

Alcoholic Beverage Warnings in Magazine and Television Advertisements

TODD BARLOW
MICHAEL S. WOGALTER*

Two experiments investigated the impact of warnings in mass-media advertising in print (magazine) or broadcast (television) alcoholic beverage ads. Experiment 1 showed that participants exposed to highly conspicuous warnings in print ads performed better on subsequent memory and knowledge tests than those exposed to less conspicuous warnings. Less conspicuous warnings were generally no better than no warnings. In experiment 2, participants viewing broadcast commercials with both-modality warnings generally performed better than those exposed to voice-only or no warnings. Print-only warnings produced performance equivalent to, or in one case lower than, both-modality warnings. Both experiments show that warnings in ads can communicate information if presented in a salient form.

Federal law currently requires that a warning appear on the labels of all alcoholic beverage containers sold in the United States (*Federal Register* 1989). Since the enactment of this law, additional legislative measures have been proposed that would require warnings in ads for alcoholic beverages (e.g., Kennedy 1990). To date, only a few studies have empirically examined the features of alcoholic beverage warnings that enhance their communication (e.g., Godfrey et al. 1991; Laughery and Young 1991; Smith 1990; Young 1991). The purpose of the present research is to examine some of the factors that may influence the effectiveness of warnings in alcoholic beverage ads.

Two experiments investigated memory for warnings in print and television alcoholic beverage ads. The first experiment examined the effects of conspicuousness and configuration of warnings in magazine ads. The second experiment examined the effects of modality and placement of the warnings in television ads. In both experiments, participants viewed the warnings under incidental exposure conditions to simulate realistic magazine and television viewing (i.e., participants were not alerted to the fact that the experiments concerned warnings).

*Todd Barlow is a human factors consultant for Monterey Technologies, 1143G Executive Circle, Cary, NC 27511. Michael S. Wogalter is assistant professor of psychology, North Carolina State University, Raleigh, NC 27695-7801. The authors would like to thank Kent P. Vaubel and John W. Brelsford for their help in this research. Portions of experiment 1 were presented at the Human Factors Society thirty-fifth annual meeting in San Francisco (Barlow and Wogalter 1991). Requests for reprints and copies of the test materials should be sent to the second author.

EXPERIMENT 1

Placing a warning in an ad does not guarantee that it will communicate its information to the reader. In this context, warnings must compete with other images for attention. There are two ways to increase the salience of warnings. One is to decrease the background noise. For example, Wogalter et al. (1991) showed that the reduction of background contextual clutter (i.e., visual noise) increased compliance to a warning. The other is to make the warning itself larger and more conspicuous, which makes it more effective in attracting and holding the reader's attention. Young and Wogalter (1990) found that conspicuous print warnings (larger type size and color) in owners' manuals were remembered better than plain print warnings. Viscusi, Magat, and Huber (1986) found that participants reported that they would behave more cautiously as warning size increased. However, Popper and Murray (1989) showed that chewing tobacco warnings were ineffective as sources of hazard information even when their conspicuousness was enhanced.

The shape of the warning may also affect attention (Riley, Cochran, and Ballard 1982). Myers et al. (1981) found that, of nine shapes tested, an octagon and an arrow pointing into a circle were most likely to be noticed. Bhalla and Lastovicka (1984) found that, in comparison to the standard rectangle, both an elongated rectangle and the arrow pointing into a circle increased memory for warnings in cigarette ads. In contrast, Jaynes and Boles (1990) found no effect of shape on compliance with warnings.

In addition, several warning design standards and guidelines (ANSI 1991; FMC Corporation 1985; Westinghouse Printing Division 1981) have advocated the

inclusion of another shape in warnings, an exclamation point surrounded by a triangle (also known as the signal icon), to attract attention and indicate the existence of a hazard. However, two recent investigations on the signal icon show equivocal evidence regarding its utility. Young (1991) demonstrated that reaction time to detect a warning was significantly faster when a signal icon was present. However, Wogalter, Jarrard, and Simpson (1992) found no beneficial effect of the presence of a signal icon on perceptions of product hazard.

The current experiment compares the effectiveness of two warning factors, conspicuousness and shape, on memory and knowledge of alcoholic beverage facts and hazards. Highly conspicuous warnings were defined as larger, bold print warnings, with high foreground to background contrast relative to low conspicuous warnings. Three shapes are compared: (a) a plain rectangle (as used in cigarette warnings), (b) an arrow pointing into a circle (as used in chewing tobacco warnings), and (c) a rectangle with a signal icon (as suggested in warning design standards and guidelines).

Method

Design. The experimental design was a 2 (conspicuousness) \times 3 (shape) between-groups design. The highly conspicuous warnings used 11-point, bold, black print on a white background. The less conspicuous warnings used plain black print on the ad background and were 60 percent smaller than the highly conspicuous warnings.

The warning shapes were (a) a plain rectangle, (b) an identical rectangle with a signal icon to the left of the text, and (c) an arrow pointing into a circle. Within each conspicuousness level, the surface areas were equivalent for all shapes. Figure 1 shows examples of each warning configuration. A condition with no warnings served as a control.

Participants. One hundred five participants from the introductory psychology courses at the University of Houston, Rice University, and Rensselaer Polytechnic Institute (RPI) were assigned randomly to the seven conditions in equal proportions by school. Fifty-five percent of the participants were male.

