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Using voice and print directives and warnings to supplement product manual instructions

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Abstract

The present research investigated the effect of supplemental messages on compliance with and recall of product manual instructions. During the unpacking of a computer disk drive supplemental messages were presented that concerned procedures to prevent product damage during installation. The supplemental messages were either presented by digitized voice (auditory) or by printed placard (visual). Two types of message were presented. Either the message gave specific warning instructions or directed users to a specific location in the product manual where the instructions were printed. Results show that the supplemental voice and print messages increased compliance behavior compared to the manual only. The voice message produced the greatest recall compared to print or no supplement. There was no effect of the warning vs directive manipulation. The results support the use of supplemental messages to communicate particularly important information. Implications for the delivery of warning instructions in product manuals are discussed.

Relevance to industry

Manufacturers are responsible for warning users about hazards associated with foreseeable use or misuse of their products. The present study shows that a supplemental print or voice message combined with a typical product manual produces significantly higher compliance than the manual alone.

Keywords: Warning; Visual displays; Auditory displays; Product manuals; Consumer product

1. Introduction

Ideally manufacturers will design out all of the potential hazards associated with the use of their products. However, sometimes this is not possible so the manufacturer will attempt to deliver warnings to the product user. Warnings for consumer products are intended to discourage user behaviors which may result in personal injury to the user or damage to the product. Frequently warnings are printed on labels affixed directly to the product. Some instructions and warnings, however, are found only in the product operators manual.

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One problem with placing important information in a product manual is that many users will not read it. Using a self-report survey, Celuch et al. (1992) found that with prior product experience people are less likely to read a product manual. Several studies (Godfrey et al., 1983; Otsubo, 1988; Wogalter et al., 1991; Wright et al., 1982) have shown that people are more willing to look for warnings associated with less familiar and more hazardous products. Otsubo (1988) found that lower product familiarity produced greater behavioral compliance compared to higher familiarity. In a review of research on consumer product warnings, DeJoy (1989) concluded that familiarity beliefs and perceived hazard were the most important factors in warning effectiveness.

Research has identified several design factors that facilitate warning communication, both on printed warning labels and in product manuals. Young and Wogalter (1990) found that making warnings in operator manuals more salient by using larger text, color highlighting and pictorial icons increased comprehension and memory. Attention and compliance with warnings can also be increased by placing the message more proximal to the task being performed (Wogalter et al., 1995) or by actually having the warning physically interfere with task completion (Frantz and Rhoades, 1993; Dingus et al., 1993; Duffy et al., 1995).

Most product warnings are print. One product-warning design factor that heretofore has been neglected is voice presentation. Most research on voice warning effectiveness has been in high-workload environments such as airplane cockpits (Simpson and Marchionda-Frost, 1984) and air traffic control simulators (Hakkinen and Williges, 1984). In years past, automated voice presentation for products was not feasible, as it would be prohibitively expensive relative to the cost of the product itself. Nevertheless research suggests that presenting warning information using the auditory modality could be useful in promoting greater attention and compliance with warnings. Kroemer et al. (1994) noted that auditory signals are better than visual displays when a message must attract attention. They define active warnings (auditory, voice) as serving to alert people of impending danger. In contrast, passive warnings (printed signs, instructions in an product manual) rely on people to recognize the important elements of the warning material. Moreover, Darrow (1983) suggested that voice warnings are better than simple auditory alarms because they can communicate more detailed information.

Two studies using a simulated chemistry task paradigm have shown increased compliance when a warning was presented by voice alone or in combination with a printed warning sign (Wogalter and Young, 1991; Wogalter et al., 1993). Voice presentation has also been found to benefit compliance in a field study with data collected at a shopping mall. Thus, research suggests that product warnings presented by voice might be useful in warning communication because of their alerting potential compared to visual displays and their ability to convey more information than non-verbal auditory signals.

Recent technological advances have allowed voice synthesis integrated circuit chips to find applications in relatively inexpensive consumer products like clocks, toys, and greeting cards. To date no research has examined the potential advantages of using voice technology to alert users to the potential hazards associated with consumer products. One purpose of the present study was to examine the effectiveness of voice chips as a means of communicating warning information.

