ABSTRACT
        A study was conducted to explore the process of
learning from television news and the relationship between audio and
visual channels. The subjects, 82 undergraduate journalism majors
enrolled in five newswriting classes, were randomly assigned to
experimental conditions. Newscasts were recorded from evening
newscasts aired by networks, and scripts were written in typical
broadcast style. Video was edited to the audio to produce the
strongest possible match between two channels. In one condition (high
redundancy) all stories had redundant audio and video. In the second
newscast (medium redundancy) half of the stories were covered by
video that did not match the audio. The third condition (low
redundancy) had video that did not match the audio in any of the
stories. Two other conditions were created to provide baseline
measures for single-channel recall. The audio from the high
redundancy condition was played to one group and the video from the
high redundancy condition was shown to another. Resulting data showed
that close coordination between audio and video improved audio recall
of television news stories and that redundancy aided story
understanding and audio information recall. (DF)

The Effect of Audio-Visual Redundancy on Audio and Video Recall in Television News

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Three newscasts consisting of a series of short voice-over television news stories were shown to subjects in this experiment. In one condition the audio and video were redundant in all stories, in the second condition the audio and video were redundant in half of the stories but not in the other half, and in the third condition none of the stories were redundant. The higher the redundancy the more audio information subjects could recall and the greater the understanding of stories. However, subjects in the high redundancy condition remembered less of the video than participants in the other two groups. Subjects attended more to the audio than the video with redundant stories and more to the video than the audio with non-redundant stories.

The Effect of Audio-Video Redundancy on

Audio and Video Recall in Television News

Concern about the dependence of the American public on television for

public affairs knowledge and evidence of low recall from the electronic

media have prompted a growing body of research in this area.

Field surveys conducted only hours after television newscasts have

been aired show that viewers are able to remember only a small fraction of

ories presented. Katz, Adoni and Parness found that television

viewers exhibted a level of recall only slightly higher than that shown by

radio listeners.[1] Neuman[2] also found low levels of recall as did

Stauffer, Frost and Rybolt.[3] The latter survey, for example, found that

viewers of network television news recalled an average of 1.9 of the 13

stories typically presented.

In the laboratory, researchers have focused on the presumed advantages

of film over other modes of presentation and have turned up conflicting

results. Jorgensen's data showed that viewers who watched a newscast with

the anchorman reading learned as much as those who saw a newscast that

contained film stories.[4] Edwardson, Grooms and Pringle found similar

results.[5] In a related study, Findahl concluded that film stories

improved recall no more than stories using still photographs.[6] A follow-

up article by Edwardson, Pringle and Proudlove indicated that interesting

visuals helped only the poorer and less educated viewers remember more

from a newscast.[7]

Gunter found that film improved recall in one study that he conducted

but not in another.[8] He suggested that the length of the stories was a

factor. Film helped viewers when they watched a series of short,

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headline-type stories but not when they viewed a number of longer stories more akin to those aired in actual newscasts.

On the other hand, Drew and Reese reported that children who watched a newscast with film did much better on recall and understanding tests than those who viewed a newscast with the anchor reading.[9]

A number of factors have been raised to account for these differences. Berry points out that some researchers have used unaided recall to measure learning while others have depended on cued recall, and the two may produce different results.[10] The authors of the studies cited above suggest that variables such as type of story, salience of the story and strength of visuals also may account for inconsistent results.

Still another variable mentioned is redundancy between the audio and video in television newsfilm stories. Articles by McDaniel[11] as well as Woodall, Davis and Sahin[12] suggest that the visual channel will enhance learning if it is complementary with the audio channel.

The answer to some of these questions would seem to lie in a better understanding of the process by which viewers learn from television news. Although television is a visual medium, researchers generally have measured audio recall only, because they assume the important information is in that channel. As a result, little is known about how viewers divide their attention between the two channels and what they process from each.

The present study looks at both video and audio recall under various conditions of audio-video redundancy and poses the following hypotheses.

> H1: The greater the redundancy between the audio and video in a news story, the greater the audio recall.