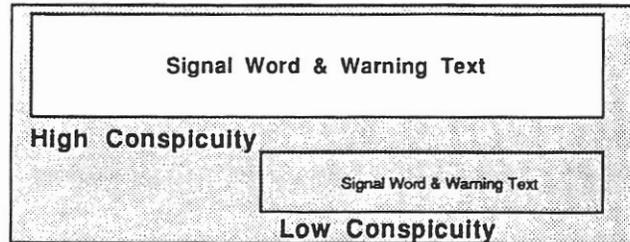
Materials and Stimuli. A preliminary study was conducted to develop the warnings. This study assessed knowledge about the hazards of alcohol consumption. On the basis of the results, 10 warnings were constructed that contained two to four lesser-known facts about the hazards of alcohol consumption. Lesser-known facts were chosen to reduce the chance that participants would be able to answer questions about the warnings without having read them. The warnings are shown in Exhibit 1.

Sixty-five alcoholic beverage ads were collected from a variety of magazines. Ads with predominantly black or white backgrounds were eliminated because (a) with

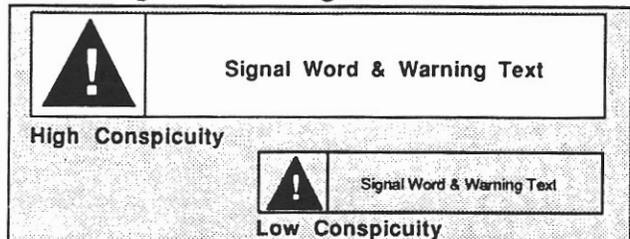
FIGURE 1

EXAMPLES OF MAGAZINE WARNING CONFIGURATIONS

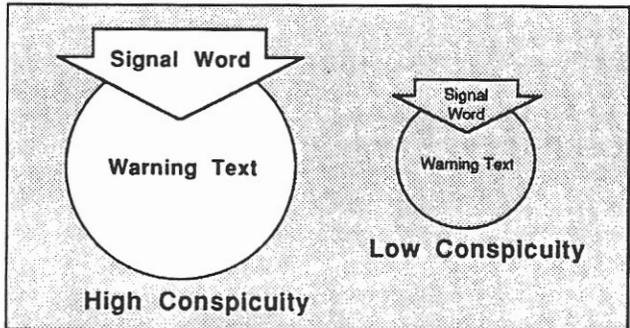
Plain Rectangle



Rectangle with Signal Icon



Circle and Arrow



NOTE.—The gray areas represent the ad background. The warnings in the ads were 21 percent larger than shown in this figure.

a black background, the warnings cannot be seen at all in the less conspicuous conditions, and (b) with the white background, the conspicuousness manipulation would be confounded with the ad background.

The 10 warnings were randomly assigned to 10 of the ads. Warnings were placed in the largest open area of the ad to avoid obscuring any advertising elements.

Forty-three ads for other products and services were selected for inclusion in the magazine on the basis of an analysis by Jacoby and Hoyer (1987) of the most frequently advertised products in the top 18 national magazines.

Two articles were chosen from *Capital* magazine, a monthly publication about people and events in the Albany, New York area. One described 50 different local entertainment activities. The other described the case of a woman convicted of killing seven of her eight children.

EXHIBIT 1

WARNINGS IN THE MAGAZINE ALCOHOLIC BEVERAGE ADVERTISEMENTS

-
- WARNING: Drinking alcohol during pregnancy may cause the baby to have behavior problems, mental retardation, or deformities.
- WARNING: Daily drinking of alcohol increases the risk of throat, stomach, and prostate cancer and diseases of the liver and heart.
- WARNING: Beverage alcohol (also called ethyl alcohol or ethanol) is an addictive drug. Children of alcoholics have 4 times the risk of being alcoholics.
- WARNING: Drinking alcohol and taking sleeping pills or pain killers can be deadly. Antibiotics, when combined with alcohol, may not work.
- WARNING: Drinking coffee, taking a cold shower or vigorous activity does NOT help to sober up. The body needs 2 hours to get rid of the alcohol from 1 drink.
- WARNING: Carbonated alcohol is absorbed faster than noncarbonated alcohol. Within 2 minutes alcohol is absorbed by the stomach and carried by the blood to the brain.
- WARNING: Acts of violence are more likely after drinking alcohol, including sexual abuse, rape, child beatings, and murders.
- WARNING: In many states, the minimum penalty for driving legally drunk is 6 months suspension of driver's license, 15 days in jail, and a \$1500 fine.
- WARNING: 55% of traffic deaths are alcohol related. With alcohol, people are overconfident and have slower responses.
- WARNING: Drunk driving is the number-one killer of children and young adults. There is an alcohol-related death every 22 minutes.
-

The articles and ads were placed in a hardcover three-ring binder. All pages were high-quality color photocopies held in laminate enclosures.

Procedure. In order to prevent participants from determining the study's purpose and to permit an incidental test of memory, they were told that a local publishing company would like to know whether *Capital* magazine's graphic layout was responsible for its success. Participants were asked to rate each page on their willingness to stop and look at the page. They were given 30 seconds to rate each two-page spread using a nine-point Likert-type scale with the following numerical and verbal anchors: (1) not at all willing to stop and look, (3) somewhat willing to stop and look, (5) moderately willing to stop and look, (7) willing to stop and look, and (9) very willing to stop and look. The magazine was then removed, and three tests were administered to participants.

