Abstract

Building on Message Framing Theory and the Elaboration Likelihood Model (ELM), this study examined how message frame impacts viewer attention to and cognitive processing of osteoporosis prevention print ads. Attention was measured with eye tracking technology, which calculated participants’ number of fixations and dwell time. Cognitive processing was assessed through a textual masked-recall exercise. Sixty women, with a mean age of 21.25±2.61 years, viewed the same 36 ads; however, the message frame changed on a randomized, rotating basis, resulting in each group viewing 12 gain-, 12 loss-, and 12 neutrally-framed ads. One-way repeated measures analyses of variance revealed that message frame significantly impacted viewers’ number of fixations, $F(2,118)=8.18$, $p<.01$, $\eta^2= .12$ dwell time, $F(2,118)=9.84$, $p<.01$, $\eta^2= .14$ and masked-recall results, $F(2,118)=22.28$, $p<.01$, $\eta^2= .27$. Viewers’ number of fixations, dwell time and recall of gain-framed osteoporosis prevention ads was significantly higher than to loss- or neutrally-framed ads, $p<.01$. Message frame was also positively correlated with number of fixations, $r=.29$, $p<.02$ and dwell time, $r=.42$, $p<.01$. Findings may help expand theory related to message framing and the ELM, while contributing to advancements in eye tracking literature and health communications practice.

Key Words: message framing, elaboration likelihood model, eye tracking technology, osteoporosis prevention, attention and cognitive processing.
Co-Authorship

This thesis presents the original work of Deborah A. O’Malley in collaboration with her advisor, Dr. Amy Latimer.
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Life has a strangely serendipitous and circuitous way of unfolding... As early as elementary school, I can remember being interested in measuring visual attention—although I didn’t fully realize it at the time. In grade five, for my science fair project, I cut coloured construction paper into different shapes and sizes. I then randomly placed the cut outs on a board, asking people which colour, shape and size they saw first. My methodology was far from rigorous or objective. And, my findings were, at best, inconsistent. Little did I know that nearly 20 years later, I’d have the opportunity to conduct a similar experiment. However, this time I’d use eye tracking technology to objectively measure visual attention to yield interesting and novel findings.

Strange that through a master’s of science degree in Kinesiology and Health Studies, I’ve ended up coming nearly full-circle. Both my bachelor’s degree in communication studies and my certificate in graphic design have circuitously led to a path in which I have serendipitously come to satisfy a curiosity that surfaced in grade school.

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As this life chapter rolls to a close, I anxiously await to see what the future holds. In the meantime, I encourage you to read on and see what these ensuing chapters have in store. . . Enjoy!
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Chapter 1 Introduction

1.1 Overview

This experimental research study used eye tracking technology (a device used to track and measure eye movements), combined with textual masked-recall (a technique used to prompt audiences to fill-in missing textual information), to determine if viewers preferentially attended to, and recalled, gain-framed over loss-framed or neutrally-framed osteoporosis prevention messages.

Gain-framed messages emphasize the benefits obtained, or losses avoided, by engaging in a health behaviour. Conversely, loss-framed messages state the benefits missed or losses incurred, by failing to engage in a behaviour (Rothman & Salovey, 1997). Neutrally-framed messages state only the facts, focusing neither on gains or losses.

While research has shown that behavioural function—as illness detecting or preventing—moderates the impact of framed appeals (Rothman & Salovey, 1997), no research, to date, has shown what message frame best attracts and retains viewer attention.

Determining how to frame messages to effectively capture and sustain audience attention could be a critical research advancement; fully engaged viewers are more likely to thoughtfully consider message content, cognitively elaborate, and ultimately act upon the information (Skumanich & Kintsfather, 1996; Krugman, Fox, Fletcher, Fischer, & Rojas, 1994). Findings may also be applicable in the health communications field.
1.2 Primary Objectives and Hypotheses

Because gain-framed messages have been shown to be more effective at persuading audiences in a disease prevention context (Rothman, Bartels, Wlaschin & Salovey, 2006), and are likely most congruent with people’s thoughts and attitudes towards the behavioural function of osteoporosis prevention, it was hypothesized that gain-framed osteoporosis messages would be more effective than loss- or neutrally-framed messages at capturing viewers’ attention, as shown by eye tracking results.

Additionally, because gain-framed osteoporosis prevention messages would presumably capture more attention, it was hypothesized that viewers would, consequently, elaborate and cognitively process gain-framed messages to a greater extent than loss-framed or neutrally-framed messages, as shown by masked-recall results.

Finally, it was expected that attention would be significantly correlated with the ability to accurately recall information, by message frame.

1.3 Thesis Organization

This thesis conforms to the regulations outlined in the Queen’s School of Graduate Studies and Research “General Forms of Theses.” Chapter two provides an in-depth review of relevant literature. The third chapter contains a manuscript, offering a summarized overview of the study, with results. It is intended that this manuscript will submitted for publication in the Health Psychology journal. Finally, chapter four contains a general discussion of findings. All cited works are listed at the back of the document. The appendix section of this paper provides example copies of the testing instruments and materials used to conduct this study.
Chapter 2 Literature Review

2.1 Breaking News About Osteoporosis

Osteoporosis is a serious public health concern that currently afflicts over 44 million Americans (National Osteoporosis Foundation, 2009) and nearly 2 million Canadians, the vast majority of whom are women (Osteoporosis Canada, 2009). A debilitating and crippling health condition, osteoporosis is characterized by low bone mass and a deterioration of bone tissue. The disease often manifests itself in the form of bone fractures, bone deformity, and pain (Krall & Dawson-Hughes, 1999). Those with osteoporosis are at increased risk for hip, vertebral, and wrist fractures (Murray & O’Brien, 1995). These fractures can lead to severe decreases in quality of life, resulting in disfigurement, lowered self-esteem, reduction or loss of mobility, and decreased independence (Coelho, Silva, Maia, Prata, & Barros, 1999; Gold, 1996). Osteoporosis may also result in premature mortality (Krall & Dawson-Hughes, 1999). Approximately 20 percent of people with an osteoporosis-related hip fracture die within one year of the fracture (Larsen, Mosekilde, & Foldspang, 2004; McBean, Forgac & Finn, 1994; Campbell, Borrie, Spears, Jackson, Brown, & Fitzgerald, 1990; Baker & Harvey, 1985). Furthermore, complications due to osteoporosis-related fractures lead to more deaths each year than the combined mortality rates of breast and ovarian cancers (Cauley, Wampler, Barnhart, Wu, Allison, Chen et al., 2008).

Osteoporosis not only takes its toll on human life. The cost of osteoporosis also heavily impacts our public health care system. In the U.S., expenditures related to the disease reach over $17 billion annually. With our aging population, osteoporosis-related
treatment costs are expected to triple by 2040 (National Osteoporosis Foundation, 2003; Miller, 1999; Melton, Thamer, & Ray, 1997).

Despite these dire health and financial consequences, the real tragedy is that osteoporosis is largely preventable. While genetic factors do contribute to the disease, modifiable behaviours, such as engaging in weight-bearing physical activities, combined with consuming adequate calcium and vitamin D, can dramatically lower the risk of osteoporosis (Johnston & Slemenda, 1993).

2.2 Osteoporosis Prevention In Young Females

Although osteoporosis is typically thought of as disease that afflicts older adults, osteoporosis prevention is particularly important for young females. Because peak bone mass is usually achieved by the age of 30 (Recker, Davies, Hinders, Heaney, Stegman & Kimmel, 1992), engaging in activities that increase peak bone mass, like weight-bearing exercises and consuming calcium and vitamin D, can reduce the risk of osteoporosis in later life (Johnston & Slemenda, 1993). Studies assessing osteoporosis risk factors show that most young females do not perform sufficient weight-bearing physical activity and do not meet the recommended daily calcium intake levels. Yet, they do not perceive themselves of being at risk for developing osteoporosis (Sedlak, Doheny, & Jones, 1998; Kasper, Peterson, Allegrante, Galsworthy, & Gutin, 1994). It is of grave concern that the majority of young women do not adequately engage in osteoporosis prevention behaviours (Sedlak et al., 1998). As such, a major challenge becomes effectively relaying osteoporosis prevention information to those at risk, especially young females, in order to increase awareness and reduce the incidence of the disease (Lappe, 1994).
2.3 Public Health Media Campaigns

In 2000, the National Institute of Health released a consensus statement on osteoporosis. Their report strongly recommended that research be conducted to determine the most effective method for communicating osteoporosis prevention information (National Institute of Health, 2000). In 2003, The World Health Organization (WHO) released a “call to action” bulletin stressing that media campaigns be devised to improve public awareness about osteoporosis prevention (Chan, Anderson, & Lau, 2003). Research has shown that media campaigns can play a particularly important role in increasing awareness about the benefits of healthy lifestyle choices (Kahn, Ramsey, Brownson, Heath, Howze, Powell, et al., 2002).

Randolph & Viswanath’s (2004), in-depth review of effective public health media campaigns shows that influential health campaigns must satisfy two components. First, these campaigns must increase awareness through information. Second, they must frame the health issue so as to attract attention, make the issue salient and suggest a resolution to the problem (Randolph & Viswanath, 2004; Wallack & Dorfman, 1996; Viswanath, Finnegan, Hannan, & Luepker, 1991). Osteoporosis prevention messages stated through print advertisements fulfill these criteria and are ideal for four reasons. First, print ad campaigns tend to be much less costly than TV ads or interpersonal group interventions, yet are just as effective at increasing information and knowledge (Sedlak, Doheny, & Jones, 2000). Second, since these campaigns rely on mass campaigning efforts, rather than individual health practitioners to disseminate new information, they are not typically as labour intensive (Jung, 2004). Third, they can reach many people simultaneously,
thereby effectively heightening awareness, while modifying beliefs and offering resolutions to people on a large scale (Compston, 2004). A final advantage of print ads over other mediums is that audiences can absorb the content at their own pace. Research shows that people are generally better at processing messages when they do so at their own speed instead of at the pace of an externally controlled medium, such as TV or radio ads (Chaiken & Eagly, 1976; Wright, 1981).

Osteoporosis print ads can, thus, play an important role in heightening awareness of the disease while bringing an increased understanding of the risk factors that contribute to osteoporosis (Piaseu, Schepp, & Belza, 2002; Sedlak et al., 2000). However, to effectively apply persuasive messaging strategies to reduce the incidence of osteoporosis, it is first necessary to examine how people respond to the idea of health risk.

2.4 Prospect Theory

Prospect Theory investigates how people make decisions when faced with choices involving risk (Kahneman & Tversky, 1982, 1979; Tversky & Kahneman, 1981). Although initially developed as a way to explain economic decision-making strategies under conditions of risk (Kahneman & Tversky, 1979), the theory can be applied to the health domain to explain why individuals take certain risks in relation to health-related behaviours.

Prospect Theory postulates that an individual's level of tolerated risk is influenced by the way information is presented (Kahneman & Tversky, 1982, 1979; Tversky & Kahneman, 1981). When information is framed in terms of the potential losses, or
negative consequences of a health outcome, people are more willing to tolerate risk. However, people are less willing to tolerate risk when information is put in terms of the potential gains, or benefits (Kahneman & Tversky, 1979; Tversky & Kahneman, 1981). In other words, when losses are made salient, people tend to be risk-tolerant, but when gains are made salient, people tend to be risk-adverse (Salovey & Williams-Piehota, 2004).

Empirical research supports this postulate. Studies assessing health-related decisions demonstrate that individuals are more likely to engage in high-risk health behaviours when considering the costs of not performing the behaviour over the benefits of engaging in the behaviour. Deciding to take an osteoporosis screening test could, for example, be considered a high-risk behaviour because taking the test could detect the possible presence of osteoporosis. In contrast, individuals are more likely to engage in risk-adverse behaviours, such as diet and lifestyle modifications to prevent osteoporosis, when considering the benefits of performing these behaviours as opposed to the costs of not carrying out these actions (Salovey & Williams-Piehota, 2004; Rothman & Salovey, 1997). In sum, the way information is framed, in terms of potential losses or gains, can influence choices, preferences, attitudes, and behaviours (Rothman, Salovey, Antone, Keough, & Drake Martin, 1993).

2.5 Message Framing

Intentionally phrasing messages to persuasively emphasize the costs or benefits of adopting, or failing to adopt, a health behaviour is a concept referred to as message
framing (Rothman & Salovey, 1997). Message framing has been shown to significantly affect attitudes, intentions, and behaviours (Arora & Arora, 2004).

When a message is framed to emphasize the losses associated with failing to perform a health behaviour, or the costs of carrying out a detrimental behaviour, it is termed a loss-framed message (Rothman & Salovey, 1997). In contrast, a gain-framed message emphasizes the benefits associated with performing a particular health behaviour, or the undesirable consequences that can be avoided by taking action (Rothman & Salovey, 1997). A neutrally-framed message states only the facts, focusing neither on the inherent losses or gains associated with taking or avoiding action.

A loss-framed osteoporosis prevention message, for example, would claim that failing to regularly engage in weight-bearing exercises might result in osteoporosis, or that inadequate calcium and vitamin D consumption may lead to osteoporosis. A loss-framed message encouraging screening for osteoporosis might claim that failing to perform a screening test does not allow for early detection of the disease. Alternatively, a gain-framed osteoporosis prevention message might claim that regularly engaging in weight-bearing exercises can prevent osteoporosis, or that osteoporosis can be avoided by consuming adequate calcium and vitamin D. A gain-framed message encouraging osteoporosis screening might claim that performing a screening test enables early detection of the disease. A neutrally-framed message would factually state that weight-bearing exercise is a suggested osteoporosis prevention activity or that calcium and vitamin D consumption are linked to osteoporosis. A neutrally-framed message may also claim screening tests can detect the presence of osteoporosis.
Although loss-framed and gain-framed messages may convey essentially the same information, just in a different tone, the perceived function of the health behaviour – as illness detecting or preventing – is believed to determine which version of the message is most effective at motivating behaviour change (Rothman & Salovey, 1997).