Although most products are accompanied by a product manual, some people may not read all or even some of the manual before installing and using the product. Certain instructions in the manual may be critical for proper installation and startup, and if they are not followed personal injury or property damage can result. Thus it may be necessary to communicate certain safety instructions at the outset of the installation procedures before a potentially harmful event occurs. Research has shown that supplementing product manual warnings with a strategically located print directive to read the manual produces greater warning compliance in a computer disk drive installation task (Wogalter et al., 1995). Additionally, Showers et al. (1992) suggested that supplementing printed product manuals with audio- or videotapes which highlight product features and safety precautions encourages the use of product manuals. A second

purpose of this research was to investigate whether supplemental voice and print messages in addition to the product manual increase warning compliance.

In the Wogalter et al. (1995) study, during installation of a computer disk drive, a supplemental message was interjected at various points during the unpacking and installation procedures which simply directed the recipient to a page location in the product manual where the specific warning instructions were given. In certain situations, however, the supplemental message may be short enough to provide actual warning information. A third purpose of the present study was to examine whether the effectiveness of supplemental information depends on message type. The content of the supplemental message either directed participants to a page in the product manual or gave actual specific instructions for avoiding equipment damage during installation.

A final purpose of the study was to examine whether indices of product familiarity (operationalized here as prior experience setting up high-tech consumer electronic products like VCRs and stereos) relates to warning compliance and memory. Previous research (e.g., Godfrey et al., 1983; Wogalter et al., 1991; Wright et al., 1982) has shown product familiarity to be inversely related to warning effectiveness measures.

2. Method

The basic task carried out by participants involved the installation of an external, floppy disk drive to a computer. The same task was used by Wogalter et al. (1995) to investigate the effects of different warning locations on compliance.

2.1. Participants

Fifty-five undergraduates at North Carolina State University between the ages of 17 and 34 yr ($M = 21.6$, $SD = 4.0$) participated. All received course credit for participating. Participants were randomly assigned to one of five conditions: print warning, voice warning, print directive, voice directive, and control (no supplemental message).

2.2. Materials

The materials included an Apple Macintosh personal computer, a Fujitsu external floppy disk drive, a plastic protective diskette, a black and white reproduction of the disk drive product manual, two miniaturized digital voice systems, five cardboard shipping boxes and various kinds of packaging materials (e.g., foam wrap, a clear plastic bag, and enough styrofoam packing material to fill the boxes). The disk drive ($13.0 \times 20.5 \times 3.5$ cm) was wrapped in the foam and placed, with the product manual, in the plastic bag. A plastic protective diskette (used for the purpose of protecting the drive head during shipping) was inserted in the drive. The plastic bag was taped closed and placed in the bottom of a shipping box. The box was filled with packing material and taped shut.

The product manual (21.5×14.0 cm) was printed in 10-point Times font, was 14 pages in length, and included computer hardware and software requirements and instructions for the setup, use, and maintenance of the disk drive. Pages 6 and 7 of the manual listed precautionary steps (i.e., warning instructions) to be performed before connecting the disk drive to the computer. This printed information in the manual was presented in both line-drawn pictures and words and instructed the user to: (1) turn off the computer, (2) touch the metal connector on the back of the computer to prevent electrostatic discharge which could damage the disk drive, and (3) eject the transport disk from the drive. These same precautionary steps also served as the content of the supplemental warning instructions or served as the material to which the supplemental directive referred.

The digital voice systems were taken directly from two relatively inexpensive store-bought greeting cards. Each consisted of a "voice chip" capable of recording and playing back a maximum of ten seconds of auditory information, a small speaker, and some peripheral hardware and switches.

