effect patterns (Horowitz, 1985a) and that compare-contrast, cause-effect, and problem-solution may be the most difficult patterns to process (Horowitz, 1985b). Such findings could have direct implications for warning communication. The more difficult to process patterns, cause-effect and

problem-solution, are likely to appear quite frequently in warnings as hazard-consequence and consequence-instructions respectively.

The idea that the use of text patterns facilitates recall has led researchers to investigate whether training in the identification and use of text patterns can further facilitate recall of a text. Horowitz (1985b) cites the work of Bartlett (1978) and Bereiter and Scardamalia (1984) as postive, albeit qualified, support for the potential of training in text patterns to facilitate recall. Through her own research she has concluded that training in cause-effect patterns can significantly influence the extent to which students elaborate upon ideas in history exam writing, and can significantly improve student ability to produce cause-effect patterns in essay exams.

One should note that the results obtained by Horowitz provide only tentative support for her conclusions. The training effect was demonstrated in one of the two texts tested and the complexity of the training makes it difficult to identify exactly what manipulation(s) contributed to the results obtained. However, of particular interest in her experiments is the use of visual representations of the text patterns. Students were better able to remember text patterns when they were represented in simple diagrams.

With respect to on-product warnings, the effectiveness of training in text patterns is likely to be a moot question. This is simply due to the communication medium (i.e. a product label rather than a classroom lecture). However, this area of research does lead one to ask if it is possible to directly represent the text pattern in warnings through the layout of the warnings (i.e., represent the relationship between the warning components through the spatial relationships of the blocks of text)? Would such representations of the warning's organization facilitate recall of the warning information?

A line of research, analogous to the study of knowledge of text patterns, concerns the effects of knowledge of topic structure. Bransford and Johnson (1972) demonstrated that knowledge of the topic of a passage, prior to reading the passage, had a dramatic effect on text comprehension and subsequent

ability to recall information from the passage. Research by Meyer, Brandt and Bluth, (1980) has suggested that recall is dependant upon the reader's ability to use a text's topic structure as a retrieval plan. Lorch and Lorch (1985) have recently conducted research to test the role of topic structure in facilitating recall.

The results of the two experiments conducted by Lorch et al. supported the hypothesis that readers use a representation of the text's topic structure to guide recall. In the first experiment, subjects recalled information about fewer topics if the topics were randomly ordered and the introductory paragraph was uninformative than if the topics were logically ordered or if the the introductory paragraph was informative. In the second experiment, the presence or absence of topic sentences was manipulated. These were sentences at the beginning of each paragraph that introduced the new topic. The results indicate that subjects recalled information about more topics if the text contains topic sentences.

Frase (1969) varied whether or not information about the text's organization was given to the subject prior to their reading of the material. The effect of preinformation, informing the subjects of the superordinate structure of the text, was non-significant. There was however a significant interaction between preinformation and trials which indicated that conceptual preinformation improved recall as trials progressed.

The results obtained by Lorch et al. are congruent with the findings of Frase and Horowitz discussed above. They are also supported by the research conducted by Slater, Graves and Piche´ (1985) and Glynn, Britton, and Muth (1985). These latter studies investigated the influence of more explicit methods of representing text structure.

In both studies the subjects constructed outlines of the text as they read. Slater et al. also manipulated whether or not subjects received a structural organizer. The structural organizer provided additional information about the structure of the text and its usefulness as an aid in recall.

Slater et al. found that the combination of structural organizer and outline reliably and markedly increased comprehension and recall. The structural organizer alone facilitated comprehesion but not recall. This would seem to indicate that the outline may have played a significant role in facilitating recall in the prior condition.

In the Glynn et al. study one of the primary manipulations was the availability of a text outline at retrieval time. Recall for the text was significantly greater when the outline was available at retrieval time.

Summary of Text Organization Literature

It is clear that the implications of many of these studies for warning design and research are limited in the same way as those of the studies of text patterns described above. Many of the manipulations which enhanced recall can not be practically transferred to an on-product warning application. However, concepts such as topic sentences might be readily incorporated in warning design. Consideration should be given to the potential for hazard statements to function as topic sentences in warnings organized according to hazards. The use of outlines to facilitate comprehension and recall would not appear to be a plausible approach in the context of on-product warnings. As suggested with text patterns, research should be conducted to investigate the potential of presenting the warning in outline format. Thus the relationship of the sub-topics in the warning might be directly represented in the layout of the warning's sentences.

In summary, the implications of the text organization literature for warning design and research are very similar those cited in Kanouse and Hayes-Roth (1980), "Cognitive Considerations in the Design of Product Warnings". Those authors conclude that a hierarchical structure which initially presents general information, followed by more detailed information, would seem to be the optimal format for warning communication. This recommendation is congruent with the research conducted by Frase (1969, 1973) on name organization. Name organization, which elicited the highest levels of recall in his research, is

essentially a hierarchical organization. Furthermore, the advantages of presenting information hierarchically (Felker, 1980) is supported by the research on topic structure and topic sentences (e.g. Lorch et al.,1985).

Two general conclusions can be drawn from the text organization literature reviewed: 1) Text organization influences comprehension levels as well as the level and organization of recall. 2) Providing explicit information about the text's organization serves to facilitate comprehension and recall of organized text.

One might expect that a warnings organization will influence the effectiveness of the warning communication. However, there is a lack of research substantiating the benefits of organization in the context of warnings. The relative effectiveness of alternative organizations of warning information has yet to be addressed in research.

Summary of Issues: Implications for Warnings Research

Two primary goals of the warning communication process are getting the user to read the warning, and presenting the information so that the user can comprehend and recall the warning information. Although little hard data has previously been available to indicate that these are points where the warning communication process breaks down, the efficacy of product warnings has come into question (McCarthy, Finnegan, Krumm-Scott, and McCarthy, 1984). The review of research on layout and text organization provides direction for research investigating the warning communciation process and the factors influencing warning effectiveness.

The research on text layout indicates that warning information might be most easily read and comprehended if presented in predictable and easily encoded units of information. Furthermore, there is some research to suggest that subjects prefer layouts that are spaced vertically and it is suggested that some degree of white space might act as a attentional or motivational factor eliciting higher levels of reading behavior.

The research reviewed concerning text organization suggests that relative to alternative organizations, higher levels of comprehension and recall can be obtained if information is organized hierarchically, and the reader is aware (or made aware) of the organization. The methods that have been investigated for increasing the reader's awareness of the text structure have ranged from several hours of classroom teaching to providing outlines of the text or including topic sentences in the text. Given the limitations in space for on-product warnings, the notion of providing topic sentences would appear to be the most practical method of heightening the readers awareness of the text structure.

An alternative method of communicating the warning structure is to provide spatial cues in the layout of the text, thereby cueing readers to the hierarchical organization of the warning. Such an approach could be effected by presenting the entire warning in the layout of an outline.

The concept of an outline layout is congruent with the guidelines suggested by both the layout and organization literature. An outline layout would allow for the hierarchical organization of text and simultaneously provide the reader with spatial cues as to the organization of the text. Additionally, an outline layout would facilitate the presentation of the warning in easily encodeable units in a vertical format. These features should enhace the comprehensibility and subsequent ability to recall the warning information.

An outline layout would also provide more white space than text in paragraph format. This is likely to increase the attention getting and motivational characteristics of the warning. The predictability of the beginning of idea units would likely be increased, as each new topic is signaled by indentation and each sentence is intiated on a new line. Thus an outline layout might indirectly increase comprehension by increasing the predictability of idea units.

A potential drawback to outline layouts is that the predictability of the beginning of a line will decrease, due to the multiple indentations of the text.

Thus one can expect that reading rates might be hindered due to inefficient eye fixations when the reader looks for the beginning of a new line. However, line lengths in outline layout will on average be shorter than those in paragraph layout, thereby reducing the tendancy to read a line twice which occurs with longer line lengths. In light of the other advantages expected to be gained from the outline format, it is likely that it would still yield a considerable improvement in the readability, comprehensibilty, and memorability of the warning relative to a paragraph format.

Research Plan and Objectives

The following experiments were designed to answer specific questions in three general areas of interest in the presentation of written warning information. 1) What are the influences of outline and paragraph layout on specific perceptions of product warnings, the ability to remember these warnings, and the probability of reading and complying with such warnings? 2) What are the influences of three different levels/types of organization on these same variables? 3) Is there an interaction between layout and organization on these variables? It is hoped that research on these three questions might provide insight into the larger question of the extent to which organization and layout influence warning effectiveness.

Four experiments were conducted to address these questions. In the first experiment, rankings of warnings on dimensions of eye appeal, ease of processing, and perceived effectiveness were obtained. In the second experiment, objective measures of the influence of layout and organization on performing a cued recall task were obtained. In the third experiment, a product was actually used and measures of behavioral compliance and performance on a cued recall task were obtained. In the final experiment, two warning layouts were compared in terms of their likelihood of being read when presented in an incidental warning paradigm.

Experiment 1. Warning Perceptions - Eye Appeal, Ease of Processing, and Perceived Effectiveness.

Three ranking tasks were conducted using eye appeal, ease of processing, and perceived effectiveness as the respective criteria. The first two factors were intended to index the likelihood of a warning being read. Though it is difficult to conceive of a warning that is effective without being read, it is quite possible that despite being read a warning can be ineffective. Thus, the last ranking task assesses the possibility that manipulations which increase the readability of the warning might inadvertantly reduce perceived warning effectiveness.

Method

Materials

The warning stimuli were developed from warnings on six consumer products, commonly available in supermarkets and department stores. These products are a: 1) steam iron, 2) electric rechargeable drill, 3) hair blow-dryer, 4) spray fabric protector, 5) spray bug killer, and 6) pool shock treatment. The primary criterion for product selection was that each product present a minimum of three different hazards. For example, a spray can might contain toxic substances that are flammable and under pressure.

The products were also chosen to present a variety of hazards (e.g. mechanical, electrical, chemical, etc.). Additionally these products represent a range in how frequently they are likely to be used, from once a day (e.g. hair dryer) to once a year (e.g. fabric protector). Individually and collectively these products are also used in a variety of locations in and around the home. An example of each of these warnings is provided in Appendix A.

An attempt was made to preserve the original warning wording and sentence structure. The intention was to ensure that the warning content would be representative of that commonly encountered on consumer products. Minor editing was necessary for the warnings to comply with the experimental design.

Content. Each warning contained three types of warning information; hazard, consequence, and instruction. Each warning statement directly stated one and only one type of warning information.

The sentences of each warning were classified according to the type of warning information they contained. Hazard statements were direct statements of an attribute of the product which presented the potential for consequences if the user did not follow the instructions. Consequence statements directly stated events which could ensue if the user failed to follow the instructions. Instruction statements were direct statements of actions which, if taken, increase or decrease the likelihood of specific consequences.

Design

This experiment was conducted according to a 2 X 3 repeated measures design. The independent variables were layout (2 levels) and organization (3 levels). The two levels of layout were outline and paragragh. The three levels of organization were: 1) organized by hazard (hierarchical), 2) organized by type of warning statement (non-hierarchical), and 3) random. The dependent measures were the relative rankings of each warning stimuli on the dimensions of eye appeal, ease of processing, and perceived effectiveness.

Organization. Warnings were organized according to hazards, type of content, and randomly. Warnings organized according to hazard begin with a hazard statement, followed by a statement of the consequence associated with that hazard, followed by safety instructions specific to avoiding that consequence. An example of a warning stimuli organized according to type of hazard is presented in Appendix B. Examples of warnings representing the remaining five cells of the design are also provided in this appendix. If the hazard presents multiple consequences, the remaining pairs of consequence and instruction statements followed. This order is then repeated for the remaining hazards addressed in the warning. The organization is hierarchical in that each hazard has specific consequences associated with it and, in turn, these consequence have specific instructions associated with them.

Warnings organized according to type of content present all of the hazard information first, followed by all the consequence information, and finally the instruction statements. Within each category of information the relative order of statements is identical to the order used in the warnings organized according to type of hazard (e.g. the second consequence statement to appear in a warning organized according to type of hazard is the second consequence statement to appear in a warning organized acording to type of content).

In the random organization of warnings, most statements are treated as a separate entity and randomly assigned to a postion in the sequence of sentences comprising the warning. A very few cases occur in which two sentences are no longer meaningful or accurate if separated. Thus it was necessary to treat these sequences of sentences as a single unit in the randomization process. Although warnings generated in this process are not purely random, their organization is more likely representative of the poorly organized warnings observed on many consumer products.

Layout. Warnings were presented in two different layouts, outline and paragraph. Warnings are presented in outline layout by using several levels of indentation and by starting each sentence on a new line. Statements are indented according to the nature of their content. Hazard statements are not indented thereby defining the left margin of the warning. Consequence statements are indented one half inch from the left margin.

Two additional levels of indentation are used for instruction statements. General instruction statements were indented one inch from the left margin. If these statements require more than one line of text, the second line is indented an additional quarter inch (i.e. one and one quarter inch from the left margin). Instructions related to or further defining the general instructions are also indented one and one quarter inch.

The random organization/outline layout condition is an exception to the above rules for warnings with outline layout. In outline conditions organized by hazard or type of statement, there is a pattern of information which can be

represented through the indentations of the outline layout. In the random condition, no such pattern exists. Consequently, no indentations are used in the random-outline condition. Only the vertical aspect of the outline layout, starting each new sentence on a new line, was maintained. The result is a layout which appears quite list-like.

Warnings with paragraph layout were presented as a simple block of text. No indentation was used. The first statement begins at the left hand margin and subsequent statements directly follow each other.

