EXAMINING THE LINK BETWEEN FRAMED PHYSICAL ACTIVITY MESSAGES AND BEHAVIOUR: AN APPLICATION OF THE COMMUNICATION BEHAVIOUR CHANGE MODEL

by

Erin Melissa Berenbaum

A thesis submitted to the Department of Kinesiology and Health Studies
In conformity with the requirements for
the degree of Master of Science

Queen’s University
Kingston, Ontario, Canada
(September, 2012)

Copyright © Erin Melissa Berenbaum, 2012
Abstract

Physical inactivity is a national issue affecting more than half of all Canadian adults (Colley et al., 2011). Health messaging, including message framing, has been a popular medium for encouraging individuals to adopt recommended health behaviours such as physical activity. Previous research has demonstrated that gain-framed messages, which emphasize the benefits of a behaviour, are more effective at promoting physical activity (PA) than loss-framed messages which emphasize the costs. However, the mechanism through which this facilitating effect occurs is unclear. The current study examined the effects of message framing on attention, attitudes, recall, decision to be active and behaviour as well as the mediating effects of these variables on the frame-behaviour relationship in accordance with the communication behaviour change (CBC) model (McGuire, 1989). Sixty moderately active women, aged 18-35 viewed 20 gain- or loss- framed ads and 5 control ads while their eye movements were recorded via eye tracking. Attitudes towards PA, message recall, decision to become active and PA behaviour during an acute bout of exercise were measured immediately following ad exposure. Self-reported PA was measured one week later. Univariate ANOVAs, ANCOVAs and logistic regressions were conducted to examine the effects of message framing on each level of the CBC model. The gain-framed ads attracted greater attention, $p < 0.05$, produced more positive attitudes, $p = .06$, were better recalled, $p < .001$, influenced decisions to be active, $p = .07$, and had an immediate and delayed impact on behaviour, $ps < .05$, compared to the loss-framed messages. However, mediation analyses failed to reveal any significant effects suggesting that alternate mechanisms may be influencing framing effects on behaviour. This study demonstrates the effects of framed
messages on several novel outcomes; however the mechanisms underlying these effects remain unclear.

Key Words: message framing, eye tracking, physical activity, attention, cognitive processing, communication behaviour change model
Co-Authorship

This thesis presents the original work of Erin Berenbaum in collaboration with her supervisor, Dr. Amy Latimer-Cheung. Erin Berenbaum was responsible for developing the research question, conducting background research, designing the study, collecting data, leading the statistical analysis, interpreting the results, and the written report of findings. Dr. Latimer-Cheung assisted with the design of the study, provided guidance on the statistical analysis, the interpretation of the results, and revised the written report for important intellectual content.
Acknowledgements

Prior to coming to Queen’s I had no idea what to expect out of my Master’s degree. Two years later I can confidently say that any expectations that I could have possibly had have been greatly exceeded- and I owe that to the many wonderful people who have been a part of my experience here at Queen’s.

First of all, to my supervisor Amy, thank you for your dedication, motivation, caring and guidance throughout these past two years. You have been an INCREDIBLE supervisor and I hope that many future students will be fortunate enough have the same wonderful experience as I did. Your positive attitude and dedication to both your work and students has been truly inspirational and because of it you have played monumental role in my academic growth. You have always made yourself available, no matter what city, province or country you were in and have always taken the time to ensure that our needs were met no matter how busy you were. I have learned more in these past two years than I would have ever imagined, I have you to thank for that.

To my family, thank you for encouraging me throughout these past two years and for supporting in my decision to do a Masters degree. To my extended Memo Lab family (Heather, MJ, Alex, Chet and Shane) - from flash mobs to conferences and Friday lab dance parties, thank you for making my time here so enjoyable and for encouraging me throughout this process. It is because of all of you that I look forward coming into the lab each and every day. Additionally, you have all been instrumental throughout the thesis process. Heather and MJ, thank you for being my personal ‘Siri’, providing me with answers to all of my (many) questions and for not running away at the sound of, “I have another question”. Alex- thanks for being a great desk mate, someone who I could
always bounce ideas off of. Your dedication and work ethic has always motivated me. Shane - thank you for supplying me with your endless stats knowledge and helping me through all my analysis endeavors. And Chet - thank you for encouraging me throughout the entire process and always lending a helping hand when in need.

Additionally, this project could not have been done without the help of Effie and Wei. Effie, thank you for your countless hours spent teaching me eye tracking and helping me troubleshoot through all of my programming difficulties. I would not have become the eye-tracking expert I am to today without your help. And a special thank you to Wei for helping me to recruit and screen over 100+ participants. Without your help I would still be recruiting today. Lastly, a big thank you to all of my wonderful participants who participated in the study. Without you there would be no project.
# Table of Contents

Abstract ........................................................................................................................................... ii
Co-Authorship .................................................................................................................................... iv
Acknowledgements .......................................................................................................................... v
List of Figures .................................................................................................................................... x
List of Tables ...................................................................................................................................... xi

## Chapter 1 Introduction ................................................................................................................. 1
  1.1 Overview .................................................................................................................................. 1
  1.2 Primary Objectives and Hypotheses ....................................................................................... 2
    1.2.1 Purpose.............................................................................................................................. 2
    1.2.2 Hypotheses....................................................................................................................... 2
  1.3 Thesis Organization .................................................................................................................. 3
  1.4 References ............................................................................................................................... 3

## Chapter 2 Literature Review ......................................................................................................... 5
  2.1 Inactivity .................................................................................................................................. 5
  2.2 Health Messaging ..................................................................................................................... 5
    2.2.1 Message Framing............................................................................................................... 6
    2.2.2 Prospect Theory ............................................................................................................... 6
  2.3 Message Framing and Health Behaviour .................................................................................. 9
  2.4 Mechanisms of Message Framing ........................................................................................... 11
  2.5 Attention and Cognitive Processing ....................................................................................... 13
    2.5.1 Eye Tracking.................................................................................................................... 14
    2.5.2 Attention and Behaviour ................................................................................................. 17
  2.6 Conclusion ............................................................................................................................... 21
  2.7 Purpose .................................................................................................................................... 22
  2.8 Hypotheses ............................................................................................................................. 22
  2.9 References................................................................................................................................ 22

