Effects of Warning Signal Words on Consumer-Product Hazard Perceptions

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ABSTRACT

This experiment investigated the influence of warning signal words and a signal icon on perceptions of hazard for consumer products. Under the pretext of a marketing research study, 90 high school and college students rated product labels on variables such as product familiarity, frequency of use, and perceived hazard. Sixteen labels from actual household products were used and stored on a computer. Nine of the products labels were used to carry the nine signal word conditions. Five conditions presented the signal words NOTE, CAUTION, WARNING, DANGER, and LETHAL together with a brief warning message. In two other conditions a signal icon (exclamation point surrounded by a triangle) was presented together with the terms DANGER and LETHAL. The final two conditions were controls, one had a warning message but had no signal word, and the other had no warning message or signal word. Seven product labels were "fillers" that never contained a warning. Results showed that the presence of a signal word increased perceived hazard compared to its absence. Between extreme terms (e.g., NOTE and DANGER), significant differences were noted, but not between terms usually recommended in warning design guidelines. The presence of the signal icon had no significant effect on hazard perception. Implications of the results and the value of the research methodology for future warnings' investigations are discussed.

INTRODUCTION

Most standards and guidelines on warning design recommend the inclusion of signal words in labels and signs to alert people that a hazard is present, and to indicate the degree of danger involved (e.g., ANSI, 1988; FMC Corporation, 1985; Westinghouse Printing Division, 1981). The standards usually recommend the terms DANGER, WARNING, and CAUTION to connote the highest to lowest levels of hazard, respectively. In recent years, research has begun to examine the validity of these guidelines. Do people actually interpret differences between warning terms? The answer to this question is equivocal. Some research has found no significant differences between terms. Leonard, Matthews, and Karnes (1986) found no differences in ratings of risk for the signal words (i.e., CAUTION, WARNING, and DANGER). Wogalter, Godfrey, Fontenelle, Desaulniers, Rothstein, and Laughery (1987) found no difference between the terms WARNING and NOTE in a behavioral effectiveness study. However, other studies (Bresnahan and Bryk, 1975; Dunlap, Granda, and Kustas, 1986) have shown reliable differences of connoted urgency between terms such as DANGER and CAUTION.

In a recent study, Wogalter and Silver (1990) examined 84 potential signal words. They specifically examined the level of hazard communicated by the three most common signal words (DANGER, WARNING, and CAUTION) plus five other terms that had been evaluated in earlier research. The results showed that DEADLY, DANGER, WARNING, CAUTION, CAREFUL, ATTENTION, NOTICE, and NOTE) signified greatest to least strength, respectively. All differences were significant except between ATTENTION and CAREFUL and between WARNING and CAUTION. Silver and Wogalter (1991) found similar results using elementary school and junior high school students.

All of the above studies used procedures that had participants evaluate the terms in the absence of any relevant context (i.e., either alone or as part of a list). While these studies used internally valid methodologies, their testing procedures lack the realism and ecological validity of an appropriate context. When tested in isolation, signal words could show effects that do not transfer to situations when they are presented with other information such as accompanying a warning message and other product label information.

The current study presents signal words in the context of warnings on consumer product labels—a more realistic method to assess their influence than heretofore employed. Participants performed the experiment under the guise of a marketing research study in which they were asked to examine the labels of several products and answer a series of questions about each product. One question was of primary interest. This question requested a judgment of the level of hazard posed by the product. In part, the other questions were included to help disguise the purpose of the study.

The five signal words compared in the present study were LETHAL[1] DANGER, WARNING, CAUTION, and NOTE. These particular terms were included because of their use in previous signal word research (e.g., Leonard et al., 1986; Wogalter and Silver, 1990), or their inclusion in safety guidelines (ANSI, 1988; FMC Corporation, 1985; Westinghouse, 1985).

Several warnings' standards and guidelines also recommend that a signal icon (exclamation point surrounded by a triangle) be included with the signal word to help gain attention and communicate the existence of a hazard.