Both outline and paragraph layouts have ragged right margins. Maximum line length was set at 6 inches. Warning stimuli were centered on an 8 1/2 x 11 inch piece of white paper. The stimuli were printed in blank ink using a 12-point Geneva font.

Subjects

Fifty-four Rice University undergraduates participated in this experiment and received extra credit in psychology courses for their participation.

Procedure

Subjects participated in one of three ranking tasks. Eighteen subjects were assigned to each task. The primary distinction between each task is the criterion used to rank the stimuli. The criteria are: 1) the warning's eye appeal, 2) ease of processing the warning, and 3) the warning's effectiveness. There is an additional difference between the task of ranking the warning according to eye appeal and the latter two tasks. The task of ranking warnings according to eye appeal requires the use of special stimuli which are adaptations of those described above.

Eye Appeal. Eye appeal rankings were intended to measure the subject's response to the layout of the information. More specifically the subject's response to the general shape of the information, prior to their analysis of the warning's content, was the dependent variable of interest. As it was assumed that processing of the warning's content would occur during the ranking task, the effect was controlled for by having subjects rank the eye appeal of warning

stimuli which were content free. This was accomplished by replacing each letter of the warning with an "X". With exception to the changes in letters, the exact warning layout was reproduced including capitalization and punctuation. Examples of the eye appeal stimuli are provided in Appendix C.

At the beginning of the experiment each subject was provided with a manila envelope containing six packets of stimuli. Each packet contained the six versions of one product's warning and a title page stating the name of the product to which the warnings pertained. The title page was always present on top of the packet with the warning versions following in random order. The order of products/packets was counter-balanced according to a latin square design. The order of stimuli within each packet was also randomized.

Subjects were informed that they were participating in an experiment designed to evaluate warnings. The experimenter then described the contents of the envelopes and briefly decribed the products to which the warnings pertained.

Subjects were then told that they would be making their rankings according to the warning's eye appeal. This criterion was defined for the subjects as their preferance for the warnings based upon their immediate visual impression of the arrangement of typing. It was then stated that all the letters in each version of the warnings had been replaced with "X's", however, the shape, capitalization, and punctuation were all the same as in the original warning versions.

Subjects were asked to rank the warnings by first reviewing all the warning versions in a packet and then restack the stimuli according to the given criterion, placing the worst warning on the bottom and the best warning on the top. Subjects were to complete this task on each of the packets in the order that they had been placed in the envelope. It was stressed to the subjects that they examine the stimuli carefully when making their rankings and that they would be allowed to proceed at their own pace.

Ease of Processing. Ease of Processing was defined in the instructions

to the subjects as the effort one needs to expend to read, understand, and remember the warning in order to use the product in a safe fashion. Stimuli for each trial of this experiment were the six versions of the actual (not x's) warning. Subjects were asked to make judgements about the relative ease of processing the warning versions. These judgements were expressed by rank ordering the warning versions along this ease of processing dimension. The procedure for ranking the warnings was the same as for the eye appeal task.

Effectiveness. Effectiveness of a warning was defined in the experimental instructions as the potential of the warning to influence the subject to behave in a safe manner while interacting with the product. Methodology was the same as for the ease of processing trials.

Results and Discussion

Eye Appeal. Rankings were collapsed across products and subjects to provide a mean ranking for each of the six versions of the warnings. These mean rankings are plotted in the top portion of Figure 1. It is evident that warnings with outline layout are ranked consistently lower (better) than the warnings with paragraph layout while the effect of organization appears to be dependent on the type of layout.

A two-way analysis of variance indicates subjects reliably ranked warnings in outline layout as having greater eye appeal than those in paragraph layout, $F(1,17)=9.31$, $p<.01$. There is also a main effect of organization, $F(2,34)=19.16$, $p<.0001$. The apparent organization by layout interaction approaches, but does not achieve, traditional levels of statistical significance, $F(2,34)=2.90$, $p=.07$.

The simple main effects of organization are significant in both the outline, $F(2,34)=7.12$, $p=.0026$, and paragragh conditions $F(2,34)=35.27$, $p<.0001$. Examination of the simple effects of organization in the outline condition reveals that warnings with hierarchical or type of statement organization were ranked as having greater eye appeal than those in random organization, $F(1,34)=13.85$, $p<.001$ and $F(1,34)=5.84$, $p<.02$ respectively. Warnings with

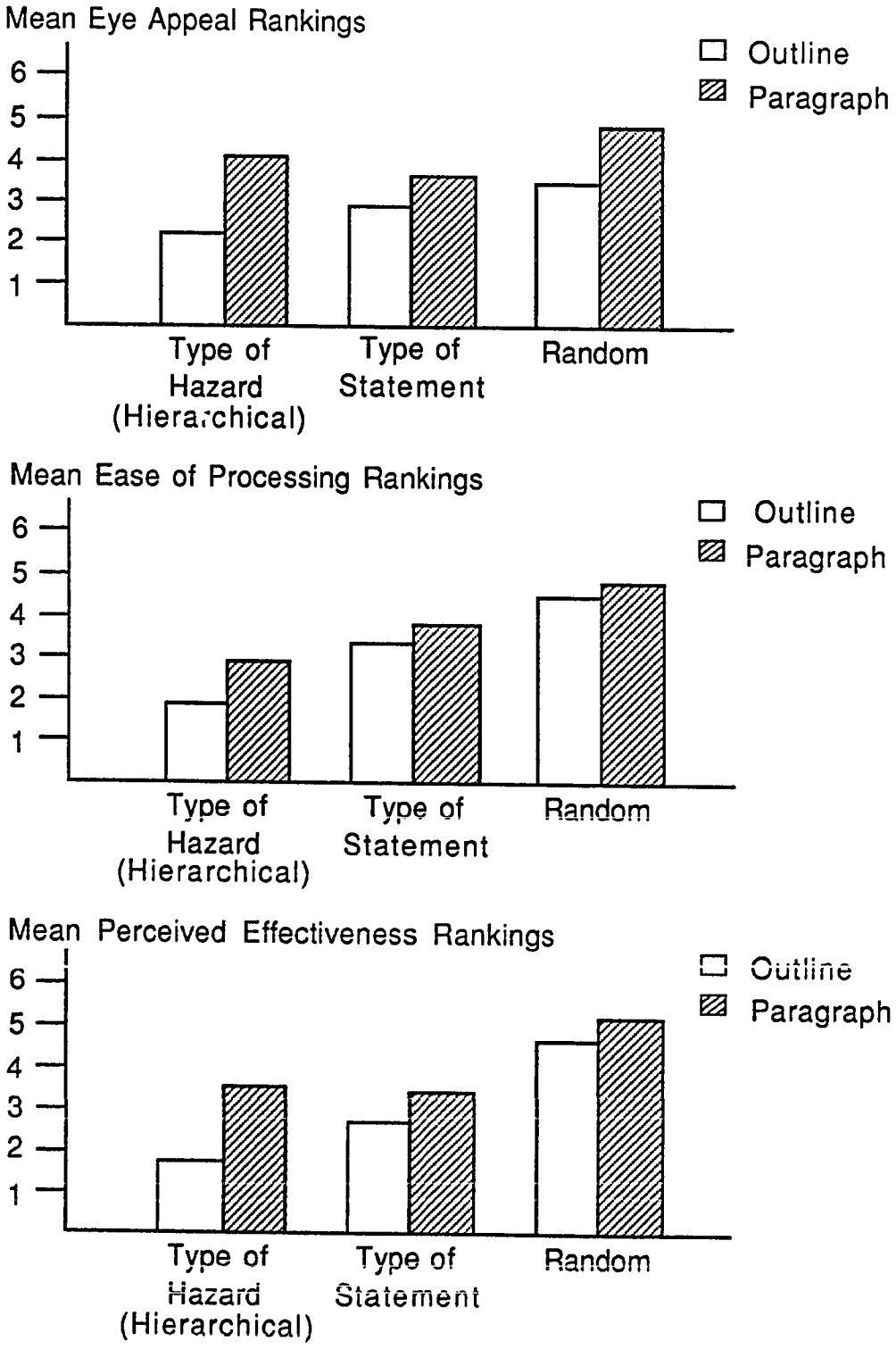

Figure 1. Rankings as a Function of Organization and Layout.

Note. Higher scores indicate lower perception of attribute.

hierarchical organization do not reliably differ from those with type of statement organization $F(1,34)= 1.70$, $p=.20$.

Analyses of the simple effects of organization in the paragraph condition indicate that warnings with hierarchical organization were ranked as having greater eye appeal than warnings with random organization, $F(1,34)= 33.20$, $p<0001$. In contrast to the outline condition, warnings in type of statement organization were ranked as having greater eye appeal than hierarchically and randomly organized warnings, $F(1,34)=5.81$, $p<.02$, and $F(1,34)=66.79$, $p<.0001$, respectively.

The effects of organization in the paragraph layout are surprising given the subtle differences in appearance of paragraph warnings. A potential explanation is available in the post-experiment comments made by several subjects. A number of subjects reported that their preference for the type of statement organization was based upon their observation that all of the capitalized statements appeared at the very beginning of the warning. They had inferred the capitalized information to be the most important information and expressed their preference for this information to be at the beginning of the warning. This would seem to indicate that although subjects were instructed to make rankings on the basis of eye appeal, an effectiveness criterion may have leaked into these rankings. Warnings that look best might be those warnings which look most effective.

In summary, an effect of layout was not surprising as this manipulation has the most dramatic effect on the appearance of the warning. The fact that outline warnings were ranked as having greater eye appeal than paragraph warnings is consistent with results obtained by Carver (1970), who found a preference for layouts with a vertical orientation. Although the effect of organization was anticipated in the outline condition, it is interesting that the effect was demonstrated in the paragraph layout. The cues to organization in the paragraph condition are more subtle. Finally, although the organized warnings were ranked as having more eye appeal, it is not known if these

warnings were recognized as being more organized.

Ease of Processing. Rankings were collapsed across products and subjects to obtain a mean ranking for each of the six versions of the warnings. A plot of the mean rankings is presented in the center portion of Figure 1.

The results obtained are similar to those obtained in the prior ranking tasks. Within each level of organization, subjects consistently rank warnings in outline layout as easier to read, understand, and remember than warnings in paragraph layout. In contrast to the eye appeal rankings, the effect of organization is more consistent across the layout manipulation. In both outline and layout conditions, warnings in hierarchical organization are ranked as easier to process than those in type of statement organization, which are ranked as easier to process than warnings with random organization.

A two way of analysis of variance indicates the main effect of organization is significant, $F(2,34)=33.54$, $p<.0001$ while the main effect of layout approaches significance, $F(1,17)=4.09$, $p=.06$. There is, however, a significant organization by layout interaction $F(2,34)=3.81$, $p=.03$.

Tests of the simple main effects of organization indicate that the effect of this variable is signifcant in both the outline, $F(2,34)=32.22$, $p<.0001$, and paragraph condition, $F(2,34)=22.49$, $p<.0001$. In the outline layout, the hierarchically organized warnings are ranked as easier to process than the warnings with type of statement organization, $F(1,34)=19.58$, $p<.0001$, which are ranked as easier to process than warnings with random organization, $F(1,34)=13.65$, $p<.001$. The same pattern of results is obtained for warnings in the paragraph condition. Hierarchically organized warnings are ranked as easier to process than the warnings with type of statement organization, $F(1,34)=9.83$, $p<.003$, which are ranked as easier to process than warnings with random organization, $F(1,34)=12.72$, $p<.001$.

Analyses of the simple effects of layout indicate that the effect of organization is significant only in the hierarchical organization, $F(1,17)=6.43$, $p<.02$.

The rankings obtained in this task present a readily interpretable pattern of results. The task required subjects to focus on the readability, comprehensibilty, and memorability of the warnings. Organization, which has been shown to effect these variables, is consequently reflected in the ranking of the warnings. The organized warnings, hierarchical and type of statement, were ranked better according to this criterion than randomly organized warnings.

It is interesting that between the organized warnings, hierarchically organized warnings were ranked as easier to process than warnings with type of statement organization. Although this finding is consistent with text organization research, it suggests that certain tradeoffs might be necessary in warning design. The use of type of statement organization might be considered preferable by some warning designers as it allows for the communication of the critical hazard statements at the very beginning of the warning. Indeed, a preference for such an organization was expressed by many subjects in the eye appeal rankings. However, rankings obtained in this task suggest that such an organization may not be the most effective in terms of ease of processing.

The effect of layout, expected to influence these variables by cueing to the reader the nature of the warning's organization, is only significant in the hierarchical organization. This likely indicates that outline layout presents a significant advantage over paragraph layout, only when there is a considerable amount of information about the text's organization to be conveyed. In the random organization conditions, layout provides little information as there is no organization to communicate. In the type of statement organization, layout is limited to reflecting that there are three categories of information; hazards, consequences, and instructions. However, with hierarchical organization, the outline layout conveys two to three times the amount of information provided in type of statement organization, by cueing the categories of information for each of the two or three hazards presented in the warning.

Perceived Effectiveness. Rankings were collapsed across subjects and products to obtain mean rankings for each of the six combinations of layout and organization. A plot of the mean rankings is provided in the bottom portion of Figure 1. As in in the prior ranking tasks, the data reveal that within each level of organization, warnings with outline layout are perceived as more effective than their paragraph counterparts. Similar to the rankings of eye appeal, the effect of organization appears to differ according to warning layout. While warnings with random organization are ranked as least effective in both layouts, the relationship between hierarchical and type of statement organizations changes across layout conditions.

A two way analysis of variance reveals a significant effect of organization, $F(2, 34)=48.40$, $p<.0001$, and a significant effect of layout, $F(1,17)=16.36$, $p=.0008$. However, the interaction between organization and layout, noted above, is significant, $F(2,34)=10.22$, $p=.0003$.