To date, the majority of message framing studies have examined how message frame impacts recipient response to a wide variety of illness detection and health enhancing behaviours. Research to date shows that loss-framed messages are more effective at encouraging screening or illness detection behaviours, such as breast self examination, mammography utilization (Finney & Iannoti, 2002), colorectal cancer screening (Edwards, Elwyn, Covey, Matthews, & Pill, 2001) and HIV screening (Kalichman & Coley, 1995). In contrast, gain-framed messages are shown to be most persuasive when encouraging health enhancing behaviours, such as sun screen use to prevent skin cancer (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999), smoking cessation (Toll, Salovey, O’Malley, Mazure, Latimer, & McKee, 2008) and the use of infant car seats to reduce injuries (Christophersen & Gyulay, 1981). This framing effect can be best explained by looking at the behavioural function, as illness detecting or preventing.

2.6 Behavioural Function

Previous empirical research demonstrates that loss-framed messages are most effective at encouraging behaviours with an illness detection function (Rothman, Bartels, Wlaschin & Salovey, 2006). For example, a preliminary message framing study by Meyerowitz & Chaiken (1987), looked at 79 female undergraduate students reactions’ to
framed pamphlets on breast self-examination—a detection behaviour. Breast self-examination tendencies were assessed immediately after the intervention and after a four-month follow-up period. The study found that participants who read a loss-framed message promoting breast self-examination had overall more positive intentions, attitudes and behaviours than people who read gain-framed or neutral-framed messages about breast self-examination. Later studies looking at message-framing and breast self-examination, or mammography utilization, have found similar results, showing that loss-framed messages are most effective at encouraging detection-related behaviours (Finney & Iannoti, 2002; Schneider, Rothman, Salovey, Apanovitch, Pizarro, McCarthy, et al., 2001; Cox & Cox, 2001; Schneider, Salovey, Pallonen, Mundorf, Smith, & Steward, 2000; Banks, Salovey, Greener, Rothman, Moyer, Beauvais, et al., 1995). Similar findings also apply to colorectal cancer screening (Edwards, Elwyn, Covey, Matthews, & Pill, 2001; Myers et al., 1991) and HIV screening (Kalichman & Coley, 1995). These detection behaviours are likely best supported by loss-framed messages because the illness detecting behavioural function involves a high-risk, probabilistic, uncertain outcome (Salovey & Williams-Piehota, 2004), which may indicate the presence of a disease or illness (Rivers, Pizarro, Schneider, Pizarro, Salovey, 2005).

In contrast, gain-framed messages are shown to be more effective at motivating promotion/prevention-related behaviours (Rothman, Bartels, Wlaschin & Salovey, 2006). For example, a message framing study by Detweiler, Bedell, Salovey, Pronin, and Rothman, 1999 looked a sun-screen use as a way to prevent skin cancer. Their study assessed the attitudes and intentions of 217 male and female beach-goers, aged 18 and
older. Participants read a printed brochure framed to emphasize either the positive benefits of sun-protective behaviours or the negative consequences associated with unsafe sun exposure. Attitudes and intentions towards sun-screen use were measured before and immediately after receiving the framed brochures. To assess the measure of sun-protective behaviour, each participant was given a coupon redeemable for free sunscreen. Participants were monitored to see whether or not they redeemed the coupon. Results indicated that participants who read the gain-framed brochures were significantly more likely to engage in sun-protective behaviours than those people who read the loss-framed brochures. The use of gain-framed messages to effectively motivate promotion- or prevention-related behaviours also applies to smoking cessation behaviours (Toll, Salovey, O’Malley, Mazure, Latimer, & McKee, 2008), dental hygiene, vaccination, condom use (O’Keefe & Jensen, 2007) and the use of infant car seats to reduce car accident-related injuries (Christophersen & Gyulay, 1981). Gain-framed messages are also more successful than loss-framed messages at increasing intentions to exercise (Robberson & Rogers, 1988) and promoting exercise adherence (McCall & Martin Ginis, 2007). Gain-framed messages are likely most effective in these contexts because the health enhancing behavioural function emphasizes the minimal risks and maximal gains associated with these preventative behavioural choices.

2.7 Matched Messaging

When the behavioural function of the message appropriately corresponds with the frame, it is possible that “matched message framing” occurs. Matched message framing is thought to happen because there is a congruency between the message frame and the
perceived function of the behaviour, as illness detecting or preventing. The notion of matched message framing is consistent with prospect theory which suggests that people prefer to take greater risk when confronted with issues involving potential costs, or losses, but prefer more certain outcomes when the potential gains, or benefits, are presented (Tversky & Kahneman, 1981).

2.8 Building the Case For Gain-framed Osteoporosis Prevention Messages

Given this knowledge, osteoporosis prevention messages should be able to apply the central postulate of prospect theory to effectively motivate behaviour change (Rivers, et al., 2005). For example, when faced with the possibility of discovering osteoporosis through a screening test, prospect theory would seemingly postulate that people would be more motivated to take the screening test if presented with persuasive messaging emphasizing the negative consequences of not getting the test, than if informed of the benefits of taking the test (Salovey & Williams-Piehota, 2004; Rothman & Salovey, 1997). In contrast, when faced with a relatively low-risk decision, such as being told to engage in weight-bearing physical activity to prevent osteoporosis, or to consume adequate amounts of calcium and vitamin D, past research suggests that people would be more persuaded to exercise and eat well when given messages that focus on the benefits of healthy lifestyle choices (McCall & Martin Ginis, 2007; Jung, 2004; Robberson & Rogers, 1988). As such, gain-framed messages would likely be more appropriate than loss-framed or neutrally-framed messages at encouraging osteoporosis prevention behaviours.
Previous osteoporosis prevention research supports this hypothesis. A study assessing the effects of gain-framed messages on calcium intake in young women surveyed 133 female university students, aged 18 to 19 years old, who lived in a Canadian university residence and consumed less than the recommended daily intake of calcium. Over the course of the one-year study, participants received informational materials and pamphlets featuring either targeted gain-framed or standard messages about calcium intake. The study found that participants who received targeted, gain-framed messages, as opposed to standard osteoporosis prevention materials, significantly increased their calcium intake levels (Jung, 2004). However, the study did not assess the effect of loss-framed osteoporosis prevention messages on calcium intake. Therefore, further research is needed to definitively determine if gain-framed or loss-framed messages are most effective at encouraging this osteoporosis prevention behaviour.

The present study is the first-known research of its kind to examine gain-framed versus loss-framed and neutral-framed messaging in the context of osteoporosis prevention. Understanding more about message framing and osteoporosis prevention is crucial because osteoporosis is a serious and wide-spread, but largely preventable disease (Osteoporosis Canada, 2009).

2.9 Message Framing and Attention

While current research shows that appropriately framed messages can impact levels of audience persuasion, no studies, to date, have examined if audiences preferentially attend to and recall gain-, loss-, or neutrally-framed messages. Determining which message frame best attracts and retains attention is a critical advancement in
message framing research because fully engaged viewers are more likely to thoughtfully attend to and consider the message content and ultimately act upon the information (Skumanich & Kintsfather, 1996; Krugman, Fox, Fletcher, Fischer, & Rojas, 1994). Applying persuasive messaging techniques to attract and sustain audience attention may also contribute to advancements in the health advertising field. Given that today’s media savvy audiences are continually bombarded with thousands of competing messages each day (McQuarrie & Phillips, 2005), it has become increasingly necessary for health promoters to cut through advertising clutter by creating effective messages that grab audience attention. After all, as Rothman & Salovey (1997) acknowledge, people cannot respond to framed messages without first perceiving them.

2.10 Elaboration Likelihood Model

For the purposes of this study, audience attention is defined as the amount of focus and cognitive thought allocated by a viewer when attending to a persuasive message. Cognitive thought can be assessed by measuring the route through which a message is cognitively processed.

According to the Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1981), which theorizes how attitudes are formed and changed, persuasive messages are processed through two distinct cognitive routes: the central route or the peripheral route of persuasion (Petty & Cacioppo, 1986). The route through which a message is cognitively processed determines how strongly viewers attend to the persuasive message, thereby influencing the direction and magnitude of their behaviour change (Petty & Cacioppo, 1986).
2.11 Central Route Processing

When audiences process a message through the central route, they actively attend to it and carefully consider the persuasive content (Cook & Flay, 1978). Through deeply engaged thought, audiences deliberately evaluate the merits of a persuasive argument, comparing their own attitudes and intentions against those suggested in the persuasive appeal. Physiologically, this elaborative assessment process has been shown to result in the development of increased storage locations and memory pathways, strengthening the chances of information being retrieved, recalled, and retained (Kisielius, 1982). As a result, centrally processed messages are more likely to lead to enduring attitude and behaviour changes (Petty & Cacioppo, 1981) and are highly predictive of future behaviours (Skumanich & Kintsfather, 1996). Rothman & Salovey (1997) claim that central processing is a necessary pre-condition for effective message framing because framing effects are strongest when the message is heavily focused upon. Past research supports this assertion. For example, in a study examining cognitive processing and its impact on attitudes and behaviour, Skumanich & Kintsfather (1996), tested how participants reacted to messages relating to organ donation. Organ donation was chosen as the subject matter because the signing of an organ donor card was believed to be a high involvement decision, indicating central route processing. Study participants were 169 undergraduate students, ranging in age from 18 to 22 years, at a medium-sized university in the United States. Participants were randomly given one of two print brochures. Both brochures contained the same mixed messaging, consisting of both positive and fear refutation statements about organ donation. However, the text in one
brochure wasprefaced with a statement describing a person undergoing an organ transplant. This preface was framed in an attempt to arouse an empathetic response from participants regarding organ donation, creating a high involvement reaction. The two brochure frames allowed the researchers to draw comparisons between the participant groups. To assess level of involvement, as well as values, empathy and attitudes towards organ donation, participants completed a series of surveys. Results revealed that recipients’ increased level of involvement with organ donation was directly linked to an increased positive attitude towards donation. In turn, the more positive participants’ attitude, the stronger the behavioural intent to sign an organ donor card. These results show that stronger involvement, akin to central route processing, ultimately leads to more enduring attitude and behaviour change (Skumanich & Kintsfather, 1996). Given that the ultimate aim of a persuasive osteoporosis prevention message is to motivate sustained health behaviour, these outcomes are very desirable.

2.12 Peripheral Route Processing

Peripheral route processing, on the other hand, does not involve elaboration of a message through extensive cognitive processing (Petty and Cacioppo, 1986). A message attended to only at the peripheral level is not as likely to be seriously considered and, consequently, will not likely result in any direct outcome or behaviour change. Therefore, persuasion via the peripheral route is less persistent and less predictive of future behaviour (Skumanich & Kintsfather, 1996). For example, Jones, Sinclair & Courneya (2003), conducted the first study of its kind to examine how source credibility, cognitive elaboration and message framing work together to affect exercise behaviour. To examine
this connection, they recruited 192 male and female undergraduate students from a large university in Canada. Participants were randomly assigned to read background information describing a credible (doctor) or noncredible (high school student) source. Participants then read gain- or loss-framed messages advocating exercise. Attitudes, exercise intentions and cognitive elaboration were measured. Study results showed that noncredible, negatively framed message were not elaborated on to the same extent as other messages. Thus, these negative messages, which were likely only peripherally processed, had little impact on participants’ intentions to exercise and exercise behaviours (Jones, et al., 2003). While this study provided evidence to support the claim that loss-framed exercise promotion messages were only peripherally processed, it is important to note that study findings may have differed if the targeted behavioural function was illness detecting, rather than illness preventing. Had these loss-framed messages been used to encourage illness detection, congruent message matching may have occurred. Through such message matching, it is possible that a viewer-message synergy might have resulted. As such, the persuasive appeals may have been more strongly cognitively elaborated upon because the framed messages would have been more consistent with viewers’ perceptions of the level of risk involved in performing an illness detecting behaviour.

2.13 Factors Influencing Message Processing

Given that the route by which a message is cognitively processed can directly impact behavioural outcome (Rothman & Salovey, 1997; Petty & Cacioppo, 1986), it is helpful to determine what factors lead audiences to preferentially attend to and elaborate
on one persuasive message over another. Characteristics of the viewers, the messages they are exposed to, and the interaction between viewers and messages are all factors that influence message processing.

According to the ELM, viewers’ ability and motivation influences the way in which a persuasive message is cognitively processed (Petty & Cacioppo, 1986). Ability is described as the level of viewers’ skill and competence. Audiences must be capable of becoming thoughtfully engaged in the ad message and, therefore, must possess adequate language skills and sufficient knowledge about the presented issue. Viewers must also have enough time and be in a quiet enough environment to carefully consider the message content (Petty, Cacioppo, & Schumann, 1983).

Motivation is the willingness to evaluate ad content. Perceived personal relevance is an important determinant of motivation. The more personally meaningful and pertinent the message, the more strongly it will be considered. Additionally, how engaging, captivating and important an ad is perceived to be also will influence motivation (Tellis, 2004). Attitude is another key factor that influences viewer motivation. People tend to accept and process messages that are congruent and favourable with their attitudes, but reject messages that are in opposition to their beliefs or generate unfavourable thoughts (Petty & Cacioppo, 1986).

From a message framing perspective, if a persuasive appeal matches recipients’ attitudes, or perceptions, of the behavioural function, a message-viewer synergy may result. Message-viewer synergy can be thought of as an experience of fit in which the message frame is appropriately matched with the recipient’s perception of the
behavioural function, as either illness detecting or preventing. When message-viewer synergy occurs, it likely leads viewers to more carefully attend to and cognitively elaborate on the message content. Such cognitive elaboration is crucial given that framed appeals can only influence behaviour when message content is integrated into recipients’ cognitive representation of the issue. Cognitive integration is especially necessary considering that there is often a gap between the time when health information is received and when it is acted upon (Rothman & Salovey, 1997).

Thus, the way a message is conveyed and the type of claims made may significantly affect viewer response, which can impact viewer attention and ultimately behaviour (Rothman & Salovey, 1997; Wegener, Petty & Klein, 1994; Takemura, 1992).

Given this understanding, it becomes important to determine whether loss-framed, gain-framed, or neutrally-framed osteoporosis prevention messages are attended to at a lesser or greater extent. Determining which message frame best captures viewer attention is critical since attention is a necessary precursor to ad processing (Wedel & Pieters, 2000). Viewers must attend to a persuasive appeal before they can form beliefs or generate intentions to act on the suggested behaviour (Petty & Cacioppo, 1981).

