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DO ADOLESCENTS ATTEND TO WARNINGS IN CIGARETTE ADVERTISING? AN EYE-TRACKING APPROACH

Currently mandated and new health warnings in the context of magazine ads for two cigarettes were studied among adolescents. Focus groups were used to garner a basic understanding of how adolescents react to cigarette advertising and currently mandated Surgeon General Warnings, and to develop new warnings. Two currently mandated warnings and two new warnings were then imbedded in magazine ads for two cigarette brands and presented to 326 adolescents. Subjects viewed each ad as long as desired while state-of-the-art eye-tracking equipment recorded point of gaze, fixation, and saccades. Following presentation of the ads and eye-tracking measurement, subjects completed a masked recall task. Analyses addressed the number of subjects who noticed the warning, their time to first fixation within the warning, and the time spent fixating on the warning. The masked recall measure permitted examination of the possible link of eye-tracking measures with cognitive processing of a warning.

Results indicated that within the competitive reading environment of a cigarette ad, new warnings attract greater readership, with quicker attention to warnings than mandated warnings. New warnings were noticed in 1 to 2½ seconds less time. Total attention devoted to all warnings ranged from 2 to 3 seconds. Eye-tracking measures were significantly related to masked recall of warning content.

We are living in an era where commercial messages and product packages frequently include warnings or other forms of information required to assist consumer decision making. During an investigation of advertiser compliance with Federal Trade Commission (FTC) standards, it was predicted that, "the 1990s may well become the 'decade of disclosure . . .'" (Hoy and Stankey, 1993).

Warnings and disclosures, whether government mandated or voluntary, have become a way of life that permeates many forms of communication and product consumption. Recent examples include the television

networks' voluntarily broadcasting parental advisories prior to excessively violent shows starting in the fall 1993 season and the 1989 Alcohol Beverage Labeling Act which requires all beer and wine containers to carry warnings on their labels indicating the dangers of alcohol consumption. Additionally, both product health claims and the change to over-the-counter status for many prescription drugs have created an environment supportive of even more disclosures (Hoy and Stankey, 1993). Although warnings are widely used, there are surprisingly few empirical studies that have evaluated their effectiveness (Mazis, Morris, and Swasy, 1991).



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While television, alcohol, health product, and pharmaceutical disclosures are taking center stage, one of the oldest and most widely used disclosures, FTC-mandated cigarette warnings, are now about to enter their third decade. Cigarette warnings are characterized as "across-the-board" affirmative disclosures because they are broadly applied to a product class, regardless of specific claims of advertising. Warnings remain one of the Federal Government's most consistent policies with respect to alerting consumers to the dangers of cigarettes.

The study reported here uses eye tracking to examine the way adolescents pay attention to both new and mandated health warnings. At issue is the number of adolescents who attend, how fast they attend, and how long they attend to warnings within cigarette advertising. The study also examines the relationship between eye tracking and masked recall in order to determine the possible link between attention and cognitive processing. Adolescents have been singled out in public policy as one of the groups needing special attention with respect to lowering cigarette consumption. Mandated warnings are intended to play a central role in lowering cigarette consumption. Yet to date, there has been little research which seeks to understand how adolescents attend to cigarette warnings.

What Constitutes an Effective Warning?

Warnings vie for attention within a competitive communication environment and must be developed in a systematic way if they are to be effective. The need for a systematic development program was recognized

by Jacoby, Nelson, and Hoyer (1982) when they argued that information needs should be assessed and warnings be evaluated prior to being inserted into advertising. During the long history of cigarette warnings there has never been a comprehensive program to investigate a specific market segment, develop warnings for the segment, and determine if the segment actually attends to the warnings. Even though the FTC, at times, applies consumer behavior principles, there is a history of failed attempts, largely due to the fact that most consumers either do not pay attention to the information or fail to interpret the information in a way that affects the behavior (Stoltman, Morgan, and Muehling, 1991; Jacoby, Nelson, and Hoyer, 1982).

While gauging the impact of warnings is a science that is still in the developmental stages, it is clear that attention and other cognitive measures such as knowledge and comprehension are important criteria. For example, Scammon, Mayer, and Smith (1991) suggest possible outcomes for warnings. These outcomes contain cognitively based criteria, including gaining attention and alerting individuals who are not aware, thus increasing awareness and knowledge, reinforcing consumers knowledge of risks and their resolve to use the product safely, and translating knowledge into action.

Attention measures serve as an important variable for the early stages of information processing in the context of hierarchy-of-effects communication models. Within this scheme, individuals process information in levels and with varying degrees of understanding. Such models posit that awareness and knowledge are forms of *cognition* that precede *affective* components

such as attitude and liking. The effective component precedes cognitive or behaviorally oriented action. The three basic psychological states in the order of cognitive-affective-conative are originally attributed to Lavidge and Steiner (1961). A number of similar models have been developed to explain the role of attention and awareness within a framework of information-attitude-behavior communication theory (Robertson, 1971).