Analyses of the simple main effects of organization indicate a significant effect of organization in both outline, $F(2,34)=42.01$, $p<0001$, and paragraph conditions, $F(2,34)=33.19$, $p<.0001$. In the outline layout the hierarchically organized warnings are ranked as easier to process than the warnings with type of statement organization, $F(1,34)=8.76$, $p=.006$, which are ranked as easier to process than warnings with random organization, $F(1,34)=80.87$, $p<.0001$.

A different pattern of results is obtained for warnings in the paragraph condition. Hierarchically organized warnings are ranked as easier to process than the warnings with random organization, $F(1,34)=47.11$, $p<.0001$, but are not ranked significantly different from warnings with type of statement organization, $F(1,34)=0.14$, $p=.71$ In fact, warnings with type of statement organization were actually perceived as somewhat more effective than the hierarchically organized warnings.

Analyses of the simple effects of layout indicate that rankings of warnings in outline layout differ reliably from those in paragraph layout in all three

warning organization condtions ($p<.05$).

Summary

The pattern of results obtained in the perceived effectiveness rankings is highly similar to those obtained in the eye appeal and ease of processing rankings. This similarity is in essence an interesting aspect of these data. Although the similarities by no means prove that perceived effectiveness is a function of layout and organization, these data are consistent with such a hypothesis.

Experiment 2. Warning Recall - Recall Under Controlled Exposure Durations.

The ease of processing ranking in Experiment 1 is designed to provide an index of the likelihood of a warning being read. The dependent measure in Experiment 2 is also intended to provide an index of the likelihood that a warning will be read. The assumption is made that warnings perceived as easy to read and remember are more likely to be read than those that appear more difficult, given all other factors are held constant. In contrast to the ease of processing ranking task of Experiment 1, it is a more objective measure of the actual ease of processing a warning.

Method

Materials

The stimuli used in this experiment are identical to those of the ease of processing and effectiveness ranking tasks. The presentation method, however, differed from Experiment 1. The stimuli were presented via overhead projector in order to control the time subjects had for viewing the warnings.

For this experiment a "product perceptions" questionnaire was adapted from a prior study which investigated the relationship between product perceptions and the likelihood of reading a warning (Wogalter, Desaulniers, and Breisford, 1986). The questionnaire required subjects to make judgements about the product including: how familiar they were with the product, how often

they had used that type of product, and how dangerous they perceived the product to be. A copy of the questionnaire is provided in Appendix D.

Six fill in the blank "warning content" questionnaires were developed, one for each product warning. The number of items in each questionnaire varied according to the amount of information contained in the warning. The number of questions on each warning ranged from 14 to 21. Each question required from one to five responses. A "warning content" questionnaire is contained in Appendix E for each of the six products.

An attempt was made to avoid replicating the wording of the warning in the questions. Thus subjects were required to understand the warning rather than to commit it to rote memorization. Each item was pretested to eliminate ambiguous questions which could have more than one correct answer. Where this was not possible, a finite set of correct responses was defined prior to the experiment.

Design

The experiment was conducted as a 2 X 2 X 3 mixed design. The independent variables were duration of exposure (2 levels), layout (2 levels), and organization (3 levels). Duration of exposure was manipulated as a between subjects variable whereas layout and organization were manipulated within subjects. The dependent measure was performance on the warning content questionnaire.

Each subject participated in six trials. A trial consisted of viewing a warning for the given period of time, answering the "product perceptions" questionnaire, and answering the relevant "warning content" questionnaire.

The manipulation of exposure duration was included in this task as it was hypothesized that an outline layout might afford greater benefits under time pressure conditions, where rapid information extraction is required. The two levels of exposure duration were More Than Average amount of time to read the warning (MTA), or Less Than Average amout of time to read the warning (LTA). The average amount of time to read each warning was determined in a

pilot study. In the pilot study, subjects were allowed to self pace their reading of the warning so that, in their judgement, they had sufficient understanding of the warning to use it in a safe manner. Reading times were recorded and the average reading times and standard deviations in reading times were calculated for each warning separately. The MTA condition was then defined as one standard deviation above the average time to read each warning and the LTA condition as one standard deviation below the average reading time.

The "product perceptions" questionnaire served two purposes: 1) it acted as filler task between viewing the warning and answering questions about the warning content, 2) it provided information about prior experiences and perceptions which might influence their performance on the recall task. The "product perceptions" questionnaire was presented via an overhead projector. Thus the experimenter was able to control the display time for this questionnaire and thereby control the amount of time between display of the warning stimuli and the start of responses to the "warning content" questionnaire.

Three versions of each of the six "warning content" questionnaires were employed in the study. Each version contained the same items but presented them in a different random order. The "warning content" questionnaire was presented as a small booklet with one question per page. This was done to encourage the subjects to answer the questions in the order they were provided. Item order effects were controlled for in this manner.

Order effects due to products (warning content) were controlled for by counterbalancing across subject groups using a Latin square design. Order effects due to the sequencing of warning design conditions were controlled for in the same manner. Thus each organization-layout combination and content condition appeared equally often in each serial position. Across the six trials for a given group, each of the six product warnings and organization-layout combination appeared only once.

Subjects

Thirty-six undergraduate students from the University of Houston participated in this experiment. They received extra credit in psychology courses for their participation.

Procedure

At the beginning of the experiment subjects were informed that they would be participating in a study designed to evaluate warning effectiveness. During the course of the experiment they would be shown warnings for six different products. Following the presentation of each warning they would be expected to answer general questions about the product and specific questions about information contained in the warning. Thus they should read the warning as carefully as possible.

Subjects were told which exposure duration condition they were in and were given a practice trial in order to familiarize them with the type of warning stimuli and amount of time pressure they would be under. Following presentation of the sample warning stimuli the "product perception" questionnaire was displayed on the screen. Sample questions were then displayed to familiarize subjects with the type of questions contained in the question booklets. Finally, the experimenter stressed that they should not respond on the basis of guesses or prior knowledge. Rather, they should respond solely upon what they recall reading in the warning.

At the beginning of each trial the experimenter told the subjects which product the warning would be addressing. The subjects were also told how many seconds that they would have to read the warning. The warning was then projected on the screen for the allotted time.

Immediately following the presentation of the warning stimuli the "product perception" questionnaire was projected. Following the one and a half minutes provided to answer the "product perception" questionnaire, the subjects were allowed to answer the "warning content" questionnaire. A maximum of three subjects participated in each session and each subject's "warning content"

questionnaire presented the questions in a different random order. Subjects were allowed ten minutes to complete this questionnaire.

Results and Discussion

Results of Experiment 2 are presented in Figure 2. Mean recall scores are graphed as a function of organization, outline, and exposure duration. As expected, subjects in the MTA time condition, on average, scored higher on the test of recall than did subjects in the LTA time condition. The graph suggests a tendency for warnings in outline layout to elicit somewhat higher recall scores than warnings in paragraph layout, and for warnings with type of statement organization to elicit lower recall scores than either heirarchical or random organizations. However, the effects of organization and layout appear to interact with each other as well as vary across conditions of exposure duration.

The results of a 2 X 2 X 3 mixed effects analysis of variance indicate that the effect of exposure duration was significant, $F(1,34)=4.55$, $p=.04$. Thus the exposure duration manipulation produced reliably different levels of performance on the warning content questionnaire. Although the effects of layout and organization appear to differ across conditions of exposure duration, the interaction of organization, layout, and exposure duration was found to be non-significant, $F(2,68)=1.00$, $p=.38$. Tests of all two-way interactions were also non-significant. ($p>.10$).

As noted above, warnings with type of statement organization consistently elicited the lowest levels of recall. Although, this effect only approached significance, $F(2,68)=2.51$, $p=.09$, it is interesting to note the warnings with type of statement organization elicited levels of recall lower than those elicited by randomly organized warnings.

The effect of layout was not statistically significant, $F(1,34)=2.24$, $p=.14$. The observed effects of layout tended to be rather modest, typically ranging from no difference to one point, where the mean score for the test was approximately 12 points. However, the hierarchically organized outline warnings elicited scores nearly two points higher than the hierarchical

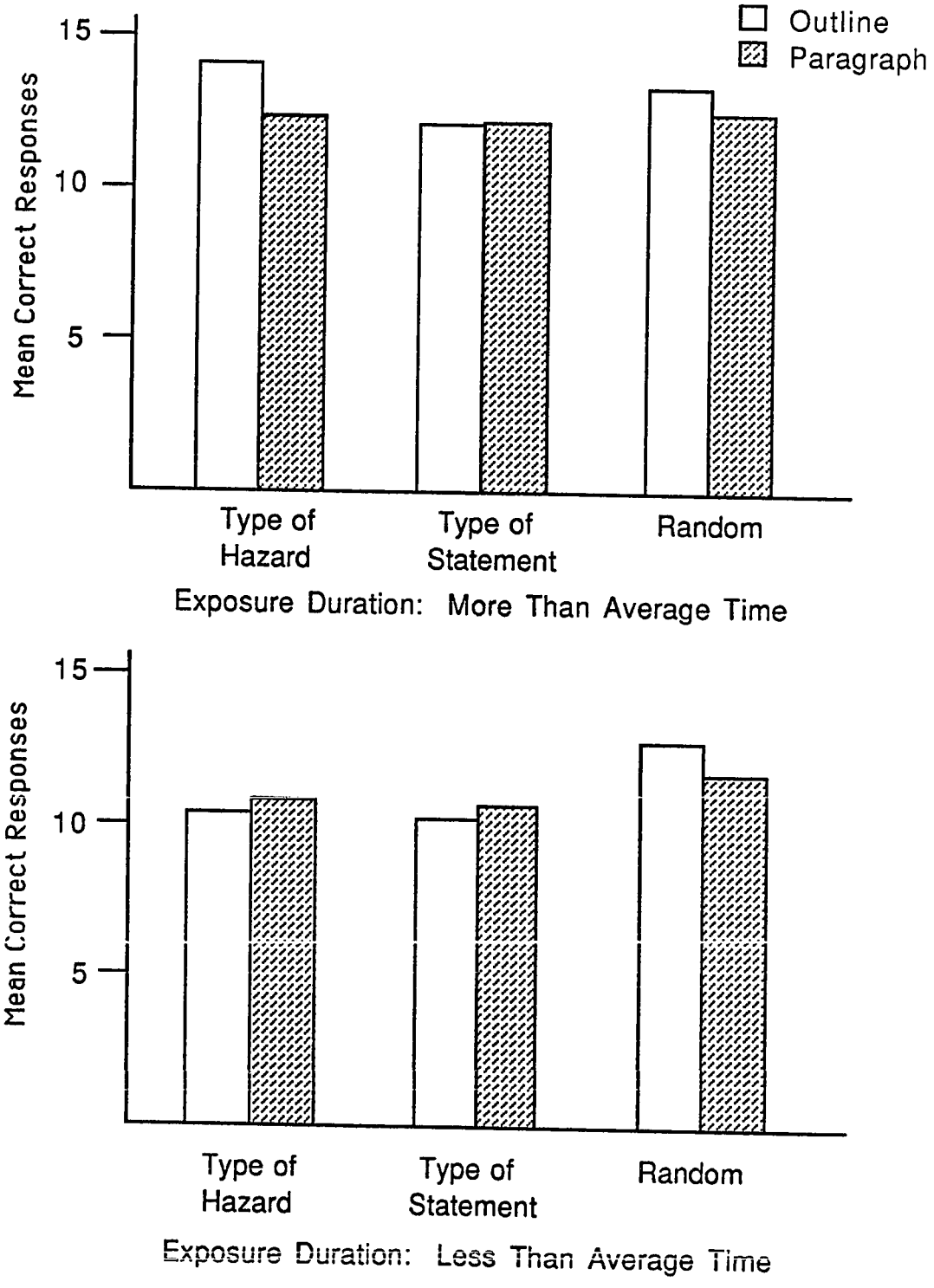

Figure 2. Mean Recall Scores as a Function of, Layout, Organization, and Exposure Duration.

paragraph warnings and both the paragraph and outline versions of warnings in type of statement organization. Although this represents a difference of approximately 15% in total recall, the differences are not reliable. Closer examination of cell means reveals that scores in all conditions were highly variable, (average SD≈ 4.0).

In summary, little can be concluded concerning the effects of organization and layout based upon these data. Although the data hint that some effects may be present, the high degree of variability in these data indicate that alternative methods of testing for the potential effects are likely to be necessary.

Experiment 3. Warning Behavior - Reading Rate, Compliance and Recall in an Incidental Warning Paradigm.

Experiments 1 and 2 present two methods and types of data from which one can address the influence of layout and organization on warning communication. Experiment 3 addresses these same issues through yet another methodology yielding data unique to Experiments 1 and 2.

In Experiment 2 the experimenter controlled the amount of time that subjects were allowed to read the warning. In contrast, Experiment 3 subjects read the warning as an incidental task. Subjects read the warning at their own pace and measures of reading behavior and ability to recall the warning information are obtained. Thus the experiment presents a third method and type of data addressing the influence of layout on warning communication. Additionally it presents the opportunity to assess the relative merits of warning perceptions, recall, and reading behavior in predicting the tendancy to read warnings.

Method

Materials

The experiment was carried out under the cover story that a pump spray dispensor was being evaluated as an alternative method of applying fabric protector, a product traditionally dispensed as an aerosol.

The warning for this experiment was the Fabric Protector warning employed in both Experiments 1 and 2. Only two versions of this warning were used. Both warning versions had hierarchical organization, one in paragraph layout, the other in outline layout.