## Chapter 3 Methods ....................................................................................................................... 30
  3.1 Design ..................................................................................................................................... 30
  3.2 Participants ............................................................................................................................... 30
    3.2.1 Sample Size ..................................................................................................................... 30
    3.2.2 Recruiting ........................................................................................................................ 31
    3.2.3 Eligibility ........................................................................................................................ 31
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.7.3 Stairs vs. Elevator</td>
<td>59</td>
</tr>
<tr>
<td>5.8 Mediation</td>
<td>59</td>
</tr>
<tr>
<td>5.9 References</td>
<td>73</td>
</tr>
<tr>
<td>Chapter 6 Discussion</td>
<td>74</td>
</tr>
<tr>
<td>6.1 Summary of findings</td>
<td>74</td>
</tr>
<tr>
<td>6.1.1 Attention</td>
<td>75</td>
</tr>
<tr>
<td>6.1.2 Attitudes</td>
<td>76</td>
</tr>
<tr>
<td>6.1.3 Recall</td>
<td>77</td>
</tr>
<tr>
<td>6.1.4 Decision Making</td>
<td>77</td>
</tr>
<tr>
<td>6.1.5 Behaviour Change</td>
<td>79</td>
</tr>
<tr>
<td>6.2 Mechanism of Message Framing</td>
<td>81</td>
</tr>
<tr>
<td>6.3 Limitations</td>
<td>85</td>
</tr>
<tr>
<td>6.4 Future Directions</td>
<td>88</td>
</tr>
<tr>
<td>6.5 Theoretical Implications</td>
<td>89</td>
</tr>
<tr>
<td>6.6 Practical Implications</td>
<td>91</td>
</tr>
<tr>
<td>6.7 Conclusion</td>
<td>92</td>
</tr>
<tr>
<td>6.8 References</td>
<td>92</td>
</tr>
<tr>
<td>Appendix A Recruitment Materials</td>
<td>99</td>
</tr>
<tr>
<td>Recruitment Email</td>
<td>99</td>
</tr>
<tr>
<td>Recruitment Poster</td>
<td>100</td>
</tr>
<tr>
<td>Appendix B Letter of Information</td>
<td>101</td>
</tr>
<tr>
<td>Appendix C Pre-Screening Survey</td>
<td>103</td>
</tr>
<tr>
<td>Appendix D Consent Form</td>
<td>108</td>
</tr>
<tr>
<td>Appendix E Ad Content</td>
<td>111</td>
</tr>
<tr>
<td>Ad Messages</td>
<td>111</td>
</tr>
<tr>
<td>Ad Images</td>
<td>113</td>
</tr>
<tr>
<td>Appendix F Questionnaires</td>
<td>120</td>
</tr>
<tr>
<td>Attitudes and Intentions</td>
<td>120</td>
</tr>
<tr>
<td>International Physical Activity Questionnaire (IPAQ)</td>
<td>121</td>
</tr>
<tr>
<td>Appendix G Ad Recall Answer Key</td>
<td>123</td>
</tr>
<tr>
<td>Appendix H Debriefing Form</td>
<td>128</td>
</tr>
<tr>
<td>Appendix I Ethics Approval</td>
<td>129</td>
</tr>
</tbody>
</table>
List of Figures

*Figure 2.1.* McGuire's (1989) communication behaviour change model..........................18

*Figure 4.1.* Simple mediation model (Preacher & Hayes, 2004).................................52

*Figure 5.1.* Mediating role of attention, recall, attitudes and decisions on subsequent message outputs of the communication behaviour change model. .................................62

*Figure 6.1.* McGuire's communication behaviour change model and summary of findings. ........................................................................................................................................75

*Figure 6.2.* The influence of moderators on path b of the mediation model. .................84
List of Tables

Table 3.1. Participant Characteristics .................................................................32
Table 3.2. Advertisement Examples .....................................................................36
Table 5.1. ANOVAs and ANCOVAs Comparing Gain- and Loss-Framed Messages for Outputs of the CBC Model .................................................................56
Table 5.2. Binary Logistic Regression Model Predicting Decisions .....................58
Table 5.3. Independent Mediation Effects of Attention, Recall, Attitudes and Decisions on Subsequent Message Outputs of the CBC Model ........................................63
Chapter 1

Introduction

1.1 Overview

Physical inactivity is a national issue affecting more than half of all Canadian adults. Currently, only 15% of Canadian adults accumulate enough physical activity to be meeting Canada’s Physical Activity Guidelines (Colley et al., 2011). Thus, it is important to promote physical activity among this inactive population. Health messaging has been a popular medium for encouraging individuals to adopt recommended health behaviours, such as physical activity, particularly through the use of message framing (Williams-Piehota, Schneider, Pizarro, Mowad, & Salovey, 2003). Message framing affects decision making processes by presenting factually equivalent messages in different ways, emphasizing either the gains or losses of engaging or not engaging in a particular behaviour (Rothman & Salovey, 1997). Based on the tenants of prospect theory (Kahneman & Tversky, 1979) prevention behaviours should be better promoted by gain-framed messages (Rothman & Salovey, 1997). While many studies have shown this to be true, the effects of gain-framed messages on prevention behaviours are small, limited to behavioural outcomes, and dependent upon the type of prevention behaviour being examined. (Gallagher & Updegraff, 2011; O'Keefe & Jensen, 2007)

There is some evidence to suggest that prevention behaviours such as physical activity are better promoted by gain-framed messages. The mechanisms through which these effects occur are still unclear. Research is needed to examine the factors mediating framing effect on
behaviours, so that message framing research can be advanced leading to the development of optimally effective health messages (Bassett, Latimer, & Martin Ginis, in press).

One model that attempts to explain the relationship between message exposure and its influence on behaviour is the communication behaviour change model (CBC) (McGuire, 1989). This model describes how manipulating one component of a message (input), such as message frame, can influence a sequence of outcomes (output steps) which are thought to induce behaviour. Few studies have used this model to examine the manipulation of health messages and those that have only examined a few of the steps, making it difficult to fully understand how messages impact behaviour.

1.2 Primary Objectives and Hypotheses

1.2.1 Purpose.

Therefore, the purpose of this study is to use the CBC model to examine the mechanisms through which message frame affects behaviour. This is done by examining the influence of message frame at each output stage of the model and examining the mediating relationships between each of these output factors.

1.2.2 Hypotheses.

H1: Gain-framed messages will be more effective than loss-framed messages at each output step of the model.

H2: Each output step will act as a mediator between message frame and the subsequent steps within the model.
1.3 Thesis Organization

This thesis was organized according to the regulations outlined in the School of Kinesiology and Health Studies “Format of Traditional Thesis” document. The second chapter contains a review of the literature relating to thesis content and the subsequent chapters contain the body of the thesis including methods, analysis, results and discussion. Finally, appendices are located at the end of the document and contain all materials used to conduct the study.

1.4 References


Chapter 2

Literature Review

2.1 Inactivity

Physical inactivity is a national issue affecting more than half of all Canadian adults. According to the 2007-2009 Canadian Health Measures Survey only 15% of Canadian adults accumulate enough physical activity to meet Canada’s Physical Activity Guidelines of 150 minutes of physical activity a week, and less than 5% get at least 30 minutes of activity on five days or more a week (Colley et al., 2011). In fact, inactivity levels among Canadian adults (aged 20-39) are increasing resulting in decreased cardiovascular fitness and muscular strength, increased waist circumferences and a greater proportion of adults with an unhealthy body composition (Canadian Fitness and Lifestyle Research Institute, 2011). These alarming trends are related to a number of health issues including increased prevalence of chronic diseases which has become an economic burden on our health care system (Katzmarzyk, Gledhill, & Shephard, 2000; Warburton, Charlesworth, Ivey, Nettlefold, & Bredin, 2010). Despite the health benefits associated with physical activity, Canadians are simply not active enough, thus highlighting the importance of public health initiatives to promote physical activity among this inactive population (Colley et al., 2011).