The first test was a 24-item questionnaire assessing cued recall (seven open-ended items) and recognition (17 multiple-choice and true-false items) of the warning content. The items on the first test were constructed to assess as many of the different informative aspects of the 10 warnings as possible. The second test assessed memory of the warning location. In this test, three areas of each alcoholic beverage ad (the warning location and two other objects) were covered by opaque ovals. Participants were asked to write a description of what originally appeared in the hidden area. The third test assessed recognition of the warning's appearance by presenting all six warning configurations (i.e., combinations of the two sizes and three shapes) and the option of a "no warning" response. The participant chose which configuration, if any, appeared in the magazine. After the third test, participants were debriefed and thanked for their participation.

Results

Scoring.—The responses to open-ended questions were scored with both strict and lenient criteria by a

coder who was unaware of the participants' assigned condition. With the strict criterion, responses were scored as correct if they matched the warning content exactly. With the lenient criterion, responses were scored as correct if they were similar in meaning to the warning content. For example, one question asked participants to list the types of medicines that are dangerous in combination with alcohol (see the fourth warning in Exhibit 1). With the strict criterion, a correct response would include both sleeping pills and painkillers. With the lenient criterion, a correct response could be any medicine similar to sleeping pills and painkillers, for example, barbiturates, depressants, and muscle relaxers. Strict scores tend to measure memory, whereas lenient scores tend to measure comprehension or knowledge (Young and Wogalter 1990).

For all tests, each correct answer was given one point. These data were converted to proportion correct scores by dividing the participants' summed scores by the total possible points. Because of the subjective nature of the lenient scoring, the reliability of the cued-recall measure was examined by having 20 percent of the data scored by another judge who was unaware of the experimental conditions. The Pearson product-moment correlation coefficient between the two scores was .83 ($p < .0001$).

The proportion data were subjected to an arcsine transformation and analyzed by 2 (conspicuousness) \times 3 (shape) between-subjects ANOVAs. To compare the control to the experimental conditions, a one-way ANOVA was performed, followed by subsequent comparisons using Fisher's least significant difference test. In the following sections, the reported test statistics are from the arcsine analyses, whereas the means are shown in the raw (untransformed) state.

Cued Recall of Warning Content. The first test on warning content included seven open-ended items that measured cued recall. Analysis of the strict scores showed a main effect of conspicuousness: $F(1,84) = 8.11, p < .01$. Participants in the highly conspicuous warning conditions ($\bar{X} = .23$) recalled more warning

content than participants in the less conspicuous warning conditions ($\bar{X} = .17$). There were no other significant effects for the strict scores, and there were no significant effects for the lenient scores.

Recognition of Warning Content. The first test also included multiple-choice and true-false items that measured recognition of warning content. Analysis of these scores showed a significant main effect of conspicuousness: $F(1,84) = 6.56, p < .05$. Highly conspicuous warnings increased recognition ($\bar{X} = .56$) in comparison with less conspicuous warnings ($\bar{X} = .50$). There was no significant effect of shape or interaction. Comparisons between the control condition and the experimental conditions showed that only the highly conspicuous rectangle with signal icon conditions ($\bar{X} = .58$) produced better recognition than the control condition ($\bar{X} = .49$): $p < .05$.

Warning Location. Participants were asked to recall the content of three areas in the ad, one of which was the warning's location. Responses were scored with both strict and lenient criteria. With the strict criterion, responses were scored as correct if they indicated the location of the warning exactly. With the lenient criterion, responses were scored as correct if they indicated a warning appeared in any one of the three locations.

Analysis of the lenient scores showed a significant main effect of conspicuousness: $F(1,84) = 72.51, p < .0001$. Participants in the highly conspicuous warning conditions ($\bar{X} = .75$) indicated that a warning appeared in the ads more often than participants in the less conspicuous warning conditions ($\bar{X} = .15$). There was no significant effect of shape or interaction. As expected, participants in the control condition did not recall seeing any warnings ($\bar{X} = .00$). Comparisons between the warning conditions and the control condition showed that recollection of the warning in all of the experimental conditions was significantly higher than in the control condition, except for the less conspicuous plain rectangle ($\bar{X} = .13$) and the less conspicuous circle and arrow ($\bar{X} = .10$) conditions.

Analysis of the strict data showed a significant main effect of conspicuousness: $F(1,84) = 73.21, p < .0001$. Participants in the highly conspicuous warning conditions ($\bar{X} = .58$) more accurately recalled the warning location than participants in the less conspicuous warning conditions ($\bar{X} = .11$). There was no significant effect of shape or interaction. Again, none of the participants in the control condition recalled seeing any warnings ($\bar{X} = .00$). Contrasts between the warning conditions and the control condition showed that participants exposed to highly conspicuous warnings correctly recalled the warning locations significantly more often than those in the control condition. None of the less conspicuous warning conditions significantly differed from the control.

Configuration Recognition. Analysis of the configuration recognition scores showed a significant main

effect of conspicuousness: $F(1,84) = 26.84, p < .0001$. The highly conspicuous configurations ($\bar{X} = .82$) were recognized more accurately than the less conspicuous configurations ($\bar{X} = .36$). No significant effect of shape or interaction was found. Comparisons between the warning conditions and the control condition showed that participants in the highly conspicuous circle and arrow ($\bar{X} = 1.00$) condition had significantly higher recognition than participants in the no-warning control ($\bar{X} = .67$) condition (whose correct answer on the test was the no-warning option). Participants in the control condition had significantly better recognition than participants in the less conspicuous rectangle with signal icon ($\bar{X} = .20$) condition and the less conspicuous circle and arrow ($\bar{X} = .33$) condition.

