

ABSTRACT

Background: Distressing imagery may inhibit health communications by inducing audiences to avoid attention to persuasive messages. Method: We used an eye-tracking methodology to compare gaze time allocated to a persuasive textual message, accompanied by either distressing high resolution colour images or less distressing two-colour images with degraded outline and detail. Results: Participants in the distressing images condition showed lower intentions to reduce drinking in the following three months. This effect may have been mediated by lower gaze time to the textual elements of the message. Participants spent more time gazing at the distressing images, which was statistically unrelated to text gaze time or persuasion, which eliminates a distraction explanation. Conclusions: These findings provide evidence of the deleterious effects of distressing imagery on persuasion. Implications for health message design are discussed.

Keywords: Persuasion; Defensiveness; Attention; Avoidance; Gaze-Tracking.

In most national populations, mortality and morbidity patterns are heavily influenced by population prevalences of risk behaviors, such as smoking, drug and alcohol misuse, unsafe sexual practices, fat consumption and physical inactivity (Kromhout, Bloemberg, Feskens, Menotti & Nissinen, 2000). Many national and regional public health authorities use marketing approaches to encourage populations to reduce risk behaviors. This involves delivering persuasive communications using print and electronic mass-media, inclusion of messages on product packaging or community-level interventions (Emery, Szczyпка, Powell & Chaloupka, 2007). A common tactic used in these campaigns is to employ vivid and disturbing images of the outcomes of unhealthy or unsafe behaviors, including graphic portrayals of diseased organs, severe injuries or severe pain (Slater, 1999). This approach is intended to both draw audience attention to messages (Baron, Logan, Lilly, Inman & Brennan, 1994) and elicit an emotional response that contributes toward decisions to reduce risk behavior (Hill, Chapman & Donovan, 1998).

However, the full potential of emotive message styles may not be realized because some audience members use various perceptual and cognitive defenses to avoid negative emotional responses (Blumberg, 2000; Ruiters, Abraham & Kok, 2001). These defenses can reduce aversive emotion, but may do so at the cost of inhibiting persuasion (Freeman, Hennessey & Marzullo, 2001; Gleicher & Petty, 1992; Jemmott, Ditto & Croyle, 1986). One defense, attentional avoidance, involves the allocation of attention away from messages that cause distress. Avoidance appears to operate with a high degree of immediacy, and is triggered by stimuli that are both emotive and self-relevant (Mendolia, 1999). Strategies used to avoid threatening stimuli include narrowing of attention to eliminate peripheral stimuli (Hansen, Hansen & Shantz, 1992), self-distraction (Boden & Baumeister, 1997), selective attention toward less threatening stimuli (Bonanno, Davis,

Singer & Schwartz, 1991; Fox, 1993) and stimulus termination (Fox, 1993). Use of avoidance causes weaker and less elaborate memory representations of threatening stimuli, which reduces their later accessibility (Hansen, Hansen & Schantz 1992) and persuasiveness (Keller & Block, 1996).

Attentional avoidance should be a particularly effective defense against overtly emotive stimuli. Dual processing theories (Loewenstein, Weber, Hsee & Welch, 2001; Slovic, et al, 2003) describe affective information processing routes, characterised by primary associations between stimuli and the emotional responses that they elicit. Affective processing requires few processing resources, is difficult to control, resistant to insight, and is activated by vivid stimulus components (Greening, Dollinger & Pitz, 1996; Slovic, et al, 2003). Emotive imagery is designed to target affective processes, and the immediacy of avoidance responses can provide a perceptual protection against such stimuli (Blumberg, 2000). There is some evidence for a link between emotive health stimuli and attentional avoidance. In an event-related potential study, Kessels, Ruiters and Jansma (2010) showed smokers to have relatively lower P300 amplitudes when viewing distressing smoking-related images compared to less distressing images. Non-smokers did not show this pattern. This was interpreted to suggest that smokers, who are more vulnerable to negative outcomes, were more prepared than non-smokers to disengage attention from distressing compared to less distressing, images.

Two studies have examined the hypothesis that attentional avoidance mediates a negative relationship between distressing imagery and persuasion. Keller and Block (1996) instructed participants to process self-referent health messages in either an imaginative and visual way or an objective and detached manner. They found that participants in the

imaginative condition showed less persuasion when confronted with a high- than low-threat message. This was mediated by poorer cognitive elaborations of the message, suggesting that participants avoided attending to it. Brown and Locker (2009) presented a textual message with highly distressing anti-alcohol medical imagery. Compared to a control condition, participants who were both heavier drinkers and who scored higher on a denial coping scale read the message for less time and were consequently less persuaded that they were at risk of alcohol-related problems.

These studies do not provide direct evidence of avoidant processes. Keller and Block (1996) inferred avoidance through participants' cognitive elaborations of stimulus material, whilst Brown and Locker (2009) relied upon covert recordings of elapsed time between opening and closing a printed information pamphlet. Eye tracking methods provide a direct and objective assessment of attention by mapping the direction of the participant's gaze. In this study, we used eye-tracking to examine whether distressing imagery reduces attentional allocation to a health message, and whether this is related to persuasion.

Current Study

Alcohol misuse causes some of the most damaging health and social problems in the UK (Academy of Medical Sciences, 2004), and research has shown that audiences can respond defensively to anti-alcohol messages (Brown & Locker, 2009; Leffingwell, Neumann & Leedy, 2007). We presented two groups of participants with identical textual anti-alcohol messages, providing information concerning the risks of hazardous drinking and the benefits of reducing drinking. These were accompanied by either distressing medical images, or the same images presented in a less distressing way.

One criticism of previous work is that researchers (e.g., Brown & Locker, 2009; Brown & Smith, 2007) use differing images to manipulate distress. This potentially enables participants in each experimental condition to draw differing inferences based on their content. This may be a particular problem in gaze-tracking studies, because differing images will have unique physical and semantic characteristics that affect their capacity to attract gaze, thus confounding any distress effects. A better option is to present the same images in distressing and less-distressing formats. Vividness and clarity are key components of the risk perception process (Greening, Dollinger & Pitz, 1996), and stimulus avoidance appears to be activated by vivid presentations (Hansen, Hansen & Schantz, 1992). Thus, rather than use differing images, we chose to influence distress by manipulating the vividness and clarity of images.