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[1] The term LETHAL was used instead of DEADLY because pilot research suggested that the term DEADLY would not realistically appear on some of the less hazardous consumer products that we employed. Wogalter and Silver (1990; Silver and Wogalter, 1991) found LETHAL to connote significantly lower hazard than DEADLY, but significantly higher hazard than DANGER.

However, the influence of the signal icon has not been studied, except for recent research by Young (1991). Young (1991) found lower search times to find a warning on a simulated alcohol beverage warning when it included the signal icon. However, the influence of the signal icon on perceived hazard has not yet been investigated. It is possible that the signal icon will serve to attract attention to the signal word and warning, and as a consequence, increase perceptions of hazard. In the present study, this symbol was paired with two signal words, DANGER and LETHAL, and its influence was examined by comparing them to the words without the signal icon.

Lastly, two other conditions served as controls to establish the base line hazard perception of the products. One condition lacked a signal word and the other lacked both the signal word and its associated warning message. In the latter condition, no danger was described on the label.

Given the results of previous research, it was expected that product labels with: (1) LETHAL would connote the greatest level of hazard of the set of terms, (2) DANGER would connote greater hazard than both WARNING and CAUTION which may not differ between themselves, (3) the signal icon paired with LETHAL and DANGER would convey higher levels of hazard than the same terms without the signal icon, (4) NOTE would connote the least hazard of the set of signal words, (5) no signal word would connote less hazard than conditions with the signal word terms present, and (6) the no signal word and warning message condition would connote the least hazard.

METHOD

Participants

A total of 90 individuals participated. Forty-five were Rensselaer Polytechnic Institute undergraduates and 45 were students from a public high school in Troy, New York.

Materials and Stimuli

Sixteen brand-name consumer products were chosen to represent a range of hazard. The front labels were digitized using an optical scanner and stored in a computer with high-resolution graphics capability. Using paint and draw software, defects from the scanning process were corrected. Signal words and accompanying warning messages used font sizes and styles that most closely matched the print on the original label. Black and white versions of the product labels were reproduced using a 300 dpi laser printer.

Nine of the 16 product labels were used in the experimental conditions (aspirin, contact lens cleaner, drain opener, fabric protector, hair-styling mousse, paint thinner, pest-control fogger, plant food, and spray adhesive). Seven "filler" labels were also used (bandages, bath soap, facial tissue, index cards, shampoo, toothpaste, and towlettes). The fillers were relatively safe products that contained no signal word or warning of any kind on the front label. The purpose of including the fillers was to help maintain belief in the marketing study by reducing the likelihood that participants would notice that the study was studying warnings.

Most of the experimental product labels contained a

preexisting warning message on the front label. When possible, this message was retained on the product label. However, for some products a different warning message was used in place of the original warning. These were adapted from a back-label warning or were constructed to describe a possible danger.

The nine experimental product labels acted as carriers for the signal word conditions. Five conditions involved only the signal words: NOTE, CAUTION, WARNING, DANGER, and LETHAL. In two other conditions, the signal icon was displayed accompanying the DANGER and LETHAL signal words, and was located above or to the left of the signal word. In addition, there were two control conditions: (a) the No Warning and Signal Word condition which lacked both the signal word and the associated warning message, and (b) the No Signal Word condition which had a warning message but no signal word. Example representations of four of the nine experimental conditions are shown in Figure 1.

Nine booklets were formed, each containing one label from all 16 products. The signal word conditions were rotated through all of the experimental product labels according to a balanced Latin square so that all experimental products appeared in every signal word/warning condition. The seven filler products were randomly inserted into the booklets. A second balanced Latin Square was used to order the product labels in the booklets.

Participants were given a questionnaire requesting responses based on nine-point Likert-type scales. The questions together the numerical and verbal anchors are shown below:

(a) *Frequency of Use:* "How frequently do you use this product?" The anchors were: (0) not at all, (2) infrequently, (4) frequently, (6) very frequently, (8) extremely frequently.