Warnings were presented to subjects in a packet comprised of an information release form, a page of product usage instructions, and a page containing the warning. The pages were always arranged in the order listed and presented to the subject in a manila envelope. The materials were presented in 10-point Roman font and printed on a laser writer. These materials are reproduced in Appendix F.

The information release form requested authorization to release a subject's data to the bogus company sponsoring the research. Thus the form enhanced the cover story that the reseach was being done for a local manufacturer interested in marketing fabric protector.

The instructions for proper use of the product were adapted from the same brand of fabric protector used in the development of the warning. Minor modifications of the instructions were necesary in order to eliminate any reference to the product as an aerosol.

The pump spray container used in the scenario was an opaque white plastic container, no label was provided on the container. To avoid exposing subjects to the real hazards of fabric protectors the spray bottle was filled with water. A small amount of mouthwash was added to scent the spray, thus providing subjects with olfactory feedback suggesting the presence of a chemical in the spray.

The final phase of the experiment employed a "consumer reaction" questionnaire. The questionnaire was in fact a composite of several "dummy" questions concerning their reaction to the product, the "product perceptions" questionnaire and the "warning content" questionnaire.

The experiment took place in a small experimental cubicle, approximately six feet wide and eight feet deep. An uphostered chair, to which the fabric

protector would be applied, was placed in the rear corner of the cubicle. An electric fan was placed one foot from the chair so as to be in plain view when the subject was to begin applying the fabric protector. The cubicle also contained a small table and a metal chair at which subjects sat while reading the information in the manila envelope. The table and chair were postioned directly in front of a one way mirror to facilitate observation of the subjects reading behavior.

Design

The experiment was designed to provide a simple comparison of the two levels of layout, paragraph and outline, for the hierarchical organization condition of the fabric protector warning. The dependent variables were reading rate, warning compliance, and cued recall.

Reading rates were obtained for both the instructions (page 2), and the warning (page 3), of the packet each subject received. The information release (page 1), was provided as a filler task to allow the experimenter sufficient time to return to the observation window and prepare to record the subjects reading times. Reading times were recorded with a stop watch and began as soon as subjects turned to the page. Reading times stopped as soon as subjects turned to the next page or turned their head away from the page to examine the product, chair, or some aspect of the room.

The specific hazard addressed by the warning, and portrayed by the experimental situation, was the use of the fabric protector in a small and poorly ventilated room. Consequently the behaviors recorded as warning compliance were: 1) opening of the door to the cubicle, 2) turning on the fan in conjunction with opening the door, and 3) moving the chair out of the cubicle to complete the task where better ventilation was available. Requests for permission to do any of the above behaviors were recorded as warning compliance. A fourth category of behavior, complaints, was recorded when subjects completed the task in the enclosed room and then stated that subjects should be allowed to do one of the three behaviors recorded above.

The measure of cued recall was the same "warning content" questionnaire used Experiment 2. The recall measure was obtained after they had finished using the product. Thus the delay between reading and recall is approximately ten minutes in Experiment 3 as opposed to one and a half minutes in Experiment 2.

Subjects

Forty-eight Rice University undergraduates participated in the experiment and received extra credit in psychology courses for their participation. Subjects were divided evenly and randomly into the two warning layout conditions.

Procedure

Upon reporting for the experiment, subjects were told that a local manufacturer had requested a study to be conducted to assess the design of a pump spray bottle. The bottle was to be used for the purpose of applying a fabric protector which would soon be marketed as a household product. The manufacturer was concerned about the adequacy of their instructions and user acceptance of a pump spray as an alternative to the traditional aerosol dispensor.

Several hand measurements and a brief medical history concerning any injuries or medical conditions (e.g. arthritis) which might influence the subjects ability to use their hands were obtained. This information was recorded on anotomical sketches of the human hand. These manipulations were included to add further credibilty to the cover story.

In the course of obtaining the brief medical history, subjects were told that the fabric protector had an alcohol base, thus it was necessary to know if they were allergic to alcohol. This question was asked to reinforce the idea that subjects would be using actual fabric protector. At this time subjects were lead to the experimental cubicle containing the uphostered chair, pump spray bottle, and manila envelope. It was explained that the chair represented a piece of furniture smaller than most pieces of furniture to which the product would likely be applied. Consequently the fabric protector was to be applied twice to the

entire chair in order to simulate application of the product to a larger piece of furniture. The actual purpose of these instructions was to create a situation where the amount of spray to be applied created a serious hazard had actual fabric protector been used.

Subjects were then directed to take a seat at the desk and the manila envelope was placed before them. They were told that the packet contained a release of information form, which they were to sign, and information that would appear on the product when it is marketed. It was explained that the latter information was provided so that they would have the same information that the consumer will have and thus enable them to simulate home usage.

The experimenter then told the subjects that he/she was going to the next room to complete some paper work. When they were ready to begin applying the product they should knock on the observation window so that the experimenter could make observations on how the product was being applied. This statement was made so that subjects would not suspect that they were being observed during the time they were reading the materials.

As the experimenter left, the door of the experimental cubicle was closed, thus enhancing the hazard situation.

Once subjects had completed application of the fabric protector to the chair they were asked to complete the "consumer reaction" questionnaire. Subjects were led to believe that the purpose of the questionnaire was to assess their opinions of the pump spray and the adequacy of the information to be provided with the product. The experimental session lasted approximately 45 minutes.

Results and Discussion

Prior to analyzing the results of the reading time, recall, and compliance measures, the paragraph and outline groups were compared on their ratings of familiarity with fabric protector products. This comparison was made to ensure that differences that might be found between the two groups on the dependent measures of interest, might not be simply due to a familiarity effect (Godfrey,

Allender, and Laughery, 1983; Wogalter, Desaulniers, and Brelsford, 1986).

Examination of the distributions of ratings of familiarity, and responses to the "frequency of use" and "last time they had used the product" questions revealed nearly identical distributions. Responses to the question, "Have you ever used this type of product before?", indicated that 9 of the 24 subjects in the paragraph condition and 11 of the 24 subjects in the outline condition had previously used a fabric protector type product. Thus the results of the four measures of familiarity suggested that comparisons could be made on the dependent measures without concern for a confound in effects due to differential familiarity.

Reading Times. The time spent reading the instructions page and the time spent reading the warning page were recorded for each subject. The instructions page was presented to both groups in paragraph layout, and thus served as a baseline measure.

Regarding the reading time data, the reader should note that although the experimenter directed the subjects to read the instructions and the warning, subjects were left in the cubicle, unsupervised. Thus they were free to carry out these instructions to whatever extent they chose. The false idea that their reading behavior was not being supervised was intentionally reinforced by: 1) the experimenter telling the subject that he would be in the next room doing paperwork and, 2) therefore asking the subject to knock on the one-way mirror when done reading and ready to begin applying the fabric protector.

The mean time spent reading the instructions is 53.1 seconds for the subjects in the outline warning condition and 53.4 seconds for subjects in the paragraph warning condition. Thus it is immediately apparent that the two groups are nearly identical on the baseline measure, the average amount of time reading the instructions , $t(46)=.05$, $p=.96$. Comparing the mean reading times for the warning, it would also appear that the outline and paragraph conditions differ very little on the time measure of interest. The outline warning was read for an average of 34.6 seconds and the paragraph warning was read

for an average of 32.2 seconds, $t(46)=.59$, $p=.56$.

Although there is very little difference in average time reading the warning under these two conditions of layout, the distribution of warning reading times (see Figure 3) reveals that the paragraph condition has a somewhat flatter distribution of reading times than the outline condition. One apparent difference is that there are four subjects with reading times under 20 seconds in the paragraph condition and no subjects with such low reading times in the outline conditions.

To pursue this finding further, the reading times of each subject were converted to words per minute (wpm) reading rates. Reading rates were calculated separately for the instructions page and warning page. The calculations are based on the assumption that each subject read the entire entire set of instructions and the entire warning. This is an assumption which will subsequently come into question.

Frequency distributions of instruction reading rates for both outline and paragraph conditions are provided in Figure 4. The shapes and loci of the distributions suggest that subjects in the two experimental conditions responded quite similarly to the instructions page. Figure 5 provides the frequency distributions of warning reading rates for the outline and paragraph conditions respectively. It is clear that reading rates for the warning in outline layout appear to be normally distributed, very similar to the distributions obtained for the instructions. The mean reading rate simply increased by approximately 50 words per minute. In contrast, the distribution of reading rates for the warning in paragraph layout is positively skewed.

Referring back to Figure 4, one will observe that the reading rates for the instructions were all under 350 words per minute. In contrast, eight subjects read the paragraph warning at rates in excess of 350 words per minute as compared to only two subjects in the outline condition. One cannot conclude that paragraph warnings facilitate higher reading rates. In fact, the median

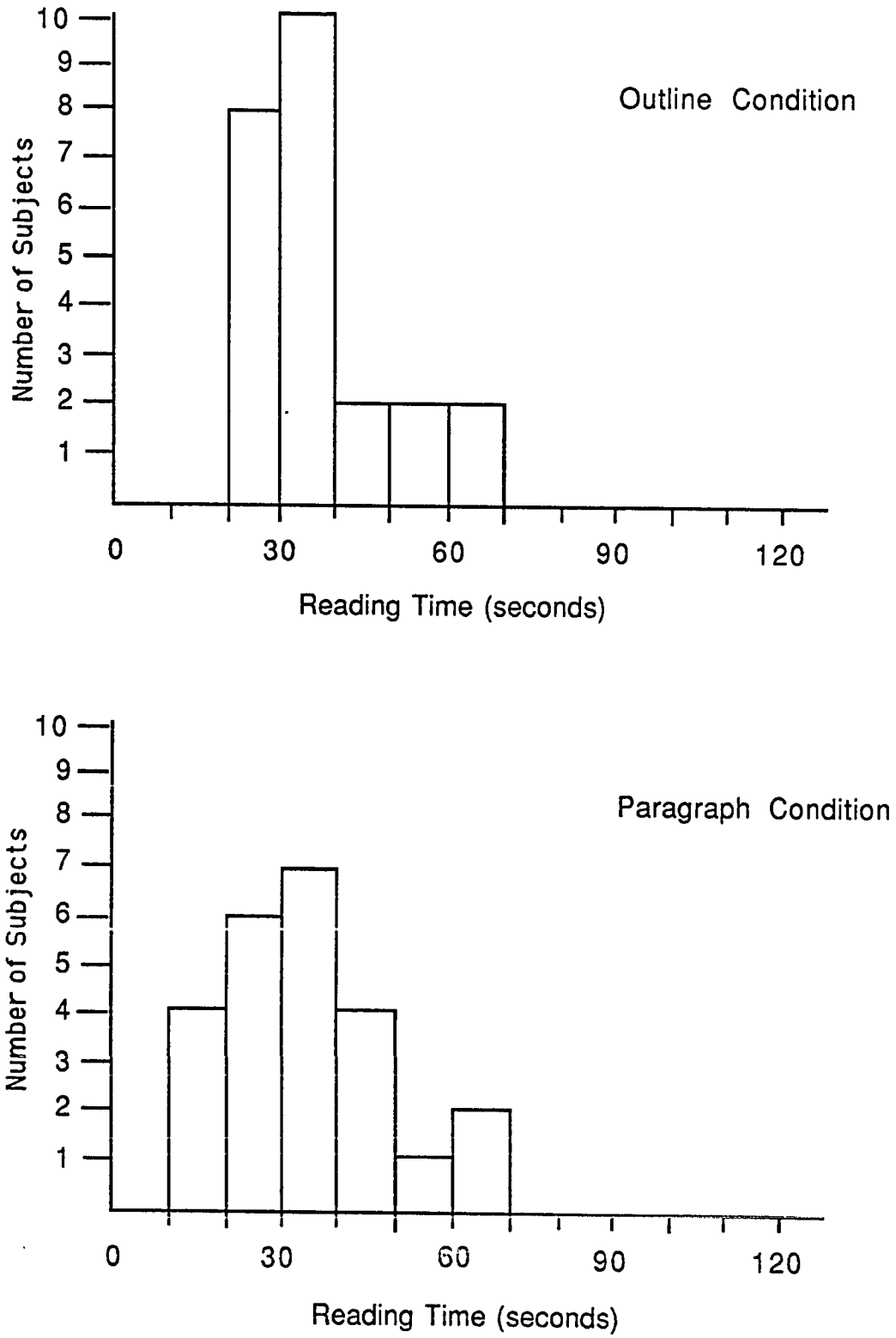

Figure 3. Warning Reading Times as a Function of Layout.