2.14 Cognitive Processing of Loss-framed Messages

One way to capture audience attention would be through the use of fear-inducing or loss-framed osteoporosis prevention messages. Presumably, loss-framed illness prevention messages evoking strong feelings of fear would grab audiences’ attention, stimulate their sense of vulnerability and, consequently, jolt them into preventative action. However, research has found the opposite reaction occurs: illness prevention
messages generating unfavourable feelings of vulnerability and inadequacy ultimately lead viewers to deny and reject the message content (Jepson & Chaiken, 1990; Siero, Kok, & Pruvn, 1984; Petty & Cacioppo, 1981). Rejection occurs because as viewers begin to process the message content, they start to evaluate the harmful consequences stated in the message. However, rather than focusing on the negative outcomes associated with the appeal, viewers tend to defensively tune out the information (Shiv, Edell & Payne, 1997). As such, viewers only peripherally process fear appeals (Hale, LeMieux, & Mongeau, 1995). Furthermore, because viewers do not elaborate on the appeal, behaviour change is unlikely to occur (Petty & Cacioppo, 1986). Fear appeals are not only rejected by viewers, but they have also been shown to negatively affect intentions to change health habits (Sutton & Eiser, 1984), unless coupled with recommendations for action or information about the efficacy of the health behaviour (Self & Rogers, 1990). As a result, it was expected that loss-framed osteoporosis prevention messages would not be effective at encouraging osteoporosis prevention behaviours since viewers would ignore or reject these negative messages. Viewers would likely reject negative message content in an effort to avoid cognitively elaborating on the potentially detrimental consequences of failing to take preventative action.

Furthermore, because loss-framed messages are best suited to behavioural functions involving screening and detection (Finney & Iannoti, 2002; Edwards et al., 2001; Schneider, Rothman, Salovey, Apanovitch, Pizarro, McCarthy, et al., 2001; Cox & Cox, 2001; Schneider, et al., 2000; Banks, et al., 1995; Myers, Ross, Wolf, Balshem, Jepson, & Millner, 1991; Kalichman & Coley, 1995), the use of loss-framed fear appeals
to encourage osteoporosis prevention would be mis-matched. Consequently, viewer-message synergy would be unlikely, making cognitive elaboration even less probable.

2.15 Cognitive Processing of Gain-framed Messages

In contrast, gain-framed appeals, which emphasize the benefits of engaging in certain health behaviours are most appropriately matched with preventative or promotional behaviours, since the health function emphasizes the low-risk benefits of engaging in the suggested behaviour. By generating positive thoughts and feelings, through favourable messaging, gain-framed messages are more likely to produce positive attitudes and, therefore, are more readily and fully accepted (Tellis, 2004; Wegener, et al., 1993). Viewers who accept positive messages are, consequently, more likely to engage in central route cognitive processing, fully attending to these messages by thoroughly considering the suggested outcomes and implications (Shiv et al., 1997; Hale et al., 1995). Thus, gain-framed messages are expected to generate a message/viewer synergy in which the favourable message content will be more strongly cognitively elaborated upon because it is more consistent with viewers’ perceptions of the positive behavioural function.

Additionally, research in the consumer advertising field shows that ads eliciting feelings of positive brand attitude are more successful at generating stronger cognitive thoughts, as seen through purchase intentions (Percy & Elliot, 2005). The more viewers think about the benefits of a product, they more likely they are to want to purchase the product (Percy & Elliot, 2005). From a corporate standpoint, this means the ad has been effective; the appeal has persuaded the viewers. The concept of positive brand attitude
may be directly applicable to the health promotion field. From an osteoporosis prevention perspective, messages promoting positive feelings can engage viewers, prompting them to cognitively process the information. This process of cognitive elaboration may ultimately lead viewers to establish intentions to act on the suggested behaviour. Intentions are thought to be a key precursor in behavioural motivation (Maddux, 1999; Abraham, Sheeran, & Johnston, 1998; Austin & Vancouver, 1996; Conner & Norman, 1996; Gollwitzer & Moskowitz, 1996; Eagly & Chaiken, 1993). Thus, facilitating viewers’ intention to act on a suggested behaviour may be a key factor in motivating behavioural change.

It is, arguably, more desirable to consider taking preventative action to stop osteoporosis, rather than to think about living with its undesirable consequences; it was anticipated, therefore, that gain-framed osteoporosis prevention messages, which appropriately match the behavioural function of osteoporosis prevention, would generate more favourable thoughts and attitudes. It was anticipated, therefore, that they likely would be more cognitively elaborated upon than loss-framed osteoporosis prevention messages.

2.16 Cognitive Processing of Neutrally-framed Messages

When neutral information is presented, negative and positive thoughts are considered to be equal. As a result, substantial cognitive elaboration is unlikely to occur, suggesting that behaviour change is also unlikely (Tellis, 2004). Therefore, neutrally framed messages were presumed to be no more effective than loss-framed messages in motivating behaviour change.
2.17 Measuring Cognitive Processing

Understanding how to best frame osteoporosis prevention messages could have important implications for creating effective advertisements that fully motivate people to take action against the disease. These advertising principles may also be highly applicable in the broader marketing and health marketing spectrums as there is limited knowledge about the processes of visual attention to advertising (Pieters, Rosbergen, & Hartog, 1996). However, due to advances in eye tracking technology, researchers can now objectively evaluate visual attention to advertisements.

2.18 Eye Tracking Technology

Eye trackers are devices used to measure eye movements. The technology provides moment-by-moment recordings of what a person looks at when viewing an advertisement. Eye tracking results can be extremely useful for determining whether and for how long a viewer looks at a feature of an advertisement (Fox, Krugman, Fletcher, Fischer, 1998), the amount of attention a viewer pays to a specific element within an ad (Pieters et al., 1996), and the order in which a viewer processes visual information (Smith, Moriarty, Barbatsis, & Kenney, 2005). As such, eye tracking results are considered to be a valid measure of information acquisition (Krugman, et al., 1994) and are assumed to provide an accurate physiological assessment of attention that is directly linked to cognitive processing (Krugman et al., 1994).
2.19 Fixations and Saccades

When the eyes acquire visual information, during saccadic eye movements, they alternate between fixations and saccades. Fixations are short periods when the eyes remain relatively still. Saccades are rapid, ballistic, eye movements that take place when the eyes change focus to a new location. Saccades are very quick. They last only for about 40-50 milliseconds (20-30 milliseconds for pictures) and account for only about 10 percent of the total time spent viewing an ad (Chandon, Hutchinson, Bradlow, & Young, 2008). During saccades, visual information is suppressed and, therefore, no new information is acquired (Rayner & Castelhano, 2008). Although saccades are not an overly useful measure for gauging visual processing, they show shifts in attention, and are thus are an integrated part of the searching and information retrieval process.

2.20 Fixations

Fixations, on the other hand, are an important and reliable indicator of attention (Dickie, Vertegaal, Sohn, Cheng, 2005). Fixations occur when the eyes are aimed, or focused, on a fixed point. During fixations, the eyes remain relatively still (Wedel & Pieters, 2000). Movement decreases because the eyes have essentially paused to acquire and intake new visual information (Pieters & Wedel, 2007). Due to this information acquisition process, fixations are assumed to be directly correlated with attention (Pieters & Warlop, 1999) because the eyes tend to fixate on an ad element while it is being cognitively processed (Krause, 1982; Just & Carpenter, 1980; Rayner, 1977, 1978). Thus, the length of time a viewer fixates on an ad element provides a physiological assessment
of attention that is linked directly to initial cognitive processing (Fox, et al., 1998; Just & Carpenter, 1980; Rayner, 1978).

2.21 Measuring Fixation Data

Fixation data will be measured in two ways: number of fixations and dwell time. Number of fixations is a calculation obtained by summing the total number of times a viewer fixates, or focuses, on the elements within a presented ad (Smith et al., 2005). By adding total number of fixations, it is possible to obtain a reliable measure of viewer attention because the number of fixations is related to the amount of information a viewer extracts from an ad (Wedel & Pieters, 2000). When a viewer carefully attends to an ad, greater numbers of fixations occur (Wedel & Pieters, 2000).

Dwell time, a related measure, is the summed total of the duration of all fixations, within an ad, in milliseconds (Pieters & Wedel, 2007). Dwell time is calculated by summing the total amount of time that a viewer spends attending to all the ad elements. Like number of fixations, dwell time is also said to be a direct measure of viewer attention and cognitive processing (Thomsen & Fulton, 2007; Fox et al., 1998). On average, viewers dwell on an ad element for approximately 200-300 milliseconds; however, the duration of the dwell time can be highly variable. Longer dwell times signify greater rates of mental activity and cognitive processing (Kahneman, 1973; Gould, 1967).
2.22 Eye Movement and Cognitive Processing

While eye movements are a proven indicator of attention, they do not always provide the full picture; what is currently missing in eye movement research is an account of the cognitive processing that takes place in order to recall message content. Indeed, for an ad to be truly effective, it must leave a long-lasting impression on viewers (Wedel & Pieters, 2000). Since remembering information is highly dependent on the processing of that information (Henderson & Castelhano, 2005; Hollingworth, 2003; Hollingworth & Henderson, 2002), the greater the cognitive elaboration that occurs, the better recall of the ad (McQuarrie, 2008).

Masked-recall exercises are a technique that can be used to quantify the relationship between attention and cognitive processing (Krugman, et al., 1994). Masked-recall occurs when a participant is shown a copy of a previously seen ad, but with a textual or visual component missing. The participant is asked to recall, or fill-in, the missing information. The accuracy of the recall can be judged and quantitatively assessed (Krugman, et al., 1994). The better the recall, the more closely viewers are believed to have attended to the ad and the more likely they are to be persuaded by the message (Tellis, 2004).

However, while masked-recall scores may be an indication of cognitive processing levels, factors such as previous experience and an individual’s memory can act as confounding variables that may influence score results. Memory psychologists have long recognized that individual experience and abilities, as well as the rewards or penalties associated with remembering information, determine whether people remember
or quickly forget information (Zechmeister & Nyberg, 1982; Pastore & Scheirer, 1974). As such, masked-recall scores are not a foolproof mechanism for indicating attention and cognitive processing of an ad. This said, previous eye tracking research validates the use of masked-recall as a means for providing an accurate measure of viewer attention and cognitive processing (Thomsen & Fulton, 2007; Pieters & Wedel, 2000; Krugman et al., 1994).

For example, a study conducted by prominent eye tracking researchers Pieters and Wedel (2000) measured the eye fixations of 88 viewers who saw 65 print ads. After seeing the ads, participants were administered a masked-recall memory test. The researchers found that higher fixations were equated with better brand recall scores (Pieters & Wedel, 2000).

Another eye tracking technology study assessing adolescents’ reactions to print advertisements featuring beer and cigarette warning labels similarly found that participants’ masked-recall scores were significantly associated with total viewing time of the warning labels. Those participants who spent more time looking at the warning labels performed better on the masked-recall exercise (Krugman et al., 1994).

A similar but more recent study used eye tracking technology to evaluate how 63 teenagers reacted to print magazine ads featuring warning messages for alcoholic beverages. Immediately after viewing the ads, participants were given a masked-recall exercise. Masked-recall results indicated a moderate positive association between fixation duration and the ability to correctly recall the message (Thomsen & Fulton, 2007).
These studies support the contention that eye movements not only reflect viewers’ levels of attention, but also depict the intensity of viewers’ cognitive processing. As such, eye tracking and masked-recall studies can be effective for providing quantitative information about cognitive processes that could not otherwise be objectively obtained.

From an osteoporosis prevention standpoint, it is essential to determine if viewers are more likely to attend to, cognitively process, and recall gain-, loss- or neutrally-framed messages. This information is critical because messages that leave a long-lasting impression are more likely to effectively impact viewers (Wedel & Pieters, 2000), motivating positive, long-lasting behaviour changes.

2.23 Study Purpose

Using eye tracking technology and masked-recall techniques, the purpose of this study was to determine if there were significant differences in the amount of attention participants paid to gain-framed versus loss-framed versus neutrally-framed print ads related to osteoporosis prevention behaviours.

2.24 Hypotheses

Because gain-framed messages have been shown to be more effective at persuading audiences in a health prevention context, and are likely most congruent with people’s thoughts and attitudes towards the behavioural function of osteoporosis prevention, it was hypothesized that gain-framed messages would be more effective than loss- or neutrally-framed osteoporosis prevention messages at capturing viewers’ attention, as shown by eye tracking results.
Secondly, because gain-framed osteoporosis prevention messages would presumably capture more attention, it was hypothesized that viewers would, consequently, elaborate and cognitively process gain-framed osteoporosis prevention messages to a greater extent than loss-framed or neutrally-framed messages, as shown by masked-recall results.

Lastly, it was expected that attention would be significantly correlated with the ability to accurately recall information, by message frame.
Chapter 3 Manuscript

Running head: MEASURING VIEWER ATTENTION AND RECALL

Gaining Perspective: Message Frame Impacts Viewer Attention To And Recall of

Framed Print Advertisements

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Abstract

Building on the theory behind message framing and the Elaboration Likelihood Model (ELM), this study examined how framed messages impact viewer attention to and cognitive processing of osteoporosis prevention print ads. Attention was measured with eye tracking technology, which calculated participants’ number of fixations and dwell time. Cognitive processing was assessed through a textual masked-recall exercise. Sixty women, with a mean age of 21.25±2.61 years, viewed the same 36 ads; however, the message frame changed on a randomized, rotating basis, resulting in each group viewing 12 gain-, 12 loss-, and 12 neutrally-framed ads. One-way repeated measures analyses of variance revealed that message frame significantly impacted viewers’ number of fixations, $F(2,118)=8.18$, $p<.01$, $\eta^2=.12$, dwell time, $F(2,118)=9.84$, $p<.01$, $\eta^2=.14$, and masked-recall results, $F(2,118)=22.28$, $p<.01$, $\eta^2=.27$. Viewers’ number of fixations, dwell time and recall of gain-framed osteoporosis prevention ads was significantly higher than loss- or neutrally-framed ads, $p<.01$. Message frame was also positively correlated with number of fixations, $r=.29$, $p<.02$ and dwell time, $r=.42$, $p<.01$. Findings may help expand theory related to message framing and the ELM, while contributing to advancements in eye tracking literature and health communications practice.

