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Effect of signal word and source attribution on judgments of warning credibility and compliance likelihood

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Abstract

Social-communication models frequently include message source as an important factor in persuasion. However, research on the contribution of source characteristics to warning effectiveness is virtually non-existent. The present research involved two experiments. Experiment 1 examined the effects of the presence (vs. absence) of the signal word WARNING, supplementing it with the source-related term GOVERNMENT to the signal word, and the addition of more specific terms (i.e., US and FEDERAL) on ratings of credibility and compliance likelihood for alcohol, cigarette, and iron supplement warnings. Higher ratings were produced with the signal word's presence than its absence and adding more specificity (and length) to the source. The highest ratings accompanied the longest, most specific prefix: US FEDERAL GOVERNMENT WARNING. Experiment 2 investigated three types of sources on credibility and compliance likelihood: (1) specific regulatory governmental agencies (e.g., US FOOD AND DRUG ADMINISTRATION), (2) specific scientific professional groups (e.g., AMERICAN MEDICAL ASSOCIATION), and (3) general statements in which an explicit source is not mentioned (e.g., Important Health Warning). The inclusion of specific sources produced higher ratings compared to a signal word (WARNING) alone. Implications for warning design and further research are discussed.

Relevance to industry

Warning messages are used to communicate information about potential hazards and how to avoid injury and property damage. This research shows that the presence of a signal word and adding specific source information (telling who is giving the message) was found to increase credibility judgments and compliance intentions. Implications for enhancing warning effectiveness are discussed.

Keywords: Warning; Signal word; Visual displays; Safety; Hazard control; Source

1. Introduction

The purpose of warning messages is to inform people about potential hazards in the environment and to persuade them to engage in behaviors that

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allow them to avoid injury or property damage (Wogalter and Laughery, 1996). Over the last decade, research has identified a variety of factors that influence the effectiveness of warning signs and labels. Some of these are perceptual (e.g., color and size) and some are motivational (e.g., cost of compliance and social influence). Another factor that has the potential to enhance warning effectiveness is the source of the warning message. The source is an entity from which a message derives or is believed to derive.

To date, very little research has examined the message source as a possible factor in warning effectiveness. Indeed, there has been only one published report on this topic and it focused on the perceived expertise of a warning's source (i.e., Lirtzman and Shuv-Ami, 1986). Specifically, these researchers found that sources seen as content-domain experts enhance warning-message credibility and were judged more credible than the government as the source.

The paucity of research is somewhat surprising for three reasons. The first concerns the existence of an extensive body of research showing that source characteristics affect message persuasiveness (McGuire, 1980). Warnings are a type of persuasion attempt that is intended to motivate people to comply with its directives. A warning that fails to persuade could lead to injury, death or property damage.

Existing research has identified various factors that affect the persuasiveness of communications including credibility, likability, power, expertise, quantitative aspects, and demographics (Lipstein and McGuire, 1978). However, much of this research has employed highly complex messages where one of two sides of an equivocal issue is presented and bias by the communication is measured. The messages in that research are different from the more unequivocal kinds of messages that a hazard warning should communicate.

The second reason for the surprising paucity of research relates to the beneficial role that well-designed warnings can potentially play in preventing serious injuries. Because of this role, it is critical that researchers identify the factors that, alone and in combination, enhance warning effectiveness. The present research begins to investigate whether having an attributable source in a warning influences its effectiveness.