However, vividness affects the processing of persuasive messages in several other ways that need to be accounted for. When vivid components are message congruent they can enhance persuasiveness (Smith & Schaffer, 2000). Conversely, vivid content can elicit counter-argumentation in audiences that are motivated and able to attend to it (Keller & Block, 1997). Both effects run counter to our avoidance model because they predict either a different outcome (greater persuasion) or process (greater attention rather than attentional avoidance), and cannot be mistaken for avoidance effects. More concerning, a study by Frey and Eagly (1993) demonstrates that vivid stimuli may inhibit message persuasiveness because they distract attention from more pallid message components. Thus images could distract attention from the text. By definition, a distractor must attract and hold attention itself. On the face of it, this is incompatible with our avoidance view that audiences disengage from distressing stimuli. Nonetheless, we examined correlations between

attention to images and text. Negative correlations between gaze time at images and text would suggest a distraction effect, which can be eliminated by statistically controlling image gaze time.

Hypotheses

We predicted that distressing images would reduce gaze allocated to accompanying persuasive textual messages, which would, in turn, inhibit persuasion, assessed by lower perceptions of alcohol related risk (Brown & Locker, 2009), poorer evaluation of messages (Freeman, Hennessy & Marzullo, 2001) and lower intentions to reduce drinking. A defensiveness interpretation would be strengthened if avoidant responses are more prominent in participants who consistently employ defensive coping strategies (e.g., Brown & Locker, 2009). Using the dispositional mental disengagement scale of the COPE (Carver, Scheier & Weintraub, 1989), we expected that any avoidance effect caused by the manipulation would be greater in higher mental disengagement scorers. Avoidance processes are stronger in participants who are vulnerable to the threat (Brown & Locker, 2009; Kessels et al., 2010; Liberman & Chaiken, 1992). This is generally interpreted as evidence of defensiveness. Thus, we expected any avoidance effect would be facilitated by greater objective vulnerability to alcohol-related problems, assessed by a version of the Audit developed for young people (Miles, Strang & Winstock, 2001). The causal model is a moderated mediation model (Mackinnon, Fairchild and Fritz (2007), whereby lower text gaze is determined by either a three-way or two two-way interactions between the distressing condition and higher mental disengagement and Audit scores, and lower text gaze then inhibits persuasion.

METHOD

Participants

Participants were staff and student drinkers at a UK university, recruited via personal approaches in public areas (n=35) or through an electronic bulletin board (n=65). Ethical clearance was obtained from that institution. A cover story was provided stating that the research was intended to test audience acceptability of anti-alcohol messages. Post-test debriefing confirmed that participants believed this. Exclusions from the sample were only made for those who reported that they do not drink alcohol. Data were obtained from 31 males and 69 females with a mean age of 31.32 (SD=9.12). 49 reported drinking once per week or less, 39 two to three times per week and 12 four or more times. 36 reported drinking one to two drinks per session, 32 three to four drinks and 30 four or more.

Materials

Anti-Alcohol Message: On the basis of the message used by Brown and Locker (2009), we used a computer mounted presentation entitled 'The Menace of Alcohol', consisting of ten screens produced using MS PowerPoint and presented consecutively. 'GazeTrackerTM' software was used to synchronize the screens with eye movement recordings. Participants were able to move forward, but not backward, through the screens at their own pace. Identical textual information was included in both conditions. Section 1 (269 words) consisted of three text-only screens providing a general introduction to the topic of alcohol misuse. The first screen explained that the materials are designed to encourage the drinker

to consider reducing drinking and that all statements contained within were supported by reliable sources. The second and third screens defined alcohol misuse, government drinking guidelines and provided general information on the consequences of misuse (e.g., ‘alcohol affects alertness and judgment, therefore increasing the risk of falls and accidents’).

Section 2 (311 words) consisted of four screens providing information on specific health consequences: Liver disease; Vascular disease; Cancer; Pancreatic disease; Traffic accidents; Antisocial behavior; and Skin disease. **The proportional relationship between risk and alcohol consumption was emphasized.** These were accompanied by images of a male with a severely swollen liver visible outside the body, a male with a distended abdomen, a female with severe burns after a drunk driving accident and a close-up image of a drinker with severe dermatitis. High resolution color images were used to enhance negative emotion. The distressing nature of the images was reduced by using an ordered dither color reduction algorithm to create a two-color version with reduced clarity of detail.

An additional twenty students participated in a manipulation check. The color images were rated as being more distressing, distress mean=3.70 ($SD=1.34$) non-distress mean=1.90 ($SD=1.10$), $t=3.29$, 18 *df*, $p<.01$, and vivid, distress mean=4.10 ($SD=1.29$) non-distress mean=2.20 ($SD=1.23$), $t=3.37$, 18 *df*, $p<.01$. There were no differences for novelty, distress mean=4.30 ($SD=1.34$) non-distress mean=3.70 ($SD=1.42$), $t=0.97$, 18 *df*, $p=.343$, interest, distress mean=2.60 ($SD=0.84$) non-distress mean=2.30 ($SD=1.34$), $t=0.60$, 18 *df*, $p=.556$, attractiveness, distress mean=1.90 ($SD=0.74$) non-distress mean=2.10 ($SD=0.99$), $t=$, 18 *df*, $p=.511$, or personal relevance, distress mean=3.10 ($SD=0.99$) non-distress mean=2.70 ($SD=0.68$), $t=1.05$, 18 *df*, $p=.307$.

Section 3 (309 words) encouraged drinkers to consider alcohol reduction and provided resources that could help them to do so. Statements described the increased risk faced by younger drinkers, and proximal and distal benefits of reducing consumption. References and contact details for further information on alcohol and health were provided. These did not contain any imagery.