Mazis and Staelin (1982) developed a model with respect to warnings and disclosures that draws on a hierarchy-of-effects perspective. The approach uses different levels of communication within an information-processing perspective that includes exposure, attention, comprehension, retention/retrieval, and decision making. This model has been used to assist policy makers in understanding consumer information processing. While the levels are not always separate they serve as a framework, particularly in situations where the intent of the communication is to impart substantial information.

Obviously, the role of attention within an information-processing scheme is germane with respect to new warnings which have not been previously seen. Additionally, attention measures are important in the context of existing warnings for which consumers have a level of familiarity. Consumers may miss or shortcut "familiar" messages, thus limiting the amount of information they process. At times, consumers have learned not to look. Fischer et al. (1993) concluded that under forced-exposure conditions subjects were able to learn more specific information from new cigarette warnings than existing warnings because they paid more attention to new warnings.

Barlow and Wolgalter (1993) also confirm the importance of understanding attention to warnings within the ad. During a recent study of alcohol warnings they concluded that a warning must be conspicuous to be seen and remembered. They note that the mere presence of a warning is not enough to guarantee attention or memory.

Cigarette Warnings As A Policy

The Federal Cigarette Labeling and Advertising Act of 1965 established the initial warning label for all cigarette packages "Caution: Cigarette Smoking May Be Hazardous to Your Health." The Public Health Cigarette Smoking Act of 1969 attempted to strengthen the warning by changing it to "Warning: The Surgeon General Has Determined That Cigarette Smoking Is Dangerous to Your Health." In 1972, the Federal Trade Commission (FTC), the federal agency responsible for regulating cigarette advertising, mandated that the warnings be included in all cigarette advertising.

Congress passed the Comprehensive Smoking Education Act in 1984, which mandated a system of four rotating warnings for cigarette packages and advertisements. The FTC did not formally evaluate the new warnings prior to their introduction (Richardson et al., 1987). Additionally, in 1986, Congress passed the Comprehensive Smokeless Tobacco Education Act, which mandated that smokeless tobacco packages and advertisements include one of the three warnings printed in a "circle-and-arrow" design.

The courts have subsequently recognized warnings as an integral part of the policy process. A recent Supreme Court ruling in the case of *Cipillone v. Liggett Group, Inc.* established that the

presence of a warning may not preempt all tort claims against cigarette manufacturers, but does preempt claims based on the failure to include more effective warnings after 1969. Successful tort claims may be brought only if they are based on fraud, misrepresentations, or conspiracy; on failure-to-warn through channels other than labels and advertising; on failure-to-warn in advertising prior to 1969; or on strict liability theories. The Supreme Court decision eliminated both judicial and regulatory attacks on current mandated warnings, unless and until Congress decides to change them. The Tobacco industry hailed the decision as a victory (Konrad, 1992). It is now regarded that warning labels provide manufacturers with a defense against damage actions (Mazis, Morris, and Swasy, 1991).

Research on Cigarette Warnings

There has been limited research on the impact of mandated cigarette warnings. Most studies investigating the impact on public knowledge have not been able to isolate the impact of warnings from other public education measures (Richardson et al., 1987). While there appears to be a presumption by both the Congress and the Supreme Court that the cigarette warnings can be effective, research indicates this may not be the case. In 1981 an FTC study concluded that the warning was in all likelihood not effective because of overexposure, wearout, lack of novelty, lack of personal relevance, and difficulty in remembering an abstract concept (Myers et al., 1981). This study, in part, led to the initiation of the four rotating warnings in 1984.

The few subsequent studies indicate that existing warnings are, at best, limited in effectively communicating the hazards of smoking. An eye-tracking study among adolescents found that only 37 percent of the subjects looked at the warning long enough to read its words (Fischer et al., 1989). Tachistoscope research used to gauge how long it takes adolescents to identify and comprehend mandated warnings in relation to new warnings revealed that, while mandated warnings are recognized, they fail to convey specific information (Fischer et al., 1993).

A survey using recognition as a measure found that 64 percent of the respondents claimed to have seen one of the four currently mandated warnings (Mazis, Morris, and Swasy, 1991). Because recognition techniques require respondents to indicate only that they recognize seeing the stimulus material, such techniques tend to be a more liberal measure of memory.

Other research conducted on warnings indicates that they lack believability (Beltramini, 1988), require high levels of reading comprehension (Malouf, 1992), and that the information is too small to be read on outdoor billboards (Cullingford et al., 1988; Davis and Kendrick, 1989).

Current Study

In a comprehensive analysis of smoking trends, Pierce et al. (1989) examined National Health Interview Surveys from 1974 to 1985. They found an overall decline in amount of smoking in the adult population. However, the same study indicated that efforts to prevent smoking among adolescents have been less successful and that one mil-

lion young persons start smoking each year. A major health implication of the overall U.S. smoking trend is that, "We need to orient our current general emphasis and resources more toward the prevention of smoking among young Americans" (Pierce et al., 1989). In reviewing the studies of smoking prevention, Leventhal et al. (1989) state that lighter, experimental smokers progress to heavier smokers and that few youngsters who become regular smokers are able to quit.