Key Words: message framing, elaboration likelihood model, eye tracking technology, osteoporosis prevention, attention and cognitive processing
Introduction

Message framing is a theory-based approach in which persuasive messages are framed to emphasize the costs (loss-framed messages) or benefits (gain-framed messages) of performing, or failing to perform a health behaviour (Rothman & Salovey, 1997). Previous research studies have found that the perceived function of a health behaviour—as illness detecting or preventing—moderates the effectiveness of framed messages (Rothman & Salovey, 1997). Loss-framed messages have been found to be more effective at encouraging screening or illness detection behaviours, such as breast self examination, mammography utilization (Finney & Iannoti, 2002), colorectal cancer screening (Edwards, Elwyn, Covey, Matthews, & Pill, 2001) and HIV screening (Kalichman & Coley, 1995). In contrast, gain-framed messages have been shown to be most persuasive when encouraging health enhancing behaviours, such as sun screen use to prevent skin cancer (Detweiler, Bedell, Salovey, Pronin, & Rothman, 1999), smoking cessation (Toll, Salovey, O’Malley, Mazure, Latimer, & McKee, 2008) and the use of infant car seats to reduce injuries (Christophersen & Gyulay, 1981).

This framing effect is well explained from the perspective of prospect theory (Tversky & Kahneman, 1981). Prospect theory postulates that the way in which decisions are stated—as losses and gains—alters personal preference. People prefer riskier options when confronted with potential costs, or losses, but prefer more certain outcomes when the potential gains, or benefits, are presented (Tversky & Kahneman, 1981). Screening/detection behaviours, therefore, are likely best supported by loss-framed messages because the illness detecting behavioural function involves a high-risk,
probabilistic, uncertain outcome (Salovey & Williams-Piehota, 2004), which may indicate the presence of a disease or illness (Rivers, Pizarro, Schneider, Pizarro, Salovey, 2005). In contrast, prevention/promotion behaviours are likely best supported by gain-framed messages because the health enhancing function emphasizes minimal risk and maximal gain associated with these behavioural choices.

When behavioural function appropriately matches with message frame, a message-viewer synergy is thought to occur in which message recipients more fully attend to the message, thoughtfully consider the persuasive appeal and ultimately act upon the information (Skumanich & Kintsfather, 1996; Krugman, Fox, Fletcher, Fischer, & Rojas, 1994). However, while appropriately matched messages have been shown to elicit behaviour change, cognitive response to framed messages remains poorly understood.

The Elaboration Likelihood Model (ELM) (Petty & Cacioppo, 1981) provides an appropriate framework for investigating cognitive processing of framed messages. According to the ELM, persuasive messages are processed through two distinct cognitive routes: the central route or the peripheral route (Petty & Cacioppo, 1986).

Recipients who process messages through the central route carefully attend to and fully consider message content (Cook & Flay, 1978). As such, centrally processed messages tend to be retained for a longer period of time, are more likely to lead to enduring attitude and behaviour changes (Petty & Cacioppo, 1981) and are highly predictive of future behaviours (Skumanich & Kintsfather, 1996). In contrast, framed messages attended to only at the peripheral level, are not likely to be carefully
considered. Consequently, viewers are unlikely to take direct action and behaviour change is not probable. Peripheral route persuasion also tends to be less predictive of future behaviour (Skumanich & Kintsfather, 1996).

Because cognitive processing of framed messages may directly impact behavioural intentions and enactment, it is necessary to determine what causes viewers to preferentially attend to one persuasive message over another. According to the ELM, attention is moderated by viewers’ motivation, ability and the perceived personal relevance of the persuasive appeal (Petty & Cacioppo, 1986). Motivated and able viewers tend to accept messages that are congruent and favourable with their attitudes (Petty & Cacioppo, 1986). Thus, if the persuasive appeal matches the recipients’ attitudes, or perceptions, of behavioural function, a message-viewer synergy may result, presumably leading viewers to more carefully attend to and centrally process the message content. Such cognitive elaboration is crucial given that framed appeals can only influence behaviour when message content is centrally integrated into recipients’ cognitive representation of the issue (Rothman & Salovey, 1997).

In contrast, framed messages generating feelings of vulnerability and inadequacy, may lead to denial and diminished cognitive processing of the health threat (Jepson & Chaiken, 1990; Petty & Cacioppo, 1981). If viewers reject or ignore, rather than cognitively process, the persuasive content, behaviour change is unlikely to occur. Furthermore, messages that are incongruent with viewers’ attitudes, because they do not appropriately match the perceived function of the health behaviour, will not likely result
in message-viewer synergy. Thus, incongruent messaging will likely, at best be only peripherally processed.

Based on this knowledge, the purpose of this study was to determine if there were differences in viewers’ attention and cognitive processing of gain-framed versus loss-framed versus neutrally-framed (messages with no inherent cost or benefit bias) messages. For this study, message content focused on osteoporosis prevention, a low-risk behavioural function associated with a probable, positive outcome.

Attention and cognitive processing were assessed through two objective measures. First, eye tracking technology—a device used to track eye movements—measured participants’ attention to the framed messages. Second, recall of selected messages was assessed by having participants fill-in the missing textual information for some of the previously viewed on the ads.

Because gain-framed messages have been shown to be more effective at persuading audiences in a health prevention context, and are likely most congruent with people’s favourable thoughts and attitudes towards the behavioural function of osteoporosis prevention, it was hypothesized that gain-framed osteoporosis prevention messages would be more effective than loss- or neutrally-framed messages at capturing viewer attention, as shown by eye tracking results.

Secondly, because gain-framed osteoporosis prevention messages would presumably capture more attention, it was hypothesized that viewers would, consequently, consciously consider and, therefore, elaborate or cognitively process gain-
framed osteoporosis prevention messages to a greater extent than loss-framed or neutrally-framed messages, as shown by masked-recall results.

Lastly, it was expected that attention would be significantly correlated with the ability to accurately recall information, by message frame.

Method

Participants

To determine how message frame influences viewer attention, convenience sampling was used to attain a sample of 60 female participants. This sample size had adequate power to detect an adequate effect size with a \( p < .05 \) (Cohen, 1998). To recruit participants, posters advertising an eye tracking research study were placed in high traffic locations across a Canadian university campus; recruitment announcements were also emailed directly to students and made in classes.

To be part of the study, participants needed to satisfy several criteria. They had to be English-speaking females, aged 18-35 years of age, with self-reported normal to corrected normal vision. Participants also needed to perceive that engaging in regular physical activity, combined with consuming adequate calcium and vitamin D, were health enhancing (as opposed to illness detecting) behaviours beneficial for preventing osteoporosis. Given that 80 percent of the people who develop osteoporosis are women (National Osteoporosis Foundation, 2009), it was deemed that osteoporosis messages targeting only women would be most relevant. The 18-35 age range was selected because after 35 years of age, peak bone mass is thought to deteriorate, contributing to the onset of osteoporosis. However, if risk factors can be identified earlier on, prior to bone mass
deterioration, it is possible to significantly reduce the impact of osteoporosis (Osteoporosis Canada, 2009). As well, this cohort is often at a transition period in life, meaning they are more amenable to new ideas (Andreasen, 1984) and are more apt to adopt healthy behaviors that could help prevent the development of osteoporosis in later life. Participant demographics are reported in Table 1.

To measure participant attention to the three message frames, the Tobii 1750 eye tracking device was used. This eye tracker resembles a flat screen computer monitor and uses near infra-red light-emitting diodes (NIR-LEDs) to generate reflection patterns from the cornea of participants’ eyes. These reflection patterns are collected by an integrated camera and sent back to a computer for mathematical processing, in which custom software calculates the three-dimensional spatial position of each eye-ball, to detect where participants are looking (Tobii, 2003). Because the integrated camera tracks the position of the eyes, it allows for continuous position shifts and head movements. Measurement precession is better than .5 degrees of visual angle, with a head movement range of approximately 55 centimeters. These factors differentiate the Tobii from other tracking devices, making this eye tracker completely non-invasive, and unobtrusive (Tobii, 2003).

The eye tracker measured, recorded and evaluated participants’ attention to the ads via the number of eye fixations and dwell times. Number of eye fixations are defined as moments when the eye is relatively stable because it has paused to gather visual information about a specific contextual element (Pieters & Wedel, 2007). In this study, number of fixation measures were calculated by summing the total number of times that a
participant’s eyes fixated, or focused, on the presented ad. Number of fixations are considered to provide a reliable indication of a person’s attention (Dickie, Vertegaal, Sohn, Cheng, 2005). When viewers carefully attend to an ad, higher fixation numbers occur (Wedel & Pieters, 2000).

Dwell time is the total duration, or time in milliseconds, that participants spend looking at an ad element (Pieters & Wedel, 2007). In this study, dwell time was measured by summing the total amount of time, in milliseconds, that a participant spent viewing each element in an ad. Dwell time is considered to be a prominent, aggregated measure of eye movement data (Rosbergen, Pieters, & Wedel, 1997) and is a valid indicator of visual attention (Christianson, Loftus, Hoffman, & Loftus, 1991). It is also thought to be a direct measure of cognitive processing (Fox, et al., 1998).

To further assess the relationship between attention and cognitive processing, masked-recall tests were administered. Masked-recall occurs when a participant is shown a copy of previously seen ad, but with a textual or visual component missing. The participant is asked to recall, or fill-in, the missing information. For this study, participants were asked to recall the missing textual information by using a pen to fill-in the blank box where the framed message associated with the corresponding picture had appeared. It is important to note that participants were not informed of the testing ahead of time because this information could have affected the way they viewed and processed the ads, as memory performance is known to be influenced by the goal of the task in which participants are engaged (Rayner, 1998; Anderson & Pichert, 1978).
The accuracy of participants’ recall was judged and assessed using a coding scale similar to the scale described by Krugman and colleagues (1994). Responses were categorized into four levels of recall. These four levels were: level one, no recall or completely inaccurate/incorrect response; level two, incorrect message frame or response containing less than two key words; level three, correct message frame and recalled at least two key words; level four, completely accurate response and recalled exact wording of the phrase (grammatical discrepancies allowed). The masked-recall coding scale used by Krugman and colleagues (1994) had an inter-coder reliability rating of .89 (Krugman, et al., 1994). The reliability ratings for this study achieved similar results, yielding an inter-coder reliability rating of .90.

**Visual Stimuli**

Participants viewed a total of 36 advertisements, 24 of which were related to osteoporosis prevention behaviors. Of these osteoporosis ads, 12 featured content pertaining to physical activity and 12 were related to calcium and vitamin D consumption. To disguise the study objective, the remaining 12 ads were unrelated to osteoporosis prevention and served as control ads. All of the control ads featured beauty and fashion products. The text displayed in all 36 ads was digitally manipulated, resulting in three similar versions of the same ad, with an identical image: a gain-framed version, a loss-framed version, and a neutral-framed version.

The advertisements shown were obtained from recent, popular consumer lifestyle and fitness magazines aimed at women audiences. These magazines included *Elle*, *Cosmopolitan*, *Fitness*, *Women’s Health* and *Glamour*. Print ads were selected from the
magazines and scanned on a flatbed scanner at 600 dots per inch (DPI), to ensure a consistently high reproduction quality. Using the PhotoShop CS image editing software, the ads were all resized to 5 inches wide by 6.5 inches high at 100 DPI. Each image was then digitally manipulated to create the appropriate message frame version and saved in JPEG format.

To ensure consistency and uniformity across all three ads, the text positioning, size, color and fonts remained the same across each ad set. As well, the length of the text, was matched, as best as possible, across all ads and message frames. The mean word count for gain-framed messages was 13.13 ± 2.94 words, for loss-framed messages it was 15.08 ± 3.21 and for neutral-framed messages it was 15.17 ± 3.21. Despite trying to control for word count, a repeated measures analysis of variance (RM ANOVA) revealed a significant difference in word count between message frames F(2,46)=20.12, p<.00. Bonferroni post hoc analysis tests indicated that gain-framed ad text was significantly shorter than both loss-framed and neutrally-framed ad text, p<.00. There was no significant difference in word count between loss-framed and neutrally framed ads, p>.05. Given that word count varied between message frames, word count was controlled for by dividing the number of words by each participants’ number of fixations and dwell time, per ad. This calculation enabled number of fixations and dwell time to be standardized for word count across each message frame. The word count variable was controlled for in this manner because previous experiments have found that the effects of framing disappear when uneven amounts of information are presented (Arora & Arora, 2004). As well, all text was contained within one to three lines, as research has shown
that readers are more likely to read all the presented text when it is less than three lines (Rayner, Rotello, Stewart, Keir, & Duffy, 2001).

To ensure that the text fulfilled its purpose of anchoring the image and persuasively motivating viewers, a separate image neutrality pilot test was conducted, prior to the message frame study. A group of 100 undergraduate students were shown the images (without the text) via a PowerPoint slide show and asked to rate the images on a 7-point scale ranging from very negative (1) to very positive (7). Results revealed that all images were perceived as neutral, with a mean score of $4.76 \pm .64$; none of the images were viewed as extremely negative (lowest value, 3.03 out of 7) or positive (highest value, 5.84 out 7).

Following the pilot test, the ads were randomized so that no order effect arose. This randomization resulted in the three ad frame versions (gain-, loss-, neutral-framed) being equally dispersed among the three types of ad content (physical activity, calcium/vitamin D consumption, beauty and fashion), yielding four ads of each format and content. This randomization was put in place because previous eye tracking research has shown that serial-position, or order, can affect viewer attention to ads (Wedel & Pieters, 2000).

Additionally, so that no viewing bias occurred, participants were randomly assigned to one of three subgroups (A, B, C), each containing 20 people. All three groups viewed the same 36 ads; however, the message frame was counter-balanced across groups. For example, the first gain-framed ad viewed by group A was seen as a loss-framed message by group B and a neutral-framed message by group C. An optimal
design would have been for the ads to randomly rotate format for each individual participant, rather than by group; however, technological constraints precluded this approach.

Procedure

Potential participants were asked to attend a 45-minute meeting at a lab on campus. There, they signed a consent form and were administered a screening and demographic survey questionnaire. This questionnaire was used to ensure that potential participants met all the study criteria and to obtain basic demographic information. Completed screening questionnaires were collected and immediately reviewed by the researcher to ensure adherence of study criteria; all individuals met the study criteria.