Eye-Movement Tracking Apparatus: Eye movements were recorded using a Cambridge Systems Video Eyetracker Toolbox, an IR reflection eye tracker that consists of a headrest that incorporates the camera, illumination and optics, connected to a dual screen RM 2.8GHz Pentium PC running Microsoft Windows 2000 Professional SP4. Stimulus presentation and data analysis was undertaken using the software package, ‘GazeTracker™’ (Eye Response Technologies, Charlottesville, VA, USA). Participants viewed stimuli on a 15” monitor placed directly in front and 47cm away from their eye line.

Pre-Manipulation Questionnaire. **We used a five-item version of the Alcohol Use Disorders Identification Test (AUDIT) to assess vulnerability to future alcohol-related problems. The AUDIT is a well-used and validated instrument that predicts future alcohol-related problems (Allen, Litten, Fertig & Babor, 1997; Connigrave, Saunders & Reznik, 1995). The version we used was developed for younger drinkers and tested on a British college sample (Miles, Winstock & Strang, 2001). It is based upon the frequency of drinking days and quantities of alcohol drunk on those days, and the presence of drinking-related problems.** The range of possible scores is 0-20 and the Cronbach alpha in this study was 0.71. We used the dispositional mental disengagement

scale of the COPE (Carver, Scheier & Weintraub, 1989) to assess disposition toward avoidant coping. The mental disengagement scale is associated with a lower uptake of preventive health behaviors and poorer illness outcomes (Burker, Eva, Sedway & Egan, 2005; Gray & Hedge, 1999). This scale asks participants to state their usual coping responses to 'difficult or stressful events', and consists of four items assessing individuals' habitual use of mental disengagement (e.g., 'I turn to work or other substitute activities to take my mind off things'). Scores are recorded on a four point scale with the following labels; 'I usually don't do this at all', 'I usually do this a little bit', 'I usually do this a medium amount' and 'I usually do this a lot'. The range was 4-16, with higher scores representing greater disengagement. **Reliability was poor, with a Cronbach alpha of 0.49.**

Post-Manipulation Questionnaire: Outcome variables were chosen because they had been shown to be sensitive to defensive processing in previous studies. Participants' were asked to evaluate the pamphlet on the following dimensions: Persuasive/not persuasive; Bad/good; Clever/stupid; and Not effective/effective on a seven point scale from -3 to 3 (Freeman, et al., 2001; Brown & Smith, 2006). Scale range was -12 to 12 with positive scores denoting positive evaluations. The scale showed a Cronbach Alpha of .96. Drinking-related risk perceptions were measured on a scale developed by Brown and Morley (2007) and used by Brown and Locker (2009). Participants rated the likelihood of their ever experiencing eight outcomes, such as 'becoming addicted to alcohol' or 'experiencing serious difficulties with family relationships due to alcohol'. Estimates were rated on a seven-point Likert scale anchored by the terms 'no chance' and 'certain', with higher scores denoting greater risk. **The Cronbach alpha was 0.88.** Intentions to reduce drinking were measured using two items pertaining to whether participants intended or were willing

to reduce drinking in the next three months (e.g., To what extent are you willing to reduce drinking in the next three months?). Responses were made on a seven point Likert scale anchored by the terms ‘not at all’ and ‘completely’. Correlation between the two items was 0.51.

Procedure

Participants completed the pretest questionnaire, were introduced to the apparatus, performed a familiarization task, were exposed to the message and completed the post-test questionnaire. These tasks were performed consecutively, although a five to ten minute break between the pretest and introduction to the apparatus was taken to set up the eye-tracking equipment. Paper-based pre-test questionnaires containing demographic information and the audit and mental disengagement scales. **They were allocated to conditions numbering 50 each by a randomizer program,** then seated at the eye-movement recording equipment, the function of which was explained and a demonstration made. To familiarise themselves with the task and equipment, participants were given a practice trial using non-health related illustrated material. This trial was also used to calibrate the eye-tracker. They were told that they were not expected to attend to any aspect that they did not wish to. The message was then presented and gaze time recorded for each section. Participants subsequently completed questionnaires relating to their perceptions of the message, risk estimates and intentions.

Derivation of eye-tracking data: Data processing was handled by the GazeTracker™ software. The raw data were the x,y position of participant gaze on each slides every 20ms. The GazeTracker™ software calculated the total gaze time spent examining the text or image through the use of ‘look zones’ corresponding to text and images. The look zones are

a data analysis feature of the GazeTracker™ software and were determined by the experimenter for each slide using the mouse to outline the desired look zone area.

Thirty-five percent of gaze time was unaccounted for, almost entirely because participants gazed outside the text and image look zones. As attentional avoidance processes cannot be differentiated from mere inattention, it is difficult to ascribe theoretical meaning to this time. However, it is important to determine whether unaccounted gaze could confound the interpretation of study results. We conducted t-tests on unaccounted time for each screen by experimental condition, finding no bias to either condition. To establish whether individual differences contributed to unaccounted gaze time, we computed correlations with Mental Disengagement and Audit scores. None were significant.

RESULTS

Preliminary analyses were conducted to identify the optimal combination of variables for causal modeling. MacKinnon, Fairchild and Fritz (2007) suggest that a precondition of mediation is that the independent variable be associated with both the outcome¹ and putative mediator, and that the mediator is associated with the outcome. Multivariate analyses were used to apply a single significance test. A MANOVA showed an experimental effect on a linear combination of intentions to reduce drinking, message evaluation and risk perceptions, $F(4,95)=2.70, p<.05, r=0.30$. Table 1 shows means and effect sizes, the largest effect being higher intentions to reduce drinking in the non-distressing image condition. We used intention to reduce drinking as the outcome variable in the causal analysis.

¹ There is some contention as to whether IV-outcome links need be statistically significant at $p=.05$ or indeed measured at all (e.g., Shrout & Bolger, 2002). We have decided to conduct the analysis and to present it for completeness.