Given that mandated warnings are developed to be an important component in deterring smoking behavior and that public health officials have acknowledged a major need to deter smoking among adolescents, it is important to understand how adolescents react to warnings. Earlier work on both warnings and adolescent smoking has documented the need to target audiences and test information prior to inserting disclosures in ads (Pierce et al., 1989; Leventhal et al., 1989; Jacoby, Nelson, and Hoyer, 1982; Stoltman, Morgan, and Muehling, 1991).

This study initially used focus groups to gain insights into smoking initiation among adolescents and their reactions to cigarette advertising, existing mandated warnings, and new warnings. Focus-group findings were also used to develop new warnings. Next, eye tracking was employed to examine how new and existing warnings operate within the context of current cigarette ads. We examined the percent of adolescents who attend to new warnings versus mandated existing warnings, how quickly adolescents attend to new warnings versus the mandated existing warnings, and how much time adolescents spend attending to new warnings versus mandated existing

warnings. Finally, measures of masked recall were used to establish a link between eye tracking and cognitive processing in the context of the new warning.

Research Questions

Four research question areas were pursued. The first three are related to understanding the way individuals attend to warnings within ads. We employ a process of planning and developing new warnings for a specific population and then compare the new warnings to the mandated existing warnings. Because warnings are competing with other aspects of the ad, it is important to understand the levels of attention that may be expected for new and existing warnings:

1. In the reading environment within cigarette advertising, will a higher percentage of adolescents attend to new warnings than mandated existing warnings?
2. In the reading environment within cigarette advertising, will adolescents attend more quickly to new warnings than mandated existing warnings?
3. In the reading environment within cigarette advertising, how much time will adolescents spend reading new warnings and mandated warnings?

While studies in other areas have made direct links between eye-tracking measures and cognitive processing, there has been very limited reporting of such information in either advertising or consumer behavior measures. The final research question is related to establishing a link between eye tracking and cognitive processing in a commercial reading environment. In this in-

stance we focus on the link between eye tracking and masked recall for the new warnings. Such a link is not possible for the existing warnings due to prior exposure to these health messages. Earlier work on eye tracking and recall as a follow-up confirms that prior knowledge is a confounding factor in building a complete model (Just and Carpenter, 1980).

4. What is the relationship between eye-tracking measures and masked recall for new warnings?

Method

Warning Development. A systematic approach, paralleling commercial practices, was taken in the development of the new warnings. Adolescents were chosen as study subjects because this age group is most likely to experiment with cigarettes and, therefore, the age when health warnings have the greatest potential to prevent initial smoking.

A creative team, including commercial graphic artists and copywriters, was employed to develop test warnings. Prior work had shown that while adolescents could recognize the presence of cigarette warnings they are not able to recall message concepts or specific risks associated with smoking (Fischer et al., 1989). Therefore, the communication goal given to this team was to provide specific and relevant health-risk information regarding cigarette use and to produce it in a format that led to a greater understanding of risk by adolescents. The warnings were to be identical in size and position to the currently mandated health warnings in cigarette advertisements. This limitation is in keeping with current

policy and provides a common basis of comparison. Other than this limitation, the creative team was given freedom to use any text, graphics, print type, or colors in developing the test warnings. Thus, the major difference to be investigated between existing and new warnings was to be the new contents of the warning box.

Focus groups ranging from 10 to 13 participants were used to test and refine the new warnings. All groups were led by marketing researchers experienced with the technique. Two initial focus groups of high-school students aged 14 to 17 from Atlanta, Georgia, were held to gain a greater understanding of adolescent decisions regarding cigarette use, their reactions to tobacco advertisements, their beliefs regarding health risks, and their reactions to the four currently mandated warnings. Based on insights from these focus groups, the creative team developed five warnings and incorporated them into current cigarette advertisements. These new warnings were tested in a second set of two focus groups with high-school students aged 14 to 17 in Augusta, Georgia. The purpose of these groups was to examine both the creative concepts and the graphic executions of the newly developed warnings as they operate within cigarette ads. Also, the groups were helpful in selecting appropriate cigarette ads in which to place the warnings. The ads were selected based on their broadest appeal to adolescents.

Conclusions drawn from these focus groups have been previously published (Fischer et al., 1993). Based on these results, the creative team selected two new warnings to compare to the existing mandated warning in the experimental phase of the

research (see Figures 1 to 4). "Smokers Inhale Carbon Monoxide" was a warning that gained adolescent attention and was universally understood by focus-group participants. Carbon monoxide was more personalized as a health risk to this age group than emphysema or heart disease. This warning was produced with a bright yellow background to increase attention. "Cigarettes Kill: One in every 3 smokers will die from smoking" was perceived as both direct and informative. This message was placed along with a stylized red-and-white graphic device.