The third reason for the lack of research concerning the source of a warning stems from the fact that the US government has mandated various kinds of warnings. This is problematic in that virtually none of them were tested before a law was passed, only a few were tested before they were enacted, and most have never been tested at all. In the US, the two most well-known government-required warnings appear on cigarette packages (and advertisements) and beverage alcohol containers. The laws requiring these warnings have specific wording and include source information in them: SURGEON GENERAL and/or GOVERNMENT. For cigarettes, the warnings begin with the signal word WARNING, whereas the beverage alcohol warning begins with the terms GOVERNMENT WARNING. Both include mention of the Surgeon General as the message source. Yet there has been no research conducted to determine whether these terms actually enhance warning effectiveness. ANSI and other warning design guidelines recommend that only a single signal word (e.g., DANGER, WARNING, and CAUTION) appear in consumer product warnings and that their print size be relatively large (compared to the other, more specific warning text) within a colored panel. The use of the terms Surgeon General and/or Government is apparently based on a belief that people will think it makes the warning more credible/believable compared to the terms' absence. Note, too, that the effect probably depends on how much they admire and/or respect the government. The prevailing mood of the public with respect to trust in the government could influence their judgments, as could have occurred in the only other study on warning source (Lirtzman and Shuv-Ami, 1986). Moreover, the surgeon general position has been vacant for most of the last 5 years, making the potential impact of this position as a warning source uncertain.

Is it useful to include source-related terms in warnings? If they provide no benefit, their use has the potential disadvantage of taking away space for the possible inclusion of additional pertinent information and/or for enlarging the remaining print for same-size warnings to make them more legible.

A related issue is whether the signal word WARNING is even necessary. While there exists a body of research comparing the hazard connotation of

various signal words such as DANGER, WARNING, and CAUTION (Wogalter and Silver, 1990, 1995), there has been very little research examining the effect of having a signal word or not. Although the research conducted thus far suggests that the presence of a signal word in a warning is better than its absence (e.g., Wogalter et al., 1994), research has not always yielded positive effects (e.g., Wogalter et al., 1987).

In two experiments, the present research examined the effect of the presence vs. absence of a signal word and various kinds of source information for warning messages for three consumer products. The two dependent measures were perceived credibility and likelihood of compliance to the warning. Additionally, Experiment 2 (described later) investigated the effects of three categories of sources with the same dependent measures.

2. Experiment 1

This experiment addresses several issues as they relate to judgments of warning credibility and compliance intention. The specific issues addressed are: (a) the presence vs. absence of a signal word WARNING, (b) the effects of adding the term GOVERNMENT to the signal word, and (c) the effects of adding other terms to GOVERNMENT WARNING (i.e., US and FEDERAL).

2.1. Method

2.1.1. Participants

Sixty-six undergraduates with a mean age of 20.3 yr (SD = 2.9) from Rensselaer Polytechnic Institute participated. Forty two of the participants (63.6%) were males; fifty four (81.8%) were Caucasians.

2.1.2. Materials and procedure

Participants viewed warning messages for three products: alcohol, cigarettes, and iron-containing vitamin supplements. Their message text follows.

Alcohol: (1) Women should not drink alcoholic beverages during pregnancy because of the risk of birth defects. (2) Consumption of alcoholic beverages impairs your ability to drive a car or operate machinery, and may cause health problems.

Cigarettes: Cigarette smoke contains carbon monoxide. Smoking causes lung cancer, heart disease, emphysema, and may complicate pregnancy. Smoking by pregnant women may result in fetal injury, premature birth, and low birth weight. Quitting smoking now greatly reduces serious risks to your health.

Iron-containing vitamin supplements: Keep away from children. Keep in original package until each use. Contains iron which can harm or cause death to a child. If a child accidentally swallows this product, call a doctor or poison control center.

The first two warning messages were derived from text that is currently required by US law for these products. The alcohol warning text message is the actual mandated text required on all beverage alcohol containers sold in the US. The cigarette warning text message was constructed by combining the four separate ("rotating") warning text messages mandated by US law to be on cigarettes packages and in advertising. The iron supplement warning was taken from one of the text messages that the US food and drug administration was considering for labels of products containing multi-vitamin and mineral pills.

The warning messages were printed on separate sheets and surrounded by a four-point rectangular black border. Each had a blank space (underlined) followed by a colon to indicate the location of added prefix wording (if any). Below the warning were six alternatives prefixes. Two were controls. One lacked the prefix entirely; only a blank line was given (i.e., no source or signal word). The other control had just the signal word WARNING (but no attributable source). The other four were identical to the signal-word present condition but also included the term GOVERNMENT; three of these conditions also included the terms US or FEDERAL or both in the prefix. Thus, the six conditions were: blank/nothing, WARNING, GOVERNMENT WARNING, US GOVERNMENT WARNING, FEDERAL GOVERNMENT WARNING, and US FEDERAL GOVERNMENT WARNING.