The cardboard shipping boxes were plain white (no printing) and measured $30.5 \times 22.9 \times 19.1$ cm. A different box was used for each experimental condition. For the print conditions, the message (warning or directive) was printed in black, bold,

san serif 24-point font on white paper (10.2 × 17.8 cm) and taped to an inside flap of the box, so that the message would be visible when the box was opened. For the print warning condition the message read, "Please turn off the computer, discharge static electricity and remove the protective diskette before installing the disk drive." The message for the print directive condition read "Please read pages 6 and 7 of the owners manual before installing the disk drive." For each of the voice conditions (warning or directive) the digital voice recording system was attached to an inside flap of the box with a switch positioned so that when the box was opened the recorded message would play. The messages were in a male voice and played for approximately 9 s at 80 dBA. The wording of the messages was exactly the same as in the corresponding print conditions. In the control condition, no supplemental message was presented when the box was opened. The product manual was present in all conditions, located in the plastic bag with the disk drive.

2.3. Procedure

The computer and an attached printer were located on a desk in the experiment room. The disk drive was packed in the appropriate box and placed on a table about 1.0 m from the desk. Participants were seated in front of the computer, which was powered on prior to the beginning of the session, and told that the box on the table to their right contained a disk drive. They were asked to imagine that they had just purchased the disk drive and brought it home. They were instructed that their task was to remove the disk drive from its shipping box and connect it to the computer. Participants were given the opportunity to ask questions about the task before they began, but once they started they could not ask any questions. They were told that if they had difficulty to figure it out as best they could on their own. Participants were also instructed to complete the task as quickly as possible but at the same time to maintain accuracy. After being told to begin, participants walked to the table where the disk drive was located. Immediately upon opening the box, participants in the experimental conditions either heard or saw the supplemental message. Participants were never specifically instructed to read the product manual except in the two directive conditions where they were told as part of these conditions to read pages 6 and 7. The experimenter silently observed from a position approximately 3.0 m behind the participants and recorded whether they complied with the three precautionary instructions listed in the product manual.

After completing the installation task, participants were given a questionnaire which asked about their experience with personal computers and other electronic equipment (VCRs, stereos). The items included whether they had ever setup or installed each of the above-mentioned types of equipment, either for themselves or helping someone else, and if so, how many times. The questionnaire also asked participants to list all of the precautionary steps that should be taken before connecting the disk drive to the computer and to provide basic demographic information (gender, age, etc.). After completing the questionnaire, participants were debriefed and thanked.

3. Results

All participants were able to connect the disk drive to the computer within ten minutes. Behavioral compliance with and recall of the three precautionary instructions were analyzed separately.

3.1. Compliance measures

If a participant complied with an instruction they were given a score of "1" otherwise they were given a "0." From these scores compliance percentages were computed for each of the three instructions separately. In addition, a composite compliance score was computed by combining all three instructions. Participants scores were summed producing a measure of overall compliance that ranged from 0 to 3.

Across all conditions, compliance rates were high: 85.5% of all participants complied with the instruction to turn off the computer, 81.8% discharged static electricity and 69.1% ejected the transport disk before connecting the disk drive.

Table 1 shows the percentage of compliance with each instruction and mean overall compliance as function of the five conditions. It is evident from this table that compliance with all three instructions was greater for all experimental conditions (supplemental plus manual) than for the control (manual only) condition.

Compliance with the "turn off the computer" instruction showed a significant effect of conditions, χ^2 (4, $n = 55$) = 12.65, $p < 0.05$. For this instruction, specific comparisons between each supplemental message condition and the control condition showed that both voice conditions (warning and directive) produced significantly higher compliance than the manual only condition ($ps < 0.01$). Neither the "discharge static electricity" nor the "eject transport diskette" instructions showed a significant effect ($ps > 0.10$). Significantly lower compliance was found for the manual only condition compared to a combined measure of all supplemental conditions, χ^2 (1, $n = 55$) = 10.57, $p < 0.01$.

Using the overall compliance scores, the combination of all supplemental conditions was significantly greater than the manual only condition, $t(53) = 2.36$, $p < 0.05$. Pairwise comparisons between each of the supplemental manual conditions and the control condition showed no significant differences ($ps > 0.05$).