Experimental Testing of the Warnings

The goal of the experimental portion of the research was to examine visual attention to warnings and to investigate the relationship between visual attention and a more traditional communication measure, masked recall. In situations where a high degree of information transfer is required for understanding and action, attention is a necessary condition of information processing. As noted earlier, being "familiar" with existing warnings may shortcut the attention process and may limit full understanding of the message.

Eye movements during exposure to an ad are physiological indicators of attention that are directly linked to cognitive processing. Attention is linked to visual fixation (Daffner et al., 1992), and visual fixation is linked to cognitive processing (Just and Carpenter, 1980; Rayner, 1978). The eye must fixate on a word or phrase as long as the word or phrase is being cognitively processed. Readers interpret a word while they are fixating on it, and they continue

to fixate until they have processed it as far as they can (Just and Carpenter, 1980; Rayner, 1977, 1978).

The majority of work regarding visual fixations can be summarized as investigations of one of three propositions (Fisher et al., 1983). First, fixations accumulate in locations judged to contain high semantic or visual information. Second, fixations are responsible for perception and are generally considered a reflection of the individual's cognitive strategy. Third, the fixation sequence allows for the encoding, storing, and subsequent reconstruction of images. Hence, eye tracking can be considered an objective, quantifiable measure of attention as it is linked to cognitive processing.

Eye-tracking data were collected with the Applied Science Laboratories Model 425OR eye tracker. The subject sits comfortably in a chair before a rear projection screen on which slides of the test ads are projected. The control to advance slides is located on the arm of the chair under control of the subject. To the front of the participant and slightly to the side was a box containing the cameras and light sources required by the eye tracker. The subject's point of gaze is recorded. The data are then analyzed to produce the eye-tracking data—fixations and saccades as distributed across the image of the ad. Unlike earlier eye-tracking devices this model requires no bite-down armature, chin rests, helmets, or headbands to control head position: subjects are free of restraint.

The cost and sophistication of equipment and the complexity of data analysis have led to eye-tracking studies with small numbers of subjects. While one study used 64 subjects to examine fixation periods among ado-

lescents (Fischer et al., 1989), and another used two separate samples of 54 and 58 subjects to determine order of viewing (Janiszewski and Warlop, 1993), the remaining published studies usually contain fewer than 20 subjects each.

The study reported here employs 326 adolescents, aged 14 to 18, recruited from high schools in the Augusta area. The schools were selected to provide subjects from a range of racial and socioeconomic groups. Both subjects and their parents provided consent for the testing and were paid \$10 to participate.

Testing Procedures

At the start of an experimental session, an individual subject was brought into a quiet room and seated in the test chair. Subjects were then told that a series of advertisements would appear on the projection screen. Using a slide projector button switch on the arm of their chair, subjects controlled advancement of the projector to see each of the ads at whatever pace they preferred. Subjects were asked to view the slides as they would advertisements seen in a magazine. Three of the five slides were current ads for other products seen in the magazines teens read. The two test slides were a Marlboro and a Camel ad, each having mandated warnings ("Surgeon General's Warning: Quitting Smoking Now Greatly Reduces Risk to Your Health"—Marlboro; and "Surgeon General's Warning: Smoking Causes Lung Cancer, Heart Disease, Emphysema, and May Complicate Pregnancy"—Camel) or each having our newly developed warnings ("Smokers Inhale Carbon Monoxide"—Marlboro; "Cigarettes Kill: One in every 3 smokers will die from Smoking!"—Camel) (see

Figures 1 to 4). The order of presentation of the two cigarette ads was rotated for balance in each of the two scenarios, and subjects were randomly assigned to each of the four resulting experimental groups.

For each subject, data containing point-of-gaze and fixation information by ad was developed. Areas of possible visual interest within each ad provided the focus of this analysis. For the current study, the point of visual interest analyzed was the health warning box in each cigarette ad. The final tabulation of these data permitted analysis of fixations for each participant.

Following the collection of the eye-tracking data, subjects were asked to complete a test of masked recall. They were given black-and-white copies of each of the five advertisements with a single masked area. For the cigarette ad, the masked area corresponded to the area of the warning. Subjects were instructed to write, in as much detail as possible, the information they recalled seeing in this masked area. Each subject provided information about cigarette use, alcohol use, age, grade, and socioeconomic status.

Masked Recall Grading. Each of the masked-recall test sheets for the cigarette advertisements was graded by two trained coders. Responses were categorized into four levels of recall ranging from no response to the exact wording of the health message. The lowest coded level corresponded to no response or to providing information that had nothing to do with the warnings (Level I). The second level represented a response that indicated a health warning was present but provided no specific information about the content of the warning (Level II). The third level represented responses that correctly identified the health