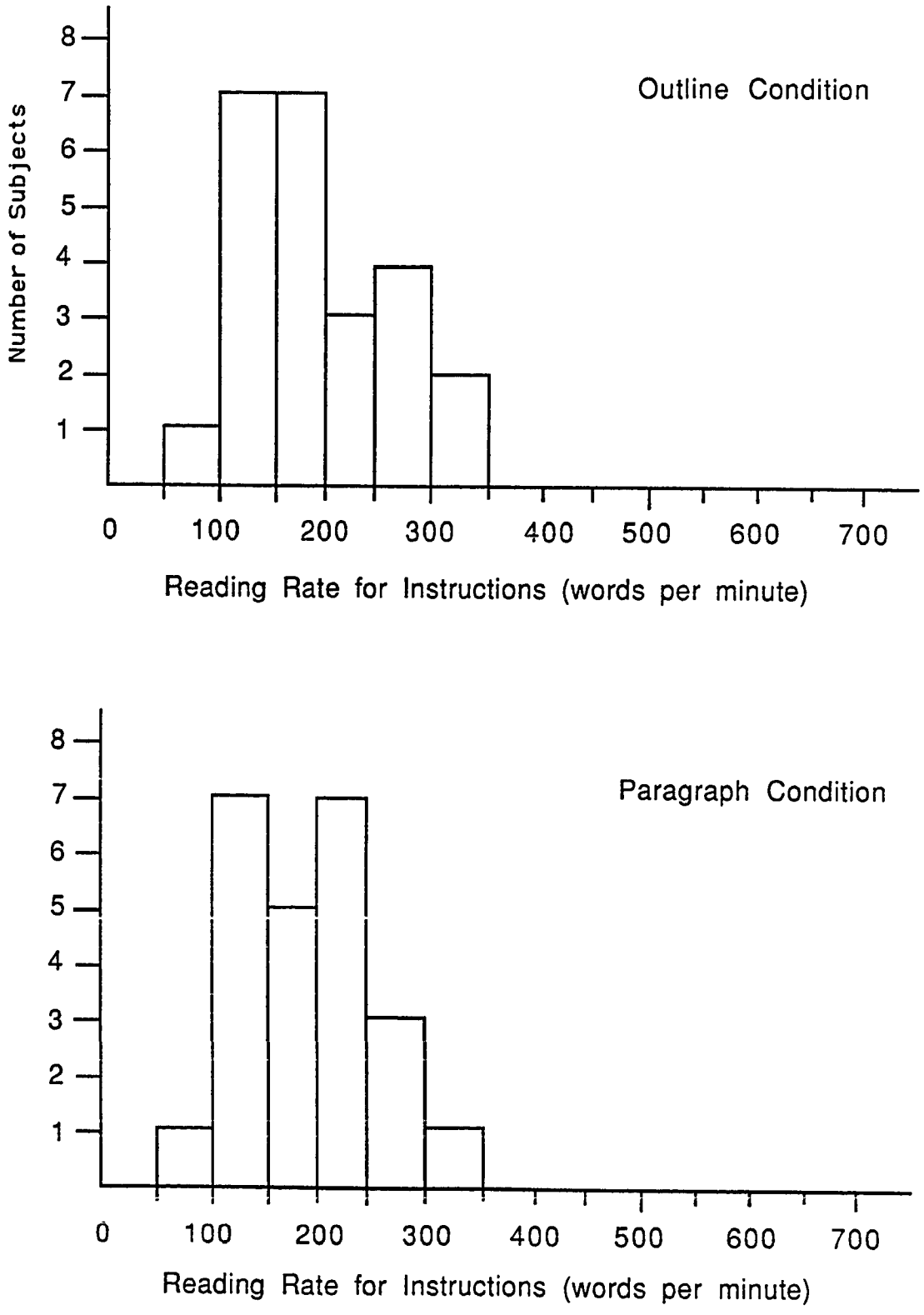

Figure 4. Instruction Reading Rates as a Function of Warning Layout.

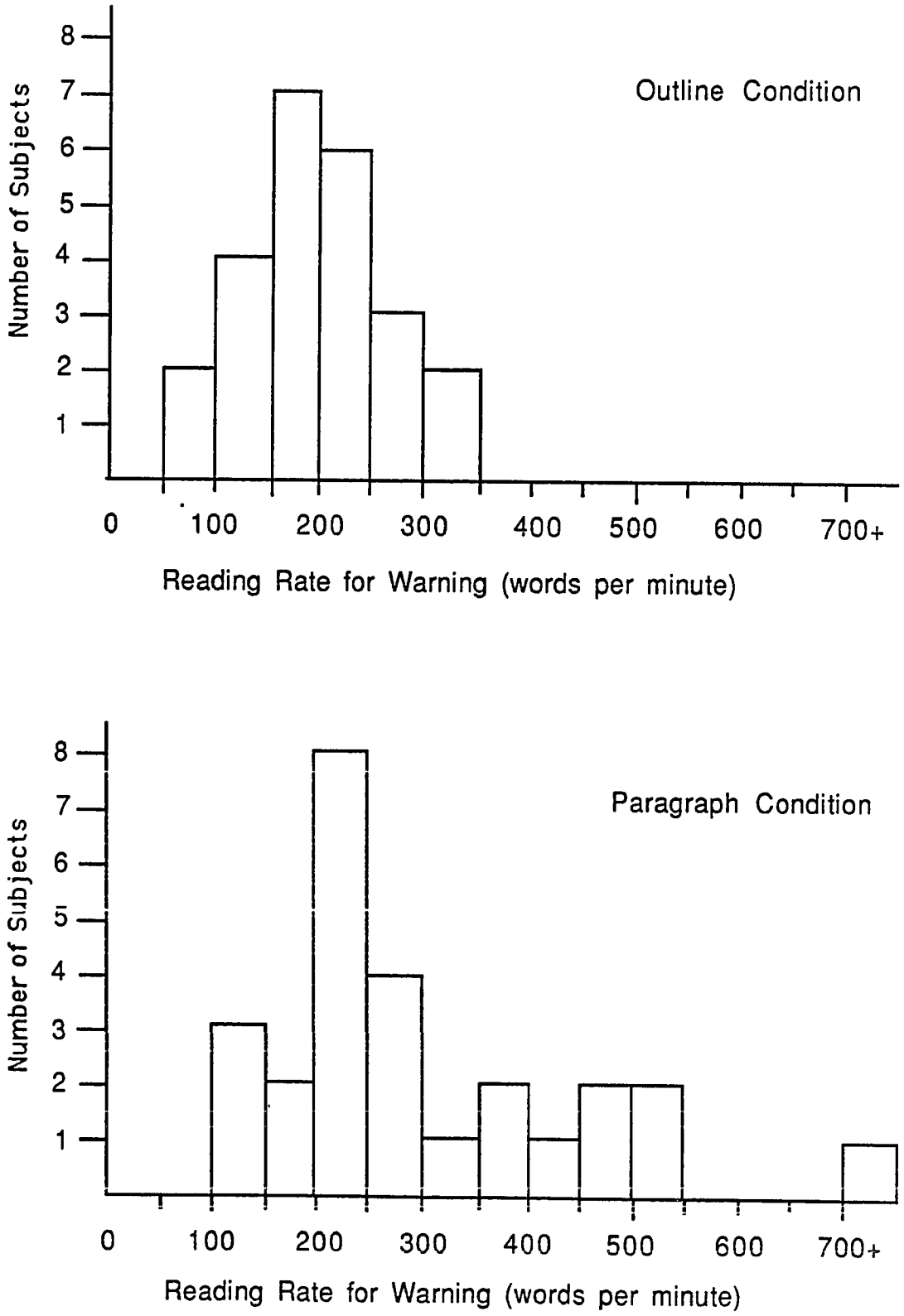

Figure 5. Warning Reading Rates as a Function of Layout.

reading rates for the paragraph and outline are quite similar, 244 and 230 wpm respectively. Rather, the paragraph layout produces greater variability in reading behavior. A test of the equality of the reading rate variances for alternative warning layouts indicated a significantly larger variance for the paragraph reading rate, $F(23,23)=4.32$, $p=.0009$.

One must ask if the subjects at the higher reading rates were in fact reading the warning, or were "skimming" the warning. Data collected in a pilot study of Experiment 2 suggests that those subjects who were reading the warning at rates in excess of 450 wpm may not have been reading for full comprehension. Nine subjects, from the same subject population used in this experiment, were asked to read warnings for six products. The six warnings included the fabric protector warning used in this experiment. Those subjects were told to read the warnings at their own pace, such that they could use the products in a safe manner. The mean reading rate for the fabric protector warning was 252 wpm, (SD = 82 wpm), the highest reading rate for this warning was 412 wpm. Similar reading rates were obtained for the warnings of the other five products.

Although caution must be taken in interpreting the above findings, the reading rates from the instructions page and Experiment 2 pilot research suggest that reading rates in the range of 250 wpm were appropriate for this subject population reading this material for full comprehension. Consequently reading rates in considerable excess of 250 wpm may be indicative of skimming, rather than reading for maximum comprehension. As such cases primarily occur with the paragraph layout, one must question whether the solid block of text presented by the paragraph layout encourages such skimming behavior to a greater degree than the outline layout.

Recall. The mean recall score for subjects in the outline condition is 9.68 (SD =3.95) and the mean score for paragraph warnings is 10.12 (SD =4.08). The difference between these means is not statistically reliable, $t(46)=.45$, $p=.65$. As in the comprehension scores obtained in Experiment 2, the high variability

of these scores does not allow one to infer an effect of layout on recall. Unfortunately, due to time constraints and subject availability, data for Experiments 1 and 2 were collected concomitantly. Consequently, the limitations of the recall measures were not recognized until both experiments were completed.

Warning Compliance. The number of subjects eliciting at least one warning compliance behavior was almost identical for the the two warning conditions. In the outline warning condition 11 of the 25 subjects complied with the warning and in the paragraph warning condition 10 of the 25 subjects complied with the warning. The similarity in compliance rates is not surprising given that subjects were instructed read the warning.

The four measures of warning compliance; use of the fan, opening of the cubicle door, moving the chair out of the cubicle before application, and complaints concerning the safety of the procedure, are provided in Table 2. The numbers represent the frequencies with which the compliance behaviors

Table 2

Number of Compliant Subjects and Frequency of Compliance Behaviors as a Function of Warning Layout

	Subjects		Behavior			
Layout	Complied with warning	Did not Comply	Used Fan	Opened Door	Left Room	Questioned Safety
Outline	11	14	2	7	1	2
Paragraph	10	15	6	8	0	1

Note. One subject in the outline condition and five subjects in the paragraph condition opened the door and used the fan.

were observed in each warning condition. One will note that the number of behaviors recorded is larger than the number of subjects recorded as in compliance. This is the result of some subjects having elicited more than one recordable behavior.

In general, the outline and paragraph warnings elicited highly similar patterns of frequencies across the four measures of compliance. Subjects having read the paragraph warning tended to use the fan somewhat more frequently. However, a Chi square test indicates the difference in frequencies is not reliable, $\chi 2$ (1, n=48)=1.35, p>.20.

Experiment 4. Tendency to Read Warnings - Frequencies of Warnings Being Read in an Incidental Warning Paradigm.

The results of Experiment 3 suggested that how much of a warning is actually read, may depend on the format of the warning. The data, however, only suggested that this might be occuring, and strong conclusions could not be drawn. One of the primary objectives of Experiment 3 was to obtain reading rates under the two conditions of layout. Consequently, subjects were directly instructed to read the warnings. If paragraph and outline layouts do differ in the ability to elicit reading behavior, the instructions to read the warning may have created a ceiling effect, providing little opportunity for the layout effect to be expressed.

In Experiment 4 the directions to read the warning were omitted from the experimental procedures. Thus, subjects were left unsupervised to read the warning, or not read the warning, according to their own discretion. The experimental paradigm is nearly identical to that used in Experiment 3 with a few exceptions which are noted below.

Method

Materials

The instructions and warnings for this experiment were placed on a label on the product rather than on two sheets of paper as in Experiment 3. This

change was made due to concern that providing information on a separate piece of paper may not elicit behavior representative of people reading information on a product label. The instructions and warning were placed on the same label, the instructions presented at the top of the label. These labels are provided in Appendix G.

The print size of the label was reduced considerably in order to fit the information on the label. Care was taken to keep the print size as large as that provided in the actual label from which the warning and instructions were adapted. The print size is representative of that found on labels of many similar products. The label was covered with a plastic lamination to add to the credibility of the product container.

One important change was made to the warning in order to obtain a measure of whether or not the warning had been read. Prior to the last warning statement, the following sentence was inserted, "Do not use this product if you have read this far."

Design

The experiment was designed to provide a simple comparison of the two levels of layout, paragraph and outline. The effect of layout was tested using the hierarchical organization version of the fabric protector warning. The dependent variables were whether or not the warning was read, total time reading the label, and performance on an immediate free recall of the warning.

Two criterion were used in determining whether or not the warning was read. The warning was considered to have been read completely if the subject read the statement, "Do not use this product if you have read this far.", and subsequently brought this to the attention of the experimenter. The warning was considered to be read partially when the subject used the product, indicating the entire warning had not been read, but was capable of recalling specific consequence or instructions statements. In other words, although these subjectsd had not read the entire warning, they had read more than just the hazard statements presented in capital letters.

Free recall was scored according to a key determined prior to the outset of the experiment. Each warning was broken down into units of information essential to understanding the warning. The scoring key is reproduced in Appendix G.

Subjects

Fifty Rice University undergraduates participated in the experiment and received extra credit in psychology courses for their participation. Subjects were divided evenly and randomly into the outline and paragraph conditions.

Procedure

The procedure for this experiment is identical to the procedure used in Experiment 3 with the following exceptions. In this study the experimenter emphasized that subjects should use the product as if they were in their own home, applying the product to their brand new furniture. The experimenter then turned the bottle briefly such that the label was visible, but not readable, to the subject. He/she stated that the manufacturer had provided the same information on the bottle that would be provided when the product was actually marketed. Subjects were then told that they could refer to this information to enable them to simulate home usage.

Results and Discussion

As in Experiment 3, the paragraph and outline groups were compared on their ratings of familiarity with fabric protector products. The distribution of responses to the three familiarity questions were found to be highly similar for the two layout conditions. Nine of the 25 subjects in the paragraph condition and 7 of the 25 subjects in the outline condition had previously used a fabric protector-type product. These results suggested that comparisons could be made on the dependent measures without concern for a confound in effects due to differential familiarity.