Discussion

In some warning conditions, knowledge and memory about the hazards of alcohol consumption were greater than in the control condition. This result indicates that warnings in magazine ads for alcoholic beverages can communicate product-related hazard information.

The results also showed that participants viewing highly conspicuous warnings retrieved more alcohol facts and hazards than participants viewing less conspicuous warnings. These results concur with Young and Wogalter (1990), who showed that participants retain more information from highly conspicuous warnings than from less conspicuous warnings. Conspicuous warnings do not blend in with surrounding pictures and text and are more likely to attract readers' attention (Wogalter et al. 1991).

Although it was expected that the rectangle with the signal icon and the circle and arrow would attract more attention than the plain rectangle, no effect for shape was found. This fails to support several earlier studies showing warning shape to be an important factor (Bhalla and Lastovicka 1984; Myers et al. 1981; Riley et al. 1982) but concurs with Jaynes and Boles (1990), who also found no effect of shape.

The possible existence of shape effects should not be dismissed, however. Shape might show possible influences under conditions not investigated in this research. For example, a change in shape might be useful after the presence of alcoholic beverage warnings in ads has become a familiar event. In the current experiment, the overwhelming effect of conspicuousness and the novelty of warnings in the ads might have obscured shape effects. Because it is unusual to find warnings in alcoholic beverage ads, once noticed they are likely to be read (Hunt, Smith, and Kernan 1989; Pezdek et al. 1989).

EXPERIMENT 2

Experiment 2 examined the effects of warnings in television ads. Research on the effects of warnings during or after television commercials has been virtually

EXHIBIT 2

WARNINGS IN THE TELEVISION ALCOHOLIC BEVERAGE COMMERCIALS

WARNING: Drinking alcohol during pregnancy may cause behavior problems or abnormal growth in the baby.

WARNING: On the U.S. roads, there is an average of one alcohol-related death every 22 minutes.

WARNING: 40% of all Americans will be involved in an alcohol-related traffic accident during their lifetime.

WARNING: Alcohol may cause health problems including high blood pressure, hypertension, and throat cancer.

WARNING: The body needs 2 hours to get rid of the alcohol in 1 beer, 1 glass of wine, or 1 shot of spirits.

nonexistent except for a series of studies by Louis Morris of the U.S. Food and Drug Administration that measured consumer reactions to warnings in prescription drug ads (Morris, Mazis, and Brinberg 1989; Morris, Ruffner, and Klimberg 1985; Morris et al. 1986).

Morris et al. (1989) examined consumer risk awareness and knowledge of risks and benefits relating to a hypothetical arthritis drug after viewing a television commercial for the drug. The risk information was presented either auditorily (by the announcer) or auditorily and visually (with written warnings on the television screen). Participants in the combined modality condition were more knowledgeable about product risks than participants in the audio-only condition.

The Morris et al. (1989) finding supports theory suggesting that simultaneous presentation of the same message in both the visual and auditory channels enhances memory (Garner 1974). In addition, an extension of Paivio's (1971) dual-code theory predicts superior memory for information presented in two modalities compared with information presented in one modality.

In comparing short-term memory for information presented in single modalities, Penny (1975, 1989) found that auditory presentation of relatively simple stimuli produced better memory than visual presentation. Warning research has also shown that the modality of presentation affects behavioral compliance (Wogalter and Young 1991; Wogalter et al. 1991). For example, Wogalter and Young (1991) found greater compliance with voice warnings than print warnings, but compliance with combined voice and print warnings was greater than with either voice or print alone.

However, experiments measuring retention of information in long-term memory have shown either no difference between the two modalities or superior memory for visually presented material (Dean, Yekovich, and Gray 1988). Dominance of visual stimuli over auditory stimuli has also been shown in previous television research comparing print and audio versions of news broadcasts (Furnham and Gunter 1985; Furnham, Proctor, and Gunter 1988).

Another factor that may influence memory for the warning is its temporal placement relative to the commercial. Simultaneous presentation of the warning and the ad may disrupt processing of the warning because of competition for attention. If so, it would be expected that a warning following the commercial would receive

greater attention and produce better memory. However, an opposite result can also be predicted. Warnings and ads presented simultaneously may result in a stronger association between the warning and the product, producing more links or cues to facilitate retrieval of the warning during product use.

Method

Design. The experimental design was a 2 (presence vs. absence of print warnings) \times 2 (presence vs. absence of voice warnings) \times 2 (time of presentation: during vs. following the commercial) between-groups design.

Participants. One hundred twenty RPI students from introductory psychology courses were randomly assigned to eight conditions. Eighty-nine were male and 31 were female. Their mean age was 18.6 years.

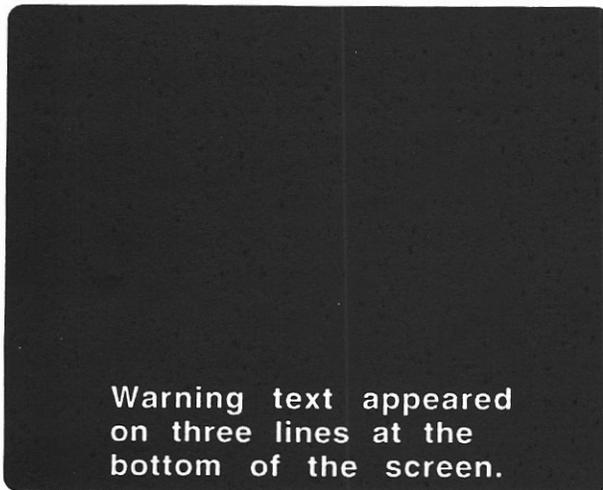
Materials and Stimuli. Alcoholic beverage commercials were embedded in a television program along with commercials for other products and services. The program was the final 25 minutes of a 1989 National Collegiate Athletic Association tournament basketball game. There were five commercial breaks in the program. Each break contained three 30-second commercials, one of which was a randomly placed alcoholic beverage commercial. The remaining two commercials were for non-alcohol-related products.