Participants were told to imagine that each of the prefixes were added to the beginning of each of the three product warning text messages (and the prefix could also be absent) and instructed to evaluate

them according to two nine-point scales. One scale asked for a rating of *credibility* of the resulting warning and the other asked for rating on the *likelihood they would comply* with the warning. The credibility rating scale ranged from 0 to 8 and was anchored at the even numbered points with the following verbal labels: (0) not at all credible, (2) somewhat credible, (4) credible, (6) very credible, and (8) extremely credible. The compliance likelihood rating scale ranged from 0 to 8 and was anchored at the even numbered points with the following verbal labels: (0) not at all likely, (2) somewhat likely, (4) likely, (6) very likely, (8) extremely likely. Participants marked their responses on answer sheets.

Initially, participants were asked to read and sign a consent form. They were told that the purpose of the study was to evaluate people's impressions of warnings that differed in wording. Upon completion of the questionnaire, they were debriefed and thanked for their participation.

2.2. Results

Table 1 shows the mean credibility and compliance likelihood ratings as a function of product warning and prefix. The table shows that as the prefix increases in specificity and length (number of characters), the ratings are greater.

Two separate 3 (product warning) $\times 6$ (prefix) repeated-measures analyses of variance (ANOVAs) were conducted: one for credibility and one for compliance likelihood. For the credibility ratings, the ANOVA showed a significant main effect of product warning, $F(2, 130) = 6.46$, $p < 0.05$, and a main effect of prefix, $F(5, 325) = 44.39$, $p < 0.0001$. The interaction was not significant ($p > 0.05$). Paired comparisons among means using the Tukey HSD test ($p < 0.05$) indicated that the iron warning was rated significantly more credible than the other two product warnings. The presence of the signal word WARNING produced higher credibility ratings compared to its absence. Adding US GOVERNMENT to the word WARNING produced significantly higher credibility ratings. The three highest rated prefixes (US GOVERNMENT WARNING, FEDERAL GOVERNMENT WARNING, and US FEDERAL GOVERNMENT WARNING) did not differ, but the two highest (with the term 'federal') were significantly greater than GOVERNMENT WARNING.

Analyses and comparisons of the compliance likelihood ratings mirrored those of the credibility ratings described above. The main difference between the two sets of scores is that for compliance likelihood the iron warning received even higher ratings (compared to the other two product warnings) relative to the difference shown with the credibility scores.

2.3. Discussion

These results indicate that (a) the presence of a signal word (WARNING) increased perceived credibility and compliance likelihood estimates compared to its absence, supporting the results of previous research on warnings (e.g., Wogalter et al., 1994); (b) adding a prefix containing an attributable source increased participants' judgments compared to the signal word (WARNING) alone, therefore supporting the suggested outcome from persuasion

Table 1
Mean ratings of credibility and compliance likelihood as a function of product warning and prefix

	Credibility			Compliance likelihood		
Prefix	Alcohol	Cigarette	Iron	Alcohol	Cigarette	Iron
[Blank]	2.67	2.71	3.07	3.11	3.06	3.82
Warning	3.64	3.81	4.36	3.89	3.96	4.92
Government Warning	4.30	4.25	4.64	4.15	4.28	5.29
US Government Warning	4.79	4.82	5.14	4.51	4.80	5.51
Federal Government Warning	5.13	5.00	5.31	4.62	4.85	5.66
US Federal Government Warning	5.33	5.13	5.41	4.69	5.13	5.77

research and theory; and (c) participants' ratings were positively related to the length and specificity of the source. Higher ratings were given to the longer prefixes. Possibly, participants perceived the longest, most specific prefix, US FEDERAL GOVERNMENT WARNING, to be the most authoritative causing the enhanced credibility and compliance intention judgments.

It should be noted that the US Government was the only source investigated in this study. It is possible that the effect of source might depend on the particular source given. Other sources may differ in their credibility with respect to the warning message and motivate compliance to greater or lesser degrees.