Another MANOVA was conducted to assess the direct effect of the experimental manipulation on gaze times at the three sections of text². A significant multivariate effect was observed, $F(4,95)=4.51, p<.01, r=.28$. Table 1 shows that, as would be expected, the experimental condition had no effect on section 1 text time. Greater gaze time was allocated to section 2 text (which contained images) in the non-distressing images condition, but no differences were detected for section 3 (which did not contain images). To provide a more clear assessment of the effects of experimentally-induced changes in text gaze time, we also computed a change score by subtracting the section 2 text gaze time from section 1 gaze time. This reduces error caused by individual differences in overall gaze time. Table 1 shows greater Section 1-2 text gaze reductions in the distressing images condition. A final precondition of mediation is that the mediator is associated with the outcome. Section 2 text gaze and section 1-2 gaze changes were correlated with intention (respectively $r=.26$ and $r=.21, df=98, p<.05$).

Table 1 shows that greater gaze time was allocated to the images in the distressing images condition. This raises the possibility that the experimental effect on text gaze was caused by the vivid images distracting attention from the text. However, there were no correlations between image gaze time and section 2 text gaze time, $r(98)=-0.10$, **section 3 text gaze time, $r(98)=-0.06, p=.430$** , section 1-2 gaze time changes $r(98)=-0.08, p=.414$, or intention, $r(98)=-0.03, p=.749$. This suggests that allocation of attention to images did not occur at the expense of text as would be predicted by a distraction explanation.

² The three text sections and section 2 image gaze time scores were positively skewed, and subjected to a square root transformation before all analyses.

Causal Analysis

A structural model was constructed to test the proposition that text gaze and changes in text gaze mediate the expected effect of the experimental manipulation on intentions to reduce drinking, and that this path is facilitated by higher vulnerability and denial scores. Three two-way and one three-way interaction effects were created by computing the products of condition (coded as 0=non-emotive message, 1=emotive message) and centred Audit and mental disengagement scores. We used two structural models, using either section 2 text gaze or section 1-2 gaze changes as mediators (Figures 1 and 2). Separate facilitation of the mediational path by mental disengagement or audit scores would be suggested by prediction of gaze or gaze change by either or both of the two-way interaction terms involving condition. Prediction by the three-way interaction suggests facilitation or moderation of experimental effects by a combination of mental disengagement and Audit. Simple slopes analysis (Aiken & West, 1991) was used to interpret any interactions.

When the duration of section 2 text gaze was used as a mediator, a maximum likelihood model showed good fit to the data, $\chi^2=18.84$, 17 *df*, $p<.01$, RMSEA=.030 (90% CL=.000,.100), CFI=.992. Parameter estimations are presented in Figure 1, showing that text gaze was greater in the non-distressing images condition, $p<.01$, and that text gaze was positively related to intentions to reduce drinking, $p<.05$. This is consistent with an indirect path between the presentation of distressing images and lower intentions, mediated by greater text gaze. Neither mental disengagement nor Audit scores influenced the above path. Text gaze was not predicted by the three way

interaction, $p = .080$, or any of the two-way interactions involving condition, mental disengagement $p = .199$, Audit, $p = .408$.

The model specifying section 1-2 text gaze change as a mediator (Figure 2) also showed good fit to the data, $\chi^2 = 18.10$, 17 *df*, $p < .01$, RMSEA = .025 (90% CL = .000, .960), CFI = .996, and suggests that an indirect relationship between exposure to distressing images and lower intention was mediated by lower section 1-2 text gaze changes. Gaze was also predicted by the three-way interaction modeled by condition, mental disengagement and Audit, suggesting that the above path was influenced by a combination of both variables.

We used simple slopes analyses (Aiken & West, 1991) to probe the three-way interaction. Four slopes were calculated, representing the regression of condition onto section 1-2 gaze change at one standard deviation above and below the mean for mental disengagement (± 2.50) and Audit (± 2.41). The slopes are presented in Figure 3, showing that the experimental manipulation had its greatest effect on gaze times in lower mental disengagement and higher Audit scorers. These participants showed the least deterioration in text gaze times between sections 1-2 (with some showing a slight increase) in the non-distressing images condition, but were among those who showed some of the greatest decreases in the distressing images condition.

Predictors of Section 2-3 Changes in Text Gaze

The experimental effect on text gaze did not extend to section 3 text. It is relevant to determine whether this is caused by those participants returning their attention to

section 3 after reducing attention between sections 1-2 text. To test this hypothesis, we computed a section 2-3 text gaze increase variable by subtracting section 2 text gaze time from section 3. This was regressed onto section 1 text gaze, section 1-2 text increase, condition, mental disengagement, audit and the two and three-way interaction variables. The regression was significant, $R^2=0.66$, $df=9,99$, $p<.01$. Significant multivariate predictors were section 1 gaze, $\beta=-0.27$, $p=.01$, section 1-2 increase, $\beta=-0.80$, $p=.01$ and Audit, $\beta=0.23$, $p=.05$. This suggests that the effects of the distressing imagery were only temporary, with those affected by the manipulation returning their attention to the remainder of the message.

DISCUSSION

We examined the effect of distressing imagery on gaze allocation to text in an anti-alcohol health message, and the resultant effect of gaze on persuasion. Consistent with predictions, the message containing distressing images was associated with lower intentions to reduce drinking within three months, mediated by less gaze times at the text accompanying those images. The experimental effect on text gaze times persisted only for as long as the images were present. Participants also allocated greater gaze times to the distressing images, but the lack of correlation between image gaze time and text gaze time suggests that this did not distract them from the text. The effect of the experimental manipulation on text gaze time was greater amongst participants scoring both higher on an objective measure of vulnerability to alcohol-related health problems and lower on a measure of mental disengagement coping style.

These findings are consistent with those of previous studies finding that distressing imagery

reduced participants' attention to messages. Rather than using indirect measures of attentional allocation, such as message elaboration (Keller & Block, 1996) or lower reading times (Brown & Locker, 2009), we employed a direct and objective measure of attention. Thus, we can provide support to the idea that distressing imagery can inhibit attention to the text that reduces the persuasiveness of health messages.