Figure 1

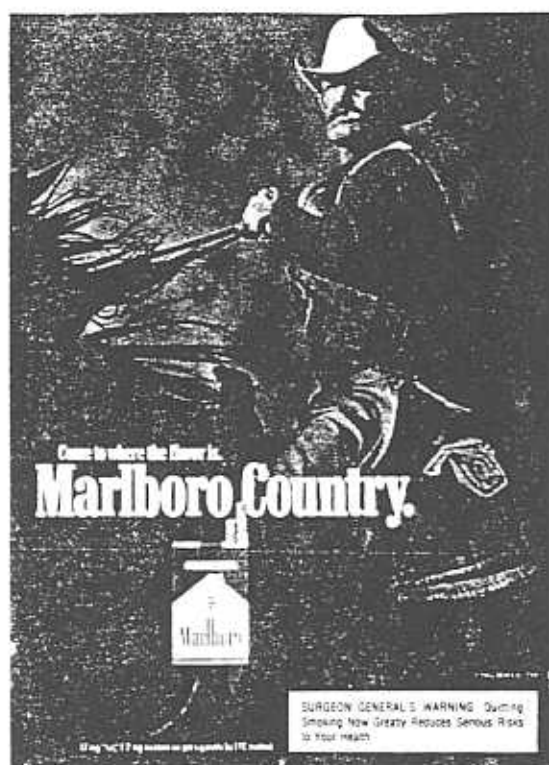


Figure 2

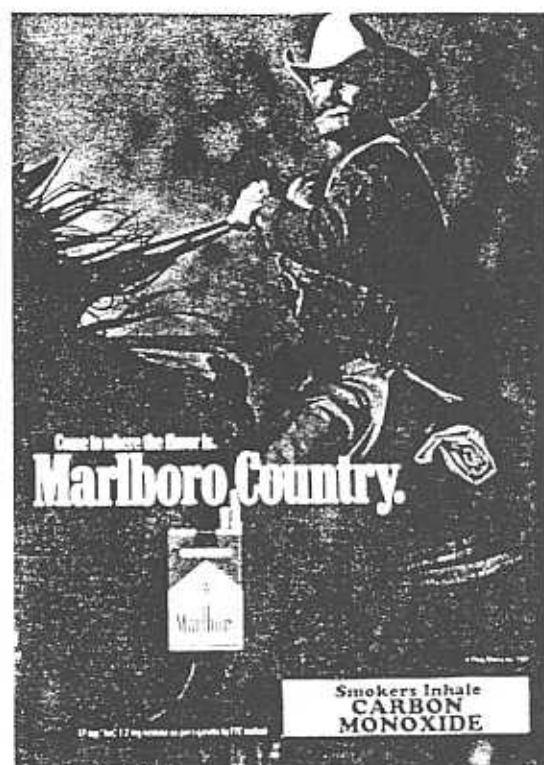


Figure 3

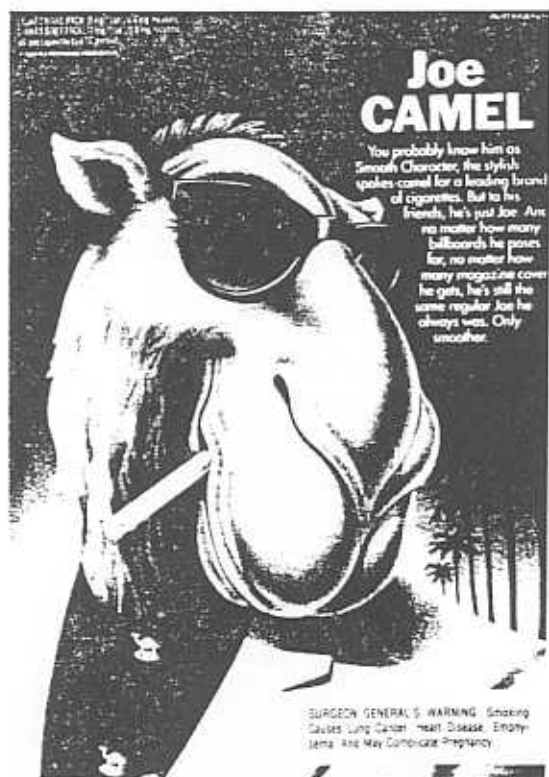


Figure 4



concept. This included mention of carbon monoxide, quitting smoking improving health, one in three dying from smoking, or that smoking causes lung or heart disease, respectively (Level III). Finally, the fourth level of recall was for responses that reported the actual wording of the warning. Minor grammatical discrepancies were permitted in this category (Level IV). The third and fourth level of grading are very similar to the standards used by Barlow and Wolgater (1993) in evaluating responses to alcohol warnings. Two coders were used to grade the responses. Inter-coder agreement was .893. Disagreements by the two coders were arbitrated by one of the investigators.

Data Analysis. The analyses focused on eye-tracking measures obtained for the four health warnings (two mandated existing and two new warnings developed by the creative team). Since the advertising environment in which the warning is placed obviously influences the measures, separate comparisons were made between the mandated and newly developed warnings for each of the two cigarette advertisements. Eye-tracking measures included percent of subjects fixating on the warning, time to first fixation, dwell time (total time fixating on the warning), and the mean number of fixations on the warning.

