

Modality of Communication and Recall of Health-related Information

ROD CORSTON & ANDREW M. COLMAN
University of Leicester, UK

ROD CORSTON is currently in the Department of Psychology, Peterborough Regional College, UK

ANDREW M. COLMAN is in the Department of Psychology at the University of Leicester, UK.

ACKNOWLEDGEMENT. This research was supported in part by Grant No. M71 from BEM Research. We are grateful to Mallory Wober and Geoff Lowe for comments on an earlier version of the article.

ADDRESS. Correspondence should be directed to:
ANDREW M. COLMAN, Department of Psychology, University of Leicester, Leicester LE1 7RH, UK. [email: amc@leicester.ac.uk.]

Journal of Health Psychology
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London, Thousand Oaks and New Delhi,
ISSN: 1359-1053 Vol 2(2) 185-194

Abstract

A health warning was presented to 89 female and 19 male students aged 17-36 years via three modalities or channels of communication: a 'talking head' (video), an audiotape recording (audio) or a printed transcript (print). The verbal content of the message was identical in all three conditions. Participants' free recall, cued recall (recognition) and global recall of the message were then measured. On two separate dependent measures and a combined measure, recall was significantly ($p < .005$) better in both the audio and print conditions than in the video condition. No significant differences in recall were found between the audio and print conditions. These results, and those of earlier studies of modality effects on recall of information, are discussed in terms of self-pacing and distraction theories.

Keywords

channel of communication, context effects, distraction theory, modality of communication, self-pacing

HEALTH WARNINGS designed to alert members of the general public to new diseases, such as AIDS, or to encourage health-related behaviours, such as having one's blood pressure checked or avoiding cigarette-smoking, are often issued in the form of short public-information or public-service announcements, which are broadcast on television or radio, published as newspaper or magazine advertisements or issued as separate leaflets (Rice & Paisley, 1981). Although the usefulness of such communications is often taken for granted (e.g. Brawley, 1983; Sprafkin, Swift, & Hess, 1983), the published evidence regarding their effectiveness is equivocal (Department of Health, 1992; Marks, 1994; McGuire, 1985; Murphy, 1980; Schmeling & Wotring, 1980; Tyler, 1984; Warner, 1977; Winett, King, & Altman, 1989). In a review of some 400 studies, R. McCarthy, Finnegan, Krumm-Scott and G. McCarthy (1984) concluded that the research had failed to establish the efficacy of public-information announcements in influencing the behaviour of their recipients. One reason for the relative inconclusiveness of the evidence is that the specific efficacy of a public-information message tends to be obscured when—as is usually the case—it is issued as part of a broader publicity campaign involving multiple awareness-increasing initiatives implemented simultaneously (Hanneman, McEwan, & Coyne, 1973).

A variety of modalities or channels of communication may be used to transmit health warnings to the public, and the particular communication modalities that are chosen may have significant effects on the recipients' responses to the information. Television or video (an audiovisual modality) is generally more engrossing or involving than radio (audio) or print (visual), inasmuch as it is perceived as more salient; commands more attention, is generally better liked; and is regarded as more credible by the majority of recipients (Andreoli & Worchel, 1978; Chaiken & Eagly, 1983). Furthermore, people tend to report that they obtain more information from television than from the other mass media (Lichty, 1982; Roper Organization, 1975, 1979), whereas objective evidence suggests that attitudes are in fact more strongly influenced by information in the print media (Barrows, 1981; Patter-

son, 1980), and research has shown that written presentation generally results in greater assimilation of information than does audio or video presentation (Barlow & Wogalter, 1993; Pezdek, Lehrer, & Simon, 1984; Wilson, 1974).