One alternative explanation to this finding may be that the non-distressing images were not sufficiently interesting to hold attention, and participants gazed at text by default. We are unconvinced by this for two reasons. First, this view assumes a fixed viewing time, whereas participants were able to move between screens when they wished. Second, similar to the distraction explanation dealt with earlier, this interpretation would suggest a negative correlation between image and section 3 text gaze times. This was not observed.

To test a defensiveness interpretation, we predicted that the experimental effect would be greater in participants who commonly use a defensive coping strategy (mental disengagement) and those with greater vulnerability to alcohol-related problems. However, the interaction differed from our prediction. Rather than high mental disengagement and high vulnerability facilitating higher section 1-2 gaze reductions, a combination of low disengagement and high vulnerability was associated with the least reduction. One interpretation is that images (or the combination of images and text) induced attentional disengagement in all participants except those with both an interest in the message (vulnerable participants) and those who are resistant to disengagement. Thus, it could be argued that the effect of the distressing images in reducing text gaze

time broadly supports a defensive interpretation.

However, this interpretation has several problems. First, the mental disengagement findings must be viewed as somewhat untrustworthy due to the poor reliability of the measure. Second, it is not clear why high disengagement/high vulnerability scorers were not also affected by the experimental manipulation. One possible explanation for this is that defensive responses are inherently self-limiting and do not increase beyond a certain point. Several researchers have noted that people limit defensive responses because their value declines as the defensive intention becomes more obvious to themselves and others (Baumeister & Cairns, 1992; Lundgren & Prislin, 1998). Thus, we suggest that the moderation analysis provides some support for a defensiveness interpretation, but this evidence is weaker than what would have been provided had the original hypothesis been fully supported and the mental disengagement measure been more reliable.

We also found that greater gaze time was allocated to distressing than non-distressing images. It is not clear whether this is a function of any emotive response that they invoked, or whether participants simply preferred them to the more pallid control images. This creates a paradox, whereby we infer that distressing images stimulate an attentional avoidance response but they attract greater attention. Lang (2000) suggests that emotive stimuli have survival value, which attracts attention and increases the resources that people allocate to encoding and storing stimulus components. It may be the case that we observed a natural tendency to fixate on distressing stimuli. This is of interest to researchers,

but needs to be reconciled with studies showing attentional disengagement from distressing stimuli (e.g., Kessels, Ruiter & Jansma, 2010). It should be noted that this is epiphenomenal to the text avoidance effect observed in this study.

Limitations

We used a convenience sample of participants from a university population, with the majority being self-selected. This has obvious problems in generalizing to the wider population, and findings may be particularly distorted by self-selection in participants with an interest in alcohol or health issues. One possible distortion caused by the self-selection process is that our sample may consist of participants who are ready to consider change. Another barrier to generalization, and one that affects the majority of research on defensive responses to health messages, is that the implicit social demands and physical environment of the laboratory and the single presentation of a message with forewarning of persuasive intent does not provide a strong representation of the world in which people experience health messages. Work is needed to test the generalizability of findings.

The 35% of unaccounted time (where the apparatus cannot track gaze or gaze is outside image and text zones) is concerning. Most will represent time spent outside the look zones, which may suggest a lack of involvement with the experiment. Possible lack of involvement can be confused with avoidance, meaning that avoidance cannot be measured in an absolute sense. However, uninvolved cannot be confused with experimentally-induced avoidance, as it is not correlated with condition, mental disengagement or vulnerability. Thus, possible low involvement does not confound our

findings.

Using eye-tracking methodology, we were able to objectively measure gaze. However, gaze cannot entirely be taken as direct measure of information processing. EEG (e.g., Kessels, et al., 2010) or neuroimaging indicators of attention would be useful. In particular, we cannot discriminate reading from mere gaze at the text. We also did not examine other known correlates of attentional avoidance, such as physiological and behavioral indicators of anxiety (Derakshan, Eysenck & Myers, 2007). These could be incorporated into future research programs. Also, much remains to be understood about the nature of the avoidance response itself. In particular, we cannot provide insight into the extent to which this is an automated or deliberative response (Mendolia, 1999).

Implications for Practice

These findings have implications for the use of imagery in persuasion campaigns, but these need to be considered within the constraints of the methods used. We used a long and detailed message, finding that distressing imagery has a short-term inhibitory effect on attention to the text and persuasion. It is difficult to generalize this to shorter messages, slogans or the use of imagery alone, although we note that other researchers have shown that presentations of distressing imagery facilitate attentional disengagement (Kessels et al., 2010).

Advertisers might be advised to be sparing with the use of material that is likely to create negative emotional responses in those to whom the message is relevant. However, such a

recommendation must heed the view that distressing imagery does not always elicit avoidant responses (Baron, et al., 1994). Moreover, negative emotion often increases persuasion (Witte & Allen, 2000), and emotive imagery is an effective means of eliciting this. Thus, it can be difficult to know in advance what responses a message might engender. Given this uncertainty, a first step in overcoming resistance processes is to explicitly search for them when testing advertising campaigns. Most campaigns undergo formative testing in front of audiences, who give qualitative feedback, and skilled interviewers can uncover message components that elicit avoidance.

An obvious issue pertains to the identification of factors that determine whether emotive imagery is or is not effective. Block and Keller (1996) found their effect to be moderated by self-efficacy. Brown and Locker (2009) found that distressing images reduce risk perception only amongst those with both high vulnerability and who report more regular use of denial as a coping strategy. Klein and Harris (2009) showed that a self-affirmation treatment moderated defensive responses to emotive imagery specifically by reducing the tendency for attentional disengagement.