2.2 Health Messaging

Health messaging has been a popular medium for encouraging individuals to adopt recommended health behaviours (Williams-Piehota, Schneider, Pizarro, Mowad, & Salovey, 2003). However, merely providing knowledge to message recipients does not always result in the
adoption of these health behaviours (Gordon, 2002). For instance, a report from the US Surgeon General’s workshop on promoting public awareness of health behaviours noted that education is not necessarily equivalent to motivation and that knowledge provided through education does not directly result in attitude or behaviour change (National Center for Biotechnology Information, 2002). Accordingly, effective physical activity messages should not only provide individuals with information, but also motivate them to become active and persuade them to consider that physical activity is appealing and achievable. One way to do this is to manipulate the way in which messages are presented through message framing.

2.2.1 Message Framing.

Message framing affects decision making processes by presenting factually equivalent messages in different ways, emphasizing either the gains or losses of engaging or not engaging in a particular behaviour (Rothman & Salovey, 1997). Gain-framed messages communicate the benefits of engaging in a health behaviour such as physical activity, while loss-framed messages communicate the costs associated with not engaging in that very same behaviour (Rothman & Salovey, 1997). For instance a gain-framed message that states “Being active reduces your risk of heart disease” emphasizes the benefits of engaging in physical activity. However, the equivalent loss-framed message emphasizing the consequences of not engaging in physical activity would state “Being inactive increases your risk of heart disease”. Despite the wording, both messages are factually equivalent- only their framing differs.

2.2.2 Prospect Theory.

Message framing is rooted in prospect theory (Kahneman & Tversky, 1979) which proposes that in the face of a decision, individuals will place more emphasis on outcomes that are certain in comparison with those that are merely probable. Depending on whether or not the
certain outcome is a positive or negative one, individuals will either choose the probable option in the case of a negative outcome (so that the negative outcome is less likely) or choose the certain option in the case of a positive outcome (so that the positive outcome is more likely). This phenomenon, known as the certainty effect, produces the tendency for individuals to make risk-seeking choices when presented with information about losses, but are risk-aversive when confronted about information regarding gains (Tversky & Kahneman, 1981).

For instance, Tversky and Kahneman (1981) demonstrate this phenomenon in an experiment using the Asian Disease Paradigm. In this study participants were presented with the following paradigm along with either two factually identical gain-framed or loss-framed options:

Imagine that the U.S. is preparing for the outbreak of an unusual Asian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed:

a) If program A is adopted, 200 people will be saved. If program B is adopted, there is a 1/3 probability that 600 people will be saved, and a 2/3 probability that no people will be saved. (Gain-framed)

b) If program A is adopted, 400 people will die. If program B is adopted, there is a 1/3 probability that nobody will die, and a 2/3 probability that 600 people will die. (Loss-framed)

They found that in the gain-framed condition participants were more likely to choose the less-risky (more certain) program A because saving 200 people with total certainty is subjectively more attractive than the possible chance of that only a fraction of the total number of individuals may be saved (Tversky & Kahneman, 1981). In contrast, participants in the loss-framed condition were more likely to select the riskier (less certain, more probable) program B, because having 400 people dying with total certainty is subjectively less attractive than the possible chance that that no one will die (Tversky & Kahneman, 1981).
Consistent with the findings from this experiment, prospect theory proposes that individuals will be risk seeking (choosing risky options, based on probability) when presented with information about losses, but are risk-aversive (choosing certain, sure outcomes) when confronted about information regarding gains (Tversky & Kahneman, 1981). Translating these tenants into a set of guidelines for creating health messages, Rothman and Salovey (1997) proposed that behaviours with certain, and thus low risk, outcomes should be better promoted by gain-framed information, while behaviours with uncertain, and thus risky, outcomes should be better promoted by loss-framed information.

Prevention behaviours, such as physical activity have certain positive outcomes and therefore should be better promoted by gain-framed messages. For instance, when given gain-framed information regarding physical activity individuals have two options (similar to the Asian Disease Paradigm). They can either a) be active and gain the certain health benefits that will results from their activity (risk-aversive option), or b) they can choose not to be active and risk the uncertain probability that health benefits may or may not be gained (riskier option). Thus, by providing gain-framed information individuals will be more likely to choose the risk-aversive option (a) and engage in physical activity.

Detection behaviours, on the other hand, such as getting a mammogram can have an uncertain and potentially negative outcome and therefore should be better promoted by loss-framed information. For instance, in the face of loss-framed information regarding mammography, individuals have the option of either a) not getting a mammogram, being certain that they will not receive any negative feedback regarding their health (risk-aversive) or they can b) get a mammogram risking the probability that they might receive some negative feedback.
about their health (riskier option). By providing loss-framed information individuals will be more likely to choose the riskier option (b) and get a mammogram.

**2.3 Message Framing and Health Behaviour**

Despite these clear inferences suggested by Rothman et al. (1997), the evidence of framing effects in the context of health messaging has been mixed. Two meta-analyses examining framing effects on health behaviours are described, followed by a review of evidence specifically looking at physical activity behaviour.

In a review, Akl et al. (2011) examined the persuasiveness of gain- and loss-framed messages as measured by hypothetical decisions or willingness to adopt behaviour in six detection and 13 prevention behaviour studies. They found that for both detection and prevention behaviours, gain- and loss-framed messages did not lead to differences in persuasiveness (Akl et al., 2011). However, the quality of evidence for these studies was low and conclusions were based on proxy measures effects rather than actual behaviour.

A meta-analysis by O’Keefe and Jensen (2007) investigated the effects of framed messages on behaviour and documented behavioural determinants including intentions and attitudes. They examined 93 message framing studies looking only at prevention behaviours and found that overall gain-framed appeals were more persuasive than loss-framed appeals (O’Keefe & Jensen, 2007). However, these differences were small and were attributable largely to the effects of dental hygiene behaviours specifically. No statistical differences were found for other prevention behaviours including safe sex, physical activity, skin cancer prevention, or diet and nutrition behaviours (O’Keefe & Jensen, 2007).

More recently, Gallagher and Updegraff, (2011), conducted a meta-analysis examining the effects of message framing on various health behaviours reported in 94 peer-reviewed,
published studies looking at both detection and prevention behaviours. For detection behaviours, no significant differences between gain- and loss-framed messages for outcome measures of attitudes, intentions or behaviour were found. For prevention behaviours, however, gain-framed messages produced significantly greater amounts of behaviour change than loss-framed messages, but no effects of message framing were found for measures of attitudes of or intentions (Gallagher & Updegraff, 2011).

Overall, the evidence suggests that prevention behaviours may be better promoted by gain-framed messages. However the effects are small, limited to behavioural outcomes and dependent upon the type of prevention behaviour being examined.