Experimental evidence suggests that the greater assimilation of information presented in print than in the audio or video modalities applies only to long-term memory for information that is relatively complex or difficult to absorb. For short-term memory, a large number of studies have consistently shown audio presentation to be superior to visual presentation, although the effect is restricted to terminal items (see Penny, 1975, 1989b, for reviews). For long-term memory, audio presentation is sometimes found to be inferior (e.g. Penny, 1989a) and sometimes superior (e.g. Conway & Gathercole, 1987; Gathercole & Conway, 1988). There is reason to suspect that modality effects in long-term memory may be mediated partly by message complexity. In an influential investigation, Chaiken and Eagly (1976) presented messages of varying complexity in terms of sentence structure and vocabulary in all three modalities. There were no significant differences in how well the simple message was understood or remembered in the three modalities, but the complex message was significantly better understood and recalled when it was presented in print than in the audio or video modalities.

The superior recall of complex material presented via print rather than video appears counterintuitive. One might expect an audiovisual medium to have a greater capacity to convey information because it involves both 'showing' and 'telling' the information to the recipients, but the recall superiority of the print modality for complex material has been replicated many times (e.g. Barlow & Wogalter, 1993; Browne, 1978; Furnham, Benson, & Gunter, 1987; Furnham & Gunter, 1985, 1987; Furnham, Gunter, & Green, 1990; Gunter, Furnham, & Gietson, 1984; Pezdek et al., 1984; Wilson, 1974; Wold, 1977).

The evidence is not entirely consistent, however. Several decades ago Williams, Paul and Ogilvie (1957) reported significantly better recall for abstract material presented via video rather than audio, and via audio rather than

print. More recently Stauffer, Frost and Rybolt (1981) failed to find any superiority of print over video in the recall of news stories, although they did find that both print and video presentation led to significantly better recall than did audio. In a later study, Wogalter and Young (1991) reported two laboratory experiments and a field experiment in all of which safety warnings were more effective in achieving compliance when delivered in the audio rather than the print modality, with audio plus print most effective of all.

More recently still, Ogloff and Vidmar (1994) found that pretrial publicity surrounding an actual case involving child sex abuse had a significantly greater prejudicial influence on potential jurors when it was presented on television than when it was in print. None of the preceding three studies manipulated message complexity, however, and this provides a possible clue to their apparently anomalous findings. The material used by Williams and colleagues, though abstract, dealt with ideas that were not difficult to grasp, used simple vocabulary and sentence structure and was not very complex in the sense of requiring deep processing for memory-encoding, and the same can probably be said of the everyday news stories used by Stauffer and colleagues, the very simple safety warnings used by Wogalter and Young, and certainly the pretrial publicity investigated by Ogloff and Vidmar, which the authors themselves described as 'very comprehensible' (p. 513). The memory superiority of the print modality over video and audio apparently applies only to material that is difficult to assimilate or to encode in memory.

The mediating effect of message complexity becomes clear in the light of various explanations that have been offered for the superior recall of some types of material presented in print compared to other modalities, especially video or television. Some researchers (e.g. Furnham et al., 1990) have drawn attention to various aspects of the presentation of printed information, such as paragraphing, punctuation and general layout, that may help recipients to 'chunk' the information in a manner that has been shown to facilitate learning of information that is not inherently easy to grasp (Baddeley, 1982, pp. 152-154).

Another learning advantage of print, and to

some extent of audio information also, is that the recipients create their own mental images rather than having them provided ready-made, and this in turn promotes greater depth of processing, which is known to lead to enhanced memory (Craik & Lockhart, 1972). Evidence in support of this explanation has emerged from research with children (Meringoff, 1980), although some commentators (e.g. Baddeley, 1978) have argued that the concept of depth of processing is circular inasmuch as it is difficult to define it independently of the memorial consequences of a processing task. A learning disadvantage of video arises from the finding that pictures may enhance memory only when they are strikingly relevant and may actively impair memory by distracting attention from the content of the message in other circumstances (Chu & Schramm, 1967; Gunter, 1979).