Participants were then individually brought into a quiet, private space where the eye tracking technology was set-up. At this time, participants were told that the study would be examining how people look at magazine ads. Participants were also notified that their eye movements would be tracked while they viewed the ads on the eye tracking screen. The researcher then gave participants instructions on how to use the technology and offered a brief explanation of how the tracking device works.

The researcher led participants through a short calibration exercise, in which participants were instructed to use their eyes to follow a moving circle on the Tobii 1750 eye tracking screen. The calibration exercise was administered to ensure that the technology was accurately customized for each participant. Following successful calibration, participants were informed that they would see a series of scanned print advertisements on the screen in front of them. They were told that they should freely
view each ad, for as long as desired, as if they were flipping through a magazine at home or while sitting in a waiting room. To advance to the next ad, participants were instructed to press the “enter” key, when ready. The free-viewing condition was implemented because previous eye tracking studies have shown that eye movement patterns and memory performance are influenced by the goal of the task in which participants are engaged (Rayner, 1998; Anderson & Pichert, 1978). As such, the free-viewing option encouraged participants to view, or process, the ads without a specific goal in mind. Additionally, the free-viewing condition provided a more ecological, as opposed to research-based approach, because outside of a laboratory setting, people generally take as much time as desired when attending to ads.

Finally, participants were told that the researcher would be leaving the room upon the start of the experiment and that they should inform the researcher when finished viewing the ads. Following this introduction, the actual experiment began and the researcher left the room.

At the completion of the study, participants completed a masked-recall exercise. For this recall exercise, participants were given printed black and white photocopies from a random selection of 12 of the 36 ads just viewed. However, this time there was no textual message associated with the picture. Instead, there was a blank box in lieu of text. Using a pen, participants were asked to fill-in the framed message associated with the corresponding picture. It is important to note that participants were not informed of the testing ahead of time because this information could have affected the way they viewed and processed the ads, as memory performance is known to influence the goal of the task.
in which participants are engaged (Rayner, 1998; Anderson & Pichert, 1978). The marked-recall responses were coded and evaluated by two trained, independent coders.

Upon completion of this exercise, participants received a $5 gift certificate and were thanked for their time.

Analyses

The data, numerically describing participants’ number of eye fixations, dwell times and masked recall scores to the osteoporosis ads was exported and analyzed in Statistical Package for the Social Sciences (SPSS) version 16.

Given that the objective of this study was to assess how message frame impacts attention to osteoporosis prevention print ads, of the three ad types described in this study (physical activity, calcium/vitamin D consumption, health and beauty products), only physical activity and calcium/vitamin D results were examined.

Three separate repeated measures analysis of variance (RM ANOVAs) were performed to determine if there were significant, $p < .05$ within-subject effects for either mean number of eye fixations, dwell time, or masked-recall results between gain-, loss- or neutral-framed osteoporosis ads. Bonferroni post-hoc analysis testing was carried out to determine where these significant differences occurred.

Finally, correlations were run to determine if there was a significant relationship between masked-recall results and both number of fixations and dwell times.
Results

First, separate one-way ANOVAs for fixation number and dwell time were run to ensure that group assignment (A, B, C) did not impact results. There were no significant differences, \( p > .05 \) in mean number of fixation and dwell time results between groups.

**Number of Fixation Results**

Next, RM ANOVA on fixation data, standardized for word count, revealed that the type of framed message did significantly affect viewer attention to osteoporosis ads, \( F(2,118) = 8.18, \ p < .01 \), with sphericity assumed, yielding a small effect size, \( \eta^2 = .12 \). Bonferroni post-hoc analysis testing indicated that osteoporosis ads featuring gain-framed messages received significantly higher numbers of fixations than loss-framed, \( p < .01 \) or neutrally-framed osteoporosis ads, \( p < .01 \). There, however, was no significant difference in the number of fixations loss-framed messages received in comparison to neutrally-framed osteoporosis messages, \( p > .05 \).

**Dwell Time Results**

RM ANOVA on dwell time data, standardized for word count, revealed that the way an osteoporosis ad was framed also impacted viewers’ dwell time, \( F(2,118) = 9.84, \ p < .01 \), sphericity assumed, yielding a small effect size, \( \eta^2 = .14 \). Bonferroni post-hoc analysis tests showed that osteoporosis messages in a gain-framed tone were dwelled on significantly longer than loss-framed or neutrally-framed osteoporosis messages, \( p s < .01 \). There was, however, no significant difference in the amount of time participants dwelled on loss-framed messages in comparison to neutrally-framed osteoporosis messages, \( p > .05 \).
**Masked-Recall Results**

RM ANOVA on masked-recall data yielded similar findings to fixation and dwell time results, showing that the way an osteoporosis ad was framed significantly impacted viewers’ ability to correctly recall the message content, $F(2,118)=22.28, p<.01$, sphericity assumed, yielding a small effect size, $\eta^2=.27$. Bonferroni post-hoc analysis testing indicated that osteoporosis ads featuring gain-framed messages were recalled more accurately than loss-framed or neutrally-framed osteoporosis ads, $ps<.01$. There was, however, no significant difference in the ability to correctly recall loss-framed over neutrally-framed osteoporosis messages, $p>.05$. See Table 2 for more information.

**Correlations**

Finally, correlations were run to determine if there was a significant relationship between masked-recall results to both number of fixations and dwell times. Results revealed that the ability to correctly recall gain-framed message content was significantly positively correlated with viewers’ number of eye fixations, $r=.29, p<.02$ and dwell time, $r=.42, p<.01$ The longer viewers attended to the ads, they better they were able to recall the information. A similar finding appeared for neutrally-framed message content, showing that as number of fixations, $r=.30, p<.02$ and dwell time, $r=.27, p<.04$ increased, masked-recall improved. However, loss-framed messages did not follow this same pattern. There was not a significant correlation between viewers’ ability to accurately recall loss-framed information and their fixation numbers or dwell time, $ps>.05$. 

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Discussion

As indicated by fixation numbers and dwell time results, gain-framed osteoporosis prevention messages received significantly more attention than either loss-framed or neutrally-framed messages. However, there was no significant difference in the amount of attention viewers paid to loss-framed over neutrally-framed messages. These findings show that, as hypothesized, gain-framed messages are indeed the best way to attract viewer attention to osteoporosis prevention print advertisements.

Furthermore, not only are gain-framed messages better attended to, they are also better recalled. As hypothesized, participants were able to remember gain-framed osteoporosis message content significantly more accurately than loss-framed or neutrally-framed message content. There was no significant difference in viewers’ ability to recall loss-framed over neutrally-framed message content, showing that neither loss- nor neutrally-framed messages had a preferential recall advantage.

Correlations also showed a significant relationship between attention and masked-recall results. As hypothesized, attention was significantly correlated with the ability to accurately recall information, for gain-framed and neutrally-framed messages. An interesting exception was with loss-framed messages. The correlation between attention and recall was not significant, suggesting viewers may have defensively ignored or rejected the loss-framed message content so as to avoid considering the negative consequences stated within these messages.
Overall, these results indicate that gain-framed osteoporosis prevention ads appear to be the most effective message frame for capturing viewer attention and prompting captive audiences to consider the message’s persuasive content.

These findings likely held true because gain-framed message content was appropriately matched with the low-risk health function of osteoporosis prevention (Rothman, Bartels, Wlaschin & Salovey, 2006). Through congruent matching, a message-viewer synergy was likely created in which the gain-framed messages were more strongly cognitively elaborated upon because they were more consistent with viewers’ perceptions of the positive behavioural function of osteoporosis prevention.

In contrast, because loss-framed messages were inconsistent with the behavioural function of osteoporosis prevention, no viewer-message synergy was created. Furthermore, because loss-framed messages likely generated unfavourable feelings of vulnerability, viewers may have been prompted to defensively deny or reject the message content (Shiv, Edell & Payne, 1997; Jepson & Chaiken, 1990; Siero, Kok, & Pruvn, 1984; Petty & Cacioppo, 1981). Given that viewers did not strongly elaborate on these loss-framed messages, it was not surprising that they were unable to accurately recall message content.

Neutrally-framed messages were likely no more effective at capturing attention than loss-framed messages because the stated benefits of taking preventative action likely did not outweigh the suggested consequences of failing to take action, or vice versa. Viewers were not likely prompted to cognitively elaborate on neutrally-framed messages
because there were no obvious benefits associated with doing so; again, the benefits did not outweigh the consequences.

This study was the first known of its kind to combine eye tracking technology with message framing to measure audience attention and cognitive processing of framed messages. This is a novel research contribution; no known study, to date, has objectively examined what type of framed message best attracts and retains audience attention. Yet, at the very essence of message framing research is the need to fully understand how to effectively appeal to audiences. Capturing audience attention is such a crucial element of audience persuasion because attention is a necessary precursor to behaviour change.

This study also adds an important contribution to the Elaboration Likelihood Model (Petty & Cacioppo, 1981), showing that the way a message is framed appears to impact the route through which it is cognitively processed. Results suggest that appropriately matched gain-framed prevention messages are centrally processed, whereas inappropriately matched loss-framed prevention messages may at best be peripherally processed. Few studies, to date, have examined the relationship between message framing and cognitive elaboration (O’Keefe & Jensen, 2008; Takemura, 1994; Takemura, 1992) and none have used eye tracking technology or masked-recall exercises to objectively assess attention and cognition. Thus, findings may help fill-in a critical research gap, showing that prevention-based messages should be gain-framed to best attract and retain audience attention.

Despite the potential contributions of this study, because it is the first, it is leaves many unanswered questions, necessitating substantial future research. An important
Another obvious limitation of this study is that the ads targeted only females. Furthermore, these females were of a very specific demographic and were obtained through convenience sampling within a limited scope at a mid-sized Canadian university. As a result, the study findings may not be generalizable to the broader population. It would, therefore, be prudent to conduct similar studies by randomly selecting both males and females from a wider demographic. Ideally, such studies would also be conducted within other countries and cultures, as it would be valuable to determine if differing populations attend to and recall framed messages differently.

In the preventative health care realm, understanding how to best frame health messages could have important implications for creating effective advertisements that motivate people to take action against osteoporosis. These same discoveries may be highly applicable in the broader marketing and social marketing spectrums since little is
known about the processes of visual attention to advertising (Pieters, Rosbergen, & Hartog, 1996).

For example, it may be beneficial to take current osteoporosis prevention materials, such as informational pamphlets, and re-write them so that they are phrased exclusively in a gain-framed manner. Additionally, because young women have the ability to make behavioural modifications to control the effects of osteoporosis in later life, it could be advantageous to create gain-framed osteoporosis prevention print materials and ads targeted specifically at young females.

This study should help serve as an initial framework, contributing to the expansion of literature on message framing, cognitive processing, and eye tracking research. Findings may also contribute to knowledge advancement in the areas of preventative health care marketing and health communications. Above all, the results from this study will, ideally, be applied to develop future osteoporosis print materials that are framed to most effectively capture audience attention, in order to motivate positive osteoporosis prevention behavior change.
References


Table 1. *Participant demographics*

<table>
<thead>
<tr>
<th>Demographic Characteristic</th>
<th>(n), Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>$M=21.25$ SD 2.61</td>
</tr>
<tr>
<td>Education level</td>
<td></td>
</tr>
<tr>
<td>Undergraduate Candidate</td>
<td>$N=(41)$ 68%</td>
</tr>
<tr>
<td>Master’s Candidate</td>
<td>$N=(14)$ 23%</td>
</tr>
<tr>
<td>PhD Candidate</td>
<td>$N=(0)$ 0%</td>
</tr>
<tr>
<td>Other</td>
<td>$N=(5)$ 8%</td>
</tr>
<tr>
<td>Wears glasses or contact lenses</td>
<td></td>
</tr>
<tr>
<td>No</td>
<td>$N=(23)$ 38%</td>
</tr>
<tr>
<td>Yes</td>
<td>$N=(37)$ 62%</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>$N=(38)$ 63%</td>
</tr>
<tr>
<td>Black</td>
<td>$N=(1)$ 2%</td>
</tr>
<tr>
<td>Asian</td>
<td>$N=(15)$ 25%</td>
</tr>
<tr>
<td>Arabic</td>
<td>$N=(2)$ 3%</td>
</tr>
<tr>
<td>Hispanic</td>
<td>$N=(1)$ 2%</td>
</tr>
<tr>
<td>Aboriginal</td>
<td>$N=(2)$ 3%</td>
</tr>
<tr>
<td>Multiracial</td>
<td>$N=(1)$ 2%</td>
</tr>
</tbody>
</table>
Table 2. **Mean number of fixations, mean dwell time and masked-recall score results by message frame**

<table>
<thead>
<tr>
<th></th>
<th>Gain-frame</th>
<th>Loss-frame</th>
<th>Neutral-frame</th>
<th>Gain versus Loss</th>
<th>Gain versus Neutral</th>
<th>Loss versus neutral-</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean Number of Fixations by Message Frame Category</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>20.87</td>
<td>19.47</td>
<td>19.12</td>
<td>0.61 (1.52)</td>
<td>0.68 (1.86)</td>
<td>0.19 (.39)</td>
</tr>
<tr>
<td>SD</td>
<td>0.96</td>
<td>0.87</td>
<td>0.92</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean Dwell Time by Message Frame Category (milliseconds)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>4 970</td>
<td>4 600</td>
<td>4 460</td>
<td>0.59 (1.47)</td>
<td>0.71 (1.99)</td>
<td>0.30 (.62)</td>
</tr>
<tr>
<td>SD</td>
<td>280</td>
<td>220</td>
<td>230</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mean Masked-recall Score Results by Message Frame Category (out of 4)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2.22</td>
<td>1.81</td>
<td>1.83</td>
<td>0.26 (.54)</td>
<td>0.24 (.49)</td>
<td>-0.01 (-.03)</td>
</tr>
<tr>
<td>SD</td>
<td>0.85</td>
<td>0.64</td>
<td>0.74</td>
<td></td>
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</table>
Table 3. *Fixation number and dwell time correlations between message frame and masked-recall scores*

<table>
<thead>
<tr>
<th>Masked-recall score</th>
<th>Pearson correlation ($r$)</th>
<th>Significance (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of Fixations</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain-frame</td>
<td>0.29</td>
<td>0.02</td>
</tr>
<tr>
<td>Loss-frame</td>
<td>-0.01</td>
<td>0.96</td>
</tr>
<tr>
<td>Neutral-frame</td>
<td>0.30</td>
<td>0.02</td>
</tr>
<tr>
<td><strong>Dwell time</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gain-frame</td>
<td>0.42</td>
<td>0.01</td>
</tr>
<tr>
<td>Loss-frame</td>
<td>-0.02</td>
<td>0.87</td>
</tr>
<tr>
<td>Neutral-frame</td>
<td>0.27</td>
<td>0.04</td>
</tr>
</tbody>
</table>
Chapter 4 General Discussion

4.1 Summary of Findings

These results demonstrate that gain-framed osteoporosis prevention messages received significantly more attention, as shown by fixation number and dwell time results, than either loss-framed or neutrally-framed messages. Not only were gain-framed messages better attended to, they were also better recalled than their loss-framed or neutrally-framed counterparts. As such, osteoporosis prevention messages stated in a gain-framed tone appear to be the most effective message frame for capturing viewer attention and prompting captive audiences to fully consider the message’s persuasive content.