The warnings used in this experiment are shown in Exhibit 2. They were constructed from (a) a preliminary alcohol knowledge survey, (b) the warnings in experiment 1, (c) the current warning on alcoholic beverage labels, and (d) the warnings in a congressional bill proposed for print and broadcast alcoholic beverage advertisements (Kennedy 1990).

Voice warnings were spoken by a male at an average rate of 146 words per minute with the total duration ranging from 5.8 to 9.9 seconds. Print warnings appeared as white text with a black outline in three horizontal lines on the bottom 15 percent of the screen. Letter height was 1.5 centimeters viewed at a distance of 1.5–2.5 meters. Print warnings were presented for durations equivalent to those in the voice warnings. Figure 2 shows a representation of the print warning.

Voice and print warnings presented during the commercial were superimposed over the last frame of the commercial. Print warnings after the commercial were presented against a black background, while voice

FIGURE 2
REPRESENTATION OF THE TELEVISION SCREEN
WITH A PRINT WARNING



warnings after the commercial were presented in conjunction with the black background. Two control conditions lacked warnings. One showed the last frame of the commercial, and the other showed a black screen after the commercial.

Procedure. A cover story was used to conceal the purpose of the study to prevent participants from determining the study's purpose and to permit an incidental test of memory. Participants were told that the research concerned people's interest in and preference for different types of television programs. All participants were told that they would watch and evaluate a sports program. To promote belief in the cover story, they completed a questionnaire about their television viewing habits before viewing the program. After the participants had watched the program for 37.5 minutes (30 seconds after the last commercial block), the experimenter stopped the videotape and gave the participants two tests.

The first test measured free recall of warning content. In this test, participants were asked to write, as specifically as possible, any product-related warnings that they saw or heard during the program. The second test measured cued recall of warning content with open-ended and multiple-choice questions. Following testing, participants were debriefed.

Results

Scoring. The scoring procedures were similar to those used in experiment 1; strict and lenient criteria were again used for the scoring of the open-ended questions. Reliability of the lenient-scored data was assessed by having a second coder who was blind to conditions

TABLE 1
MEAN PERFORMANCE ON KNOWLEDGE AND MEMORY
MEASURES AS A FUNCTION OF MODALITY

Modality condition	Free recall		Cued recall	
	Strict	Lenient	Strict	Lenient
Print and voice	.025	.64	.54	.64
Print only	.005	.68	.48	.58
Voice only	.005	.66	.43	.48
No warning	.000	.00	.16	.26

rescore 20 percent of the data. The Pearson correlation between the two scorers was .93 ($p < .0001$).

The proportion data were transformed to arcsine scores and then analyzed with 2 (presence vs. absence of voice) \times 2 (presence vs. absence of print) \times 2 (during vs. after presentation placement) between-subjects ANOVAs. Subsequent comparisons were made with Fisher's least significant difference test. Because warning placement produced no significant effect (main effect or interaction) in any analysis, it will not be mentioned further in this section. The means in Table 1 are shown untransformed and collapsed across the placement variable.

Free Recall of Warning Content. Performance as measured by the strict scores was low in all conditions, and the ANOVA showed no significant effects. The ANOVA with the lenient scores showed significant main effects of print ($F(1,112) = 55.38, p < .0001$) and voice ($F(1,112) = 34.50, p < .0001$). However, these effects were produced as a consequence of a significant interaction: $F(1,112) = 61.85, p < .0001$. Subsequent comparisons showed that participants exposed to warnings in either or both modalities exhibited greater recall of the warning content than participants in the control conditions ($p < .05$).

Cued Recall of Warning Content. The ANOVA on the strict scores showed significant main effects of print ($F(1,112) = 34.61, p < .0001$) and voice ($F(1,112) = 34.61, p < .0001$), and a significant interaction ($F(1,112) = 7.85, p < .01$). Participants exposed to warnings in either or both modalities exhibited greater recall than participants in the control conditions ($p < .05$). In addition, participants exposed to warnings in both modalities recalled more information than participants exposed to voice warnings ($p < .05$).

The ANOVA on the lenient scores showed results similar to the strict analysis. In addition, the combined-modality warnings produced significantly higher performance than the print warnings ($p < .05$).

Discussion

Though each test showed somewhat different results, the pattern of the means was reasonably consistent

across all measures. Warnings presented in either one or both modalities produced greater knowledge and memory scores than the control conditions. This indicates that the hazards of alcoholic beverage consumption can be communicated effectively in television commercials.

In general, combined modality warnings and print warnings produced greater knowledge and memory compared with voice warnings. For one measure, combined modality warnings produced significantly better performance than print warnings. Together these results show (1) a warning combining voice and print is superior to either alone and, (2) of the two modalities, print has a greater effect than voice. The results concur with research (e.g., Morris et al. 1989; Young and Wogalter 1990) and theory (Garner 1974; Paivio 1971) asserting that redundancy through dual-modality presentation facilitates memory over nonredundant, single-modality messages. The results also support other television research showing visual superiority (Furnham and Gunter 1985; Furnham et al. 1988). However, the superiority of print over voice contrasts with previous short-term memory (Penney 1989) and warning compliance (Wogalter and Young 1991; Wogalter et al. 1991) research.