The percent of subjects who fixate on the warning and the time to the first fixation on the warning are clearly measures of the warning's ability to attract attention to itself. To examine the validity of the other eye-tracking measures as an indication of effectiveness for the new warnings, subjects were divided into those with low recall (recall levels I and II) and those with high recall (recall levels III and

IV). The physiological measures of attention duration were then compared between high- and low-recall groups. This comparison assesses the degree to which attention duration, measured physiologically, is associated with the cognitive measure, masked recall. Similar comparisons for the mandated warnings were not performed because recall of these warnings is heavily biased by prior knowledge of the mandated existing warning.

Results: New vs. Existing Warnings

In both advertising contexts, Marlboro and Camel, the new warnings were superior to the mandated warnings with respect to attracting attention. In both cases, more participants attended to the new warnings than attended to the old warnings, and the new warnings attracted attention to themselves more quickly than the mandated warnings. However, the results were not so clear in the context of holding attention. The new warning was superior to the old warning in this sense only in the case of the Camel ad. We submit that disparity of message length is the reason that an advantage for the new warning was not observed in the case of the Marlboro ad.

The masked-recall results dramatically display the bias resulting from familiarity with existing warnings and, therefore, are not useful for comparing the old versus the new warnings. However, the masked-recall results for the new warnings demonstrate the validity of the physiological measures used to compare the warnings' abilities to hold attention.

Attracting and Holding Attention: New vs. Existing Warnings.

In order to warn, the message must of course attract attention to itself. For both the Camel and Marlboro ads, the new warnings were attended to by higher percentages of respondents than the mandated warnings. Moreover, those attending to the warnings fixated more quickly on the new warnings than on the old warnings. Hence, it is clear that the new warnings are superior with respect to ability to attract attention. This is extremely important in a reading environment in which there is competition for visual attention.

Table 1 shows the results with respect to the first research question: Will a higher percent of adolescents attend to new warnings than mandated existing warnings? For both the Marlboro and Camel advertisements, significantly more respondents fixated on the new warnings than

Table 1
Comparison of New versus Mandated Existing Warnings for Ability to Attract Attention

Measure	Marlboro ad		Camel ad	
	New	Mandated existing	New	Mandated existing
% of participants fixating on warning	97.2	86.0*	88	77.6*
Time (in seconds) before first fixation on warning	3.99*	4.79	10.45*	12.93

* Significantly lower than corresponding value at 5% risk level.

on the mandated existing warnings. For the Marlboro ad, the percentage of participants attending to the new warning was 11.2 percentage points higher than the percentage of respondents attending to the old warning. For the Camel ad, the difference between the percentages attending to the new and existing warnings was 10.4 percent.

Table 1 also addresses the second research question: Will adolescents attend more quickly to the new warnings than existing warnings? For each of the two advertisements, the average time to fixate on the warning among those who did fixate on the warning is significantly lower for the new warning than for the existing warning. For the Marlboro ad, the new warning was attended to almost a second (.8) faster. For the Camel ad, the warning was attended to almost two and one-half seconds (2.48) faster.

Holding Attention. A warning message must not only attract attention: it must hold attention so that the viewer reads and comprehends the message. The new warning was superior to the mandated warning in the context of holding attention in the case of the Camel ad but not in the case of the Marlboro ad. However, the latter comparison is not meaningful due to disparity in the length of the warning message.

Table 2 addresses the third

A warning message must not only attract attention: it must hold attention so that the viewer reads and comprehends the message.

research question: Will adolescents spend more time reading new warnings than mandated existing warnings? The mean dwell time (total amount of time for all fixations) and mean number of fixations for the mandated existing and new warnings for each of the two advertisements are reported in Table 2.

For the Camel ad, the average dwell time was significantly higher among people viewing the new warning as opposed to the mandated existing warning. Also, the mean number of fixations among those viewing the revised warnings is directionally higher than the mean number of fixations among those viewing the mandated warning. These results indicate that in the context of the Camel ad, the new warning not only attracts attention more often and more quickly but also holds attention longer. The difference in holding power cannot be explained by the length of the message (i.e., number of words); the new and mandated warnings are quite comparable. The mandated

warning is 14 words and the new warning is 11 words.

For the Marlboro ad, the average dwell time for the mandated warning is directionally higher than the average dwell time for the new warning. Also, the mean number of fixations is significantly higher for the mandated warning than it is for the new warning. In this instance, the amount of time attending to the warning is affected by the length. The number of words for the two warnings used in the Marlboro advertisement are very different. The new warning in the Marlboro ad is terse, containing only four words. On the other hand, the corresponding existing warning contains many more words (13), thus requiring more dwell time. It is our belief that the reason for the higher attention on the physiological measures for the old warning as compared to the new warning, in the context of the Marlboro ad, is simply the disparity in the length between the two warning messages, as noted earlier. The creative group was not constrained with respect to text or graphics in the warning box. This was a purposeful decision not to preclude any approaches deemed effective by the creative team and to which adolescents reacted favorably in the focus groups.

In terms of length, the new warning in the Marlboro ad is an outlier compared to all of the warnings. The simple nature of the new Marlboro warning is demonstrated in the next section by the relatively large number of individuals who exactly recall the wording of the warning.