2.3.1 Message Framing and Physical Activity.

Because physical activity is a prevention behaviour, and prevention behaviours are better promoted by gain-framed messages (Gallagher & Updegraff, 2011; O'Keefe & Jensen, 2007), then physical activity messages should be more effective and produce greater amounts of behaviour change when they are presented in a gain-framed manner. For instance, Latimer and colleagues (2008) conducted a randomized control trial assigning healthy sedentary individuals who called the US National Cancer Institute's Cancer Information Service to received gain-, loss, or mixed-framed messages on three separate occasions. They found that gain-framed messages resulted in stronger intentions to perform physical activity at the two week time point compared to the loss-framed condition, and at nine weeks participants in the gain-framed condition had greater levels of physical activity participation (Latimer et al., 2008).

Additionally, in the meta-analysis by Gallagher and Updegraff (2011), gain-framed messages were significantly more effective at producing behavioural change when looking at physical activity behaviours specifically (Gallagher & Updegraff, 2011). Although this gain-
framed advantage for physical activity behaviour was significant, the effect was still quite small \((r = 0.16)\) and was reliant on mostly self-reported data (Gallagher & Updegraff, 2011).

To date the current research has identified a trend where gain-framed messages tend to be more effective at promoting prevention behaviour compared to loss-framed messages (Gallagher & Updegraff, 2011; O’Keefe & Jensen, 2007). This pattern holds true when looking specifically at physical activity behaviour, although these effects are small (Gallagher & Updegraff, 2011; Latimer et al., 2008). Despite being small, these effects are important as small effects can translate into larger more meaningful change if applied to a large population of individuals (Rose, 1995) and may contribute to the effects of a larger intervention with multiple components (Latimer, Salovey, & Rothman, 2007). However, in order to use framing effects appropriately in a population setting, or multi-component intervention, it is important to understand the mechanisms through these which framing effects occur. This is one area in which message framing research is lacking.

2.4 Mechanisms of Message Framing

Although, there is some evidence to suggest that prevention behaviours such as physical activity are better promoted by gain-framed messages, the mechanism through which this occurs is still unclear. Future research is needed to examine the factors influencing this framing effect on prevention behaviours so that message framing research can be advanced leading to the development of optimally effective health messages (Bassett, Latimer, & Martin Ginis, in press) and practitioners can use appropriately framed messages in practice (Rothman & Updegraff, 2011). For example, if attention is an important mediator of framing effects on behaviour then
messages can be designed to attract greater amounts of attention which would lead to greater amounts of behaviour change.

Most message framing studies have been largely unsuccessful in identifying mechanisms (i.e., mediators) underlying these messages framing effects (Rothman & Updegraff, 2011). For instance, social cognitive variables including attitudes and intentions have been shown to influence behaviour (Azjen, 1991), and therefore may play a role in the framing effects on behaviour. However, these constructs alone may not fully explain the impact of a messages’ effectiveness. Gallagher & Updegraph (2011), found significant effects of message framing on behaviour; but no significant advantage for gain-framed messages over loss-framed messages were found when looking at measures of attitudes and intentions, suggesting that additional mechanisms other than social cognitive variables may be influencing the framing effect on behaviour.

Rothman and Updegraff (2009), have suggested other potential mediators of framing effects including the degree and ease of message elaboration, and the degree of attention elicited by framed messages (Rothman & Updegraff, 2011). Lee & Aaker (2004), for example, reported greater ease of message processing when the frame of a message fit the type of message being presented (i.e., when prevention messages were gain-framed and detection messages were loss-framed). Additionally, Updegraff et al. (2007), found that participants were more attuned to the quality (greater elaboration) of the arguments in messages that were more persuasive, suggesting that a greater degree of message elaboration mediated the persuasiveness of the message. If persuasive messages elicit greater amounts of message elaboration (a form of cognitive processing), then they might also elicit greater amounts of attention since attention is an earlier stage of cognitive processing (Greenwald & Leavitt, 1984). For example, Rothman & Updegraff
(2009) propose that framed messages may garner different degrees of attention which may elicit different levels of interest for the message, affecting an individual’s ability to remember the message; thus mediating the relationship between the presentation of framed messages and their effect on behaviour. They suggest that some framed messages are more effective than others because individuals may be more likely to pay greater attention and better recall those messages, subsequently leading to changes in behaviour (Rothman & Updegraff, 2011).

2.5 Attention and Cognitive Processing

Attention is an early stage of cognitive processing (Greenwald & Leavitt, 1984) and previous research by O’Keefe and Jensen (2008) has found that differently framed messages elicit different degrees of cognitive processing. This suggests that framed messages may, in fact, be attracting different amounts of attention thus supporting Rothman and Updegraff’s (2009) inference of attention as a mediator of framing effects. For instance, in a meta-analytic review, O’Keefe and Jensen (2008) compared the results of 42 different message framing studies on health behaviours (both prevention and detection) looking at measures of message processing to examine how gain- and loss- framed messages differ in the degree to which they engage attention and thought. They examined memory for message content and number of message related thoughts as indicators of the message processing (O'Keefe & Jensen, 2008). They hypothesized that there would be greater message processing for loss-framed messages due to evidence of negativity bias where individuals have heightened sensitivity to negative information. Contrary to their hypothesis, their results revealed that gain-framed messages had greater levels of message processing than loss-framed messages for disease prevention behaviours and no significant differences were found for detection behaviours. More
specifically, gain-framed messages had significantly greater message processing than loss-framed messages for outcomes of message memory; however, no differences were found for measures of post-message thoughts, suggesting that in prevention behaviours, attention or message processing may be contributing the effectiveness of gain-framed messages in producing behaviour change (O'Keefe & Jensen, 2008). One important limitation to note is that attention was not directly measured and was assessed from measures of recall and thought listing. In order to fully understand how attention influences the effectiveness of framed messages, more objective measures of attention are needed. One method frequently used to assess how much attention an individual is engaging in is the use of eye tracking.

2.5.1 Eye Tracking.

Eye-tracking uses infrared light to track the pupil and can measure eye movements, which have been shown to be a reliable indicator of the target of a person’s attention and can provide a sensitive, real-time behavioural index of their attention (Cheng, Dickie, Sohn, & Vertegaal, 2005; Henderson, 2003).

Attention is typically examined through two separate eye movement measures including fixations and dwell time. Fixations are defined as moments when the eye is relatively stable because it has paused to gather visual information about a specific contextual element, while dwell time is the total amount of time that participants spend looking at an ad, or ad element (Pieters & Wedel, 2007; Rayner, 1998).

Eye movements have also been shown to relate to cognitive processing (Carpenter & Just, 1976; Rayner, 1998) and have been used to measure attention in a number of messaging studies including those specifically looking at health messaging. For instance, Thompson et al. (2007) used eye-tracking to examine how much attention adolescents pay towards responsibility
messages in alcohol print advertisements. Similarly, Fischer, et al. (1989) looked at attention towards health warnings on tobacco advertisements. Eye-tracking has also been used to look at how individuals look at print advertisements (Rayner, Rotello, Stewart, Keir, & Duff, 2001).