Lirtzman and Shuv-Ami (1986) found that using government as a source was perceived as less credible than content domain sources (e.g., a consumer protection research group). In Experiment 1, the appearance of government as the source raised warning-effectiveness perceptions. Moreover, when this source was given greater emphasis and specificity by adding US and FEDERAL, perceived effectiveness was increased further. Besides the manipulation differences between the Lirtzman and Shuv-Ami (1986) study and the present one, the effects of government as a source might also depend on the extent to which people trust the government for guidance. Nevertheless, it is also possible that the effects seen in the present study is simply one in which participants gave higher ratings for the longer source names. Whether it is the presence of any source or the length of the source name that produced the effects on the ratings can not be determined by this experiment. Therefore, Experiment 2 examines the effects of various categories of sources as well as the effect of adding other terms (non-source related wording) to the signal word prefix.

3. Experiment 2

This experiment examined three categories of sources: (1) specific regulatory governmental agencies (e.g., US FOOD AND DRUG ADMINISTRATION), specific scientific professional groups (e.g., AMERICAN MEDICAL ASSOCIATION, AMERICAN PEDIATRIC ASSOCIATION), and general statements without a directly attributable source (e.g., IMPORTANT HEALTH WARNING). As in Experiment 1, the effect of presence vs. absence of the signal word WARNING was also examined.

3.1. Method

3.1.1. Participants

Fifty-seven undergraduates from Rensselaer Polytechnic Institute participated. This group had a mean age of 19.9 yr (SD = 1.5). Thirty-six were males. Forty-six were Caucasians.

3.1.2. Materials and procedure

The warning messages and the rating scales were the same as that described in Experiment 1. Below each warning message were 12 alternative prefixes. Two were controls. One lacked the prefix entirely; a blank line was given (i.e., lacked both the signal word and source). The other control had the signal word WARNING. The other 10 alternatives, before the signal word WARNING, had either specific sources or general statements. Three were specific regulatory government agencies: US SURGEON GENERAL's, US CONSUMER PRODUCT SAFETY COMMISSION, and US FOOD AND DRUG ADMINISTRATION. Two were specific scientific professional groups: AMERICAN MEDICAL ASSOCIATION, and AMERICAN PEDIATRIC ASSOCIATION. The other six prefixes were general statements: HEALTH, SAFETY AND HEALTH, US PUBLIC HEALTH, MEDICAL HEALTH, and IMPORTANT HEALTH. The latter four had approximately the same letter length of the specific government prefix US SURGEON GENERAL's.

3.1.3. Procedure

The procedure was identical to that described in Section 2.1.3.

3.2. Results

3.2.1. Credibility

A 3 (product warning: alcohol, cigarette and iron supplement) × 12 (prefix) repeated measures

analyses of variance (ANOVA) was applied to the credibility ratings. The effect of product warning was not significant, $F(2, 112) = 2.85$, $p > 0.05$. The ANOVA showed a significant main effect of prefix, $F(11, 616) = 25.61$, $p < 0.0001$. These means are shown in the right-most column of Table 2. Paired comparisons using the Tukey HSD test ($p < 0.05$) showed that participants gave higher credibility ratings when the signal word WARNING was present than when it was absent. Adding to the signal word a general prefix (the words SAFETY AND HEALTH, IMPORTANT HEALTH, and MEDICAL HEALTH) significantly increased credibility compared to the signal word alone, except for adding the shortest one. HEALTH WARNING did not differ from Warning alone.

The four highest rated prefixes (US SURGEON GENERAL's, AMERICAN MEDICAL ASSOCIATION, US FOOD AND DRUG ADMINISTRATION, and AMERICAN PEDIATRIC ASSOCIATION) did not significantly differ from each other, but the two highest-rated (US SURGEON GENERAL's and AMERICAN MEDICAL ASSOCIATION) were rated significantly more credible than the remaining conditions.