In terms of improving the effectiveness of health messages, it is probably most important to identify moderators that can be incorporated into a message. One well-known strategy is to provide clear and easily-implemented behavioral recommendations (Job, 1988). As attentional avoidance processes appear to show automated characteristics (Mendolia, 1999), this would need to precede, rather than follow, the delivery of distressing images. Gleicher and Petty (1992) improved persuasion by reassuring participants about the efficacy of remedial actions before presenting a fear-arousing textual threat, although they did not specifically apply this to attentional avoidance. We found that experimental effect on text

gaze time in this study persisted only whilst the images were present. Thus, another strategy could be to separate emotive imagery from key informational components of the message and place it at a point where it precedes or follows information upon which communicators wish audiences to elaborate. This approach is untested, but may be worth consideration in future research.

The possible negative implications of using emotive images for the presentation of public health messages should be carefully considered. We found that images created attentional avoidance effects that appear to inhibit persuasion. However, imagery can also be of critical importance in attracting attention to messages in a competitive environment, and further investigations are required to better understand the nature and implications of avoidance processes and message-related factors that moderate their effects.

REFERENCES

- Academy of Medical Sciences (2004). *Calling Time: The Nation's Drinking as a Major Health Issue*. Academy of Medical Sciences: London.
- Aiken, L.S., & West, S.G. (1991). *Multiple Regression: Testing and Interpreting Interactions*. Sage: Newbury Park, CA.
- Allen, J.P., Litten, R.Z., Fertig, J.B., & Babor, T. (1997). A review of research on the Alcohol Use Disorders Identification Test (AUDIT). *Alcoholism: Clinical and Experimental Research*, 21, 613-619.

- Baron, R., Logan, H., Lilly, J., Inman, M., & Brennan, M. (1994). Negative emotion and message processing. *Journal of Experimental Social Psychology, 30*, 181-201.
- Baumeister, R.F. & Cairns, K.J. (1992). Repression and self-presentation: When audiences interfere with self-deceptive strategies. *Journal of Personality and Social Psychology, 62*, 851-862.
- Block, L.G., & Keller, P.A. (1997). Effects of self-efficacy and vividness on the persuasiveness of health communications. *Journal of Consumer Psychology, 6*, 31-54.
- Blumberg, S.J. (2000). Guarding against threatening HIV messages: An information processing model. *Health Education and Behavior, 27*, 780-794.
- Boden, J.M., & Baumeister, R.F. (1997). Repressive coping: Distraction using pleasant thoughts and memories. *Journal of Personality and Social Psychology, 73*, 45-62.
- Bonanno, G.A., Davis, P.J., Singer, J.L., & Schwartz, G.E. (1991). The repressor personality and avoidant information processing: A dichotic listening study. *Journal of Research in Personality, 25*, 386-401.
- Brown, S.L., & Locker, E. (2009). Defensive responses to an emotive anti-alcohol message. *Psychology and Health, 24*, 517-528.
- Brown, S.L. & Morley, A. (2007). Fuzzy sets, risk perception and comparative optimism. *British Journal of Psychology, 98*, 575-587.

Brown, S.L., & Smith, E.Z. (2007). The effect of reducing opportunities for downward comparison on comparative optimism. *Psychology and Health, 22*, 255-268.

Carver, C.S., Scheier, M.F., & Weintraub, J.K. (1989) Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56*, 267-283.

Chapman, S., Wong, W.L., & Smith, W. (1993). Self-exempting beliefs about smoking and health: Differences between smokers and ex-smokers. *American Journal of Public Health, 83*, 215-219.

Connigrave, K.M., Saunders, J.B., & Reznik, R.B. (1995). Predictive capacity of the AUDIT for alcohol-related harm. *Addiction, 90*, 1479-1485.

Coulter, R.H. & Pinto, M.B. (1995). Guilt appeals in advertising: What are their effects? *Journal of Applied Psychology, 80*, 697-705.

Derakshan, N., Eysenck, M.W. & Myers, L.B. (2007). Emotional information processing in repressors: The vigilance-avoidance theory. *Cognition and Emotion, 21*, 1585-1614.

[Emery, S.L.](#) ; [Szczyпка, G.](#), [Powell, L.M.](#) & [Chaloupka, F.J.](#) (2007). Public health obesity-related TV advertising: Lessons learned from tobacco. *American Journal of Preventive Medicine, 33*, S257-S263.

- Freeman, M.A., Hennessey, E.V., & Marzullo, D.M. (2001). Defensive evaluation of antismoking messages among college-age smokers: The role of possible selves. *Health Psychology, 20*, 424-433.
- Frey, K.P. & Eagly, A.H. (1993). Vividness can undermine the persuasiveness of messages. *Journal of Personality and Social Psychology, 65*, 32-44.
- Fox, E. (1993). Allocation of visual attention and anxiety. *Cognition and Emotion, 7*, 207-215.
- Gleicher, F., & Petty, R.E. (1992). Expectations of reassurance influence the nature of fear-stimulated attitude change. *Journal of Experimental Social Psychology, 28*, 86-100.
- Greening, L., Dollinger, S.J., & Pitz, G. (1996). Adolescents' perceived risk and experience with natural disasters: An evaluation of cognitive heuristics. *Acta Psychologica, 91*, 27-38.
- Hansen, C.H., Hansen, R.D., & Shantz, D.W. (1992). Repression at encoding: Discrete appraisals of emotional stimuli. *Journal of Personality and Social Psychology, 63*, 1026-1035.
- Hill, D., Chapman, S., & Donovan, R. (1998). The return of scare tactics. *Tobacco Control, 7*, 5-8.