The overall compliance data were also analyzed by modality of the presented message (i.e., voice vs print) and whether the message was a warning or a directive. A 2×2 (auditory vs visual modality) $\times$ (warning vs directive message) ANOVA showed no significant effects, $ps > 0.10$.

3.2. Recall measures

The questionnaire assessed recall of the three precautionary steps. Responses were scored as correct if they had similar meaning to the warning instructions given on pages 6 and 7 of the manual. Additional precautions such as "be careful" and "don't drop the disk drive" were considered incorrect. The recall data was compiled and analyzed in the same manner as the compliance data.

Recall of each warning instruction was analyzed separately and an overall recall score representing the total number of instructions recalled (0–3) was computed. Table 2 shows the percentage of participants in each condition who correctly recalled each instruction and the mean overall recall scores for each condition. Although recall of the instructions in the manual only condition was lower than or equal to all of the supplemental conditions, chi-square analyses showed no significant recall effects ($ps > 0.10$). While a one-way between-subjects analysis of variance (ANOVA) failed to show a significant effect of conditions on overall recall, $F(4,50) = 2.06$, $p = 0.10$, planned contrasts among conditions showed that the voice warning supplement condition produced significantly greater overall recall compared to the manual only condition, $t(21) = 2.33$, $p < 0.05$. Moreover, a 2×2 (modality) $\times$ (message type) ANOVA on overall recall revealed a main effect of modality, $F(1,40) = 4.99$, $p < 0.05$. Significantly more instructions were recalled when the supplemental messages were presented by voice than by print. No significant effect of warning vs directive, nor an interaction was found ($ps > 0.10$).

Table 1
Percentage of participants who complied with each instruction and mean overall compliance (ranging from 1 to 3)

Condition	% Turn off computer	% Discharge static electricity	% Eject protective diskette	Mean overall compliance
Manual only (control)	54.6	54.6	63.6	1.73
Manual plus supplemental				
Print warning	90.0	70.0	90.0	2.50
Voice warning	100.0	58.3	91.7	2.50
Print directive	81.8	81.8	81.8	2.46
Voice directive	100.0	81.8	81.8	2.64

Table 2
Percentage of participants who recalled each instruction and mean overall recall (ranging from 1 to 3)

Condition	% Turn off computer	% Discharge static electricity	% Eject protective diskette	Mean overall recall
Manual only (control)	45.5	54.6	9.1	1.09
Manual plus supplemental				
Print warning	50.0	70.0	20.0	1.40
Voice warning	83.3	83.3	41.7	2.08
Print directive	45.5	72.7	27.3	1.27
Voice directive	81.8	72.7	9.1	1.82

3.3. Familiarity

Reported experience setting up computers, stereos, and VCRs was used as a measure of familiarity with electronic equipment. Participants were asked how many times in the past they had "set up" each of these types of equipment, either for themselves or assisting someone else. Experience varied widely among participants. Approximately one-fourth (13 of 55) reported having set up or installed electronic equipment three times or less, whereas a like number reported having done this more than 15 times. Experience with computers alone was just as varied. Twenty-one participants reported no experience setting up or installing a computer, while 16 participants had performed the activity at least three times. Participants were divided into three groups (high, medium, and low) based on experience (a) setting up computers and (b) all types of electronic equipment. ANOVAs comparing these experience groups on measures of compliance and recall showed no significant differences ($ps > 0.05$). Additional analyses examining participants divided by a median split were also not significant ($ps > 0.05$).

4. Discussion

The results show that compliance with product manual warning instructions can be increased through the use of supplemental messages. Although significant effects were found for only one of the three specific instructions, overall compliance was reliably greater when supplemental warnings and directives accompanied the product manual. The lack of significant findings for the "discharge static electricity" and the "eject transport diskette" instructions is most likely due to a ceiling effect. A high percentage of participants in all experimental conditions complied with the instructions making it difficult to show significant differences among conditions since compliance was near maximum. Had compliance rates been lower the experiment might have been more sensitive (i.e., more power) to detect differences in compliance among conditions.