The ANOVA also showed a significant interaction, $F(22, 1232) = 2.73$, $p < 0.0001$. Simple effects analysis showed that the pattern of means was consistent with the main effect of prefix described above except that the American Pediatric Association and US Consumer Product Safety Commission had significantly higher credibility ratings in association with the iron supplement warning message compared to the other two product warning messages.

Table 2
Mean ratings of credibility as a function of product warning and prefix

	Product warning message			
Prefix	Alcohol	Cigarette	Iron	Mean
[Blank]	2.81	2.95	3.07	2.94
WARNING	3.51	4.00	4.09	3.87
US SURGEON GENERAL's WARNING	5.25	5.72	5.61	5.53
US CONSUMER PRODUCT SAFETY COMMISSION WARNING	4.49	4.68	5.33	4.84
US FOOD AND DRUG ADMINISTRATION WARNING	5.25	5.32	5.54	5.37
AMERICAN MEDICAL ASSOCIATION WARNING	5.53	5.56	5.46	5.51
AMERICAN PEDIATRIC ASSOCIATION WARNING	5.02	4.95	5.67	5.21
HEALTH WARNING	4.32	4.44	4.54	4.43
SAFETY AND HEALTH WARNING	4.54	4.56	4.89	4.67
US PUBLIC HEALTH WARNING	4.75	4.75	4.68	4.73
MEDICAL HEALTH WARNING	4.74	5.00	4.82	4.85
IMPORTANT HEALTH WARNING	4.72	4.67	4.72	4.70
MEAN	4.58	4.72	4.87	

3.2.2. Compliance likelihood

A 3 (product warning: alcohol, cigarette, and iron supplement) × 12 (prefix) repeated measures ANOVA on the compliance likelihood ratings showed significant main effects of product warning, $F(2, 112) = 5.20$, $p < 0.01$, and prefix, $F(11, 616) = 19.09$, $p < 0.0001$. These means are shown on the bottom row (product warning message) and the right-most column (prefix) of Table 3. The Tukey's test showed that compliance likelihood ratings were significantly higher for the iron than for the cigarette warning. Participants gave higher compliance likelihood ratings when the signal word WARNING was present than when it was absent. All of the source conditions produced significantly higher compliance likelihood ratings than the signal word alone, except for the shortest general prefix HEALTH. The only other significant differences were between the highest-rated (specific) prefix AMERICAN MEDICAL ASSOCIATION compared to the three general prefixes HEALTH, SAFETY AND HEALTH, and IMPORTANT HEALTH.

The ANOVA also showed a significant interaction, $F(22, 1232) = 2.32$, $p < 0.001$. Simple effects analysis followed by paired comparisons showed

Table 3
Mean ratings of compliance likelihood as a function of product warning and prefix

	Product warning message			
Prefix	Alcohol	Cigarette	Iron	Mean
[Blank]	3.53	3.16	3.91	3.53
WARNING	4.23	3.88	4.79	4.30
US SURGEON GENERAL's WARNING	5.33	5.12	5.54	5.33
US CONSUMER PRODUCT SAFETY COMMISSION WARNING	4.88	4.46	5.79	5.04
US FOOD AND DRUG ADMINISTRATION WARNING	5.40	5.09	5.51	5.33
AMERICAN MEDICAL ASSOCIATION WARNING	5.51	5.30	5.84	5.55
AMERICAN PEDIATRIC ASSOCIATION WARNING	5.16	4.86	5.89	5.30
HEALTH WARNING	4.81	4.40	5.28	4.83
SAFETY AND HEALTH WARNING	4.95	4.37	5.44	4.92
US PUBLIC HEALTH WARNING	5.07	4.53	5.40	5.00
MEDICAL HEALTH WARNING	5.05	4.61	5.47	5.04
IMPORTANT HEALTH WARNING	4.95	4.53	5.42	4.96
MEAN	4.91	4.52	5.36	

that the pattern of means was consistent with the main of effects of warning and prefix described above except that the prefixes AMERICAN PEDIATRIC ASSOCIATION and US CONSUMER PRODUCT SAFETY COMMISSION were rated higher when combined with the iron supplement warning than when combined with the other two product warning messages.