Although many health messaging studies have used eye-tracking to measure attention, only three known studies have directly examined attention patterns to study message framing. One study by Kuo, Hsu, and Day (2009) used eye-tracking technology to study the differences in cognitive effort between both gain- and loss-framed messages. They presented 56 college students with four different decision making paradigms that were either positively or negatively framed, similar to those described by Kahneman and Tversky (1979), and asked participants to select one of two options (i.e., risk-seeking or risk-aversive). They recorded eye movements while participants viewed the paradigm and examined attention and cognitive effort as measured by processing time per word and fixations per word. They found that overall not only did participants choose risk-seeking options more often in the loss-framed situations, compared with the gain-framed situations (consistent with prospect theory), but they spent more time per word processing the loss-framed options and had more fixations per word on the loss-framed choices, suggesting that the amount of attention spent on a message may be related to their decision regarding the message (Kou, Hsu, & Day, 2009). However the relationship between cognitive effort and decisions was not directly assessed and the decisions made by participants were hypothetical; their behaviour and/or decisions may have differed had the situations been real.

Two additional studies have used eye-tracking to examine the impact of message framing on attention in the context of health behaviour change. For instance, O’Malley & Latimer (in press) used eye tracking to assess attention directed towards framed osteoporosis prevention advertisements. Participants were presented with gain-, loss- and neutral- framed osteoporosis
advertisements while their eye movements (i.e., fixations and dwell time) were recorded. Cognitive processing was also measured in a masked recall test following exposure to the messages. Between-participant analyses revealed that not only did participants have significantly longer dwell times and a greater number of fixations on the gain-framed ads compared with the loss- or neutral-framed ads, but the gain-framed ads were also better recalled than both the loss- and neutral-framed ads. Additionally, they found that measures of attention were positively correlated with recall measures for the gain- and neutral-framed messages, but they found no significant correlations between viewers’ eye movement (attention) measures and their ability to accurately recall the loss-framed messages. Although these findings indicate that measures of attention may be related to subsequent measures of cognitive processing for osteoporosis prevention framed messages, it is unclear if the same conclusions can be made for messages regarding physical activity.

In a study by Bassett and colleagues, (in press) examining attention and cognitive processing in the context of physical activity, undergraduate participants were exposed to either gain- or loss-framed messages promoting physical activity while recording how long participants dwelled on each of the messages using a head mounted eye tracking device (Bassett et al., in press). Additional measures of cognitive processing were measured in a message recall task following message exposure. They found that participants spent a significantly greater amount of time dwelling on the gain-framed messages compared to the loss-framed messages but no differences between gain-and loss-framed messages were found for measures of message recall (Bassett et al., in press). Additionally, in contrast to the findings by O’Malley et al. (in press), dwell time on the physical activity messages was not significantly correlated with message recall (Bassett et al., in press).
Although these studies provide increased evidence for a gain-framed advantage when assessing attention towards prevention behaviour framed messages (specifically physical activity), and some evidence of a relationship between attention and recall, because behaviour was not assessed in either study, it is unclear how these differences in attention and recall relate to the changes in physical activity behaviour that were previous reported by Gallagher and Updegraaff (2011).

2.5.2 Attention and Behaviour.

One model that attempts to explain the relationship between attention, recall and subsequent behaviour change is the communication behaviour change model (CBC) (McGuire, 1989), which was designed to guide the development and evaluation of public education campaigns (Nutbeam & Harris, 2004). This model describes a matrix in which a series of input and output factors are combined to influence the persuasiveness of a message (see Figure 2.1). The input factors are the various components of a message that can be manipulated to change attitudes and behaviour while the outputs are the information processing sub-steps that the message must evoke in order for it to be persuasive (McGuire, 1989).
McGuire (1989) describes five separate input factors that can be manipulated to influence the persuasiveness of the message. These include the source, channel, receiver, destination and message. The source input describes characteristics of whom the message is presented by. This includes the person, group or organization that the message is perceived to have come from and is thought to influence the credibility, clarity and relevance of the message (Nutbeam & Harris, 2004). The channel is the mode through which the message is communicated (i.e., verbal, print, electronic) and can influence both the reach and cost of communicating the message. The receiver input describes characteristics of the recipient of the message including age, education, intelligence, attitudes and other demographic factors. The destination is the outcome or goal of the message and may include attitude or behaviour change. The last input described by McGuire (1989) is the message input, which includes both the content and presentation of the message.

![Table](image)

**Table**: McGuire's (1989) communication behaviour change model

<table>
<thead>
<tr>
<th>Output Factors</th>
<th>Source</th>
<th>Channel</th>
<th>Receiver</th>
<th>Destination</th>
<th>Message</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interest</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Understanding</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Skill Acquisition</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Attitude Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Memorization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Recall</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Decision Making</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Behaviour Change</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reinforcement</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maintenance</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2.1. McGuire's (1989) communication behaviour change model*
For instance, changing the frame of a message would be considered a manipulation of the message input factor.

These input factors can interact and influence the output factors of the persuasion process, which is a 12-step sequence linking the initial exposure of the message to the final outcome of behaviour change (see Figure 2.1) (McGuire, 1989). For instance, McGuire (1989) postulates that in order for a message to be effective an individual must first be exposed to the message or new information. Secondly, the individual must attend to the information being presented. Once a message is attended to, it must be understood and accepted by the viewer reflected by their attitude change. This new information is then stored in memory so that it can later be retrieved and acted upon. Once the individual decides to change their behaviour and act upon it, the individual must be reinforced for engaging in the behaviour so that it will be maintained.

Although these steps seem straightforward, there are a number of factors to consider when using this model to examine the effectiveness of communication messages. McGuire (1989) notes that each of the output steps are conditional and the likelihood of achieving each of these steps decreases as you move further along each stage. For instance, the likelihood of attracting attention (step 2) is greater than the likelihood of that attention resulting in behaviour change (step 10). Similarly, gain-framed messages attract greater amounts of attention than loss-framed messages (Bassett et al., in press; O’Malley & Latimer, in press) and result in greater amounts of behaviour, but the effects on behaviour are significantly smaller (Gallagher & Updegraff, 2011). The stages between message exposure and the behaviour (including attention) may be mediating the relationship between these two stages, reducing the likelihood of reaching the last stage of the model (behaviour change). For example, the small effect of message framing
on behaviour may be due to the fact that individuals are directing different amounts of attention to the messages, which in turn is influencing its effect on behaviour through changes in subsequent outputs including memory, attitudes and decisions (intentions).

Thus attention may be mediating the relationship between the exposure to the framed messages and its effect on behaviour. In cases where framing effects on behaviour were not found, it may be that individuals were not attending to the message and thus having no effect on subsequent outputs factors including behaviour. However, this relationship between attention towards framed messages and its effect on behaviour has not yet been systematically studied, and few studies have used the communication behaviour change model to examine message effects on behaviour.