In the production of news programs, pictures of doubtful relevance are often used to accompany stories that have to be covered because of their importance but for which no useful visual material is available. In the audio modality, paralinguistic (i.e. non-verbal vocal) information may similarly function as a distraction and may impair memory-encoding of the verbal content of the message, although the effect is probably weaker in this case, because research in the field of non-verbal communication has shown that paralinguistic cues generally have less impact than do visual cues (Knapp, 1992; Mehrabian, 1972).

Most important, according to some authorities (e.g. O'Keefe, 1990, pp. 184-185), is the fact that reading is self-paced, whereas information presented in the audio and video modalities is not. The significance of this difference is that when identical messages are presented in different modalities of communication for experimental comparisons, with exposure times equalized between treatment conditions for control of the extraneous variable of learning duration, most participants who receive written messages have time to read and to reread the whole or part of the text, but in the other conditions the recipients have no control over the pace of presentation and therefore do not have the advantage of repetition. Furthermore, it is only in the print modality that the reader has some control over the order of presentation of information, and there

is evidence that the order of presentation of information has a greater effect on recall in the audio than it does in the print modality (Unnava, Burnkrant, & Erevelles, 1994).

The self-pacing and rearrangement properties of the print modality may explain the learning superiority of complex material presented in print, and they may also explain why this superiority is not apparent for simple material (Chaiken & Eagly, 1976), because simple information can presumably be assimilated easily without repetition or rearrangement. This explanation may also account for the apparently contradictory findings of Williams, Paul and Ogilvie (1957), Stauffer, Frost and Rybolt (1981), Wogalter and Young (1991) and Ogloff and Vidmar (1994), because the messages used in those studies appear to have been relatively simple and easy to assimilate.

In the case of certain types of health warning, notably those providing information about newly discovered health risks and how to avoid them, the primary objective is to educate people rather than to persuade them, and the proximate goal is, therefore, to communicate information that will be remembered by the recipients. Health warnings are often unavoidably complex and relatively difficult to assimilate (R. McCarthy et al., 1984; Murphy, 1980; Rice & Paisley, 1981) and, in the light of the research outlined, the modality of communication may therefore be of prime importance in determining their effectiveness.

The following study was designed to examine the recall of a fictitious but realistic health warning presented in the video, audio and print modalities. To avoid some of the problems that have arisen in earlier research in this area, the health warning contained information that was rather complex and not easily assimilable, and the distracting effects of irrelevant visual material were minimized in the video condition by using a specially prepared audio-visual presentation in the form of a 'talking head' without extraneous pictures. The effects of paralinguistic cues were equalized between the video and audio modalities by using the same soundtrack in both conditions. Previous studies in this area have been criticized for assessing memory using recognition measures only, which may obscure the learning advan-

tage of the print modality because reading requires more cognitive effort and leads to greater depth of information-processing than television viewing does (Furnham et al., 1987, p. 106). In the following study, therefore, memory for the information viewed, heard or read was assessed by both free recall and cued recall (recognition) measures. It was hypothesized in the light of earlier research and theorizing that participants in the print condition would remember most about the health warning and that participants in the video condition would remember least.

Method

Design

In a single-factor randomized design, participants were assigned to three treatment conditions in which a realistic health warning regarding a fictitious new disease was presented to them in one of three different modalities of communication: a video 'talking head', an audio message taken from the soundtrack of the video version, and a print message transcribed from the video and audio versions. The verbal content of the message was thus identical in all three treatment conditions, and the paralinguistic information was identical in the video and audio conditions. After exposure to the health warning, the participants responded to a questionnaire designed to measure their free recall and cued recall (recognition) of the health warning.

Participants

The sample consisted of 89 male and 19 female undergraduate students aged between 17 and 36 years who volunteered to participate. Volunteers were assigned to treatment conditions quasi-randomly, the constraints being the volunteers' availability for the scheduled testing sessions and a requirement to include the same number of participants in each treatment condition. Participants were naïve as to the aims of the research but were told that there was some form of information delivery and a questionnaire involved.