3.2.3. Discussion

The results show that the presence of specific, reputable, expert sources compared to their absence in warnings increases judgments of message credibility and raises people's reported compliance likelihood. There were no significant differences among any the scientific/professional group and the governmental agency sources. The sources given consistently the highest ratings across all three products were the AMERICAN MEDICAL ASSOCIATION, The US FOOD AND DRUG ADMINISTRATION, and SURGEON GENERAL's. These specific entities are appropriate warning sources for the type of (consumable) products included in this study. Among the professional group and government sources, the AMERICAN PEDIATRIC ASSOCIATION and US CONSUMER PRODUCT SAFETY COMMISSION were rated somewhat lower (but not significantly) than the other specific sources. The analyses also noted that these two specific entities were given significantly higher ratings when combined with the iron supplement warning probably because this text message explicitly notes an injury to children.

General statements with no mention of a specific source (e.g., SAFETY AND HEALTH, IMPORTANT HEALTH) produced ratings that were intermediate between the specific source and the no-source conditions. None of the general-statement (no-specific source) conditions significantly differed from any of the specific source and no source conditions ($p > 0.05$).

A warning message lacking both a signal word and a source statement received lower ratings than one with the signal word Warning alone (i.e., no source). Similar to Experiment 1, the presence of a signal word benefits the two measures employed in this research. Warning messages containing just the signal word (alone), in turn, received lower ratings than ones that also included a specific source comprised of a highly reputed specific scientific/professional group or government agency.

It might also be noted that longer sources, as measured by letter count, received the highest ratings in the experiment. As observed in Experiment 1, specificity tends to be confounded with length. However, the effects seen in this study can not be fully explained by the length factor. Note that the length of the source US SURGEON GENERAL's is approximately the same as all but one of the general-statement (no specific source) conditions. However, the US SURGEON GENERAL's warning was among the highest rated conditions in

the experiment. Thus, it would appear that it is the content of the print that is controlling people's evaluations, not its length.

These results are consistent with social-persuasion theory and research indicating that a message's impact is affected by source characteristics. Apparently, when a warning message appears to emanate from a (specific) reputable, expert source, the warning appears more credible and its presence enhances compliance intentions.

4. General discussion

The present study is only the second study to systematically assess the effects of warning source. The results are consistent with social-persuasion research showing that effectiveness depends on the characteristics of the source. When a warning message appears to come from a specific, reputable, expert source, it apparently makes the warning appear more credible and enhances compliance intentions. Specifically, the results showed that warnings having sources such as the US FEDERAL GOVERNMENT (Experiment 1), the AMERICAN MEDICAL ASSOCIATION, the US FOOD AND DRUG ADMINISTRATION, and the SURGEON GENERAL's (Experiment 2) are better than warnings lacking such a source. There were no differences between scientific professional groups and government agencies. General statements with no attributable source produced intermediate ratings.

When applying these findings to the design of warnings, there are potential tradeoffs to consider. First, the available surface area for warnings is frequently restricted in size. Second, the amount of information that one can give without chasing off readers is limited. And third, there are legibility concerns when warning messages are viewed in degraded environments, particularly, by people who are visually impaired. It is therefore possible that adding extra words dealing with the source might preclude the inclusion of other potentially useful information, or it might require the use of smaller size print. Each of these possibilities carry with them the potential to negatively impact legibility and noticeability. Clearly, these tradeoffs should be considered in designing and evaluating the content of a warning.

The research reported here is one of the first investigations on the effects of warning source. Only a few on the many factors associated with source were examined. Other relevant variables could be systematically manipulated in future research, for example, on the effects of media stars, manufacturers, and trade organizations as the warning message source. Research is also needed to determine whether the effects depend on receiver/audience characteristics (e.g., demographics). Furthermore, other methodologies (as opposed to the subjective evaluation technique that were employed in the present research) should be considered. For example, evaluation of source effects under more realistic task-behavior conditions would be desirable. Together, such future investigations will help to determine the present results' generality and will assist in identifying the parameters of source effects in warning communications.

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