Cue summation theory predicts that information cues which occur simultaneously in the audio and video channels are more likely to be

stored in long-term memory than cues presented in only one channel.[13]

Severin[14] found this to be the case, as did Reese.[15]

> H2: The greater the redundancy between the audio and video
>   channels, the greater the story understanding.

This is a logical extension of cue summation theory ideas. A better

recall of facts from a television news story should increase the

probability that the viewer understands the story. Although Reese found

that redundancy improved recall, he did not find a similar effect for

story understanding.[16] He suggested, however, that the visuals in his

study were only ''broadly'' related to the audio and that closer

synchronization might have produced positive results.

> H3: The lower the amount of redundancy between the audio and
>   video channels, the higher the video recall.

Some cognitive pyschologists say there are three stages of human

information processing: sensory registers, working memory, and long-term

memory. Although a great deal of information impinges on the sensory

registers, only a limited amount ends up in long-term memory. Theorists

hold that there is a filter or bottleneck that limits the capacity of the

system. They disagree, however, about the nature and location of that

bottleneck.[17]

Singer suggests that television often overloads the information

processing system, especially when there is voice-over audio accompanied

by interesting video. According to Singer, the video is likely to win out

over audio in this situation because of the ability of movement in the

video to capture the viewer's attention.[18] This would seem to indicate

that a conflict between the audio and video would severely overload the

system and the viewer's attention would be drawn to the video.

With redundant audio and video, however, there is evidence that the viewer often attends primarily to the audio. An experiment by Drew and Cadwell found viewers' attention focused on the audio in a typical voice-over television news story to the extent that they did not notice serious editing errors. When the audio was removed, the errors were spotted easily.[19]

> H4: People who are frequent viewers of television news should exhibit better visual recall than those who are frequent readers of newspapers, and frequent newspaper readers should score higher than frequent television news viewers on audio recall.

Singer points out that although humans have the ability to encode information using both verbal and imagery systems, many favor one strategy over the other.[20] Woodall, Davis, and Sahin also suggest that some viewers may be visually dependent, favoring the imagery mode, while others may be verbally dependent.[21] It seems logical to assume that the heavy users of television news favor the imagery system.

Methods

Because this study focuses on the process of learning from television news and the relationship between the audio and visual channels, a series of 15-second long voice-over stories were used to operationalize the study. The short length of the stories permitted a closer relationship between the information in the two channels than would have been possible with longer stories. Fifteen seconds is about half the length of typical voice-over stories aired in local newscasts.[22]

The video used in the experiment was recorded from evening newscasts aired by the networks. Scripts were written in typical broadcast style,

and video was edited to the audio to produce the strongest possible match between the two channels. An effort was made to use stories equivalent in importance and in attractiveness of the video. Also, stories that did not receive a great deal of national publicity were chosen (i.e., a Pentagon decision to increase the crew size on nuclear submarines). The stories had distinctive video, but subjects were not likely to bring a great deal of information about them into the experimental setting.

Five short newscasts were produced, each containing 14 stories placed in random order. In one condition (high redundancy) all stories had redundant audio and video. In the second newscast (medium redundancy) half of the stories were covered by video that did not match the audio. The third condition (low redundancy) had video that did not match audio in any of the stories. The content and order of the audio was the same in all three of these conditions. The non-redundant video used clearly did not belong with the audio but did not present dramatic contrasts with it. For example, a story about the problems of disposing of nuclear power plants was covered with a seashore scene in the non-redundant condition. Also, in the medium condition, the stories that had non-redundant video were chosen by random selection so subjects would not be able to recognize a pattern and anticipate the placement of stories.

Two other conditions were created to provide baseline measures for single-channel recall. The audio from the high redundancy condition was played to one group and the video from the high redundancy condition was shown to another.

Three dependent variables and two conditional variables were used in the study. Video recall was measured by videotaping a series of freeze frames and asking the subjects to identify any pictures that they

remembered seeing in the newscast. The freeze frames were mostly medium shots that clearly represented the video, both redundant and non-redundant, used in each of the newscasts. Subjects in each condition had to select from a series of 26 freeze-frames the 14 that were actually taken from the newscast they had watched. The other video (distracting material) came from stories not used in any of the newscasts.