Materials

The 446-word health warning began with a statement that 'the Department of Health has issued the following warning against the dis-

order caused by a wheat mite (ANDRENIS 1B) found in white bread' and continued with a brief history of the disorder, a list of its main symptoms, a summary of preventive measures and, finally, an outline of treatment following infection. The printed version was presented as a two-page document headed 'A Health Warning'; the video version, which lasted 4 minutes and 15 seconds, showed an actor (a head-and-shoulders shot of a slightly balding 48-year-old man in a sports jacket and tie) speaking directly to the camera with no visual cues other than the 'talking head'; and the audio version was simply the soundtrack of the video version. To ensure parity of exposure time in all three treatment conditions, participants in the print condition were allowed 4 minutes and 15 seconds to read the printed version.

The dependent variable measures were incorporated into a two-part questionnaire distributed to participants immediately after they had viewed, heard or read the health warning. The first part, which was designed to measure participants' free recall of the health warning, was simply a ruled page with the following heading: 'In the space provided below, write down as much of the health message as you can recall.' One point was scored for each correct item of information recalled.

The second part of the questionnaire consisted of 10 multiple-choice questions designed to measure cued recall (recognition) of the health warning. Examples of the cued recall items are:

The message presented to you described a type of mite. Was it (a) a white mite, (b) a wet mite, (c) a wheat mite, (d) a bread mite? (Choose one answer); Which five of the following are main symptoms of the disorder: (a) nausea, (b) headache, (c) indigestion, (d) loss of appetite, (e) blurred vision, (f) dizziness, (g) aching limbs, (h) fatigue, (i) flatulence, (j) skin rash, (k) bloated abdomen? (Choose five answers).

The cued recall items were selected and modified on the basis of pilot-testing to ensure that none was too easy or too difficult to provide a wide range of scores among a student sample. One point was scored for each correct answer, and the maximum possible cued recall score was 18.

Procedure

Participants were tested in groups ranging in size from 6 to 15. Participants were told that they were about to be exposed to a short health warning and (depending on the treatment condition) that it would be on video, audio or in the form of printed text. In the video and audio conditions, the health warning was delivered to the group as a whole, that is, the video cassette or audio cassette was played to the group. In the print condition, participants were given individual copies of the printed version of the health warning.

Once the message had been delivered, the tape was turned off (or in the print condition after 4 minutes and 15 seconds the printed sheets were collected) and copies of the questionnaire were distributed face downward. The instructions on the questionnaire were read aloud to the group, and questions about procedure were answered. The participants were then asked to turn over the first lined page and to fold the body of the questionnaire behind it. This prevented them from seeing any later cued recall questions, which contained clues that could have helped them in the free recall section of the questionnaire. Participants were given 5 minutes to write down, in their own words, as much as they could recall of the health message. At the end of the 5 minutes, they were asked to complete the remaining 10 cued recall questions in their own time.

After responding to questionnaire, participants were debriefed and thanked for taking part in the research.

Results

Preliminary checks

The free recall measure yielded a range of scores from zero to 22 ($M = 10.37$, $SD = 3.90$), and the cued recall scores ranged from 4 to 17 ($M = 12.66$, $SD = 2.05$). These ranges, means and standard deviations turned out to be broadly comparable between the free recall and cued recall scores, and it was therefore considered justifiable to calculate an aggregate measure of global recall by simply summing the free recall and cued recall scores. The global recall score is equivalent, as far as statistical results are concerned, to an unweighted mean.

Table 1. Mean recall scores across communication modality^a

Recall	Modality		
	Video (n = 36)	Audio (n = 36)	Print (n = 36)
Free	8.06 (3.92)	11.22 (3.65)	11.83 (4.13)
Cued	11.61 (2.80)	13.22 (1.55)	13.17 (1.81)
Global	19.67 (6.11)	24.44 (3.97)	25.00 (5.08)

^a Figures in parentheses in the body of the table are standard deviations.

Effects of communication modality

One-way analyses of variance were applied to test for any significant differences in free recall, cued recall and global recall across treatment conditions. Cell means and standard deviations are shown in Table 1.