(b) *Attention:* "How likely is it that this product label would capture your attention if it were on a supermarket shelf?" The anchors were: (0) not at all likely to capture attention, (2) unlikely to capture attention, (4) likely to capture attention, (6) very likely to capture attention, (8) extremely likely to capture attention.

(c) *Familiarity:* "How familiar are you with this product (or a product of the same type)?" The anchors were: (0) not at all familiar, (2) slightly familiar, (4) familiar, (6) very familiar, (8) extremely familiar.

(d) *Hazard:* "How hazardous is this product?" The anchors were: (0) not at all hazardous, (2) slightly hazardous, (4) hazardous, (6)very hazardous, (8) extremely hazardous.

(e) *Likelihood of Purchase:* "How likely are you to buy this product?" The anchors were: (0) not at all likely to buy, (2) unlikely to buy, (4) likely to buy, (6) very likely to buy, (8) extremely likely to buy.

(f) *Expected Cost:* "How much do you think this product would cost." For this question, participants were asked to write the best estimate of the price in the space provided on the answer sheet.

Procedure

Participants were first given a consent form to sign. Participants were told that the study was a marketing

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Figure 1

Example Images of Four Label Conditions Differing on the Presence of a Signal Word, Signal Icon, and Warning Message.

Signal Word plus Signal Icon

Signal Word Present

No Signal Word

No Signal Word or Warning
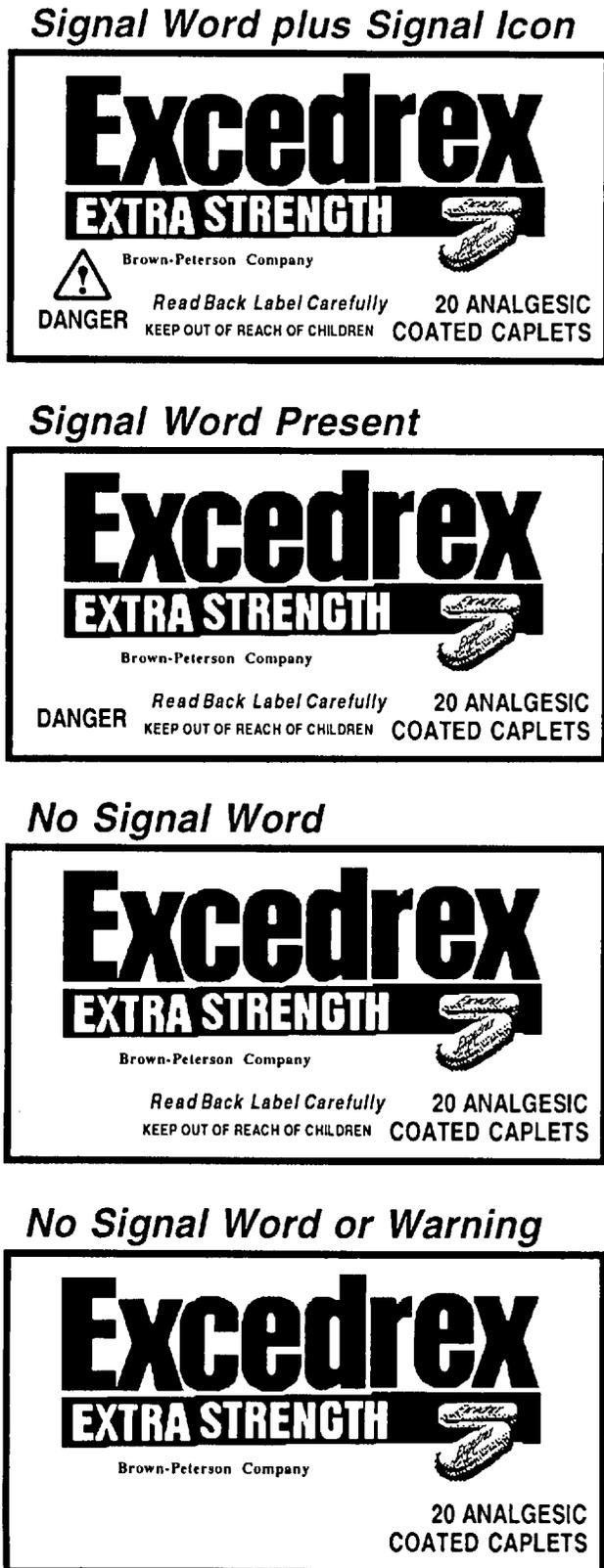
research survey dealing with people's perceptions of consumer products. Participants were given one of the nine product booklets and they were asked to examine all of the labels before beginning their ratings. After this initial examination, participants were given the questionnaire that asked them to rate the products on the six dimensions described above. They were told to rate the products in the order shown in their booklet. After completing the set of ratings, participants were debriefed and thanked for their time.

