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Formats for Section Safety Messages in Printed Manuals

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This study compared four formats for safety messages in printed manuals based on layouts found in a new standard of the American National Standards Institute (ANSI Z535.6, 2006). These four designs are specifically for use as *section safety messages.* Two used a signal word panel, and two used a safety alert symbol (exclamation in a triangle). The four formats were rated by 55 college students from three different classes using a five-point scale for hazardousness. All four messages were presented on the same page of a test booklet, with order balanced using a Latin Square. Results of a Friedman test indicated significant differences in ratings. The ranked order of the formats based on estimated median was yellow safety alert symbol left of the text (3.37), signal word in black panel above text (3.13), signal word in black panel imbedded in first line of text (2.87), and black hazard alert symbol left of the text (2.13). Post-hoc analyses of ratings using a Bonferroni test indicated the signs fit into three groups: the two highest rated signs, the second and third rated signs, and the lowest rated sign.

INTRODUCTION

A tremendous number of consumer and industrial products are accompanied by printed documentation such as assembly instructions, installation manuals, user guides, and maintenance manuals. These documents routinely contain warnings for hazards associated with intended use and foreseeable misuse of the product. Providing effective warnings and other safety messages helps manufacturers and distributors discharge their legal and social responsibilities to provide users with information about hazards and appropriate behaviors (Hall, 1986; Robinson & Etter, 2000; Peters & Peters, 1999, chap. 1).

The manner of presenting safety information in product documents may take many forms – some more effective than others. The now outdated approach of using all capital letters to distinguish a warning from other text in a document has given way to research-based formats that more effectively attract attention and communicate the safety message. An expanding body of research and legal literature on warnings, communication, and risk acceptance has accompanied the evolution in standards and guidelines for effectively informing consumers of product hazards (Miller & Lehto, 2001; Peters & Peters, 1999; Wogalter, DeJoy, & Laughery, 1999; Wogalter, 2006). A recent result of this evolution is a voluntary consensus standard for safety messages in documents accompanying products (Frantz & Hall, 2005).

This new standard is entitled "American National Standard for Product Safety Information in Product Manuals, Instructions, and Other Collateral Materials" (ANSI Z535 Committee on Safety Signs and Colors, 2006). One of the purposes is to "establish a uniform and consistent visual layout for safety information in collateral materials" for a broad range of products. Visual layouts are provided for safety messages divided into supplemental directives, grouped safety messages, section safety messages, and embedded safety messages. The layouts offer designers several options for: (1) a signal word, (2) a signal word panel, (3) symbols and other graphics, (4) color, and (5) the conveyed message. The various options for the components and layouts present numerous potential issues for research.

One such issue was addressed in this project – the layout of components in *section safety messages.* These messages are for safety information applicable to a section of a manual or other document. They are placed at the beginning of the section or before other messages to which they apply. These prominent positions in the document should assure that people who look through the manual at least glance at the messages. However, getting them to take time to read the messages is critical. Thus, for *section safety messages,* an ideal format will both capture the readers' attention and convey the impression that the message is important enough to read.

Layout options in Section 8 of the Standard call for a text message combined with either a signal word in a signal word panel or a safety alert symbol (exclamation

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inside an equilateral triangle). A signal word panel may be placed above the text message, left justified, or left of the text message in line with the first line of text. Alternatively, a safety alert symbol may be placed left of the text message. The examples of safety alert symbols in Section 4 of the Standard include the options of a triangle with a black background and a white exclamation, and a triangle with a yellow background and a black exclamation.

Previous studies examined effects of including a safety alert symbol and a signal word within a colored signal word panel. Wogalter, Jarrard, and Simpson (1994) found no significant difference with or without the safety alert symbol using a perceived hazardousness rating scale. Jensen and McCammack (2003) found significantly higher ratings with the safety alert symbol using a severity scale. Neither study examined use of the safety alert symbol outside a signal word panel for communicating the impression of hazardousness, severity, or importance. Another study found that replacing an old style text warning with an ANSI style warning in a printed manual increased recall of the warning, but failed to increase compliance (Huntley-Fenner, Harley, Trachtman, and Young, 2006).

These prior studies do not provide sufficient empirical evidence for the technical writers to differentiate among the optional formats. The purpose of this study was to compare four formats from the ANSI Standard for *section safety messages* in terms of conveying the impression that the message concerns something sufficiently hazardous to warrant taking time to read the message.