Furthermore, as hypothesized, there was a significant correlation between viewer attention and the ability to accurately recall information, for gain-framed and neutrally-framed messages. This pattern did not hold true for loss-framed messages, perhaps because viewers defensively denied or rejected the negative, loss-framed message content.

It is likely that gain-framed messages were better attended to and recalled than either loss-framed or neutrally-framed ads because the message content was appropriately matched with the low-risk health function of osteoporosis prevention. Through congruent matching, a message-viewer synergy was likely created in which gain-framed messages were more strongly cognitively elaborated upon because they were more consistent with viewers’ perceptions of the positive behavioural function of osteoporosis prevention.
4.2 Study Strengths

Contributions to message framing research. This study was the first known of its kind to combine eye tracking technology with message framing to measure audience attention and cognitive response to framed messages. This is a novel research contribution. No known study, to date, has objectively examined what type of framed message best attracts and retains audience attention. Yet, at the very essence of message framing research is the need to fully understand how to effectively appeal to audiences. Capturing audience attention is such a crucial element of audience persuasion because attention is a necessary precursor to behaviour change; fully engaged viewers are more likely to thoughtfully consider message content, cognitively process it, and ultimately act upon the information (Skumanich & Kintsfather, 1996; Krugman, Fox, Fletcher, Fischer, & Rojas, 1994).

Additionally, while previous message framing research has shown that gain-framed appeals are most effective at motivating certain low-risk, prevention-oriented behaviours (Rothman, Bartels, Wlaschin, & Salovey, 2006), no known research, to date, has compared message frames to determine the best way to state an osteoporosis prevention message. This study provides preliminary evidence to indicate that the behavioural function of osteoporosis prevention is indeed best supported by gain-framed messaging. In line with current message framing research, people are likely best persuaded by gain-framed osteoporosis prevention ads because the behavioural functioning of these messages highlights the important benefits of engaging in preventative behaviour (McCall & Martin Ginis, 2007; Jung, 2004; Robberson & Rogers, 1988). Gain-framed osteoporosis prevention messages also provide a low-risk, probable
outcome associated with preventative action (Salovey & Williams-Piehota, 2004; Rothman & Salovey, 1997).

These findings validate the theoretical basis behind message framing, showing that prevention-oriented behavioural functions are best matched with gain-framed messages (Rothman, et al., 2006). While it has been acknowledged that theory is necessary for maximizing message impact (Brawley & Latimer, 2007), there has been a definitive lack of theory-based messages in many current health promotion materials (Gainforth, Barg, Latimer, Schmid, O’Malley & Salovey, Under review). This study may, therefore, help further the theoretical validity and applicability of message framing. At this point in time, validating message framing has become increasingly important, given that the effectiveness of the concept has recently been called into question (O’Keefe & Jensen, 2007).

Further adding to message framing literature, this study was the first to show that appropriately matched (gain-framed prevention) messages do indeed result in a message-viewer synergy. When this synergy occurs, eye tracking and masked-recall results indicated that message content was better attended to, more strongly cognitively elaborated on and, consequently, better recalled. Previous studies have only speculated on how to appropriately frame messages in order to best capture viewer attention (Dunegan, 1993). This study suggests that message-viewer synergy is a key aspect necessary for capturing attention.

Additionally, this study adds to the breadth of message framing research. Until now, no study has looked at framed messages from an “input”, or viewer reaction
perspective. Rather, most studies have examined how framed messages affect viewer “output”, or behaviour. Exploring the link between input and output seems integral given that audiences’ initial reaction to framed messages appears to affect their cognitive response, and may ultimately impact behaviour (Skumanich & Kintsfather, 1996; Krugman et al., 1994). By being the first study to objectively gauge audience reaction to framed messages, this study leads the way for future research to further explore the important connection between viewer reaction and response to framed messages.

Finally, from an applied perspective, findings could have important implications in the preventative health field. The knowledge that osteoporosis prevention messages are best stated in a gain-framed context could help health promoters/communicators create effective advertising campaigns that grab audiences’ attention and, ultimately, prompt behaviour change.

Contributions to the Elaboration Likelihood Model. This research also adds an important contribution to the Elaboration Likelihood Model (Petty & Cacioppo, 1981), showing that the way a message is framed impacts the route by which it is cognitively processed. Few studies, to date, have examined the relationship between message framing and cognitive elaboration (O’Keefe & Jensen, 2008; Takemura, 1994; Wegener, Petty, & Klein, 1994) and none have used eye tracking technology or masked-recall exercises to objectively assess attention and cognition. The current findings may help fill-in a critical research gap, showing that prevention-based messages should be gain-framed to best attract and retain audience attention.
Furthermore, through masked-recall results, this study offers current, objective evidence to support the claim that (osteoporosis prevention) gain-framed messages are centrally processed, whereas their loss-framed and neutrally-framed counterparts are, at best, only peripherally processed. This finding has relevance for the preventative health realm because the manner in which framed appeals are processed has significant influence on the ultimate impact of the message (Rothman & Salovey, 1997). Centrally processed messages are more likely to lead to enduring attitude and behaviour changes (Petty & Cacioppo, 1981) and are highly predictive of future behaviours (Skumanich & Kintsfather, 1996). Given that the ultimate aim of a persuasive health message is to motivate sustained behaviour change, these outcomes are very desirable.

It should be noted, however, that there is currently no definitive metric for measuring central or peripheral route processing. Thus in actuality, masked-recall results—which provided a quantitative measure of the relationship between attention and cognitive processing (Krugman, Fox, Fletcher, & Rojas, 1994)—revealed only that gain-framed messages were recalled significantly more accurately than loss- or neutrally-framed messages. However, this recall accuracy strongly suggests that gain-framed messages were centrally processed, while loss- and neutrally-framed messages were at best only peripherally processed.

Methodological strengths. As a randomized control trial with three independent study groups (A,B,C), the study design enabled the direct relationship between attention and message frame to be independently and accurately measured. As such, it can confidently be asserted that that message frame does appear to moderate audience attention, at least
to osteoporosis prevention ads. This finding shows that audiences preferentially attend to
gain-framed (osteoporosis prevention) messages over loss-framed and neutrally-framed
messages.

As well, the creation of the advertisements specifically for the study population,
(18-35 year old females) made the study design unique. All ads were intended to be
appealing to the target group in hopes of making the issue of osteoporosis prevention
more relevant to participants. Furthermore, the eye technology used was unique in that it
was non-obtrusive and allowed for a free range of motion. These factors contributed to a
comfortable atmosphere were participants could freely view the images at their own pace.
The combination of these elements helped create a realistic, ecological study design.

4.3 Study Limitations

While this study contributes much to the literature on message framing and the
Elaboration Likelihood Model, future research is needed to cover some of the gaps left
open from this study.

One such gap is that this study did not conclusively demonstrate that message
frame influences viewer attitudes, thereby impacting motivation to cognitively process
message content. As well, the study falls short in demonstrating that increased attention
directly results in behavioral modifications to prevent osteoporosis. Therefore, to
determine if positive attitudes and behavioural modification correlate directly with
attention and cognitive processing of framed messages, future research must be
conducted. Such research could, perhaps, use pre- and post-test measures to determine if
attitudes and behaviour are indeed altered by cognitive processing of the message.
An additional research gap is in relation to matched message framing. This study appeared to appropriately match gain-framed messages with osteoporosis prevention behaviours. However, although the study’s hypotheses were supported, all that was shown was that gain-framed messages were indeed most effective at attracting and retaining audience attention to preventative health behaviours, specifically osteoporosis. Thus, it remains to be discovered if appropriately framed messages are equally as effective at attracting audience attention and prompting cognitive elaboration to detection-related health behaviours, such as osteoporosis screening. As previously discussed, these detection behaviours are typically most effective at persuading audiences, when stated in a loss-framed context. Therefore, to fully gauge and understand the implications of message framing and audience attention, this study will need to be replicated with a behaviour that is best suited in both a loss-framed and neutrally-framed context. Only then can the results of the study be fully realized.

Another obvious limitation of this study is that the ads targeted only females. Furthermore, these females were of a very specific demographic and were obtained through convenience sampling within a limited scope at a mid-sized Canadian university. As a result, the findings may not be generalizable to the broader population. It would, therefore, be prudent to conduct similar studies by randomly selecting both males and females from a wider demographic. Ideally, such studies would also be conducted within other countries and cultures, as it would be valuable to determine if differing populations attend to and recall framed messages differently.
Additionally, because personal relevance, and involvement, is a key component of cognitive elaboration (Cook & Flay, 1978), results may have differed within an older, more affected age group who may have been perceived osteoporosis to be an issue to be of greater importance. It is possible that an older population may have been more impacted by loss-framed messages emphasizing the risks associated with not taking preventative action, since loss-framed messages support high-risk, probabilistic outcomes (Salovey & Williams-Piehota, 2004). However, because the ads were designed to appeal to the target group, it is suspected that relevance did not play a large part in affecting study results.

Finally, it is important to note that there was a significant difference in the average number of words between gain-, loss- and neutrally-framed messages, simply due to the grammatical structure of each message frame. To account for this difference, a calculation was run to standardize viewers’ number of fixations and dwell time by the total word count, per ad. While this calculation accurately revealed significant differences between framed messages, it put unintentional emphasis on the textual component of the ads. As such, attention paid to the pictorial element may not have been accurately accounted for, potentially affecting study results. However, because all groups saw the same ad picture, just with a different textual message—and because the neutrality of the pictures was validated prior to the study—it can be assumed that the pictorial element functioned as an illustration of the verbal message (Jörg & Hörmann, 1978). Therefore, it is likely that viewers’ primarily focused on the ad’s textual message, rather than the pictorial element. Past research validates this assumption. A recent eye tracking study
examined how advertising viewing format impacted audience attention to osteoporosis prevention print ads. Three ad viewing formats were tested: image-only, text-only and image-text ads. Sixty female participants, aged 18-35, viewed 12 osteoporosis ads, four of each viewing format. Results revealed that viewers fixated significantly longer on text-only osteoporosis ads compared to image-text ads, showing that viewers focused significantly more on the ad text than the pictures (O’Malley & Latimer, Under review). Other eye tracking studies have similarly found that viewers attend more to text than pictures in ads (Pieters & Wedel 2004; Rayner, Rotello, Stewart, Keir, & Duffy, 2001; Wedel & Pieters, 2000). Given this knowledge, the word count calculation run in this study should not have negatively impacted study results. However, future research should verify this assumption by testing attention to framed text with the absence of pictures. Doing so would make textual masked-recall testing difficult and might compromise the study’s ecological validity because most print ads feature a combination of images and text; however, it would be beneficial to isolate the potentially confounding ad image variable.

4.4 Future Directions

Because this experiment is the first known study of its kind to combine eye tracking technology with message framing to objectively measure audience attention and cognitive response, it lays preliminary groundwork, paving the way for important future developments in the area. Further research should explore the link between attention and message framing to determine if increased audience attention is correlated with positive viewer attitudes or results in positive behavioural modifications. Future studies should
also determine if gain-framed messages are universally better for capturing audience attention, or if this finding holds true only for appropriately matched gain-framed behaviours.

In the preventative health care realm, understanding how to best frame health messages could have important implications for creating effective advertisements that motivate people to take action against osteoporosis. These same discoveries may be highly applicable in the broader marketing and social marketing spectrums since little is actually known about the processes of visual attention to advertising (Pieters, Rosbergen, & Hartog, 1995).

For example, it may be beneficial to take current osteoporosis prevention materials, such as informational pamphlets, and re-write them so that they are phrased exclusively in a gain-framed manner. Additionally, because young women have the ability to make behavioural modifications to control the effects of osteoporosis in later life, it could be advantageous to create gain-framed osteoporosis prevention print materials and ads targeted specifically at young females.

4.5 Conclusion

It is hoped that this study serves as an initial framework, contributing to the expansion of literature on message framing, cognitive processing and eye tracking research. It is also hoped that these findings contribute to knowledge advancement in the areas of preventative health care marketing and health communications. Above all, it is hoped that the results from this study will be applied to develop future osteoporosis print
materials that are framed to most effectively capture audience attention, in order to motivate positive osteoporosis prevention behavior change.
References


*Osteoporosis International, 3*(1), 54-55.


O’Malley, D. A., & Latimer, A. E. (Under review). Using eye tracking technology to determine the most effective viewing format for osteoporosis prevention print advertisements.


Recruitment Materials

Eye Tracking Research Study: Recruitment Message

Dear Students,

An exciting research project involving eye tracking technology and the effective elements of advertising is currently underway.

This announcement is being sent to you to tell you about this interesting study and to request your participation.

The study, located on campus, will likely take less than half an hour to undertake. Upon completion, you’ll be given a $5 gift certificate to Tim Horton’s to thank you for your time.

If you would like to be a research participant, please reply to Deborah O’Malley (7do@queensu.ca), by no later than January 27, providing your name, email address and daytime phone number.

Thank you so much for helping out a fellow student. Your participation is HUGELY appreciated!

Cheers,

Deborah O’Malley, Principal Researcher
7do@queensu.ca

Jordanne Dalgleish, Research Assistant
If you don’t **LOOK** at this poster,
you’re **missing out** on a **great opportunity**
to participate in a unique research study involving
**eye tracking technology** and advertising.