One study that did use the CBC model to guide the delivery strategy of their health messages was the Stanford 3-City Project (Farquhar et al., 1977). They used the model to develop a community health education program to reduce the risk of cardiovascular disease in three separate cities. In this study, the source (input) of the messages was manipulated (i.e., face-to-face communication vs. media messages) and output measures including knowledge, behavioural and physiological measures were assessed both pre- and post- intervention (Farquhar et al., 1977). Although the model was used in the development of the project, only a select few output variables (knowledge and behaviour) were analyzed making it difficult to fully understand the mechanisms through which the messages were effective. McGuire (1989) describes this as the neglected mediator fallacy where campaign designers select inputs in efforts to evoke changes in only one or two output factors among the complete set of 12 steps. This ignorance to the remaining mediating steps prevents researchers from fully understanding the impact of a
message input at all levels of the model and prevents them from fully understanding of the mechanisms through which the manipulation is effective.

Thus, the CBC model provides a good framework for examining the effectiveness of an input manipulation, such as message frame, at all output levels and allows for the examination of each output as a mediator of the next, helping to explain the mechanism through which framing effects influence behaviour. Few studies have used this model to examine the effectiveness of health messages and those that have, failed to account for all mediating variables that may be influencing behaviour. If we can understand how the manipulation of a message input such as of message frame affects each one of the outputs of the CBC and how these outputs are related then we can better understand the mechanisms through which framing occurs.

2.6 Conclusion

Overall, previous research examining the effectiveness of framed physical activity messages has suggested that gain-framed messages are more effective at producing behaviour change (Gallagher & Updegraff, 2011). However, their effects are quite small and the mechanism through which framing effects occur is still unclear. It has been proposed that degree of attention directed towards a message may play a role in explaining message framing effects (Rothman & Updgraaff, 2011). Previous research using eye tracking has found that in addition to changing behaviour, gain-framed messages also attract greater amounts of attention than loss-framed messages (Bassett et al, in press; O’Malley & Latimer, in press). However, the relationship between attention and behaviour has not been previously examined and the amount of attention a message receives may be mediating its effect on behaviour in addition to a number of other factors illustrated in the CBC model.
2.7 Purpose

Therefore the purpose of this study is to use the CBC model to examine the mechanisms through which message frame affects behaviour by examining the influence of message frame at each output stage of the CBC model (as shown in Figure 2.1) and to examine the mediating relationships between each of these output factors.

2.8 Hypotheses

H$_1$: Gain-framed messages will be more effective than loss-framed messages at each output step of the CBC model.

H$_2$: Each output step will act as a mediator between the previous and the subsequent steps (see Figure 2.1). Specifically, attention will mediate framing effects on attitude change; attitude change will mediate framing effects on recall; recall will mediate framing effects on decisions and decisions will mediate framing effects on behaviour.

2.9 References


Chapter 3

Methods

3.1 Design

This study employed a 2 group (gain-framed vs. loss-framed) x 2 time (pre vs. post) mixed factorial experimental design.

3.2 Participants

3.2.1 Sample Size.

The study was powered to adequately detect differences in attention because attention is thought to be the point of initiation for message framing effects on behaviour (McGuire, 1989). Sample size was calculated in GPower® (version 3.1) with the following parameters: Effect size $f = 0.33$, $\alpha = 0.20$, power = 0.80, numerator $df = 1$, number of groups = 2, number of covariates 1 (Faul, Erdfelder, Buchner, & Lang, 2009). A medium effect size was used in the calculation because it corresponds with data reported (partial $\eta^2 = 0.10$) in a previous eye-tracking study looking at differences in attention towards framed leisure-time physical activity messages (Bassett et al., in press). Based on this calculation, the desired sample size was 42 participants (21 per group).

However a larger sample is required to adequately detect effects on behaviour. Because small to medium effects of message frame on behaviour were found in a meta-analysis looking at message framing and physical activity behaviour ($r = .16$; Gallagher & Updegraff, 2011) a total of 26-64 participants (13-32 per group) were required to detect differences between two different sample means at $\alpha$ of .05 (Cohen, 1992). Thus, the sample size was increased to 60 (30 per
group) participants to allow for the detection of effects of both attention and behavioural measures.

3.2.2 Recruiting.

Potential participants were recruited via email lists and posters placed in buildings across Queen’s University campus including the libraries and cafeterias. Fitness facilities including the Athletics and Recreation Centre were excluded to avoid individuals who might already be highly active. Additionally, participants were recruited through word of mouth. All potential participants were contacted via email, provided informed consent and were screened to ensure that they met the eligibility criteria prior to participating.

3.2.3 Eligibility.

To be eligible, participants had to a) be an English speaking female aged 18-35, b) have perfect vision or wear contact lenses (glasses not permitted), c) have no vision problems d) have no contraindications to physical activity e) not have previously participated in another message framing eye tracking study in our lab and f) not be meeting Canada’s physical activity guidelines (i.e. 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week in bouts of 10 minutes or more and strength training two times per week) but intend to increase their physical activity in the next two months. Of the 147 participants screened, 60 met study criteria. Of those excluded, 38 of them were already meeting Canada’s physical activity guidelines, 1 was male, 16 were not intending to increase their physical activity, 11 had contraindications to physical activity, 6 did not complete the survey, 2 had corrected vision but did not have contact lenses, and the remaining 13 decided not to participate after confirming their eligibility.

3.2.4 Demographics.

The mean age of participants was 20.10 years ($SD = 2.47$). The majority of the participants were Caucasian (65.0%, $n = 39$), undergraduate students (96.7%, $n = 58$), and had
normal vision (63.3%, n = 38). Most participants spoke English as their first language (74.5%, n= 45), but all participants were able to read and understand English. See Table 3.1 for participant characteristics.

Table 3.1. *Participant Characteristics.*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Gain Group n = 30 (%)</th>
<th>Loss Group n = 30 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yr)</td>
<td>20.37±3.02</td>
<td>19.83 ±1.78</td>
</tr>
<tr>
<td>Vision</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>21 (70%)</td>
<td>17(56.7%)</td>
</tr>
<tr>
<td>Corrected-Normal</td>
<td>9 (30%)</td>
<td>13 (43.3%)</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Undergrad</td>
<td>28 (93.3%)</td>
<td>30 (100%)</td>
</tr>
<tr>
<td>Master’s candidate</td>
<td>2 (6.7%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Primary Language</td>
<td></td>
<td></td>
</tr>
<tr>
<td>English</td>
<td>21 (70%)</td>
<td>22 (73.3%)</td>
</tr>
<tr>
<td>Other</td>
<td>9 (30%)</td>
<td>8 (26.7%)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Caucasian</td>
<td>19 (63.3%)</td>
<td>20 (66.7%)</td>
</tr>
<tr>
<td>Asian</td>
<td>8(26.7 %)</td>
<td>8 (26.7%)</td>
</tr>
<tr>
<td>Multiracial</td>
<td>2 (6.7%)</td>
<td>1 (3.3%)</td>
</tr>
<tr>
<td>Undisclosed</td>
<td>1 (3.3%)</td>
<td>0 (0%)</td>
</tr>
<tr>
<td>Other</td>
<td>0 (0%)</td>
<td>1(3.3%)</td>
</tr>
</tbody>
</table>