There are at least four possible explanations for superiority of print warnings compared to voice warnings. The first concerns the retention interval. In the current study, the commercials were spaced throughout a half-hour program, and, as a result, most knowledge was probably retrieved from long-term memory. Thus, the discrepancy with earlier research may lie in the memory systems. Short-term memory may benefit from auditory presentation (Penney 1989), whereas long-term memory may benefit from visual presentation (Dean et al. 1988). In warning compliance research (Wogalter and Young 1991; Wogalter et al. 1991), the warning directive was probably incorporated into an immediate action plan (e.g., donning protective gear before the task) where it remained in short-term memory as the participant decided on the correct sequence of behavior.

The second explanation lies in the nature of television viewing. Participants were in an empty room except for the television. The combination of the highly visual medium of television and the lack of distractions probably contributed to the visual superiority. In previous warning compliance research (Wogalter and Young 1991; Wogalter et al. 1991), print warnings were embedded in a set of instructions or presented on a sign in a visually cluttered environment. These conditions probably enhanced the utility of the voice warnings.

A third explanation for print superiority concerns the duration of the warnings. Although presentation time was equivalent for all conditions, the temporal nature of auditory presentation might have limited processing of the voice warnings because participants were forced to process them at the rate at which they were spoken. In contrast, given typical reading rates of

approximately 178 words per minute (Miyao et al. 1989), the presentation time allowed participants to review the print warnings thus enhancing memory of the material.

A final explanation may be that auditory superiority depends on the difficulty of the information to be remembered. Most of the studies reviewed by Penney (1975, 1989) used simple word stimuli. Chaiken and Eagly (1976) measured comprehension of both easy and difficult print, audio, and videotaped messages. For difficult messages, comprehension of the print messages was greater than in the other two conditions. For easy messages, there was no difference between modes. Though difficulty level was not manipulated in the present experiment, the selection of relatively unknown facts about alcohol consumption and participants' relatively low scores on the memory and knowledge tests suggests that the information was difficult rather than easy.

No effect of warning placement (during vs. following) was found. However, the technical limitations imposed on the during-commercial warnings might not be representative of the way an ad could interfere with a warning. Had the during-commercial warning been given in conjunction with the motion and sound of commercial messages, warning salience might have decreased relative to the after condition (Morris et al. 1989).

GENERAL DISCUSSION

One purpose of warnings is to communicate product or situational hazards to persons at risk (Wogalter, Allison, and McKenna 1989). The most important finding of this research is that warnings in mass-media advertising can communicate safety and health information. The differences in test scores between participants who saw and/or heard warnings and those who did not indicate that knowledge of alcoholic beverage hazards increased as a result of exposure to warnings. However, the experiments also showed that the effectiveness of warnings in ads depends on the way they are presented. There were some warning conditions in which participants were no more knowledgeable about the hazards of alcohol consumption than participants in the control condition. Thus, the warnings in those formats would be unacceptable, because their impact is no different than having no warning at all.

Experiment 1 showed that successful communication in the print media depends on the salience (represented here by conspicuousness) of the warning. Salience increased the likelihood of the viewer's seeing and reading the warning. In the less salient conditions, participants' knowledge and memory of the warnings was no better than performance in the no-warning control condition.

In magazine ads, warning shape had no effect. As described earlier, the large effect of conspicuousness might have obscured the effect of shape. Further re-

search could address whether shape becomes a more important factor under conditions such as when the novelty of warnings in alcoholic beverage ads is reduced over repeated exposures. In addition, subsequent investigations could determine other ways to increase warning salience, for example, by using color and pictorials and by varying combinations of several dimensions.

In experiment 2, warnings combining voice and print, as well as print alone, produced the best knowledge and memory scores. The superiority of the print mode is probably a result of (1) the use of long-term memory for storage and retrieval, (2) the visual nature of television viewing, (3) the opportunity for more extensive processing, and (4) the use of lesser-known information content.

Because magazines and television differ in the ways information is presented, different kinds of information are better suited for each medium. The print medium lends itself to longer, more complex verbal information, as it usually allows readers to review the information at their own pace (Furnham, Benson, and Gunter 1987). Since the presentation speed of information on television is not under the viewer's control, complex information may not be communicated well by voice (Bettman, Payne, and Staelin 1986).

However, interpretation of these findings should be tempered by several considerations. The first is that people are often engaged in other activities while watching television and thus will be dividing their attention between the program and other tasks. Voice warnings can attract attention and potentially convey a message to viewers who are not looking at the television (Stoneman and Brody 1983). However, there are conditions that are more conducive to the reception of print than voice warnings, such as when the viewer is listening to something other than the television program. Given the likelihood that these conditions exist, warnings using both print and voice will maximize the probability that the viewer will receive the information (Warshaw 1978).

A second consideration is that other variables might affect whether print will be better than voice warnings in television commercials. The warning messages employed in this study were relatively short ($\bar{X} = 17$ words), were on the screen in large print (letter height of 1.5 centimeters at a distance of 1.5–2.5 meters), and were shown for a relatively long duration ($\bar{X} = 7.8$ seconds). Most product-related information in television commercials today is presented in smaller print and for shorter durations. Under such conditions, the effectiveness of print warnings might be negligible.