If you’re:

- Female
- Aged 18-35
- Have normal to corrected normal vision
  (you can wear glasses or contacts, but must not have any other vision problems)
- Have never participated in an eye tracking study before

You’re eligible to be part of this unique research study

As a participant, you’ll not only be helping to **advancing science**,
but you’ll also receive a **Tim Horton’s gift certificate**!

To become a research participant, and find out more details about the study,
please contact Deborah O’Malley (7do@queensu.ca) by **Dec. 15**
Screening Materials

Demographic questionnaire

Name: ___________________________

E-mail address: __________________ Phone number: ________________

Please fill-in the below fields with the most appropriate response.

1. What is your gender?
   - Female
   - Male

2. What is your age? __________

3. Are you currently a Queen’s University student?
   - Yes
   - No

4. What level of education are you currently pursuing?
   - Undergraduate degree
   - Master’s degree
   - PhD
   - Other: please specify ________________________________

5. Do you have normal (no vision problems) to corrected-normal (wear glasses or contacts) vision?
   - Yes
   - No

6. Do you wear glasses and/or contacts to see better all or some of the time?
   - Yes
   - No
7. Do you have any vision problem (other than near or far sightedness) that might prevent you from participating in an eye tracking study?

☐ Yes: please explain______________________________________________
☐ No

8. Have you ever participated in an eye tracking study before?

☐ Yes
☐ No

9. What is your mother tongue (first/primary language)?

☐ English
☐ French
☐ Spanish
☐ Arabic
☐ Other

10. What is your ethnicity?

☐ Caucasian/White
☐ Black
☐ Asian
☐ Arabic
☐ Hispanic or Latino
☐ Indigenous or Aboriginal
☐ Multiracial
☐ Would rather not say
☐ Other: please specify ________________________________________________

11. Being physically active and regularly consuming calcium and vitamin D:

☐ Can help me enhance my health
☐ Can help me detect an illness I might have

12. Being physically active and regularly consuming calcium and vitamin D are behaviours that could:

☐ Help me prevent a disease, like osteoporosis
☐ Help me detect a disease, like osteoporosis
Consent Forms

Letter of Information

Hello,

Thank you for volunteering to participate in our research study involving eye tracking technology and advertisements.

This study is designed to assess what young women pay attention to in advertisements.

The study is being conducted by Assistant Professor, Dr. Amy Latimer, and MSc. candidate, Deborah O’Malley, within the School of Kinesiology and Health Studies at Queen’s University.

As a volunteer in this study, you will be asked to attend one (approximately 45 minute) meeting.

The meeting will be held on the Queen’s campus in the Physical Education Centre (PEC) facility, room 203a.

During this time, you will be asked to read and sign a consent form. Upon your written and verbal consent, you will be asked to complete a brief pre-screening demographic questionnaire.

Assuming you meet all the screening criteria (you must be an English-speaking female, aged 18-35, with normal to corrected normal vision and must have never before participated in an eye tracking study), you will be eligible to participate in the eye tracking research study.

As a research participant, you will first be given verbal instructions on how to use the eye tracking technology and a brief explanation of how the tracking device works.

Comfortably seated, you will then be asked to view, at your leisure, several advertisements.

The ads will be displayed on a special computer screen that tracks eye movements. This device is non-restrictive; you can move your head and body freely, meaning you should not feel any pain or discomfort. There are no known risks associated with using this technology.

Once you have finished viewing all the advertisements, you will be asked to complete a questionnaire.
The information attained during this study will be collected and treated in a confidential manner. Please note, should you choose to volunteer in this study, you may refuse to answer any questions or withdraw at anytime without any consequences. As well, all your data will remain confidential.

Any information that is obtained in connection with this study and that can be identified in connection with you, the participant, will remain confidential and will be disclosed only with your permission, or as required by law.

All participant data will be referred to by numerical codes to ensure anonymity of all information received.

All hardcopy data obtained for this study will be secured in a locked filing cabinet located in the social sciences lab and will be accessible only to the student researcher and faculty investigator.

All electronic data will be securely stored on a password-protected computer located in the social sciences lab. When possible, all relevant electronic files will also be password protected. The password will be known only by the student researcher and the faculty investigator.

Upon completion of the study, all hardcopy data will be retained and stored in a locked filing cabinet for the period of five years. After this time, all records will be shredded and discarded. Electronic data will be stored in an archive on a password-protected computer.

Should the results from this study be published, your name will not be disclosed.

As a participant, you can take pride in knowing that you are contributing to a novel study involving eye tracking technology and attention to advertisements. Through your involvement, you are enabling a research study in which findings might have a powerful impact on advertising techniques for years to come. You will also receive a $5 gift certificate to Tim Horton’s to thank you for your time.

If you are interested in being a research participant, please reply back to this email by indicating which meeting slot you would like to attend. The meeting slots are outlined below:

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If you are not able to attend any of these meeting times, please suggest an alternative day and time that best suits your schedule.

Thank you, again, for your interest in volunteering. You are sure to derive great enjoyment and learning from this experience!

Should you have any questions or concerns about this research study, please feel free to contact Deborah O’Malley at 7do@queensu.ca or the primary Faculty Investigator, Dr. Amy Latimer at 613-533-6000, ext. 78773 or amy.latimer@queensu.ca

If you have any questions regarding your rights as a research participant, you may contact the GREB at: http://www.queensu.ca/vpr/greb/contact.htm or Dr. Steve Leighton at chair.greb@queensu.ca or (613) 533-6081.

Please keep this information sheet on hand so that you have all contact information available to you, should you have any concerns at a later date.

Sincerely,

Deborah O’Malley, MSc. Candidate
Dr. Amy Latimer, Assistant Professor
Informed Consent Form

You are volunteering to participate in a research study being conducted by Assistant Professor, Dr. Amy Latimer, MSc. candidate, Deborah O’Malley and BAH candidate, Jordanne Dalgleish, within the School of Kinesiology and Health Studies at Queen’s University.

PURPOSE OF THE STUDY
This study is designed to assess what young women pay attention to in health advertisements.

PROCEDURES
As volunteer for this study, you have been asked to come into the laboratory for one, approximately half-hour session. The laboratory is located on the Queen’s campus in the Physical Education Centre (PEC) facility, Room 203A, Social Sciences Lab.

Now at the lab, you are asked to read and sign this consent form. Upon your written consent, you will be asked to complete a brief pre-screening questionnaire.

Assuming you meet the screening criteria (female, aged 18-35, with normal to corrected normal vision and never before participated in an eye tracking study), you will be randomly divided into one of three groups and asked to view, at your leisure, several advertisements shown on a special computer screen that tracks eye movements. Once you have finished viewing all the advertisements, you will be asked to complete another questionnaire.

If you choose to participate in this study, you may refuse to answer any questions or withdraw at anytime without any consequences. (See below section entitled “Participation and Withdrawal” for more details).

PARTICIPATION AND WITHDRAWAL
This a voluntary study. As a volunteer, you are free to choose whether or not you would like to participate in this study. If you do wish to volunteer, you may withdraw from the study at anytime, without any consequences. You may also exercise the right to have your data removed from the study. Furthermore, you can refuse to answer any of the study’s questions while still remaining in the study.

The researcher and/or investigator reserve the right to withdraw you, or your data, from the study at anytime, should circumstances arise which warrant taking such action.

RIGHTS OF PARTICIPANTS
You have the right to withdraw your consent at any time and to discontinue participation in the study without any penalty. You are not waiving any legal claims, rights or
remedies because of your participation in this research study. This study has received ethics approval from the Queen’s University General Research Ethics Board (GREB).

CONFIDENTIALITY
Any information that is obtained in connection with this study and that can be identified in connection with you, the participant, will remain confidential and will be disclosed only with your permission, or as required by law.

All participant data will be referred to by numerical codes to ensure anonymity of all information received.

All hardcopy data obtained for this study will be secured in a locked filing cabinet located in the PEC building and will be accessible only to the student researcher and the faculty investigator. All electronic data will be securely stored on a password-protected computer. When possible, all relevant electronic files will also be password protected. The password will be known only by the student researcher and the faculty investigator.

Upon completion of the study, all hardcopy data will be retained and stored in a locked filing cabinet for the period of five years. After this time, all records will be shredded and discarded. All electronic data will be stored in an archive on a password-protected computer.

Should the results from this study be published, participants’ names will not be disclosed.

POTENTIAL RISKS AND DISCOMFORTS
You will not experience any pain or discomfort resulting from the eye tracking study. The eye tracker is self-contained and non-invasive. The technology allows for complete head movement and does not constrain any part of the body. There are no known risks associated with using this technology.

POTENTIAL BENEFITS TO PARTICIPANTS, SCIENCE AND SOCIETY
As a participant, you can take pride in knowing that you are contributing to a novel study involving eye tracking technology and attention to advertisements. Through your involvement, you are enabling a research study in which findings might have a powerful impact on advertising techniques for years to come. You will also receive a $5 gift certificate to Tim Horton’s for your time.

The scientific community may benefit by being able to expand its knowledge about advertising elements that are most effective at attracting viewer attention.

These findings might benefit society by leading to the development of effective advertisements that more successfully reach target audiences.
QUESTIONS OR CONCERNS
If you have any questions or concerns about this research study, please feel free to contact Deborah O’Malley at 7do@queensu.ca or the primary Faculty Investigator, Dr. Amy Latimer at 613-533-6000, ext. 78773 or amy.latimer@queensu.ca If you have any questions regarding your rights as a research participant, you may contact the GREB at: http://www.queensu.ca/vpr/greb/contact.htm or Dr. Steve Leighton at chair.greb@queensu.ca or (613) 533-6081.

SIGNATURE OF PARTICIPANT
I understand the information provided in the study, entitled “Using eye tracking technology to determine the effective elements of health advertisements,” as described herein. I have read the Letter of Information and this Consent Form in full. I understand that participation in this study is voluntary and that I am free to withdraw without penalty at any time. My questions have been answered to my satisfaction and I fully agree to participate in this study.

Please sign this document in the space provided below. After the signing the document, please verbally state your consent to the researcher.

______________________________________
Name of participant
______________________________________   __________________
Signature of participant      Date

SIGNATURE OF INVESTIGATOR
In my judgment, I believe the participant is voluntarily and knowingly giving informed consent and possesses the legal capacity to give informed consent to participate in this research study.

______________________________________
Signature of investigator
______________________________________   __________________
Date
Appendix B: Pre-test Image Neutrality Study

Images
Image Rating Scale

Part I

I have read the Informed Consent Form in full. I understand that by filling out the Image Rating Scale questionnaire, I am authorizing my consent to participate in this component of the study.

☐ Yes
☐ No

Part II

Please check the box the most appropriately describes you.

I am a:
☐ Male
☐ Female

I am a Queen’s University undergraduate student:
☐ Yes
☐ No

Part III

Now, a series of 36 images will be presented to you. Please rate each image according to how it makes you feel.

The image may conjure up negative feelings, such as feelings of being scared, upset or uncomfortable.

Or, the image may provoke positive feelings, such as feelings of being happy, excited or pleasantly comfortable.

Alternatively, the image may prompt neither negative nor positive feelings. Instead, you may feel neutral towards the image.

Do not think too much about your reaction to the image. Go with your first, initial, instinctual impression or feeling. Please mark only one response per image.
Ad set #1-

1. **Image #1**

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18. Image #6

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24. Image #12

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25. Image #1

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32. Image #8

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34. Image #10

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35. Image #11

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36. Image #12

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Instructions

Hi. Thank you very much for volunteering to participate in this study.

Please have a seat and make yourself comfortable.

In front of you there is a special computer screen with integrated eye tracking technology. This technology will be tracking your eye movements while you view a series of advertisements.

We’ll begin by completing a short calibration exercise.

Please look at the screen in front of you. There will be a series of dots moving around the screen. Without moving you head- moving your eyes only –follow the dot, looking closely at the small, black dot.

---Once the calibration is complete---

We’re now ready to begin the experiment.

You should start by putting your finger on the “enter” key.

On the screen, a series of advertisements will appear. Please view each ad freely, as if you were at home, or in a waiting room. You’re welcome to look at each ad for as long you would like.

When you’re ready, you can advance to the next ad by pressing the enter key.

To begin the study, I will press the start button for you.

When you have finished viewing all the ads, a dialogue box will appear asking you to save the data. Please do not touch the screen. Instead, please come and get me. I will enter in the appropriate information.

You will then be asked to complete a questionnaire.

If you have any questions, please feel free to let me know. So as not to distract you or make you nervous, I’ll be at my desk outside of this room.

At the end of this process, I will give you a gift certificate to thank you for your time.

Do you have any questions?
Briefing Note

(Upon completion of ad viewing and survey questionnaire)

Thank you for participating in this study.

For ethical reasons, I’d like to let you know that the actual intent of this study was to assess attention, measured through eye tracking, to osteoporosis advertisements.

Do you have any questions or concerns about this study?

Thank you, again for your help.

Here is your gift certificate.

Have a great day!
Appendix D: Message Frame Text and Sample Ads
OSTEOPOROSIS (6 calcium)

1. **cal-1**
   - **G:** Calcium, found in milk, can help you prevent osteoporosis
   - **L:** Not having calcium, found in milk, may cause you to get osteoporosis
   - **N:** Milk: a source of calcium; it is recommended you drink two or more glasses a day

2. **cal-2**
   - **G:** Soy milk contains calcium; consuming calcium aids in your fight against osteoporosis
   - **L:** Soy milk contains calcium; failing to consume calcium may cause you to get osteoporosis
   - **N:** Soy milk contains calcium; it is a good alternative to cow or goat milk

3. **cal-3**
   - **G:** Eating foods high in calcium, like cheese, can help you prevent osteoporosis
   - **L:** Failing to eat foods high in calcium, like cheese, can result in you getting osteoporosis
   - **N:** Cheese is a source of calcium; it is recommended you consume a lot of calcium each day

4. **cal-4**
   - **G:** Pass the word on. Osteoporosis can be hereditary. You can take action now to stop the disease
   - **L:** Pass the word on. Osteoporosis can be hereditary. If you don’t take action now, you may not stop the disease.
   - **N:** Pass the word on. Osteoporosis can be hereditary. It can be passed on from generation to generation.