The second dependent variable, audio recall, was similar in design. Subjects were given a list of 26 slug lines that described the audio content of news stories (i.e., The Columbian coffee crop) and were instructed to identify any that they recalled from the newscast. Again, 14 of the descriptions were actually taken from the newscasts, and the rest came from stories not used in the experiment.

A third dependent variable measured understanding by asking multiple-choice questions about the central points of the stories. The central point was defined as knowledge about the main actor of the story and action taken. For example, subjects were given credit for understanding the California Wildlife story if they knew that geese in central California were endangered because they had been drinking poisoned water. This test was comparable to open-ended type measures of story understanding used in several other television news recall studies.[23]

Finally, for the two conditional variables, subjects were asked to indicate how many days a week they read a newspaper and how many days a week they watch local or national news on television. These questions were treated as a measure of preference for verbal or imagery processing.

The experiment was pretested using the medium redundancy condition with subjects similar to those used later in the actual experiment. As a result of the pretest, a number of changes were made. Item analysis of

the understanding test indicated that some questions were too difficult so they were rewritten. Also the decision was made to change the nature of the video used on non-redundant stories. In the pretest, video was simply exchanged among stories within the newscast to create non-redundant stories. However, discussion with subjects after the pretest indicated that they had attempted to remember the video and connect it with the correct audio. They began using this strategy once they became aware of the pattern. For this reason, video that did not appear in the newscast was used to create non-redundant stories in the actual experiment.

Procedure

Eighty-two beginning undergraduate journalism majors took part in the study. They were enrolled in five newswriting classes that were randomly assigned to experimental conditions. The experimenter told subjects he was working on a study involving television news so he wanted to show them a newscast and get their reactions. After the newscast ended, the experimenter handed out a questionnaire and played the freeze-frame tape.

Results

Data analysis with MANOVA showed a significant difference for the redundancy manipulation ($F = 6.75$; d.f.$= 6,88$; $p < .00002$). Univariate ANOVA also was performed on each dependent variable.

The results support the first hypothesis that greater redundancy in the newscast would produce higher audio recall ($F = 4.04$; d.f.$= 2.46$; $p < .00005$). The data were further analyzed by including the audio group and

performing Scheffe tests on the differences between means (see Table 1). The medium redundancy group recalled significantly more stories than the low redundancy group, and the high redundancy group remembered more than the low redundancy group or the audio only group. There was no significant difference between the high and medium groups, but the means would be predicted by the hypothesis.

Univariate ANOVA also supports the second hypothesis. The groups that saw the newscasts with a closer relationship between the audio and video displayed greater understanding of the story ($F= 11.73$; $d.f.= 2.46$; $p <$ .00008). Although the mean scores follow predictions, the Scheffe tests show a significant difference between the high and low redundancy conditions only. The audio condition falls between the low and medium redundancy groups but is not significantly different from the high redundancy group.

The data for the video recall measure are significant ($F= 4.04$; $d.f.= 2.46$; $p < .02$), but the means do not follow the predictions of hypothesis three exactly. The means in Table 1 show that the high redundancy group recorded the lowest scores on visual recall and the medium and video only group are ranked as expected. However, the medium redundancy group is out of order and, according the Scheffe test, is the only group that differs significantly from the high redundancy condition.

Incorrect answers to the dependent variables also were analyzed with the ANOVA and Scheffe tests. The results reflect a mirror opposite of the correct responses. For example, the high redundant group made the fewest errors on audio recall and the most errors on video recall. This is interesting because subjects were instructed on the questionnaire not to guess if they did not know the correct answers. This would lead one to

expect few differences in the number of incorrect responses. It should be noted also that subjects did very well at rejecting the distracting material in the recall tests, but made most of their errors on stories that were actually in the newscast. In other words, they seemed to be quite sure about what they did not see or hear, but were somewhat uncertain about what they did actually see and hear.