RESULTS

Mean hazard ratings (and standard deviations) of the signal word/warning conditions for both participant groups are shown in Table 1. A correlation of the mean hazard ratings between the two groups of participants (high school students and college undergraduates) in this table showed a strong positive relation, $r = .95$, $N = 9$, $p < .0001$.

A 2 (participant group) X 9 (signal word condition) mixed-model analysis of variance (ANOVA) showed a significant main effect of participant group, $F(1, 88) = 4.97$, $p < .05$. In general, the high school students ($M = 5.29$) gave higher ratings than the college students ($M = 4.77$). The ANOVA also showed a significant main effect of signal word condition, $F(8, 704) = 9.41$, $p < .0001$. Comparisons among the means showed that the No Warning or Signal Word condition produced significantly lower hazard ratings than all of the other conditions except the No Signal Word or NOTE conditions ($ps < .05$). The No Signal Word condition produced significantly lower hazard ratings than all of the conditions with signal words. NOTE produced significantly lower hazard ratings than DANGER and LETHAL—with or without the signal icon. Both CAUTION and WARNING produced significantly lower

TABLE 1

Mean Hazard Ratings of Signal Words for High School and College Students

Condition	High School		College		Overall	
	Mean	SD	Mean	SD	Mean	SD
No Warning or Signal Word	4.49	(2.88)	3.82	(2.44)	4.16	(2.68)
No Signal Word	4.42	(2.54)	3.53	(2.13)	3.98	(2.37)
NOTE	5.11	(2.46)	4.27	(2.22)	4.69	(2.37)
CAUTION	5.16	(2.52)	4.58	(2.15)	4.87	(2.35)
WARNING	5.36	(2.41)	4.62	(2.01)	4.99	(2.24)
DANGER	5.71	(2.34)	5.02	(1.73)	5.37	(2.07)
LETHAL	5.76	(2.48)	5.73	(2.25)	5.74	(2.35)
DANGER with Icon	5.69	(2.62)	5.13	(1.88)	5.41	(2.28)
LETHAL with Icon	5.96	(2.34)	6.18	(2.00)	6.07	(2.17)
mean	5.29		4.77			

hazard ratings than LETHAL—with or without the icon. Finally, DANGER was significantly lower than LETHAL with the icon. There was no significant interaction of participant group and signal word condition, $F(8, 704) < 1.0$, $p > .05$.

Specific examination of the signal icon involved a 2 (participant group) X 2 (presence vs. absence of icon) X 2 (DANGER vs. LETHAL) mixed-model ANOVA. This analysis produced only a main effect of signal word, $F(1, 88) = 4.14$, $p < .05$, showing that LETHAL ($M = 5.91$) was perceived more hazardous than DANGER ($M = 5.39$). No other effects were noted in this analysis, including none involving the signal icon. There was no main effect of signal icon or an interaction.