A third consideration involves the environment in which the research took place, that is, at a university and not in the participants' homes. Efforts were made to simulate a "natural" reading or viewing environment as much as possible while maintaining experimental control, such as the use of incidental exposure proce-

dures to prevent participants from knowing the purpose of the research. Of the two experiments, experiment 2 (the television study) was probably the most realistic. The task in experiment 1 (the magazine study) possibly led participants to give more attention to the ads and the warnings than would be expected during casual magazine reading. The reason for using the procedure in experiment 1 was to maximize experimental control over exposure to the pages of the magazine. However, because participants rated two-page spreads, they had the opportunity to look at whatever they wanted to on either page—as in a normal magazine-reading situation. Further investigations could employ a more realistic situation, such as leaving the magazine on the table in front of participants while the experimenter appears busy preparing for some other task. However, with this scenario it can be expected that many participants will not open the magazine, or, if they do, some may skip the pages of the alcoholic beverage ads entirely. Thus, investigators should be prepared to employ many participants when attempting to compare the effects of different warning formats.

Finally, interpretation should also be tempered by the subject population employed in these experiments. As with many psychological studies, the sample was composed of undergraduate students, which could limit the results' generalizability to other subject populations. However, college students are one of several groups greatly at risk for developing alcohol-related problems, such as drunk driving and alcoholism (Magner 1988). It is the group at which most alcoholic beverage advertisements are aimed (Tenowitz 1988) and so is a population worthy of study in its own right (Andrews, Netemeyer, and Durvasula 1990). Most college students are underage drinkers who are nearing age 21, the age that allows legal purchase of alcoholic beverages in the United States. It is particularly relevant to ensure that this group receives the facts and hazards associated with alcohol. Armed with this knowledge, these young adults will be able to make better, more informed decisions regarding alcoholic beverage consumption. The present results suggest that warnings in ads can be an effective means of communicating this information.

Though alcoholic beverage ads were used as the vehicle to present warnings in the present research, the results may be applicable to ad warnings for other kinds of consumer products (e.g., medicines and recreational vehicles). These results show that the mere presence of a warning in advertising does not guarantee that it will be noticed, attended to, and remembered. Warning effectiveness depends on its salience and the medium in which it is presented.

[Received October 1991. Revised November 1992.]

REFERENCES

- Andrews, J. Craig, Richard G. Netemeyer, and Srinivas Durvasula (1990), "Believability and Attitudes toward Al-