3.3 Procedure

The study procedure was approved by the Queen’s General Research Ethics Board (GREB). Potential participants were screened via an online survey to ensure they met all eligibility criteria. They also provided demographic information at this time. Eligible participants were assigned to either the gain- or loss-framed group based on the order they had contacted the research assistant overseeing participant scheduling. This research assistant did not participate in data collection. The first participant was assigned to the gain-framed group, the second to the loss-framed group, and subsequent participants were assigned to their group on an alternating basis. Eligible participant were asked to attend a 1 hour meeting at a lab on campus and were
instructed to come wearing exercise attire (i.e., running shoes and athletic clothing). At the start of the meeting all participants were met by the researcher on the first floor of the building and were brought up to the lab on the forth floor by elevator. Once in the lab, participants provided written consent and completed the International Physical Activity Questionnaire (IPAQ) as well as baseline measures of attitudes and intentions. At this time, participants were told that the study would be examining how people look at print ads and that their eye movements would be tracked while they viewed the ads on the eye tracking screen.

Participants were first led through a short calibration and validation procedure. Following successful calibration, participants fixated on a centre cross on the screen and were then shown a series of 25 print advertisements presented in a randomized order because serial-position or order has been shown to affect a viewers’ attention to ads (Wedel & Pieters, 2000). Participants viewed each ad, for as long as desired advancing to the next ad by pushing a button on a hand held console. This free-viewing option encouraged participants to view or process the ads without a specific goal in mind (Rayner, Miller, & Rotello, 2008). Following each ad participants completed a manual calibration check to ensure that the eye tracker was recording accurately. If the calibration was successful, participants continued on to view the next ad. If unsuccessful, the calibration and validation procedure was repeated before continuing. After viewing all 25 ads, participants completed measures of attitudes and intentions once again.

Participants were then told to head up to another lab, one floor higher where the second part of the experiment would take place. The experimenter casually pointed out the stairs to the participant and headed back to the lab to retrieve a forgotten item, leaving the visible area. The method of transportation (stairs vs. elevator) taken by the participant was recorded by the experimenter from a nearby location, out of site from the participant. The second lab was a
private exercise gym. Participants were given a brief orientation to the facility and were offered a chance to sign up to use the facility during an open gym session in the following week.

Participants then completed at 20 minute workout (walking or running) on a Woodway Mercury 68” treadmill at a self-selected speed. For the first two minutes, participants adjusted the speed and incline to an intensity they wished to maintain for the remainder of the workout. At two minutes the speed and incline were held constant and participants indicated their ratings of perceived exertion (RPE) at the 10 and 20 minute time points. At the end of the workout, participants received $20 for completing the in lab component of the study.

One week following their meeting, participants were contacted via email to complete an online follow-up survey including the IPAQ and prompted recall measures. Participants were then debriefed on the purpose of the study. Participants who completed the follow-up survey were entered into a draw to win a $50 Luluemon gift card.

3.4 Visual Stimuli

Participants in each of the two groups viewed 25 physical activity print advertisements including 20 ads with framed messages and five control ads. Of the 20 framed ads, two promoted stairs usage (vs. elevator) and an additional two ads promoted working out at an increased intensity. The remaining framed ads promoted physical activity behaviour by stating either the benefits of engaging in (gain-framed), or the costs of not engaging in (loss-framed) the behaviour.

For every gain-framed ad a matching loss-framed ad was created. The gain- and loss-framed advertisements had similar message content only differing in their messages frame; however the images differed between the two conditions to match the description in the message.
The control ads contained neutral-framed messages related to physical activity but did not provide any information about the costs or benefits of engaging in the behaviour. These neutral framed messages were paired with a corresponding image which was the same across both gain- and loss-framed groups (see Table 3.2 for examples).

All messages were restricted to one or two lines of text and both gain- and loss-framed versions of the ads were matched in terms of font size and type. The mean word count for gain- and loss-framed messages was 10.85 ($SD=3.65$) and 11.70 ($SD=3.69$) words respectively which was significantly different ($p < .05$). All images were taken from online internet sources and included female models from a variety of ethnic backgrounds that were in the same target age range as participants (18-35 years) (see Appendix B for complete set of messages and ads).

All ads were 600 pixels in length and 800 pixels in width and were constructed using PhotoShopCS image editing software and saved in a Bit Map Picture (bmp) format. Each ad consisted of a solid coloured text box containing the framed message as well as a corresponding image. The text box was located directly below the image for all advertisements.
Table 3.2. Advertisement Examples.

<table>
<thead>
<tr>
<th>Type of Advertisement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gain-Framed</td>
</tr>
<tr>
<td>Loss-Framed</td>
</tr>
<tr>
<td>Neutral-Framed (Control)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ad</th>
<th>Gain-Framed</th>
<th>Loss-Framed</th>
<th>Neutral-Framed (Control)</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1.png" alt="Image" /></td>
<td><img src="image2.png" alt="Image" /></td>
<td><img src="image3.png" alt="Image" /></td>
<td>Make a move.</td>
</tr>
</tbody>
</table>

Active today. Stronger Tomorrow.  
Inactive today. Weaker Tomorrow.
3.5 Measures

Five separate output measures from the communication behaviour change model (McGuire, 1989) were assessed. Because of time constraints, only a select few outputs factor were measured, although it would have been ideal to measure all 12 output steps. Because participants in each group viewed the same number of ads, there was no need to measure message exposure. Message understanding was not measured. The messages were not complex and it was assumed that participants would be able to understand all messages presented, especially since the education levels of all participants was the roughly the same; all participants were either undergraduate or graduate students. Skill acquisition was not measured. All participants were screened to ensure there were no contraindications to exercise. Thus it was assumed that all participants had a minimal skill level to perform physical activity. Recall was used as an indicator of message memorization and the reinforcement and maintenance of the behaviour was not assessed due to time constraints. Additionally, interest was not assessed. However, the remaining 5 output measures including attention, attitudes, recall, decision making and behaviour were measured.

3.5.1 Attention.

Eye movements were used as an indicator of attention and were measured using the EyeLink 1000 desk mounted eye-tracking device. This eye-tracking device uses an infrared light camera system to track eye movements at a 1000hz sampling rate. It uses the position of the pupil to calculate the eye’s gaze point position on a computer screen determining where participants are looking on an image within a 0.25º- 0.5º average accuracy range (SR Research., 2010). Images were presented on a 16-inch Samsung SyncMaster 753DF monitor situated 75cm away from the participant and projected images at a 100hz refresh rate.
Two separate measures of eye movements were used including number of fixations and dwell time. 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; Rayner, 1998). Fixations are considered to provide a reliable indication of a person’s attention. When viewers carefully attend to an ad, higher fixation numbers occur (Wedel & Pieters, 2000). Fixation counts were calculated by summing the total number of times a participant’s eye fixated on the presented ad (total fixations).