The media-use conditional variables only partially support hypothesis four. When entered into a multiple regression equation, newspaper reading shows no significant relationship to video recall, while television news viewing shows a small negative relationship ($B = -.34$, $R^2 = .10$, $p < .009$). On the other hand, the frequency of television viewing is not a significant predictor of audio recall, but newspaper reading is ($B = .67$, $R^2 = .38$, $p < .0001$).

Discussion

The data show that close coordination between audio and video improved audio recall of television news stories, confirming Reese's findings. This study, however, found that redundancy aided story understanding, whereas the Reese article did not.[24] The difference in types of news stories used probably accounts for the inconsistency. Reese used long stories with video ''broadly'' related to audio. The experiment described here used short stories with strong manipulation of redundancy.

The use of video recall in this study also makes it possible to develop some observations about how people divide their attention between the audio and video channels when watching television news. Comparison of audio and video recall scores within the three conditions of redundancy

displays a clear pattern. In the high redundancy condition, audio recall is significantly higher than video recall (stepwise two-tailed t-test, $p <$ .006). The low redundancy group, on the other hand, had higher video recall scores than audio recall scores (stepwise two-tailed t-test, $p <$ .02). The medium group did better on audio recall than on video recall for six of the seven redundant stories in the newscast. They scored higher on the video than the audio in five of the seven non-redundant stories.

This pattern indicates that when watching redundant television news stories, viewers focused most attention on the audio while still attending to the video. When there is conflict between the audio and video, however, viewers attend to the video at the expense of the audio. This is consistent with Singer's suggestions that video dominates attention when the viewer is overloaded with information.[25]

A puzzle remaining, however, is the high video recall score from the medium redundancy group. The answer may lie with the Stauffer, Frost, and Rybolt survey.[26] They found that viewers who had been instructed to pay close attention to network newscasts were able to recall significantly more stories than viewers who had not received those instructions. It's probable that the first non-redundant story prompted the medium group to pay closer attention to the news stories, and this especially helped video recall.

Inspection of the individual story scores supports this explanation. The medium group did better on video recall than the other two groups regardless of whether the stories were redundant or non-redundant. With audio recall, however, the medium group did better than the low redundancy group on redundant stories, but worse than the high redundancy group on

the non-redundant stories. On the non-redundant stories they did about the same as the low redundancy group. In other words, this ''instruction'' helped them with video recall in both redundant and non-redundant stories, but helped them with audio recall only in redundant stories.

The strong positive relationship between newspaper reading and audio recall is consistent with media dependency studies.[27] It is possible that the print users came to the experiment better informed than the frequent television news viewers. As mentioned earlier in this paper, however, the stories used here were not in the mainstream of the news. Another possibility is that frequent newspaper readers are more efficient processors of information.

The negative relationship between video recall and frequent television viewing is difficult to explain. Perhaps, as Singer implies, heavy television viewers become passive information processors because television is so easy to watch.[28]

Footnotes

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[22]K. Tim Wulfemeyer, ''A Content Analysis of Local Television Networks: Answering the Critics,'' _Journal of Broadcasting_, 26:481-486, (1980).

[23]Drew and Reese, _op.cit._, and Reese, _op.cit._.

[24]Reese, _op.cit._, p. 86.

[25]Singer, _op.cit._, p. 46.

[26]Stauffer, Frost and Rybolt, _op.cit_.

[27]Lee Becker, Idowu Sobowale and William Casey, ''Newspaper and Television Dependencies: Effects on Evaluations of Public Officials,'' _Journal of Broadcasting_, 23:465-475 (1979).

[28]Singer, _op.cit._, p. 51.

TABLE 1

Mean Recall and Understanding Scores
for Experimental Groups

Video Recall		Audio Recall		Understanding	
HIGH	8.82 a	LOW	7.79 ab	LOW	5.31 a
LOW	10.00	AUDIO	8.63 c	AUDIO	6.10
VIDEO	10.64	MEDIUM	10.61 a	MEDIUM	8.11
MEDIUM	10.78 a	HIGH	11.41 bc	HIGH	8.76 a

Means that share letters within columns are significant at .05 or higher.

HIGH	= All stories redundant
MEDIUM	= Half of the stories redundant
LOW	= None of the stories redundant
AUDIO	= Audio only
VIDEO	= Video only