- cohol Warning Label Information: The Role of Persuasive Communications Theory," *Journal of Public Policy and Marketing*, 9, 1-15.
- ANSI (1991), *American national standard for product safety signs and labels: Z535*, New York: National Electrical Manufacturers Association.
- Barlow, Todd and Michael S. Wogalter (1991), "Alcohol Beverage Warnings in Print Advertisements," in *Proceedings of the Human Factors Society 35th Annual Meeting*, Santa Monica, CA: Human Factors Society, 451-455.
- Bettman, James R., John W. Payne, and Richard Staelin (1986), "Cognitive Considerations in Designing Effective Labels for Presenting Risk Information," *Journal of Public Policy and Marketing*, 5, 1-28.
- Bhalla, Gaurav and John L. Lastovicka (1984), "The Impact of Changing Cigarette Warning Message Content and Format," *Advances in Consumer Research*, Vol. 11, ed. Thomas C. Kinneer, Provo, UT: Association for Consumer Research, 305-310.
- Chaiken, Shelly and Alice H. Eagly (1976), "Communication Modality as a Determinant of Message Persuasiveness and Message Comprehensibility," *Journal of Personality and Social Psychology*, 34 (October), 605-614.
- Dean, Raymond S., Frank R. Yekovich, and Jeffrey W. Gray (1988), "The Effect of Modality on Long-Term Recognition Memory," *Contemporary Educational Psychology*, 13 (April), 102-115.
- Federal Register* (1989), "Implementation of the Alcoholic Beverage Labeling Act of 1988" (Pub. L. 100-690, 27 CFR pts. 4, 5, 7, and 16), Vol. 54, Washington DC: Department of Treasury, 7160-7164.
- FMC Corporation (1985), *Product Safety Sign and Label System*. Santa Clara, CA: Westinghouse.
- Furnham, Adrian, Isabelle Benson, and Barrie Gunter (1987), "Memory for Television Commercials as a Function of the Channel of Communication," *Social Behaviour*, 2, 105-112.
- and Barrie Gunter (1985), "Sex, Presentation Mode, and Memory for Violent and Non-violent News," *Journal of Educational Television*, 11 (2), 99-105.
- , Eddie Proctor, and Barrie Gunter (1988), "Memory for Materials Presented in the Media: The Superiority of Written Communication," *Psychological Reports*, 63 (October), 935-938.
- Garner, Wendell R. (1974), *The Processing of Information and Structure*. Potomac, MD: Erlbaum.
- Godfrey, Sandra S., Kenneth R. Laughery, Stephen L. Young, Kent P. Vaubel, John W. Brelsford, Keith A. Laughery, and Elizabeth Horn (1991), "The New Alcohol Warning Labels: How Noticeable Are They?" in *Proceedings of the Human Factors Society 35th Annual Meeting*, Santa Monica, CA: Human Factors Society, 446-450.
- Hunt, James M., Michael E. Smith, and Jerome B. Kernan (1989), "Processing Effects of Expectancy Discrepant Persuasive Messages," *Psychological Reports*, 65 (December), 1359-1376.
- Jacoby, Jacob and Wayne D. Hoyer (1987), *The Comprehension and Miscomprehension of Print Communications: An Investigation of Mass Media Magazines*, East Sussex: Erlbaum.
- Jaynes, Linda and David B. Boles (1990), "The Effects of Symbols on Warning Compliance," in *Proceedings of the Human Factors Society 34th Annual Meeting*, Santa Monica, CA: Human Factors Society, 984-987.
- Kennedy, Joseph P. (1990), *Sensible Advertising and Family Education Act*, 102d Cong., H. Doc. 4493, Washington, DC: Government Printing Office.
- Laughery, Kenneth R. and Stephen L. Young (1991), "An Eye Scan Analysis of Accessing Product Warning Information," in *Proceedings of the Human Factors Society 35th Annual Meeting*, Santa Monica, CA: Human Factors Society, 585-589.
- Magner, Denise K. (1988), "Alcohol-related Problems Have Not Decreased on Most College Campuses, Survey Indicates," *The Chronicle of Higher Education*, (November 9), p. A35.
- Miyao, Masaru, Selim S. Hacialihzade, John S. Allen, and Lawrence W. Stark, (1989), "Effects of VDT Resolution on Visual Fatigue and Readability: An Eye Movement Approach," *Ergonomics*, 32 (June), 603-614.
- Morris, Louis A., David Brinberg, Ronald Klimberg, Lloyd Millstein, and Carole Rivera (1986), "Consumer Attitudes about Advertisements for Medicinal Drugs," *Social Science and Medicine*, 22 (6), 629-638.
- , Michael B. Mazis, and David Brinberg (1989), "Risk Disclosures in Televised Prescription Drug Advertising to Consumer," *Journal of Public Policy and Marketing*, 8, 64-80.
- , Michael Ruffner, and Ronald Klimberg (1985), "Warning Disclosures for Prescription Drugs," *Journal of Advertising Research*, 25 (October/November), 25-32.
- Myers, Matthew L., Craig Iscoe, Carol Jennings, William Lenox, Eleanor Minsky, and Andrew Sacks (1981), *Staff Report on the Cigarette Advertising Investigation*, Washington, DC: Federal Trade Commission.
- Paivio, Alan (1971), *Imagery and Verbal Processes*, New York: Holt, Rinehart & Winston.
- Penney, Catherine G. (1975), "Modality Effects in Short-Term Verbal Memory," *Psychological Bulletin*, 82 (January), 68-84.
- (1989), "Modality Effects and the Structure of Short-Term Verbal Memory," *Memory and Cognition*, 17 (July), 398-422.
- Pezdek, Kathy, Tony Whetstone, Kirk Reynolds, Nusha Askari, and Thomas Dougherty (1989), "Memory for Real-World Scenes: The Role of Consistency with Schema Expectation," *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 15 (July), 587-595.
- Popper, Edward T. and Keith B. Murray (1989), "Communication Effectiveness and Format Effects on In-Ad Disclosure of Health Warnings," *Journal of Public Policy and Marketing*, 8, 109-123.
- Riley, Michael W., David J. Cochran, and John L. Ballard (1982), "An Investigation of Preferred Shapes for Warning Labels," *Human Factors*, 24 (December), 737-742.
- Smith, Sandra J. (1990), "The Impact of Product Usage Warnings in Alcoholic Beverage Advertising," *Journal of Public Policy and Marketing*, 9, 16-29.
- Stoneman, Zolinda and Gene H. Brody (1983), "Immediate and Long-Term Recognition and Generalization of Advertised Products as a Function of Age and Presentation Mode," *Developmental Psychology*, 19 (January), 56-61.
- Tenowitz, Ira (1988), "Miller Looks for Lite Torch to Tap Youth," *Advertising Age*, (August 1), p. 3.

- Viscusi, W. Kip, Wesley A. Magat, and Joel Huber (1986), "Informational Regulation of Consumer Health Risks: An Empirical Evaluation of Hazard Warnings," *Rand Journal of Economics*, 17 (Autumn), 351-365.
- Warshaw, Paul R. (1978), "Application of Selective Attention Theory to Television Advertising Displays," *Journal of Applied Psychology*, 63 (June), 366-372.
- Westinghouse Printing Division (1981), *Westinghouse Product Safety Label Handbook*, Trafford, PA: Westinghouse.
- Wogalter, Michael S., Scott T. Allison, and Nancy A. McKenna (1989), "The Effects of Cost and Social Influence on Warning Compliance," *Human Factors*, 31 (April), 133-140.
- , Stephen W. Jarrard, and S. Noel Simpson (1992), "Influence of Signal Words on Perceived Product Hazard," in *Proceedings of the Human Factors Society 36th Annual Meeting*, Santa Monica, CA: Human Factors Society, 935-939.
- , Raheel Rashid, Steven W. Clarke, and Michael J. Kalsher (1991), "Evaluating the Behavioral Effectiveness of a Multi-modal Voice Warning Sign in a Cluttered Environment," in *Proceedings of the Human Factors Society 35th Annual Meeting*, Santa Monica, CA: Human Factors Society, 718-722.
- and Stephen L. Young (1991), "Behavioural Compliance to Voice and Print Warnings," *Ergonomics*, 34 (January), 79-89.
- Young, Stephen L. (1991), "Increasing the Noticeability of Warnings: Effects of Pictorial, Color, Signal Icon and Border," in *Proceedings of the Human Factors Society 35th Annual Meeting*, Santa Monica, CA: Human Factors Society, 580-584.
- and Michael S. Wogalter (1990), "Comprehension and Memory of Instruction Manual Warnings: Conspicuous Print and Pictorial Icons," *Human Factors*, 32 (December), 637-649.