Free recall A significant effect due to modality of communication on free recall of the health warning was found:

$$F(2,105) = 9.71, p < .001, \text{ effect size } \eta^2 = .15.$$

Tukey-HSD multiple comparisons ($p < .05$) showed that free recall of the health warning was significantly better in both the audio and print modalities than it was in the video modality but that there was no significant difference between the audio and print modalities.

Cued recall A similar significant though slightly smaller effect due to modality of communication on cued recall was found:

$$F(2,105) = 6.67, p < .002, \text{ effect size } \eta^2 = .11.$$

Tukey-HSD multiple comparisons ($p < .05$) showed the same pattern of differences as with free recall: cued recall of the health warning was significantly better for both audio and print than it was for video, and there was no significant difference between audio and print.

Global recall Global recall differed significantly across treatment conditions:

$$F(2,105) = 11.75, p < .001,$$

with a modest though substantial effect size $\eta^2 = .18$. Once again, Tukey-HSD tests ($p < .05$)

showed that there was no significant difference in global recall between the audio and print modalities, but global recall of the health warning in both the audio and print modalities was significantly better than in the video modality. This is hardly surprising in view of the fact that this dependent variable is merely the sum of the other two, but global recall in the audio and print modalities may nevertheless have turned out to be significantly different in spite of its component elements failing to be significantly different independently; in the event this did not happen, and the pattern of significant differences was entirely consistent across all three dependent measures.

Discussion

Modality of communication had a significant effect on free recall, cued recall (recognition) and global recall of the health warning. Almost one-fifth of the variance in global recall of the health warning was explained by differences in the modality through which it was presented to the participants (effect size $\eta^2 = .18$). These results confirm in general terms the findings of several earlier investigations that recall of a complex message is substantially affected by the modality through which it is presented, and they confirm that this applies to a health warning of the type similar to some that are issued as public information or public service announcements in the press and broadcasting media. It should be borne in mind that this conclusion is based on a single assessment immediately following presentation of the health warning and that other factors may influence cognitive processing over longer time periods following exposure.

The results reported only partly confirm our hypotheses, however. In the light of previous research and theorizing, we hypothesized that participants in the print condition would remember most about the health warning and that participants in the video condition would remember least. On each of the three dependent measures used in this study, the only significant difference was between the video presentation, which yielded relatively low recall scores, and the audio and print presentations, which both yielded significantly higher recall scores. In other words, both audio and print modalities

were associated with significantly higher recall scores than was video but, contrary to expectations, print did not yield significantly higher recall scores than audio did. In fact, mean recall scores for print and audio barely differed from each other: on global recall, which provided the most general measure and also the widest range of scores, the mean score for print ($M = 25.00$, $SD = 5.08$) was less than one point higher than the mean for audio ($M = 24.44$, $SD = 3.97$).

The results of this investigation therefore only partly replicate those of Chaiken and Eagly (1976), who found that their complex message was significantly better recalled when it was presented in print than it was in the audio or video modalities but did not differ significantly between the audio and video modalities. Our results confirm those of Chaiken and Eagly in showing superior recall in the print than in the video modality but fail to confirm Chaiken and Eagly's finding of superior recall in the print rather than the audio modality; in addition our results also show significantly higher recall in the audio than they do in the video modality, which were not significantly different in Chaiken and Eagly's study.

The superior recall of complex material presented in the print modality compared to video, on which our findings agree with those of Chaiken and Eagly (1976), has been reported many times (e.g. Barlow & Wogalter, 1993; Browne, 1978; Furnham et al., 1987; Furnham & Gunter, 1985, 1987; Furnham et al., 1990; Gunter et al., 1984; Pezdek et al., 1984; Wilson, 1974; Wold, 1977). There is less agreement in the literature over the comparative effects of audio and video presentations, on which our findings do not correspond with Chaiken and Eagly's. In particular, in two separate studies, Furnham and Gunter (1985, 1987) found recall scores for audio significantly higher than for video presentations, which is in line with the findings reported in this article, and some other studies have reported the opposite effect, namely significantly higher recall scores for video than for audio presentations (e.g. Furnham et al., 1987; Furnham et al., 1990; Gunter, Furnham, & Leese, 1986). It seems reasonable to conclude that the comparative effects on recall of audio and video presentations are variable and poorly understood.