The extremely high compliance rates across all experimental conditions can be attributed to several factors. The temporal and spatial placement of the supplemental messages in the task made it almost impossible not to attend to them. Also participants may have behaved more cautiously for fear of damaging an expensive piece of equipment that belonged to someone else. Several participants seemed somewhat intimidated by the task. Upon hearing that they would be connecting something to a computer, a number of them responded with some degree of concern and asked if instructions would be provided.

The results failed to show significant compliance differences due to message modality (voice vs print) or content (warning vs directive). While the voice modality tended to show greater warning compliance in some conditions, compliance rates were not significantly different from those for the print conditions – although both were consistently higher than for the manual only condition. This indicates that supplemental voice messages can communicate warning information as effectively as the

printed version. However, these results might be confined to the type of messages used in the present study. Longer or more complex messages might show a deficit for the voiced version (Penney, 1989). Nevertheless, since consumers typically are given only the information in the product manual the present results suggest that any supplemental information, whether in voice or print, is beneficial.

While the compliance results did not show a significant difference between voice and print, the recall data showed better memory when the supplemental message was presented auditorily as opposed to visually. This supports Penney's (1989) conclusion that simple sequential items, like warning instructions, are held more strongly in memory if presented in an auditory stream, like speech, than in a visual stream, like print. However, it does not support other research showing that print warnings are recalled more easily than auditory warnings such as in Barlow and Wogalter (1993). Barlow and Wogalter (1993) has voice vs print warnings embedded in television advertisements, and so differences in both the vehicle of presentation and the situation might account for the discrepancy.

Although we failed to find a significant difference for message type (warning vs. directive) results indicated that a brief directive can be as effective as a direct warning. This result is important because a directive may have advantages when the full warning message cannot be given via voice because of time constraints or printed because of limited surface space (e.g., when the product has multiple hazards). For example, if a warning message is long or complex the most effective way to communicate might be to briefly point out the most severe, probable, and temporally important hazards and then direct the user to another location for further information (such as to a more complete product manual). Although message content (warning vs directive) had no differential effects in this experiment, additional investigations are necessary to determine whether this factor is influential in other situations or with other products.

The inability to find an effect of product experience (familiarity) was somewhat surprising and fails to support previous findings showing an influence of familiarity on warnings related variables (e.g., Godfrey et al., 1983; Otsubo, 1988; Wogalter et al., 1991; Wright et al., 1982). One possible explanation for this finding is that even participants who were experienced and had performed tasks similar to the experimental procedure several times in the past may not have been confident enough to perform the task without attending to the instructions. Additional research is necessary to determine whether confidence or some other factor might be moderating this effect, however.

The present results show increased compliance with a set of precautionary instructions in a product manual when a supplemental message is delivered compared to when it was not (i.e., the manual only conditions). This supports the finding of Wogalter et al. (1995) that the presence of a well placed supplemental message facilitates the likelihood of precautionary behavior. Implementation of these supplemental messages, particularly in the print form, is relatively inexpensive to implement. Moreover, the costs are likely to be offset by reduced consumer complaints and product returns particularly in the early stages of product ownership when the product may be damaged by incorrect installation procedures. The results also support the idea proposed by Wogalter and Young (1991) of using voice chips as a means of presenting warning information. Although the cost of implementing voice warnings has dropped dramatically in recent years due to mass production, they are probably still too costly and complicated to implement in very inexpensive, commonly used consumer products. Nevertheless, voice warnings might be beneficial in situations where cost is less constrained and where the direction of users' visual focus can not be guaranteed.

One limitation of the present study is the use of a student population for participants. While students are not a representative sample of the general population of users of consumer products, for the type of product being considered here (computers) young, educated adults presumably make up a significant percentage of users. Also, because students were drawn from a number of different academic disciplines, a wide variety of backgrounds and experiences were represented in the sample. However, caution should be exercised in generalizing to other populations.

There are relatively few studies in the warnings literature that have measured actual compliance behavior, rather than using evaluations based on subjective judgments such as ratings and rankings or using comprehension/memory tests. Thus these results are not only important because they provide positive evidence for the utility of supplemental warnings and directives, but also because they demonstrate that such messages can change people's behavior.

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