- Jansen, A., Nederkoorn, C. & Mulkens, S. (2005). Selective visual attention for ugly and beautiful body parts in eating disorders. *Behaviour Research and Therapy*, 43, 183-196.
- Jepson, C., & Chaiken, S. (1990). Chronic issue-specific fear inhibits systematic processing of persuasive communications. *Journal of Social Behavior and Personality*, 5, 61-84.
- Jemmott, J.B.III, Ditto, P.H. & Croyle, R.T. (1986). Judging health status: Effects of perceived prevalence and personal relevance. *Journal of Personality and Social Psychology*, 50, 899-905.
- Job, R.F.S. (1988). Effective and ineffective use of fear in health promotion campaigns. *American Journal of Public Health*, 78, 163-167.
- Keller, P.A., & Block, L.G. (1996). Increasing the persuasiveness of fear appeals: The effect of arousal and elaboration. *Journal of Consumer Research*, 22, 448-459.
- Keller, P.A., & Block, L.G. (1996). Vividness effects: A resource-matching perspective. *Journal of Consumer Research*, 23, 295-304.
- Kessels, L.T.E., Ruiters, R.A.C. & Jansma, B.M. (2010). Increased attention but more efficient disengagement: Neuroscientific evidence for defensive processing of threatening health information. *Health Psychology*, 29, 346-354.
- Klein, W.M.P. & Harris, P.R. (2009). Self-affirmation enhances attentional bias toward threatening components of a persuasive message. *Psychological Science*, 20, 1463-1467.

Knight, J.R., Wechsler, H., Kuo, M., Seibring, M., Weitzman, E.R., & Schuckit, M.A.

(2002). Alcohol Abuse and Dependence Among U.S. College Students. *Journal of Studies on Alcohol*, 63, 263-270.

Kromhout, D., Bloemberg, B., Feskens, E., Menotti, A. & Nissinen, A. (2000). Saturated fat,

Vitamin C and smoking predict long-term population all-cause mortality rates in the seven countries study. *International Journal of Epidemiology*, 29, 260-265.

Lang, A. (2000). The limited capacity of mediated message processing. *Journal of*

Communication, 50, 46-70.

Leffingwell, T.R., Neumann, C., & Leedy, M.J. (2007). Defensively biased responding to

risk information among alcohol-using college students. *Addictive Behaviors*, 32, 158-165.

Lench, H.C., & Levine, L.J. (2005). Effects of fear on risk and control judgments and

memory: Implications for health promotion messages. *Cognition and Emotion*, 19, 1049-1069.

Loewenstein, G.F., Weber, E.U., Hsee, C.K., & Welch, N. (2001). Risk as feelings.

Psychological Bulletin, 127, 267-286.

Lundgren, S.R. & Prislin, R. (1998). Motivated cognitive processing and attitude change.

Personality and Social Psychology Bulletin, 24, 715-726.

- MacKinnon, D.P., Fairchild, A.J. & Fritz, M.S. (2007). Mediation analysis. *Annual Review of Psychology*, 58, 595-614..
- Mendolia, M. (1999). Repressors' appraisal of emotional stimuli in threatening and non-threatening emotional contexts. *Journal of Research in Personality*, 33, 1-26.
- Peters, E., Slovic, P., Hibbard, J.H., & Tusler, M. (2006). Why worry? Worry, risk perceptions, and willingness to act to reduce medical errors. *Health Psychology*, 25, 144-152.
- Pineles, S.L. Shipherd, J.C., Welsh, L.P. & Yovel, I. (2007). The role of attentional biases in PTSD: Is it interference or facilitation? *Behaviour Research and Therapy*, 45, 1903-1913.
- Raghunathan, R., & Trope, T. (2002). Walking the tightrope between feeling good and being accurate: Mood as a resource in processing persuasive messages. *Journal of Personality and Social Psychology*, 83, 510-525.
- Ruiter, R.A.C., Abraham, C., & Kok, G. (2001). Scary warnings and rational precautions: A review of the psychology of fear appeals. *Psychology and Health*, 16, 613-630.
- Shrout, P.E. & Bolger, N. (2002). Mediation in experimental and nonexperimental studies: New procedures and recommendations. *Psychological Methods*, 4, 422-445.
- Slater, M.D. (1999). Drinking and driving PSAs: A content analysis of behavioral influence strategies. *Journal of Alcohol and Drug Education*, 44, 68-81.

- Slovic, P., Finucane, M.L., Peters, E., & MacGregor, D.G. (2003). Risk as analysis and risk as feelings: Some thoughts about affect, reason, risk and rationality. *Risk Analysis*, 24, 311-322.
- Smith, S.M. & Shaffer, D.R. (2000). Vividness can undermine or enhance message processing: The moderating role of vividness congruency. *Personality and Social Psychology Bulletin*, 26, 769-779.
- Stockburger, J., Renner, B., Weike, A.I., Hamm, A.O. & Schupp, H.T. (2009). Vegetarianism and food perception. Selective visual attention to meat pictures. *Appetite*, 52, 513-516.
- Witte, K., & Allen, M. (2000). A meta-analysis of fear appeals: Implications for effective public health campaigns. *Health Education and Behavior*, 27, 591-615.

Table: Means and SDs (in parentheses) of Outcome Variables and Gaze Time (in seconds) by Condition.

	Full Sample	Non-Distressing Images (n=50)	Distressing Images (n=50)	Effect Size <i>r</i>
Intention to Reduce	7.67 (3.41)	8.32 (3.54)	7.02 (3.18)	20.
Message Evaluation	24.34 (7.31)	25.04 (8.51)	23.64(5.87)	10.
Risk Perceptions	18.03 (8.50)	17.44(9.19)	18.62(7.80)	07.
Image Gaze Time ^ϕ	18.38 (12.78)	14.36 (7.66)	22.41(15.44)	29.
Text Gaze Section 1 ^ϕ	58.74 (18.00)	58.57(17.00)	58.91(19.11)	01.
Text Gaze Section 2 ^ϕ	49.79 (21.55)	53.85 (22.71)	45.74 (19.74)	19.
Text Gaze Section 3 ^ϕ	43.44 (15.82)	42.79 (14.83)	44.08 (16.88)	03.
Section 1-2 Gaze Change	-8.94 (16.41)	-4.72 (17.86)	-13.18 (13.73)	26.

^ϕ Untransformed means of these positively skewed variables are shown here but transformed data were used in inferential analyses.

Figure 1. Structural Model with Section 2 Text Gaze as the Mediator Variable.