A series of 2 X 9 ANOVAs on the ratings for the other five questions showed only main effects: for capturing attention, $F(1, 88) = 18.74$, $p < .0001$, where the college students ($M = 3.02$) reported that the labels were more likely to capture their attention than the high school student ($M = 2.04$); and for familiarity, $F(1, 88) = 5.86$, $p < .05$ where the college students ($M = 3.43$) reported that they were more familiar with the products than the high school students ($M = 2.88$). None of the ANOVAs showed a significant involvement of the signal word factor (main effect or interaction) for the five non-hazard questions ($ps > .05$).

DISCUSSION

In general, the presence of a signal word raised hazard perceptions compared to its absence. Though there were differences between extreme terms, there were no significant differences between the intermediate terms CAUTION, WARNING, and DANGER—the signal words recommended by most standards and guidelines. This is consistent with results by Leonard et al. (1986). Nevertheless, the ordering of the means concurs with the ordering of the terms as defined by standards and the results of other research (Wogalter and Silver, 1990; Silver and Wogalter, 1991). Perhaps significant differences between the intermediate terms would be found with more participants and greater statistical power.

No effect of signal icon was shown. However, a positive trend was apparent when it was added to the term LETHAL, which produced the highest mean in the experiment. The signal icon's greatest utility is probably in attracting people's attention to the warning (Young, 1991), and may not have any additional influence beyond this (such as affecting hazard perception).

Results showed that the high school and college students produced consistently ordered hazard ratings to the signal word conditions, although they were significantly higher for the high school than the college students. This result concurs with the findings of Silver and Wogalter (1991) that younger individuals (elementary and middle school children) give higher hazard ratings to signal words than older individuals (college students). The age difference might be the result of more frequent exposure to hazard labels and signs by older individuals and the consequent habituation to the words arising from benign experiences. Frequent exposure probably reduces people's wariness. This explanation is similar to the familiarity effect shown in other research (Godfrey, Allender, Laughery, and Smith,

1983; Godfrey and Laughery, 1984; Wogalter, Brelsford, Desaulniers, and Laughery, 1991). With greater familiarity, people perceive a product to be less hazardous, are less likely to look for and read a warning, and are less willing to comply with a warning.

It had been expected that the two control conditions would produce different effects, and in particular, that labels with no warning or signal word would be perceived less hazardous than those lacking a signal word. This expectation arises from the fact that there is no hazard described on labels with no warning or signal word. However, no significant difference was found between the two control conditions, and interestingly, a trend in the opposite direction is apparent. At this point, the reason for this unexpected trend is unclear, and further investigation is needed to determine its reliability. The result might be related to an effect suggested by Ursic (1984) and extended in other research (Laughery and Stanush, 1989; Leonard, Ponsi, Silver, and Wogalter, 1989; Silver, Leonard, Ponsi, and Wogalter, 1991). That is, having no warning produces some uncertainty in the minds of consumers as to the safeness of a product. As a consequence of having some doubt, hazard perception is increased compared to labels that provide at least some information on hazards.

A comment on sampling is noteworthy. While the experiment did include a sample of students from a public high school representing a cross section of ethnic socioeconomic categories, the sample may not reflect all consumers. Currently, data are being collected at various public locales (e.g., shopping centers and libraries) to determine the present finding's generality. However, given that earlier work using other populations (e.g., Dunlap et al. 1986; Silver and Wogalter, 1991) has found relatively consistent results, we expect few differences from the present study with the data currently being collected

The present research adds to our knowledge of signal words, showing that signal words are capable of changing people's perceptions of product hazard. But in addition to the study's basic findings, the research methodology makes other advances. First, the research employed procedures to disguise the true purpose of the research (under the guise of a marketing research study), so that indirect and more realistic influences of the signal words could be measured. Second, the signal words were exposed to participants in the context of warning messages on product labels, providing greater external and face validity than previous research in this area. Third, the method of constructing the stimuli (e.g., computer digitization and manipulation of labels) holds promise for other investigations on the effects of warnings and label variables (e.g., on message content and format).

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