METHODS

Materials & Procedures

Booklets were prepared containing various safety-related messages for evaluation. One page contained the four warnings shown in Figure 1. Each format was developed to conform to the guidelines in the Standard (ANSI Z535.6-2006). Text messages were the same. To assess the impression of message importance, a general hazardousness scale was used. It was placed to the right of each warning. The scale had five response options: No hazard, Low hazard, Moderate hazard, High hazard, and Extreme hazard. The potential confounding effects of page order was controlled by using a structured balancing, and the placement of the four safety messages on the page was balanced with a Latin Square.

A randomized complete block design was used, with participants being the blocks, and the four signs being the treatments. Testing took place in classrooms. Access to the classrooms was obtained prior to testing by asking instructors for permission. Participation of students was obtained by providing a $5 honorarium for completing the forms. Students were informed their participation was voluntary. Following a brief explanation of the survey, students were handed a test booklet with a cover page, instructional pages, and test pages.

Participants

The 57 participants for the study were students taking undergraduate courses at the University. The use of human subjects was approved by the University's Institutional Review Board prior to the start of the project. After data collection, results from two participants were excluded because they reported color blindness. That left ratings of 55 participants for data analysis. Of these, 30 were female and 25 were male. Their ages ranged from 18 to 45, with mean 24.3, mode 22, and median 22.

Data Analysis

Rating values were coded from zero to four for the no hazard to extreme hazard response categories. The null hypothesis of no difference among the signs was examined using the Friedman two-way analyses. Post hoc analyses compared treatments using Bonferroni's multiple comparison procedure.

RESULTS

Ratings for the ANSI Standard Z535.6 sign formats were evaluated using the Friedman test with Minitab software. Results of 55 ratings for each sign format are shown in Table 1.

The Friedman test indicated the median ratings for the four signs differed significantly ($p = 0.000$). Given that finding, Minitab computes an estimated median rating as the grand median (2.875) plus or minus the treatment effect. The ranked order of the four formats based on estimated median was:

d. Yellow safety alert symbol (3.37),
b. Signal word panel above text (3.13),
a. Signal word panel imbedded in text (2.87), and
c. Black safety alert symbol (2.13).

The sum of ranks data listed in Table 1 serve as a measure of the relative size of treatment medians. The maximum possible sum of ranks would be obtained if all 55 participants rated the same treatment as being most hazardous (55 x 4 = 220). The yellow safety alert symbol had the highest sum, 170. The lowest sum was for the black safety alert symbol, 95. In between these were the two formats with a signal word panels.

A Bonferroni test for all pairwise comparisons, using a 95% confidence level, indicated two of the six pairwise comparisons (d – b and b – a) were not significantly different. Figure 2 provides a graphical depiction of the pairwise differences. A tabular presentation of the ordered ratings is in Table 2. The two highest rated signs (d and b) formed a group. The second and third highest rated signs (b and a) formed a second group. The lowest rated sign (c) differed from all others.

Table 1. Ratings of Four Sign Formats

Sign Format	Estimated Median	Sum of Ranks
a. Signal word panel on first line of text	2.87	137
b. Signal word panel above text	3.13	149
c. Black safety alert symbol left of text	2.13	95
d. Yellow safety alert symbol left of text	3.37	170