The four tested warnings ranged in length from four words to fourteen words. Warnings also varied in terms of color, type, and complexity. Despite the differences, the mean dwell time for all of the warn-

Table 2
Comparison of Summary Physiological Measures between New and Existing Mandated Warnings

Physiological measure	Marlboro		Camel	
	New	Mandated existing	New	Mandated existing
Mean dwell time on warning	2.06	2.48	2.58*	1.99
Mean number of fixations on warning	6.02	7.32*	7.48	6.60

* Significantly higher than corresponding figure at 5% risk level.

ings ranged only from 1.99 to 2.58 seconds. While we cannot consistently differentiate to what extent dwell times are due to specific content differences (length, color, type, and complexity), the similarities across warnings in mean dwell time are of interest. We interpret the data to indicate that, within the reading environment of a cigarette advertisement, warnings as they are now mandated are at best likely to interest the average reader 2 to 3 seconds. The 2 to 3 seconds spent with the warning is about the time an average reader can read approximately five words (Heller, 1982). In this context, warnings need to be very brief and to the point.

Masked Recall. As anticipated, prior knowledge is a factor. A greater percentage of participants was able to report the presence of the existing warning than was able to report the presence of the new warning in both cases. Additionally, there were considerably more incorrect or blank answers for the new as opposed to the existing warnings. These results demonstrate the difficulty of using recall measures to establish superiority for alternatives compared to existing warnings. Prior exposure to existing warnings creates a knowledge base which acts as an advantage for the existing warnings in the context of recall measures.

Table 3 summarizes the masked-recall results. The only warning able to produce an exact recall score of over 10 percent is the new warning in the Marlboro Ad. This warning was by far the simplest in terms of text.

Validity of Eye-Track Measures. Positive relationships between dwell time and level of masked recall of warning content, and number of fixations and level of masked recall of

Table 3
Masked Recall Results

	Marlboro		Camel	
	New (159) %	Mandated existing (167) %	New (159) %	Mandated existing (169) %
Exact correct wording	10.7	3.6	2.5	4.2
Concept correct	25.2	32.4	43.4	32.5
Warning presence noted	35.8	55.1	32.1	43.7
Blank or incorrect	28.3	8.9	22.0	9.6

warning content, were obtained for both new warnings. In other words, the longer a participant spent attending to a new warning (no bias due to familiarity), as reported in the eye-tracking data, the more information the participant tended to remember at the masked-recall question. Hence, the eye-tracking physiological measures have validity as indicators of what a participant retains after viewing the warning.

The fourth research question addresses the issue of validity of eye-tracking measures as indicative of warning effectiveness: What is the relationship between eye-tracking measures and masked recall for new warnings? In situations where prior knowledge does not exist, with respect to warning information (i.e., new warnings), a positive relationship should exist between eye-track measures and masked

recall. While the eye-track-recall relationship has been established in other areas (Just and Carpenter, 1980), little published information exists with respect to advertising and consumer behavior information.

Dwell time and average number of fixations are used to establish the relationship to masked recall. Respondents were divided into two groups: high recallers, those who were able to reproduce the exact warning or the concept of the warning in the masked-recall exercise, and low recallers, those who only reported the presence of a health advisory, wrote an incorrect response, or left the box blank. To be classified in the high-recall category, a subject must attend to, process, and remember specific health information in the warning box. For each of the two new warnings, the means for the two relevant

Table 4
Comparison of Eye-Tracking Measures between High and Low Recallers for New Warnings

Physiological measure	Marlboro ad		Camel ad	
	High recallers	Low recallers	High recallers	Low recallers
Mean dwell time on warning	2.57	1.78*	3.09	2.02*
Mean number of fixations on warning	7.2	5.20*	8.89	5.90*

* Significantly lower 5% risk.

physiological measures were calculated for each of these two groups. Table 4 displays the findings. The average dwell time on the warning as well as the average number of fixations on the warning is significantly greater for the high-recall group than for the low-recall group for both ads. Hence, in this instance, the dwell time and number of fixations, both measures of time spent looking at the warning, can be used as surrogate measures for information processing and recall.

Discussion

This study has examined the issue of attention and recall using physiological data from eye tracking. It is unique in warning research in that it focuses on visual attention rather than other factors such as comprehension, attitude, or beliefs. We argue that attention is a critical process prior to comprehension, attitude development, or changes in behavior. Warnings are competing in an environment where many other elements in the advertising vie for readers' attention. It is important to understand how many individuals attend to the warning, how quickly they attend, and if attention translates into information processing.

In the context of obtaining attention, the new warnings tested in this study possess two clear advantages over the existing mandated warnings: (1) new warnings are able to attract the attention of more individuals, and (2) new warnings gain attention in a shorter period of time. Both of these advantages are important issues with respect to the efficacy of warnings. Obviously, it is important to reach many of the target group as possible. With respect to attracting attention, data revealed at

least a 10 percent improvement for each of the two new warnings. Data also showed that individuals attended to the new warnings from slightly less than 1 second to 2.5 seconds faster. In a competitive reading environment, where subjects determine the areas to which they will attend, time to attention is an important factor.