Reading Frequencies. The frequency of subjects having read the warning partially, and the frequency of subjects not having read the warning at all, are provided in the first two columns of Table 6. Totaling the first two columns

reveals that approximately half the subjects did not read the warning, thus the ceiling effect, present in Experiment 3, is not a problem in these data. In their own right, these data are interesting in that they illustrate that 23 subjects, almost half, did not read the warning.

Cell frequencies in these columns reveal that a substantially larger proportion of the subjects given a warning in outline layout read, or at least partially read, the warning. A Chi square test of the difference in these proportions indicates that the difference is statistically significant, $\chi 2(1, n=50)=3.94, p<.05$.

The frequency of subjects having read the warning fully, and the frequency of subjects that did not read the entire warning, are provided in the last two columns of Table 6. In a few cases, subjects stopped reading the warning and refused to apply the fabric protector in the cubicle. These subjects were also recorded as having read the warning fully.

Table 3

Frequency of Subjects Reading Warning as a Function of Warning Layout

	Reading Behavior			
Layout	Partial or Complete Reading	Did not Read	Complete Reading (Did not use product)	Did not Read Completely (Used Product)
Outline	17	8	12	13
Paragraph	10	15	4	21

Totaling these columns one finds that less than a third of all subjects read the entire warning. Examining cell frequencies, one can see that while the outline warning was read by about half the subjects, the porportion reading the

paragraph warning was only 1 in 5. A Chi square test of the difference in these proportions indicates that the difference is significant, $\chi 2(1, n=50)=5.88$, $p<.05$.

Reading Rates. As in Experiment 3, the time for each subject to read the label was converted to a words per minute reading rate. Again, reading rates were calculated on the assumption that each subject read the entire warning. Although the data reported above do not support such an assumption, the method is helpful in comparing reading behavior under the two layout conditions.

Comparing label reading rates for all subjects, both those recorded as having read the warning partially and those that did not, reveals that the median reading rate is 275 wpm for the outline condition and 434 wpm for the paragraph condition. As stated in the caveat to the reading rate measure, the higher reading rate for the paragraph condition can not be taken to indicate that paragraphs were read more quickly. That is, the reading rates are likely inflated by those subjects who did not actually read the warning.

Indeed, when one examines the effect of layout for only those subjects who at least partially read the warning, the median reading rates are nearly identical. The median reading rate is 200 wpm for outline and 202 wpm for the paragraph condition. Thus it is clear that the inflated difference in reading rates was due to the larger proportion of subjects in the paragraph condition who did not read the warning.

In Experiment 3 it was suggested that reading rates in excess of 450 wpm were likely indicative of the tendancy to skim the warning rather than actually read it. Thirteen subjects in the paragraph condition of Experiment 4 had reading rates in excess of 450 wpm, none of these subjects were recorded as even partially reading the warning. Surprisingly, 9 subjects in the outline condition had reading rates in excess of 450 wpm, however, 5 of these subjects were recorded as having partially read the warning.

Free Recall. Comparing mean recall scores, subjects in the outline condition scored somewhat higher in free recall (M=3.04) than subjects in the

paragraph warning condition (M=1.88). However, given that the warning is read, subjects reading the paragraph warning (M=4.6) will remember just as much if not more than those subjects reading the warning in outline layout (M=4.5). Tests of the effect of layout in both these comparision are not significant; $t(48)=1.4$, $p>.10$, and $t(24)=.96$, $p>.10$, respectively.

To summarize, the results of Experiment 4 support the hypothesis that layout influences the likelihood that a warning will be read. Warnings with outline layout were read by a larger proportion of subjects than warnings in paragraph layout. Given that the warning is read, there is no evidence to suggest that layout influences the overall level of recall for the warning.

GENERAL DISCUSSION

In Experiment 1 the eye appeal ranking provided a measure of how layout and organization might affect one's "first glance" reaction to the warning. Stimuli which were devoid of meaningful content were used, the eye appeal stimuli simply presented the subjects with the shape of the information. The results indictate that the layout and organization manipulations do influence the shape of the information such that differential preferences for the eye appeal of warnings are obtained. Organized warnings with outline layout are ranked as having greater eye appeal than warnings randomly organized or in paragraph layout.

Ease of processing was the ranking criterion of primary interest in this study as this criterion was expected to be most highly related to whether or not a warning is ultimately read. If, in fact, the tendancy to read a warning is influenced by an informal utility analysis, it would seem likely that the benefits of reading a warning are weighed against the ease of processing it. The results of the second ranking task indicate that ease of processing is reliably influenced by the organization of the warning, hierarchically organized warnings were ranked as the easiest to process.

Layout was found to reliably effect perceptions of ease of processing only

in hierarchically organized warnings. It was hypothesized that the effect of layout was only exhibited in the hierarchically organized warnings because that organization presented the greatest amount of information to be conveyed, thus there was a larger difference in the amount of information cued by the alternative layouts. The paragraph layout provided no cues to the organization of the warning whereas the outline layout, through indentations, categorized the information by hazard, and by type of warning statement (i.e. hazard, consequence, and instruction).

The effectiveness rankings were included in Experiment 1 to provide a check for the possibility that the layout and organization manipulations might have an unforseen effect on the perceived effectiveness of the warning. There was concern that the manipulations might effect subjective criteria, other than eye appeal and ease of processing, which are important in subjective assesments of warnings.

The mean rankings obtained on the effectiveness criterion were noted to be very similar to those of eye appeal and ease of processing. Both layout and organization were found to influence perceptions of effectiveness, hierarchically organized warnings in outline layout being perceived as the most effective. The similarities in the results of the three ranking tasks suggest the possibility that both eye appeal and ease of processing directly influence perceptions of warning effectiveness. However, from these data it is not possible to determine the extent, if any, of the influence these factors have on the perceived effectiveness of warnings.

The results of the three ranking tasks indicate there is a degree of concensus among raters in terms of how the manipulations influenced eye appeal, ease of processing, and effectiveness. Although without such a concensus it is not likely that these manipulations would reliably influence warning effectiveness, one does not know if the differences in these mean rankings reflect a magnitude of effect of practical import.

Experiment 2 was conducted to assess more objectively the effects that

these manipulations would have on the ability to recall specific information that was presented in the warning. Unfortunately, the high degree of variance associated with the mean recall scores makes it difficult to assess the effects, if any, that the layout and organization manipulations had on recall. The only effect that was found to be statistically reliable was the effect of exposure duration. However, the effect of exposure duration was not of particular interest as the purpose of the manipulation was simply to observe how the effects of layout and organization might interact with this variable. The effects of layout and organization that were observed tended to be of modest size and inconsistent across conditions.

One interesting aspect of these data is that the type of statement organization consistently elicted the lowest levels of recall and randomly organized warnings elicited levels of recall comparable to those for warnings with hierarchical organization. Unless this effect is simply due to error variance, the pattern of means indicates that organization was of very little benefit in the recall task, and perhaps even acted as a handicap.

One potential explanation is that the organization of the warnings was not encoded, subjects simply treated each sentence as an independant item to be committed to rote memorization. From this perspective, organization simply influenced the serial order of presentation of the individual warning statements. Although Rothstein (1985) did not find evidence for a serial position effect in the recall of warning information, given such an effect were established, it would have important implications for warning design.

The results of the recall and compliance measures in Experiment 3 were not particularly interesting. The effect of layout was not expressed in either of these measures. The recall measure was the same as used in Experiment 2 and it is not clear if layout simply does not have an effect on recall or the test used was not sufficiently sensitive. The failure to obtain an effect of layout in the compliance measure was expected, as differential compliance rates were only expected to occur due to differential tendancies to actually read the

warning. Since subjects were directly instructed to read the warning, little opportunity was provided for differential compliance rates to be observed.

In contrast to recall and compliance, the reading rate measures provided an interesting comparison of the effects of layout on reading behavior. The two groups of subjects exhibited similar means and variances for instruction reading rates. However, manipulation of warning layout resulted in considerably greater variability in reading rates for warnings in paragraph layout than for warnings in outline layout. The argument was made that the higher reading rates observed for the paragraph warning likely reflected a tendancy to skim the warning rather than read the warning for maximum comprehension.

Experiment 4 extended the findings of Experiment 3 by allowing subjects greater personal discretion in determining the extent to which they read the warning. As a result, the effect of layout was demonstrated in the differential proportion of subjects who read the complete warning and therefore did not use the product. Subjects receiving the outline layout were more likely to read the entire warning than were subjects who received the paragraph warning.

The results of Experiment 4 are consistent with the conclusions drawn from the reading rate measures obtained in Experiment 3. In Experiment 3 the hypothesis was presented that the higher median reading rate for the paragraph layout simply reflected that subjects were skimming rather than reading. This hypothesis was supported in Experiment 4. By examining reading rates for only those subjects who were recorded as actually reading the warning, the reading rates for the two layouts were found to be nearly identical. As suspected, a very low proportion of subjects with reading rates in excess of 450 wpm were found to have actually read the warning.

To summarize, the results of these four experiments indicate that organization and layout can influence perceptions of a warning's eye appeal; how easily it can be read, understood, and remembered; and how effective the warning will be. There was little evidence to support the hypothesis that outline

layout and hierarchical organization will lead to higher levels of recall than the paragraph layout and alternative organizations tested in these experiments. However, results obtained in Experiments 3 and 4 indicate that layout can have a large influence the likelihood of a warning being read.

Further research should be considered which extends the current findings to a greater variety of products and testing environments. The effect of layout on the tendancy to read a warning should also be attempted with other organizations, such as type of statement organization. One will also recall that a large effect of organization was found in the ease of processing rankings. This suggests that the effect of organization on the likelihood of reading a warning should also be tested.

With respect to future research, the methodology developed in Experiments 3 and 4 might be considered a useful tool for conducting warnings research in a laboratory setting. A major stumbling block in the study of warning effectiveness has been the difficulty of creating a believable scenario which subjects believe to be potentially hazardous. It was apparent from the comments and behaviors elicited by subjects in these experiments that this methodology was successful in accomplishing this goal. It was common for subjects in Experiments 3 and 4 to develop distressed expressions on their faces as they read the warning, and often began to survey the ceiling and walls of the experimental cubicle for air vents. Post experiment debriefings revealed that nearly every subject was completely convinced by the cover story. One subject even asked for a free sample of the fabric protector!

In conclusion, the results of Experiments 3 and 4 have important implications for the design of consumer product warnings. The effect of layout on the tendency to read a warning is an important finding since the proportion of people who read a warning will largely determine the level of warning compliance one can expect. The results indicate that presenting warnings in outline layout will increase the likelihood that the warning will be read and consequently ehance the effectiveness of the warning.

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APPENDIX A

EXAMPLES OF PRODUCT WARNINGS

Hair Dryer Warning, Type of Hazard Organization, Outline Layout.

APPLIANCE IS NOT WATERPROOF.
- Electrocution can result if appliance becomes wet.
  - Do not place in or drop into water or other liquid.
    - Do not place or store hair dryer where it can fall or be pulled into tub or sink.
    - Do not use while bathing.
  - Do not reach for hair dryer if it has fallen into water.
    - If hair dryer has fallen into water unplug immediately.
  - Always unplug hair dryer immediately after using.

APPLIANCE PRODUCES EXTREME HEAT.
- Fires can be started by hairdryer.
  - Do not place hair dryer on any surface while it is operating.
    - Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked.
    - Never use while sleeping.
    - Keep the air openings free of lint and hair.
  - Do not operate in the presence of explosive and/or flammable fumes.
    - Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered.
- Skin can be seriously burned by hot air.
  - Do not direct hot air toward the eyes or other heat sensitive areas.
  - Never allow nozzle of hair dryer to contact skin for more than 15 seconds.

APPLIANCE HAS MOVING PARTS.
- Hair and motor can be damaged.
  - Keep your hair out of hair dryer.
    - Keep your hair away from the air inlets.
  - Never drop or insert any object into any opening.
    - When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.

Hair Dryer Warning, Type of Hazard Organization, Outline Layout.

DRILL IS ELECTRICAL.
- Misuse can result in electrocution.
  - Do not use power tool in damp or wet locations.
    - Do not expose power tool to rain.
  - Prevent body contact with grounded surfaces when using.
    - Do not touch pipes, radiators, ranges, refrigerator enclosures or other similar surfaces while drilling.
  - When drilling into wall do not touch metal part of drill in case you hit a live wire.
- Motor can be source of ignition.
  - Do not use in presence of flammable liquids or gases.

DRILL HAS MOVING PARTS.
- Materials can get caught in drill.
  - Do not wear loose clothing or jewelery when operating drill.
    - Wear protective hair covering to contain long hair.
  - Remove adjusting keys and wrenches before turning on.
- Fragments may fly from drilling surface.
  - Use safety glasses when drilling.
  - Use dust mask if operation is dusty.

DRILL CONTAINS RECHARGEABLE BATTERY.
- May leak caustic substance if damaged.
  - If battery leaks on skin wash it off immediately.
  - Neutralize battery leakage with mild acid, lemon, or vinegar.
  - If battery leakage gets in eyes flush with water for 5 minutes.

Steam Iron Warning, Type of Hazard Organization, Outline Layout.

APPLIANCE IS ELECTRICAL.

Misuse can result in electrocution.

Always disconnect from electrical outlet when filling with water or emptying and when not in use.

Do not immerse the iron in water or other liquids.

The iron should always be turned off before plugging or unplugging from outlet.

Do not operate if the iron has been dropped or damaged.

Do not dissassemble the iron, take it to a qualified service center for examination and repair.

Incorrect assembly can cause electric shock when iron is used.

PRODUCES EXTREME HEAT.

Serious burns or fire can result.

Let iron cool completely before putting away.

Close supervision is necessary when being used by or near children.

Do not leave iron unattended while connected or on ironing board.