5. **cal-5**
   - **G:** Frozen yogurt is a source of calcium. Adequate calcium can decrease bone loss and prevent osteoporosis
   - **L:** Frozen yogurt is a source of calcium. Inadequate calcium can increase bone loss, leading to osteoporosis
   - **N:** Frozen yogurt is a source of calcium. Yogurt and ice cream are also tasty sources of calcium

6. **cal-6**
   - **G:** Ice cream is a source of calcium. Adequate calcium can reduce your risk of osteoporosis
   - **L:** Ice cream is a source of calcium. Inadequate calcium can increase your risk of osteoporosis
   - **N:** Ice cream is a source of calcium. There are many other delicious foods also high in calcium
VITAMIN D (6 vitamin D)

1. vitd-1
G: Vitamin D is important to overall health; taking supplements can prevent osteoporosis
L: Vitamin D is important to overall health; failing to take supplements can cause osteoporosis
N: Vitamin D is important to overall health; vitamin D can increase calcium absorption

2. vitd-2
G: Double up in your fight against osteoporosis! Drinking milk with added vitamin D decreases your risk of the disease
L: Not doubling up in your fight against osteoporosis? Not drinking milk with added vitamin D increases your risk of the disease
N: Now you can double up on your milk choices! You can drink either 1% or 2% milk with added vitamin D everyday

3. vitd-3
G: Don’t look back with regret; taking vitamin D supplements can prevent osteoporosis later in life
L: Why look back with regret? Failing to take vitamin D supplements can lead to osteoporosis later in life
N: Taking vitamin D supplements is an alternative way to ensure adequate vitamin D consumption

4. vitd-4
G: It’s never too early to start preventing bone disease; taking vitamin D can prevent long-term health consequences
L: It’s never too early to start preventing bone disease; but not taking vitamin D can have long-term health consequences
N: Bone disease can strike at any age; osteoporosis is a common form of bone disease that afflicts 25% of women

5. vitd-5
G: Taking vitamin D supplements on a regular basis can help prevent osteoporosis
L: Not taking vitamin D supplements on a regular basis can lead to osteoporosis
N: Vitamin D supplements are one way to ensure you consume adequate amounts of the vitamin
6. vitd-6
G: If you drink orange juice with added vitamin D you will decrease your risk of osteoporosis
L: If you do not drink orange juice with added vitamin D, you will not decrease your risk of osteoporosis
N: Orange juice with added vitamin D is one way to ensure you consume adequate amounts of vitamin D

FITNESS (12 fitness)

1. fit-1
G: Physical activity can reduce your risk of osteoporosis
L: Physical inactivity can increase your risk of osteoporosis.
N: Be physically active for maximal health.

2. fit-2
G: Biking is a good form of exercise; exercise can reduce your risk of osteoporosis
L: Biking is a good form of exercise; failing to exercise can increase your risk of osteoporosis
N: Biking is a form of exercise; a used bike can be bought for a reasonable price

3. fit-3
G: Doing weight bearing-exercises will help you prevent osteoporosis
L: Failing to do weight-bearing exercises will increase your risk of osteoporosis
N: Weight-bearing exercise tone the body and result in muscle development

4. fit-4
G: Running maintains health; it can also decrease your risk of osteoporosis
L: Running maintains health; failing to run may increase your risk of osteoporosis
N: Running maintains health; a marathon runner completes a 42 km running race

5. fit-5
G: Playing squash is a fun way to keep fit; exercise can help you prevent osteoporosis
L: Playing squash is a fun way to keep fit; failing to exercise can lead to osteoporosis
N: Playing squash is a fun way to keep fit; there are squash courts located on campus

6. fit-6
G: Bike for healthy bones; cycling can help you prevent osteoporosis
L: Bike for healthy bones; not cycling can result in you getting osteoporosis
N: Bike for healthy bones; you can ride the stationary bike during winter
7. **fit-7**
G: Yoga can increase strength and flexibility; doing yoga can reduce your risk of osteoporosis
L: Yoga can increase strength and flexibility; failing to do yoga can increase your risk of osteoporosis
N: Yoga can increase your strength and flexibility; there are many different styles and types of yoga

8. **fit-8**
G: Eating a healthy, balanced diet, combined with physical activity, can aid in your battle against osteoporosis
L: Failing to eat a healthy, balanced diet, combined with physical inactivity, can result in you losing the battle against osteoporosis
N: Eating a healthy, balanced diet and doing regular physical activity is recommended for optimal health

9. **fit-9**
G: Stay focused on keeping healthy and active to help prevent osteoporosis
L: Failing to stay focused on keeping healthy and active might result in osteoporosis
N: Focus on keeping healthy and active by eating a balanced diet and by exercising

10. **fit-10**
G: Get on the right track! Keeping active lowers your risk of osteoporosis
L: Not on the right track? Not keeping active increases your risk of osteoporosis
N: Get on the right track! Keeping active by trying a variety of sports or activities

11. **fit-11**
G: On the ball? Weight-bearing exercises can help decrease your risk of osteoporosis
L: Not on the ball? Not doing weight-bearing exercises can increase your risk of osteoporosis
N: Get on the ball! A ball is one way to do weight-bearing exercise and build core strength

12. **fit-12**
G: Stretch the limits? Maintaining flexibility and strength decreases your risk of osteoporosis
L: Not stretching the limits? Failing to maintain flexibility and strength increases your risk of osteoporosis
N: Stretch the limits! Maintain flexibility and strength by doing regular exercises on a daily basis
HEALTH/BEAUTY (12 health/beauty)

1. hb-1
G: If you buy Cashmere, you’ll enjoy silky smoothness every time
L: If you don’t buy Cashmere, you won’t enjoy silky smoothness every time
N: Cashmere is silky smoothness every time, it’s number one in the market

2. hb-2
G: If you use this lipstick, you’ll have fruity red lips that are so truly kissable
L: If you don’t use this lipstick, you’ll miss out on fruity red lips that are so truly kissable
N: This fruity red lipstick is for truly kissable lips; pucker up, they’ll be waiting

3. hb-3
G: If you buy Rolex, you’ll flow perfectly in sync
L: If you don’t buy Rolex, you won’t flow perfectly in sync
N: Rolex keeps you in perfect sync, every time

4. hb-4
G: Push into the future - wear Diesel to avoid getting stuck in the past
L: Not pushing into the future? If you don’t wear Diesel, you’ll get stuck in the past
N: Diesel jeans push you into the future so you don’t look stuck in the past

5. hb-5
G: If you wear this perfume, you’ll sweep them off their feet
L: If you don’t wear this perfume, you won’t sweep them off their feet
N: Sweep them off their feet; watch them hit the ground every time

6. hb-6
G: Wearing this watch will give you passion and precession blended into one
L: If you don’t wear this watch, you’ll be missing out on passion and precession blended into one
N: This watch is passion and precession blended into one; it is finely crafted for only the best

7. hb-7
G: By wearing Elle perfume, you’re spraying on style
L: If you don’t wear Elle, you’re missing out on style
N: Spray on style and elegance with Elle perfume
8. **hb-8**
G: If you wear this crystal necklace, you’ll shine with natural brilliance
L: If you don’t wear this crystal necklace, you won’t shine with natural brilliance
N: Shine with natural brilliance; be the centre of glamour and adornment

9. **hb-9**
G: If you choose Fruit Smacks lips gloss, you can show your naturally good taste
L: If you don’t choose Fruit Smacks lips gloss, you won’t show your naturally good taste
N: Fruit Smacks lips gloss has naturally good taste; pucker up and say mmm

10. **hb-10**
G: If you choose Pantene, you’ll jet off into midnight skies
L: If you don’t choose Pantene you’ll fade away into midnight skies
N: Pantene is like the midnight sky awaiting for your knight in shining armor

11. **hb-11**
G: If you try new Trident you’ll experience a fruity twist
L: If you don’t try new Trident, you’ll miss out on a fruity twist
N: New Trident has a fruity twist; try it, zen you’ll love it

12. **hb-12**
G: If you try Cadbury Thins, you’ll experience a mouthful of guiltless pleasure!
L: If you don’t try Cadbury thins, you’ll be missing out on a mouthful of guiltless pleasure!
N: Cadbury thins are a mouthful of guiltless pleasure; only 100 calories per bar!
Sample Ads

Group A
- Ad #1: gain-framed

Group B
- Ad #2: neutral-framed
- Ad #3: gain-framed

Group C
- Ad #3: loss-framed
Appendix E: Masked Recall Instructions, Exercise and Coding Sheet
Masked Recall Instructions

Part two: instructions

Thank you for completing part one of the eye tracking study.

Now, for part two, you are asked to recall the textual messages from some of the ads you just viewed.

In the blank box (on each ad), please write the textual message that corresponds with the ad. If you don’t remember the entire message, please try to complete it to the best of your abilities.

You have as much time as you need to complete this exercise. When you’re finished, please let the researcher know.

If you have any questions, please ask them now.

Thank you!
Masked Recall Exercise
Masked Recall Coding Sheet

*note: underline=key words; bold=message frame

Ad #1
G: If you use this lipstick, you'll have fruity red lips that are so truly kissable
L: If you don’t use this lipstick, you’ll miss out on fruity red lips that are so truly kissable
N: This fruity red lipstick is for truly kissable lips; pucker up, they’ll be waiting

Participant response score:

1 □ no response or largely incorrect
2 □ no specific/incorrect message frame, less than two key words
3 □ correct message frame w/ at least two key words
4 □ almost entirely correct/exact, actual message

Ad #2
G: Pass the word on. Osteoporosis can be hereditary. You can take action now to stop the disease
L: Pass the word on. Osteoporosis can be hereditary. If you don’t take action now, you may not stop the disease.
N: Pass the word on. Osteoporosis can be hereditary. It can be passed on from generation to generation.

Participant response score:

1 □ no response or largely incorrect
2 □ no specific/incorrect message frame, less than two key words
3 □ correct message frame w/ at least two key words
4 □ almost entirely correct/exact, actual message
Ad #3
G: If you drink orange juice with added vitamin D you will decrease your risk of osteoporosis
L: If you do not drink orange juice with added vitamin D, you will not decrease your risk of osteoporosis
N: Orange juice with added vitamin D is one way to ensure you consume adequate amounts of vitamin D

Participant response score:
1 no response or largely incorrect
2 no specific/incorrect message frame, less than two key words
3 correct message frame w/ at least two key words
4 almost entirely correct/exact, actual message

Ad #4
G: Wearing this watch will give you passion and precession blended into one
L: If you don’t wear this watch, you’ll be missing out on passion and precession blended into one
N: This watch is passion and precession blended into one; it is finely crafted for only the best

Participant response score:
1 no response or largely incorrect
2 no specific/incorrect message frame, less than two key words
3 correct message frame w/ at least two key words
4 almost entirely correct/exact, actual message
**Ad #5**

**G:** Bike for **healthy bones**; cycling can help you **prevent** osteoporosis

**L:** Bike for **healthy bones; not** cycling can **result** in you getting osteoporosis

**N:** Bike for **healthy bones; you can ride the stationary bike during winter**

Participant response score:

1. [ ] no response or largely incorrect
2. [ ] no specific/incorrect message frame, less than two key words
3. [ ] correct message frame w/ at least two key words
4. [ ] almost entirely correct/exact, actual message

**Ad #6**

**G:** It’s never too early to start preventing **bone disease**; taking **vitamin D** can **prevent** long-term health consequences

**L:** It’s never too early to start preventing **bone disease**; but not taking **vitamin D** can **have** long-term health consequences

**N:** Bone disease can strike at any age; osteoporosis is a common form of bone disease that **afflicts 25% of women**

Participant response score:

1. [ ] no response or largely incorrect
2. [ ] no specific/incorrect message frame, less than two key words
3. [ ] correct message frame w/ at least two key words
4. [ ] almost entirely correct/exact, actual message
Ad #7
G: Calcium, found in milk, can help you **prevent** osteoporosis
L: Not having calcium, found in milk, may **cause** you to get osteoporosis
N: Milk: a source of calcium; it is recommended you **drink** two or more glasses a day

Participant response score:

1    no response or largely incorrect
2    no specific/incorrect message frame, less than two key words
3    correct message frame w/ at least two key words
4    almost entirely correct/exact, actual message

Ad #8
G: If you **try** Cadbury Thins, you’ll experience a mouthful of **guiltless pleasure**!
L: If you **don’t** try Cadbury Thins, you’ll be **missing out on** a mouthful of **guiltless pleasure**!
N: Cadbury Thins are a mouthful of guiltless pleasure; only 100 calories per bar!

Participant response score:

1    no response or largely incorrect
2    no specific/incorrect message frame, less than two key words
3    correct message frame w/ at least two key words
4    almost entirely correct/exact, actual message
Ad #9
G: Vitamin D is important to overall health; **taking supplements** can **prevent osteoporosis**
L: Vitamin D is important to overall health; **failing to take supplements** can **cause osteoporosis**
N: Vitamin D is important to overall health; vitamin D can **increase calcium absorption**

Participant response score:
1 □ no response or largely incorrect
2 □ no specific/incorrect message frame, less than two key words
3 □ correct message frame w/ at least two key words
4 □ almost entirely correct/exact, actual message

Ad #10
G: **Doing** weight bearing-exercises will help you **prevent osteoporosis**
L: **Failing to do** weight-bearing exercises will **increase your risk** of osteoporosis
N: **Weight-bearing exercise** **tone** the body and result in **muscle development**

Participant response score:
1 □ no response or largely incorrect
2 □ no specific/incorrect message frame, less than two key words
3 □ correct message frame w/ at least two key words
4 □ almost entirely correct/exact, actual message
Ad#11
G: Get on the right track! Keeping **active lowers your risk** of osteoporosis
L: Not on the right track? Not keeping **active increases your risk** of osteoporosis
N: Get on the right track! Keeping **active** by trying a variety of **sports or activities**

Participant response score:
1 [ ] no response or largely incorrect
2 [ ] no specific/incorrect message frame, less than two key words
3 [ ] correct message frame w/ at least two key words
4 [ ] almost entirely correct/exact, actual message

Ad#12
G: Soy milk contains **calcium**; **consuming** calcium **aids** in your fight against osteoporosis
L: Soy milk contains **calcium**; **failing to consume** calcium may **cause** you to get osteoporosis
N: Soy milk contains **calcium**; it is a good alternative to **cow or goat milk**

Participant response score:
1 [ ] no response or largely incorrect
2 [ ] no specific/incorrect message frame, less than two key words
3 [ ] correct message frame w/ at least two key words
4 [ ] almost entirely correct/exact, actual message