We do not argue that the warnings developed for this study are the answer per se: we do, however, argue that a policy based on warnings should develop messages that meet specific communication goals. In an era when disclosures and warnings are becoming commonplace, emphasis needs to focus on their development and testing. Our findings confirm recent empirical work on alcohol warnings, which conclude that presentation style in print ads makes a significant difference with respect to whether the warnings are seen and remembered (Barlow and Wolgalter, 1993).

... the use of in-ad health warnings can be improved if they are targeted, novel, simple, and tested for effectiveness prior to use.

A successful link between eye-tracking measures related to holding attention and masked recall is established. This allows for an interpretation that eye-track data provide useful measures of cognitive processing, as well as attention.

In this study, the most appropriate comparison between new and existing mandated warnings are the number of people fixating and the amount of time it

takes them to fixate. These measures are straightforward in terms of interpretation. However, eye-tracking measures related to holding attention—length of time as measured by dwell time and mean number of fixations—are at least partially driven by length of text. Because we allowed the designers, with input from the focus groups, to develop specific warnings, we did not ensure comparability in terms of length of text between new and existing warnings. For the Camel ads, the new and existing warnings are deemed to be comparable, thus ensuring a meaningful comparison. For the Marlboro ads, new and existing warnings are not comparable, thus creating a bias. Future eye-tracking studies measuring length of viewing should take this issue into account.

The development of new warnings will no doubt differ with respect to the information requirements and the amount of necessary text or symbols. However, these results indicate that individuals' attention to warnings range from 2 to 3 seconds. Therefore, it is logical to assume that warnings in this framework should be kept simple. Current warnings use up to 24 words and are not likely to be fully effective in 2 to 3 seconds.

Eye tracking provides a unique opportunity to investigate attention levels in advertising. The technique is typically used as a design tool for understanding where and how individuals look at stimulus material. For the most part, the vast majority of such studies in marketing communication use small sample sizes, and the data are subjected to qualitative analysis. This study employed large samples with quantitative analyses.

Subjects were free of restraint of a headset because they looked at a screen, thus decreasing the

impact of instrumentation. To be sure, there is a degree of artificiality introduced by having subjects look at a screen rather than a magazine. However, it is extremely unlikely that subjects changed their point of gaze within the reading situation. Where subjects look and how soon they identify a target area is far more likely to be determined by content and physiology than by the viewing environment. Moreover, it is acknowledged that under eye-tracking conditions total reading time might be greater than under more natural conditions. While this could potentially push readers to pay more attention than usual to the warnings, there is no reason to believe any one warning has an inherent advantage. Finally, the 2 to 3 seconds spent on the warning is likely to be on the high side rather than on the low side.

Conclusion

Given the task of educating the public about product risks, any communication program should start by establishing clear goals and measuring progress toward these goals. With this in mind, the current federal policies regulating cigarette warnings are a solution without a well-defined problem. Are they designed to reduce cigarette use, to balance advertising messages, to provide specific risk information, to simply "warn," or to limit corporate product liability?

The strategy of using four rotating warnings has not changed since 1984. As importantly, the structure of the warnings which utilizes a box and black-and-white text has not changed since 1965 when it became required on packages and 1972 when it became required in advertising! Research to date indicates that there is general knowledge that

the warning box at the periphery of cigarette advertisements is a health message, but that it functions in no more specific manner. While a number of factors such as lack of interest, messages which are not germane, poor execution, and the competitive environment can explain the inability of warnings to communicate specific information, it is also likely that the current system of warnings suffers from "wearout." In many cases consumers may shortcut the warning without getting to the specific message. This would explain why many respondents in this study reported that a warning existed but fewer were able to recall the concepts correctly. Further support for the wearout explanation is found in a tachistoscope study on warnings (Fischer et al., 1993). After nine exposures for a cumulative total of 5.88 seconds, 79 percent of the subjects were able to identify an existing mandated warning as a warning, yet only 15 percent were able to recall the warning's general concept.

Lawmakers and advocates need to ask if this limited level of communication meets Congressional intent. It is very likely that Congress will, in the near future, revisit the issue of tobacco warnings and will consider mandating warnings on other products. With this in mind, we suggest that federal policy be based on very specific communication goals and develop an ongoing plan to measure how well the goals are achieved. If in-ad warnings are used, as is the case currently for cigarettes, measurement should be done in the context of the ad environment, since the ad and the health message by design compete for the viewer's attention. An evaluation needs to be made with respect to the benefits of repetition versus wearout.

Periodic monitoring would allow for an evaluation of when warnings are losing effectiveness against target markets, with respect to both initial attention and holding power.

Finally, the use of in-ad health warnings can be improved if they are targeted, novel, simple and tested for effectiveness prior to use. A policy that ignores any of these four critical elements will likely achieve only the limited success of the current mandated warnings. ■

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