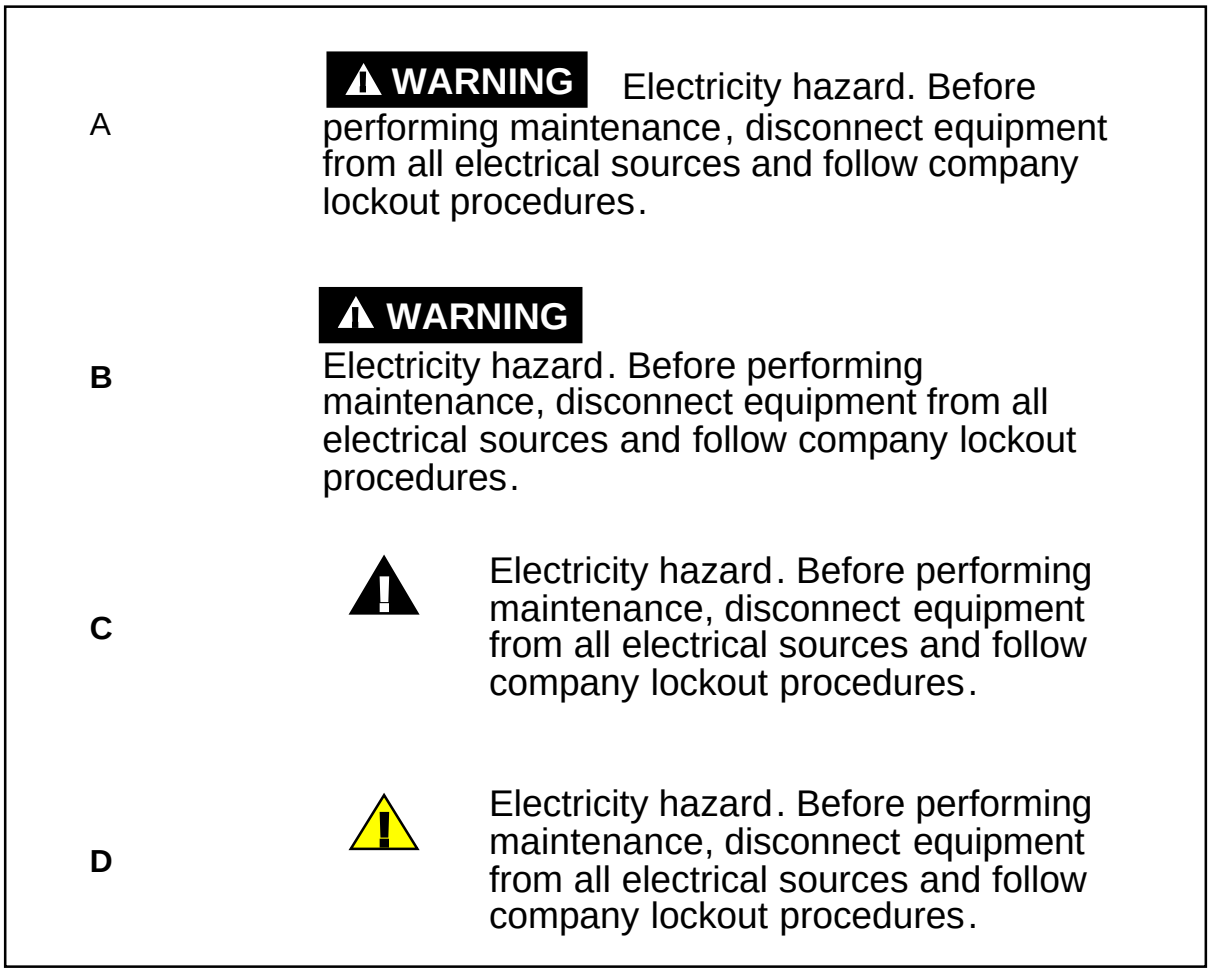

Figure 1. Sign formats rated by participants in the study. The order of these signs on pages of the test booklets was balanced using a Latin Square.

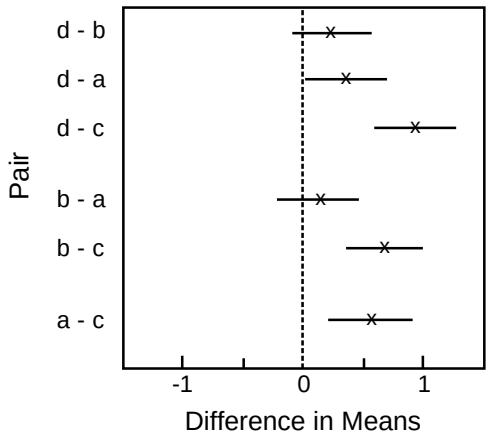

Figure 2. Mean differences (x) for all six pairwise comparisons. Lines show 95% confidence limits for the mean differences.

DISCUSSION

Ratings of hazardousness for the four signs indicated significant differences. The post-hoc analyses indicated three groups: the two highest rated signs, the second and third rated signs, and the lowest rated sign. A rather clear conclusion is that the black safety alert symbol is least effective for communicating hazardousness. Of the other three sign formats, the most effective formats were the yellow safety alert symbol left of the message and the signal word panel above the message.

The study had limitations. First, it was limited to comparisons of four specific sign formats that follow the ANSI Standard for *section safety messages.* Second, it based comparisons on ratings of hazardousness. This scale was used as an indicator of how effectively the format conveyed the impression that the message was important enough to read. Third, the study did not examine the important issue of salience when used in a printed manual. This issue would be an appropriate topic for future studies.

Technical writers responsible for choosing a format for safety information in product documentation need to make a multi-criterion decision. The results of this study may be one consideration in the decision process.

Table 2. Sign Formats Grouped by Similar Ratings of Hazardousness

Signs in Order of Ratings	Estimated Median	Bonferroni Groups
d. Yellow safety alert symbol left of text	3.37	▌
b. Signal word panel above text	3.13	▌ ▌
a. Signal word panel on first line of text	2.87	▌
c. Black safety alert symbol left of text	2.13	▌

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