Burns can occur from touching hot metal parts, hot water or steam.

Use caution when you turn a steam iron upside down, there may be hot water in the resevoir.

APPLIANCE USES 1200 WATTS.

May create circuit overload resulting in blown fuses or electrical fire.

Do not operate another high wattage appliance on the same circuit.

Do not use an extension cord unless absolutely necessary.

If extension cord is necessary, use a 10 ampere cord.

Cords rated for less amperage may overheat.

Insecticide Warning, Type of Hazard Organization, Outline Layout.

CONTENTS ARE TOXIC.
- Harmful if swallowed, inhaled or absorbed through skin.
  - (Atropine is antidotal.)
  - Do not apply to humans or pets.
    - Do not allow humans or pets to contact treated surfaces until dry.
  - Do not use as space spray.
    - Remove pets and cover fish bowls before spraying.
    - Do not spray food, water, dishes or utensils.
  - Wash thoroughly with soap and water after handling and before eating or smoking.

EXTREMELY FLAMMABLE.
- Do not use near fire, heated surfaces, sparks or flame.

CONTENTS UNDER PRESSURE.
- Heat or pressure can cause bursting.
  - Do not puncture or incinerate container.
  - Do not expose to temperature above 130°F

Fabric Protector Warning, Type of Hazard Organization, Outline Layout.

VAPOR / AIRBORNE MIST IS TOXIC.

Product use without ventilation in a closed area may also be harmful or fatal.

Keep small children and pets out of area until treatment has thoroughly dried.

Wait 60 minutes before spraying each can, if indoor application requires more than one can.

Maintain cross ventilation through use of fans, open windows and doors.

Do not use in small rooms, bathrooms or closets.

Do not spray into eyes, mouth, or onto skin.

CONTENTS ARE FLAMMABLE.

Product use near heat or flame can cause flash fire.

Keep spray and vapors away from heat sources and open flames such as ovens, furnaces, stoves, and dryers when in operation.

CONTENTS UNDER PRESSURE.

Container can burst if exposed to high temperatures or punctured.

Do not puncture, incinerate, or store at temperature above 120°F (49°C).

Pool Shock Warning, Type of Hazard Organization, Outline Layout.

CONTENTS ARE FLAMMABLE.
- Contamination may start a chemical reaction with:
- generation of heat,
- liberation of hazardous gases, and
- possible fire and explosion.
  - Mix only into water
    - Use only thoroughly clean dry utensils.
  - Store in cool dry well ventilated area away from heat
    - or open flame.
    - Keep product dry in tightly closed container when not in use.
    - Do not reuse empty container.
  - In case of contamination or decomposition, do not reseal
    - container.
    - If possible, isolate container in open and well ventilated area.
    - Flood with large volumes of water.

CONTENTS ARE CAUSTIC.
- Highly corrosive.
- Causes skin and eye damage.
- Irritating to nose and throat.
  - Do not get in eyes, on skin or on clothing.
    - Avoid breathing dust and fumes.
  - Do not handle with bare hands.
    - When handling, wear rubber gloves and goggles or face shield.
  - Remove and wash contaminated clothing before reuse.

CONTENTS ARE TOXIC.
- May be fatal if swallowed.
- This product is toxic to fish.
  - Do not contaminate lakes, streams or ponds by cleaning
    - of equipment or disposal of wastes.

APPENDIX B

EXAMPLES OF WARNING ORGANIZATIONS AND LAYOUTS

Type of Hazard Organization, Outline Layout.

APPLIANCE IS NOT WATERPROOF.
- Electrocution can result if appliance becomes wet.
  - Do not place in or drop into water or other liquid.
    - Do not place or store hair dryer where it can fall or be pulled into tub or sink.
    - Do not use while bathing.
  - Do not reach for hair dryer if it has fallen into water.
    - If hair dryer has fallen into water unplug immediately.
  - Always unplug hair dryer immediately after using.

APPLIANCE PRODUCES EXTREME HEAT.
- Fires can be started by hairdryer.
  - Do not place hair dryer on any surface while it is operating.
    - Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked.
    - Never use while sleeping.
    - Keep the air openings free of lint and hair.
  - Do not operate in the presence of explosive and/or flammable fumes.
    - Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered.
- Skin can be seriously burned by hot air.
  - Do not direct hot air toward the eyes or other heat sensitive areas.
  - Never allow nozzle of hair dryer to contact skin for more than 15 seconds.

APPLIANCE HAS MOVING PARTS.
- Hair and motor can be damaged.
  - Keep your hair out of hair dryer.
    - Keep your hair away from the air inlets.
  - Never drop or insert any object into any opening.
    - When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.

Type of Hazard Organization, Paragraph Layout.

APPLIANCE IS NOT WATERPROOF. Electrocution can result if appliance becomes wet. Do not place in or drop into water or other liquid. Do not place or store hair dryer where it can fall or be pulled into tub or sink. Do not use while bathing. Do not reach for hair dryer if it has fallen into water. If hair dryer has fallen into water unplug immediately. Always unplug hair dryer immediately after using. APPLIANCE PRODUCES EXTREME HEAT. Fires can be started by hairdryer. Do not place hair dryer on any surface while it is operating. Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked. Never use while sleeping. Keep the air openings free of lint and hair. Do not operate in the presence of explosive and/or flammable fumes. Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered. Skin can be seriously burned by hot air. Do not direct hot air toward the eyes or other heat sensitive areas. Never allow nozzle of hair dryer to contact skin for more than 15 seconds. APPLIANCE HAS MOVING PARTS. Hair and motor can be damaged. Keep your hair out of hair dryer. Keep your hair away from the air inlets. Never drop or insert any object into any opening. When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.

Type of Statement Organization, Outline Layout.

APPLIANCE IS NOT WATERPROOF.
APPLIANCE PRODUCES EXTREME HEAT.
APPLIANCE HAS MOVING PARTS.

Electrocution can result if appliance becomes wet.
Fires can be started by hairdryer.
Skin can be seriously burned by hot air.
Hair and motor can be damaged.

Do not place in or drop into water or other liquid.
Do not place or store hair dryer where it can fall or be pulled into tub or sink.
Do not use while bathing.

Do not reach for hair dryer if it has fallen into water.
If hair dryer has fallen into water unplug immediately.

Always unplug hair dryer immediately after using.

Do not place hair dryer on any surface while it is operating.
Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked.
Never use while sleeping.
Keep the air openings free of lint and hair.

Do not operate in the presence of explosive and/or flammable fumes.
Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered.

Do not direct hot air toward the eyes or other heat sensitive areas.

Never allow nozzle of hair dryer to contact skin for more than 15 seconds.

Keep your hair out of hair dryer.
Keep your hair away from the air inlets.

Never drop or insert any object into any opening.
When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.

Type of Statement Organization, Paragraph Layout.

APPLIANCE IS NOT WATERPROOF. APPLIANCE PRODUCES EXTREME HEAT. APPLIANCE HAS MOVING PARTS. Electrocution can result if appliance becomes wet. Fires can be started by hairdryer. Skin can be seriously burned by hot air. Hair and motor can be damaged. Do not place in or drop into water or other liquid. Do not place or store hair dryer where it can fall or be pulled into tub or sink. Do not use while bathing. Do not reach for hair dryer if it has fallen into water. If hair dryer has fallen into water unplug immediately. Always unplug hair dryer immediately after using. Do not place hair dryer on any surface while it is operating. Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked. Never use while sleeping. Keep the air openings free of lint and hair. Do not operate in the presence of explosive and/or flammable fumes. Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered. Do not direct hot air toward the eyes or other heat sensitive areas. Never allow nozzle of hair dryer to contact skin for more than 15 seconds. Keep your hair out of hair dryer. Keep your hair away from the air inlets. Never drop or insert any object into any opening. When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.

Random Organization, Outline Layout.

Fires can be started by hair dryer.
Do not direct hot air toward the eyes or other heat sensitive areas.
Do not operate in the presence of explosive and/or flammable fumes.
Do not reach for hair dryer if it has fallen into water.
Never drop or insert any object into any opening.
APPLIANCE IS NOT WATERPROOF.
Never use while sleeping.
Do not place or store hair dryer where it can fall or be pulled into tub or sink.
Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered.
Keep the air openings free of lint and hair.
Never allow nozzle of hair dryer to contact skin for more than 15 seconds.
When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas.
Do not place in or drop into water or other liquid.
Always unplug hair dryer immediately after using.
Hair and motor can be damaged.
Keep your hair away from the air inlets.
APPLIANCE HAS MOVING PARTS.
If hair dryer has fallen into water unplug immediately.
Do not place hair dryer on any surface while it is operating.
APPLIANCE PRODUCES EXTREME HEAT.
Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked.
Electrocution can result if appliance becomes wet.
Skin can be seriously burned by hot air.
Keep your hair out of hair dryer.
Do not use while bathing.

Random Organization, Paragraph Layout.

Fires can be started by hairdryer. Do not direct hot air toward the eyes or other heat sensitive areas. Do not operate in the presence of explosive and/or flammable fumes. Do not reach for hair dryer if it has fallen into water. Never drop or insert any object into any opening. APPLIANCE IS NOT WATERPROOF. Never use while sleeping. Do not place or store hair dryer where it can fall or be pulled into tub or sink. Do not use outdoors or operate where aerosol (spray) products are being used or where oxygen is being administered. Keep the air openings free of lint and hair. Never allow nozzle of hair dryer to contact skin for more than 15 seconds. When carrying hair dryer in handbag or suitcase be careful not to let bobby pins or other small objects enter the grille areas. Do not place in or drop into water or other liquid. Always unplug hair dryer immediately after using. Hair and motor can be damaged. Keep your hair away from the air inlets. APPLIANCE HAS MOVING PARTS. If hair dryer has fallen into water unplug immediately. Do not place hair dryer on any surface while it is operating. APPLIANCE PRODUCES EXTREME HEAT. Never block the air openings of the hair dryer or place it on a soft surface such as a bed or couch where the air openings may be blocked. Electrocution can result if appliance becomes wet. Skin can be seriously burned by hot air. Keep your hair out of hair dryer. Do not use while bathing.

APPENDIX C

EXAMPLES OF EXPERIMENT 1: EYE APPEAL STIMULI

Type of Hazard Organization, Outline Layout.

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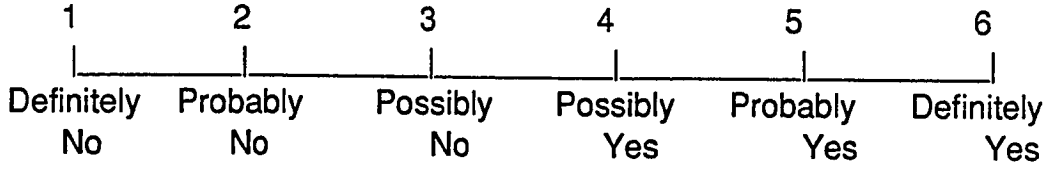
APPENDIX D

PRODUCT PERCEPTIONS QUESTIONNAIRE

Q-1 Do you think there should be a warning concerning this product? Use the numbers on the scale below to indicate your answers.



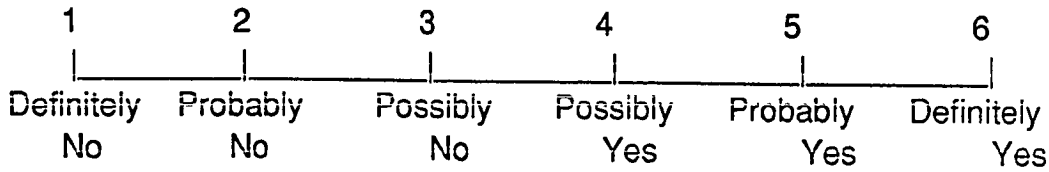
Q-2 Where would you most expect to find warnings concerning this product?

A) on the product
B) on the package
C) at the beginning of an instruction booklet
D) at the end of an instruction booklet
E) on a piece of paper separate from instructions
F) I would not expect a warning on this product.

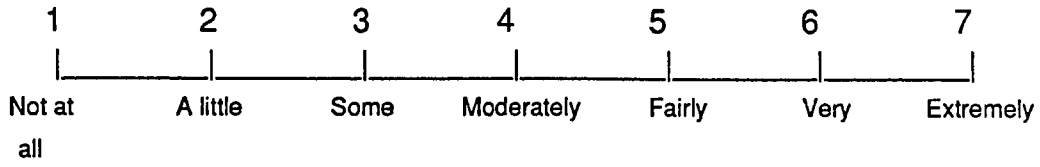
Q-3 Where would you least expect to find warnings concerning this product?

A) on the product
B) on the package
C) at the beginning of an instruction booklet
D) at the end of an instruction booklet
E) on a piece of paper separate from instructions
F) I would not expect a warning on this product.

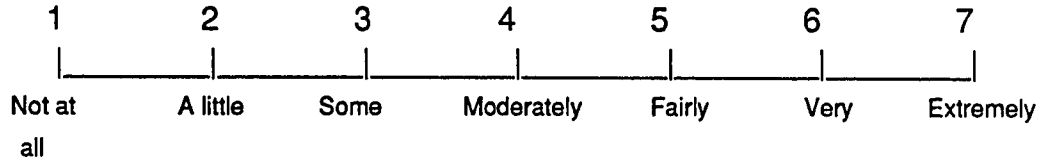
Q-4 If you saw a warning on this product would you read it?