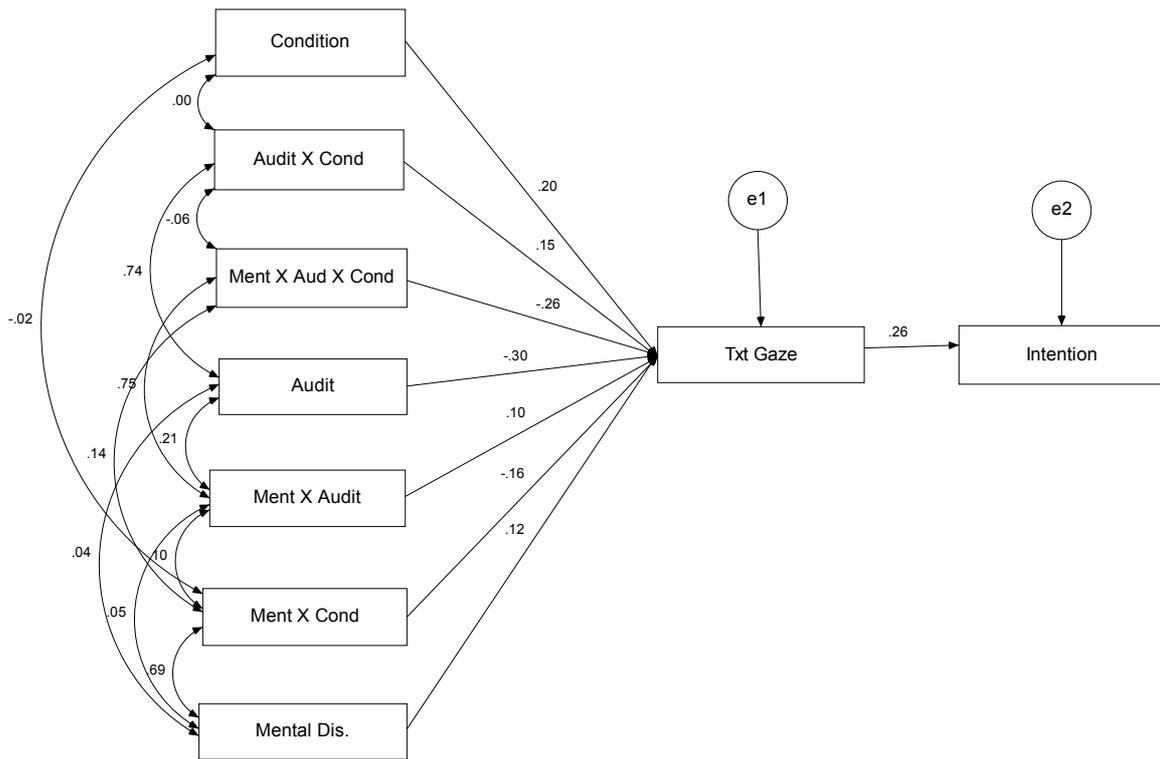


Figure 2. Structural Model with Section 1-2 Text Gaze Change (Increase) as the Mediator Variable.

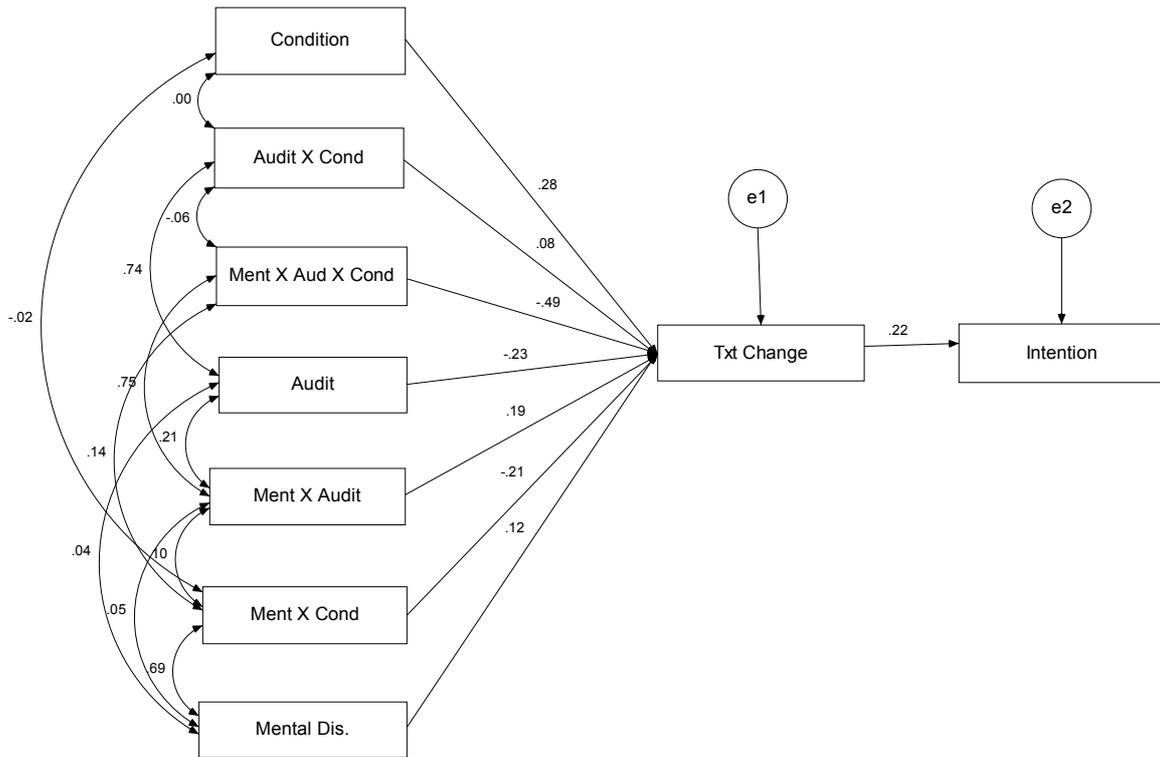


Figure 3: Interaction between Condition and Mental Disengagement Predicting Changes in Text Gaze Time (in seconds) Between Sections 1 and 2.