A tentative explanation is nevertheless possi-

ble. In a discussion of the effect of communicator salience on persuasion, Chaiken and Eagly (1983) pointed out that the presentation of a message in the video or audio modalities has the effect of drawing the recipients' attention to the communicator and away from the message itself, thereby enhancing the effects of the communicator's personal characteristics, which may be positive or negative. The contradictory findings in the literature regarding the relative effects on recall of video and audio presentations are explicable if we make the reasonable assumption that communicators differ from one another in the degrees to which their visual and paralinguistic characteristics tend to distract attention from what they say and interfere with memory-encoding of the content of their messages. Perhaps some communicators have especially distracting forms of vocal delivery, so that recall of their audio messages is significantly impaired relative to print (as in Chaiken and Eagly, 1976) or in some cases even relative to video (as in some other studies previously cited), whereas other communicators have styles of vocal delivery that are not significantly more distracting than print presentation (as in the study reported in this article and some others discussed earlier). Of course, the extent to which a communicator's paralinguistic behaviour is distracting depends on the particular recipients of the communication: a strong Australian accent, for example, may be distracting to a British or American audience but not to an Australian or New Zealand audience. In any case, because of the well-established 'visual dominance' effect in information-processing (Posner, Nissen, & Klein, 1976), the effects of the paralinguistic cues are likely to be swamped by those of the visual cues in the video modality.

This interpretation tends to support the distraction theory of modality effects, according to which recall of a complex message is better following print than video presentation because pictures, unless strikingly relevant, can actively impair memory encoding by distracting attention from the content of the message (Chu & Schramm, 1967; Gunter, 1979). What is required to explain the entire spectrum of findings is an additional assumption that paralinguistic cues can have a similar distracting effect, but that this effect is variable depending on the communicator's vocal idiosyncrasies (and how

these interact with the audience) and is likely to be weaker than the visual distraction effect, because of visual dominance and the fact that paralinguistic cues generally have been shown to have less impact than visual cues have (Knapp, 1992; Mehrabian, 1972).

This analysis, and indeed the empirical findings reported in this article, do not support the most plausible explanations of modality effects, according to which it is because of the opportunity for self-pacing or rearrangement of the contents of the message that recall of complex material presented in this modality tends to be superior (O'Keefe, 1990, pp. 184–185; Unnava et al., 1994). This type of explanation fails to account for the significant recall differences between audio and video presentations reported in this article and in a number of other studies, because neither audio nor video presentations offer any opportunities for self-pacing or rearrangement of message content. The self-pacing and rearrangement theories may be valid as far as they go, in fact some such mechanism is almost bound to operate, but they do not appear to provide a complete explanation of all the observed modality effects. Additional psychological processes are evidently at work, and the distraction theory, suitably modified to accommodate paralinguistic effects and intercommunicator differences, enables the variable recall differences found between audio and video presentations to be understood.

It is worth commenting, finally, on the practical implications of research in this area. There is persuasive evidence in the literature that a message that is complex or difficult to assimilate is generally better recalled if it is presented in print rather than on video or television, and the findings reported in this article confirm that conclusion strongly in the special case of a complex public-health warning. This does not mean, however, that 'difficult' public-health warnings and other complex messages should necessarily be disseminated via newspapers, magazines and leaflets to the exclusion of television. The experimental findings apply to recipients who are given equal exposure to messages presented in different modalities and are constrained to pay attention to them, but it remains true that television is more involving and attention-grabbing than any of the print media, and in naturalistic conditions people may

be more likely to pay heed to information presented on television (Andreoli & Worchel, 1978; Chaiken & Eagly, 1983).

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