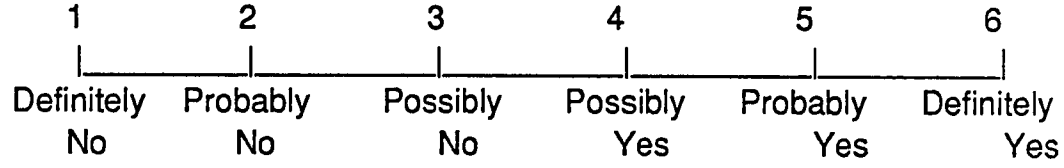
Q-5 How hazardous do you feel this product is?



Q-6 How familiar are you with this product?



Q-7 Do you think a warning that is visible when the product is in use would make the product less attractive?



Q-8 Have you ever used this type of product? (yes/ no)

Q-8 How often have you used this type of product?
(daily / weekly / monthly / yearly / never)

Q-10 When was the last time that you used this product?

A) within the last week
B) within the last month
C) within the last 3-6 months
D) within the last year
E) more than a year ago
F) never

APPENDIX E

WARNING CONTENT QUESTIONNAIRE

BUG KILLER

HT1. Named in the warning are three general characteristics of the product that make it dangerous. They are: _____ , _____ and _____.

2. Name three ways the warning stated that the poison can accidently enter the human system.

H3. According to the warning, this chemical should not be applied to _____ or _____ because _____ can result.

4. The warning states: "Do not allow humans or pets to _____ until _____".

5. What medication should be given as an antidote if someone is poisoned by this product?

6. The warning states that "this product should not be used as _____."

7. What are two precautions that the warning instructs should be done before spraying?

H8. Because it is toxic the warning mentions several **houshold items** on which this product should not be sprayed, such as: _____ , _____, _____ or _____.

H9. Because this product is flammable, the warning states, it should not be used near _____, _____, or _____.

10. Store this container at temperatures below _____.

11. When disposing of the container the warning specifies two things that one should be careful of: that the container is neither _____ or _____ because _____ could result.

13. It will be safe to contact the treated surfaces _____.

T 14. Name three actions the warning states you should or should not take with this product. (Be specific about which are the do's and which are the dont's when answering.)

T 15. Name two accidents, referred to in the warning, that could occur when misusing this product.

FABRIC PROTECTOR

1. Spraying this product produces a _____ mist.

3. _____ and _____ should be kept out of area until _____.

4. If indoor application requires more than one can, wait _____. before further application.

5. When using indoors one should always make sure there is _____.

6. This product should never be used in rooms that are _____ or _____.

7. The warning states that care should be taken not to spray into your _____, your _____, or onto your _____.

8. The warning states: "Product use near heat or flame can cause _____.

9. The warning instructs to keep spray and vapors away from heat sources and open flames. Four heat sources stated in the warning are: _____, _____, _____, and _____.

H 10. Since the contents are under pressure, _____ is possible if the container is _____ or _____.

11. The product should be stored at temperatures below _____ degrees farenheit or _____ degrees celsius.

12. What are three things about the product, stated in the warning, which make it dangerous?

H 14. Two reasons you should not spray this product in a closet are that the closet is _____ and _____ .

T 15. Name three precautions stated in the warning that should be taken while using this product.

T 16. What are three different accidents that this warning mentions?

HT 17. What are the characteristics of this product, named in the warning, that make it dangerous?

18. When you use this product the contents are released into the air as both a _____ and a _____ .

POOL SHOCK

H,T1. Name three **properties of this product,** stated in the warning,that make it dangerous.

2. If the container felt warm you might suspect that the pool shock is _____ and that _____ may be present.

3. What is the only thing you should mix this into?

4. The tools used to mix this product should be _____ and _____

5. Name four general characteristics, stated in the warning, of the place you would store this product.

6. When not in use this product should be kept _____ and in an a _____ container.

7. According to the warning, once the container is empty it should never be _____.

8. If you accidently contaminate the pool shock, the warning describes three actions that you should or should not take, what are they? (Be clear about which are the do's and which are the don'ts when answering)

H9. Because this chemical is caustic, the warning states it can be damaging to your _____ and _____ and irritating to your _____ and _____.

10. Care should be taken so that you do not get this chemical in your _____, on your _____ or on your _____.

11. When using this product you should avoid breathing the _____ and _____ that are produced by the pool shock.

12. If swallowed this product may cause the person to _____.

13. What are two times named in the warning when one could accidently contaminate a lake or stream?

H14. This product should not be allowed to enter ponds or streams because _____.

T15. Name three consequences of misusing this product that were stated in the warning.

17. (T or F) In case of contamination or decomposition reseal container and store in a cool dry place.

18. When handling wear protective clothing such as _____ and _____ or _____.

19. What should you do with a shirt that has been worn during use of this product?

T20. What are four things stated in the warning you should or should not do to

maintain safety with this product? (Be specific)

STEAM IRON

T1. Name four consequences, mentioned in the warning, of misusing this product.

H,T2. What are three characteristics of this product, discussed in the warning, which require special care to be taken when using this product?

3. The warning states that the iron should always be disconnected when the iron is being _____ or _____ and when _____.

4. Once you are done ironing you should _____ before unplugging it.

5. The warning states that you should not operate the iron if it has been _____ or _____

6. If the iron requires examination and repair you should _____ and you should not _____.

7. If the iron is incorrectly reassembled, what is the consequence and when would it happen?

8. You have unplugged the iron, before putting it away you should _____.

9. The warning states that when the iron is being used by or near children, you should _____.

10. The warning states that an iron should never be _____ when connected or on an ironing board.

11. Burns can occur from _____, _____, or _____.

12. The warning states that you might get burned by hot water in the iron if _____.

H13 Specifically, what characteristic of this electrical appliance may cause it to produce a circuit overload?

14. The warning names two consequences of a circuit overload; they are _____ and _____.

15. If you use an extension cord, the warning suggests it should have a rating of _____.

16. What does the warning say will happen if you use an inadequate extension cord?

H17. Because this is a 1200 watt appliance, what are two things the warning states you should not do?

T18. What are three things stated in the warning that you should do to maintain safety?

ELECTRIC - RECHARGEABLE DRILL

H,T1. Three characteristics of the drill, stated in the warning, that make it dangerous are that it is _____, has _____ and contains _____.

2. The warning states: "Do not use power tool in _____ or _____ locations".

3. The warning states that one should not expose this tool to _____.

4. What type of surfaces, other than wet, does the warning state you should not lean against while drilling and provide four examples that were given in the warning.

5. According to the warning, when should you not touch the metal part of the drill and why?

H6. What part of **this drill** makes it a potential source of ignition? Be specific.

7. You should not use this tool when flammable _____ or flammable _____ are in the area.

H8. Because the drill has moving parts care should be taken that _____.

9. Three things stated in the warning that might get caught in the drill are

_____, _____ and _____.

10. The warning states: "Remove _____ and _____from the drill before turning it on".

H11. Because materials fly from the drilling surface, the warning suggests that you wear _____ and possibly wear_____ when drilling.

12. If operation is dusty, the warning advises to use _____.

13. The drill contains _____.

14. The warning states that the drill may leak _____ if it is _____.

15. If battery leaks on skin what are the two things the warning instructs to do?

16. What are three things mentioned in the warning that can be used to neutralize the battery leakage.

17. If battery leakage gets in eyes **what should you do** and **for how long**?

T18. Name five general types of accidents stated in the warning that could happen as a result of the hazards of this product.

H19. What two different types of accidents can happen because the drill is

electrical?

T21. What are four actions, named in the warning, that you should or should not take to avoid injury when using this product?

HAIR DRYER

H1. This product will cause electrocution if it becomes wet because it is not _____ .

2. Electrocution can result if _____.

3. This appliance should not be placed in _____ or _____.

4. Two locations, named in the warning, this appliance should not be placed or stored are _____ and _____.

5. The warning states, you should never use this appliance while _____.

6. The warning states: if hair dryer has fallen into water you should _____ and you should not _____.

H7. Because this apliance produces extreme heat, two different types of accidents that could result are _____ and _____ .

T8. What are five accidents named in the warning that can result from using this appliance.

9. The warning states: "do not place the hair dryer on _____ while s operating."

10. If you place the hair dryer on a soft surface while it is running, what would it do to the hair dryer and what might result?

11. What type of regular maintenance should be given to the air openings?

12. _____ and _____ are two examples of explosive gases/fumes, provided in the warning, around which you should not operate the hair dryer.

H13. The warning states: "Do not direct hot air towards _____ or _____" because it can _____.

14. The warning advises you to never allow nozzle of hair dryer to contact _____ for a length of time more than _____.

15. The warning states: "Keep _____ out of hair dryer by keeping it away from _____."

16. The warning states: "Never drop or insert _____ into _____ of the hair dryer.

18. What precautions should be taken when carrying a hair dryer in a suitcase and why?

H,T19. What are three characteristics of this product that make it dangerous?

T20. What are four do's and don'ts stated in the warning you should remember?

APPENDIX F

EXPERIMENT 3: INFORMATION RELEASE, PRODUCT INSTRUCTIONS, AND WARNING

RELEASE FORM

To the prospective subject:

We are conducting product research on the use of pump spray containers for Roebic Manufacturing, Beaumont. To this end, we will perform several tests during this session. In order to report on our results, we must have the consent of each subject to release data concerning him or her to Roebic Manufacturing.

All data collected in your session will be kept completely confidential by Roebic and the Rice University Psychology Department. Your anonymity is guaranteed; your name will not be released to Roebic, and will go on no special "mailing list". No one will attempt to sell you anything as a result of your participation in this experiment.

PARTICIPANT'S CONSENT:

I have read the above statement and give Rice University Psychology Department my permission to release data connected with my participation in this experiment to Roebic Manufacturing, Inc.

Signed,
(signature)

_____

Print name:

_____

Directions:

Shake well before using

Test for colorfastness: In hidden area, spray fabric until wet; on needlework, spray printed canvas and each yarn until wet, wipe with absorbent cloth. If any color rubs off, do not use.

Do not use on leather, clear plastic, fiberglass or imitation suede. Hold can upright six inches from fabric and spray with slow, sweeping motion until evenly wet. Overlap spray areas.

Allow fabric to dry for at least three hours before using. Test fabric for repellency with a few drops of water. If water soaks in, apply more protector.

Shiny surface synthetics (nylon, etc.) may require a lighter application sprayed at a closer distance. Brush slightly or machine dry for 20 minutes at a low temperature if white deposit occurs after drying.

Durability: Periodically test fabric for repellency with a few drops of water. If water soaks in, reapply. Reapply after cleaning or laundering.

VAPOR/AIRBORNE MIST IS TOXIC.

Product use without ventilation in a closed area may also be harmful or fata.

Keep small children and pets out of area until treatment has thoroughly dried.

Wait 60 minutes before spraying each can, if indoor application requires more than one can.

Maintain cross ventilation through use of fans, open windows and doors.

Do not use in small rooms, bathrooms, or closets.

Do not spray into eyes, mouth, or onto skin.

CONTENTS ARE FLAMMABLE.

Product use near heat or flame can cause flash fire.

Keep spray and vapors away from heat sources and open flames such as ovens, furnaces, stoves, and dryers when in operation.

STORAGE PRECAUTIONS.

Container can burst if exposed to high temperatures.

Do not incinerate or store at temperatures above 120°F (49°C).

APPENDIX G

EXPERIMENT 4: FABRIC PROTECTOR LABELS AND FREE RECALL SCORING KEY

Fabric Protector - Free Recall Scoring Key. Subject_____

_____ VAPOR / AIRBORNE MIST IS **TOXIC.**

_____ Product **use without ventilation** in a closed area may also be **harmful or fatal.**

_____ **Keep** small **children out** and
_____ **pets out** of area
_____ until treatment has thoroughly **dried.**

_____ **Wait** 60 minutes **before spraying each bottle,** if indoor application requires more than one bottle.
_____ Wait **60 minutes** before spraying each bottle

_____ **Maintain cross ventilation** through use of
_____**fans,** open **windows** and **doors.** (any or all)

_____ **Do not use in small rooms,** bathrooms or closets.

_____ Do not spray into eyes, mouth, (either or both)
_____ or onto **skin.**

_____ CONTENTS ARE **FLAMMABLE.**

_____ Use near heat or flame can cause **flash fire. (explosion)**

_____ Keep spray and vapors away from **heat sources** and

_____ open **flames**
_____ such as **ovens, furnaces, stoves,** and **dryers** when in operation. (any or all)

_____ **EYE IRRITANT.**

_____ Prolonged exposure to spray and vapors **will cause drying of mucous membranes.**

_____ + _____ = _____
Concepts Details Total

Directions:
Shake well before using. In hidden area, spray fabric until wet. Wipe with absorbent cloth. If any color rubs off, do not use.

Hold bottle upright six inches from fabric and spray with slow sweeping motion until evenly wet. Overlap spray areas.

Allow fabric to dry for at least three hours before using. Test fabric for repellency with a few drops of water. If water soaks in, apply more fabric protector.

WARNING

VAPOR / AIRBORNE MIST IS TOXIC.
Product use without ventilation in a closed area may also be harmful or fatal.
Keep small children and pets out of area until treatment has thoroughly dried.
Wait 60 minutes before spraying each bottle, if indoor application requires more than one bottle.
Maintain cross ventilation through use of fans, open windows and doors.
Do not use in small rooms, bathrooms or closets.
Do not spray into eyes, mouth, or onto skin.

CONTENTS ARE FLAMMABLE.
Product use near heat or flame can cause flash fire.
Keep spray and vapors away from heat sources and open flames such as ovens, furnaces, stoves, and dryers when in operation.

EYE IRRITANT.
Prolonged exposure to spray and vapors will cause drying of mucous membranes.
Do not use if you have read this far.
Avoid exposing eyes, nose and throat to vapors/mist for extended periods of time.

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