Dwell time is the total amount of time that participants spent looking at an ad, (Pieters & Wedel, 2007; Rayner, 1998). Dwell time was measured by summing the total amount of time, in milliseconds, that a participant spent viewing an ad (total dwell time) and has shown to be a valid indicator of visual attention (Christianson, Loftus, Hoffman, & Loftus, 1991).

Because the loss-framed messages had significantly more words than the gain-framed messages ($p < .05$) total fixations and total dwell time measures were standardized for word count by dividing the total number of fixations and total dwell times by the number of words in each ad. Eye movement measures for each ad were averaged together. Separate averages for each measure were calculated for both the control and framed ads.

3.5.2 Attitudes.

The term being ‘physically active’ was defined as “engaging in at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week in bouts of 10 minutes or more and strength training two times per week”. Attitudes were measured using the stem “For me being physically active next week would be….”, followed by seven adjective pairs rated on a 7-point rating scale with the following anchors; bad-good, beneficial-harmful (reverse coded), worthless-valuable, unenjoyable-enjoyable, pleasant-unpleasant (reverse-coded), interesting-
boring (reverse-coded), and relaxing-stressful (reverse-coded). These items were adapted from previous research examining the relationship between attitudes and physical activity behaviour (Armitage, 2005; Rhodes & Courneya, 2004). The mean of these seven items was calculated at each time point (Cronbach’s $\alpha = .76-.78$). When tested in the context of physical activity, these items have been shown to correlate with both intentions and behavior ($r = .44, p < .001$ and $r = .26, p < .01$ respectively) and have shown to be a significant predictor of intentions (Beta = 0.20, $p < .01$) (Bozionelos & Bennett, 1999). These items have also been shown to have good internal validity when previously tested in the context of physical activity in university students and adults (Cronbach’s $\alpha$s = .81 to .90; Armitage, 2005; Bozionelos & Bennett, 1999).

3.5.3 Message Recall.

Message recall, a commonly employed measure of cognitive processing (O'Keefe & Jensen, 2008) was assessed using a prompted recall test. Participants were presented with 10 randomly selected ads that they had previously been exposed to in the experiment. For every ad presented to the gain-framed group, the matching loss-framed ad was shown to participants in the loss-framed group. All participants in each group viewed the same 10 ads. For each ad, five messages options were presented and participants were asked to select the correct message that corresponded to the image. Two of the message options were gain-framed, two were loss-framed and the last option was neutral-framed. The percentage of correct responses was calculated - a recall measurement strategy adopted from previous message framing research (Bassett et al., in press; Block & Keller, 1995). The same pattern of findings (greater recall in gain-framed messages) found by Block et. al (1995) and O’Malley et. al (in press) using recall tests are similar to those found in other memory tests examining the recall of framed messages including findings from thought listing tasks (O'Keefe & Jensen, 2008).
A prompted recall test was used rather than a free recall task (i.e., recalling messages without any cues), because Blaxton, (1989) states that free recall tasks use contextually driven processing, which is a form of top-down processing where an individual’s higher level knowledge and expectations influence their processing and thus can affect their recall (Blaxton, 1989). Prompted (cued) recall tasks use more data-driven (bottom-up) processing (Blaxton, 1989) which is used when information is unfamiliar or complex. Therefore, the prompted recall task is less affected by prior knowledge making it a more accurate measure of recall, less-biased by prior experience. Because participants may be more familiar with one message frame over another (Gainforth et al., 2011), this familiarity or prior experience may influence the recall of the message in a free recall task. By using a prompted recall test instead, this bias towards a particular message frame can be avoided.

3.5.4 Decision.

3.5.4.1 Open Gym Sign Up.

Participants’ decision to be active in the following week was measured by their response to an opportunity to participate in a free open gym session. Participants were given the option to sign up to attend one, two or no free open gym sessions in the following week. Alternatively, participants could indicate that they would have liked to sign up if the session were offered on a different day. Sign-up responses were dichotomized into two categories; those who a) did and b) did not sign up. Individuals who chose not to sign up for the open gym session were classified into one category and those who chose to sign for any of the remaining options (1 day, 2 days or an alternative day), were categorized into the other category.

3.5.4.2 Intentions.

Intentions were used as a secondary measure of participants’ decisions to engage in physical activity. Two items adapted from Ajzen, (2001) were used to measure intentions. These
items included: “I intend to be physically active next week (likely-unlikely)”; and “I will try to be physically active next week.” (definitely true-definitely false). Note, the same definition of physical activity described for measures of attitudes was used. Both items were measured on a 7-point scale and were reverse coded. The average of these two items was used as an overall measure of intentions (Cronbach’s $\alpha = 0.85$-0.86). Similar items measuring intentions have been shown to be internally reliable with Cronbach’s $\alpha$’s between .72 and .76 (Armitage, 2005). When tested among undergraduate students, similar measures have shown to be significant predictors of physical activity behaviour ($\text{Beta} = 0.43$-0.54) (Norman & Connor, 2005).

3.5.5 Behaviour.

3.5.5.1 Self Reported Physical Activity.

Self reported physical activity was measured using the short form of the International Physical Activity Questionnaire (IPAQ, 2012a). Individuals reported the frequency and duration of their moderate, vigorous and walking physical activity in the previous seven days (Craig et al., 2003). MET-minutes/week were calculated by multiplying the number of self-reported minutes spent engaging in physical activity at each intensity by the MET equivalency for each type of activity (vigorous= 8.0 METS, moderate=4.0 METS, walking = 3.3METS) (IPAQ, 2012b). A total physical activity score (total MET-minutes/week) was calculated by summing each individual’s moderate, vigorous and walking MET-minutes/week. Tested in 12 countries, the IPAQ has been shown to be a reliable (Spearmans correlation coefficients > 0.65) measure comparable to other self report measures of physical activity (Craig et al., 2003). It has also been proven valid when compared with accelerometer results in Swedish adults ($r = .34, p < .001$) (Ekelund, Sepp, Brage, Becker, & Jakes, 2005).
3.5.5.2 Ratings of Perceived Exertion.

Ratings of perceived exertion (RPE) were measured using the Borg RPE Scale (Borg, 1970). RPE is measured on a 15-point scale ranging from 6 to 20 where 6 equals no exertion at all and 20 equals maximal exertion. This scale has been shown to have good reliability when tested across different experimental conditions on a treadmill \( r = .78 \), and has been shown to be a valid measure of work effort, strongly relating to heart rate \( r = .74 \) and work intensity when tested among sedentary undergraduate women (Stamford, 1976). Previous research has also found a positive linear relationship between RPE, workload and heart rate with high a correlation between all three variables \( r = .90 \) (Skinner, Hutsler, Bergsteinova, & Buskirk, 1973). RPE was measured at 10 and 20 minutes into participants’ workouts. To control for differences in participants’ treadmill and/or exercise experience, self-selected treadmill speed and incline was recorded. Treadmill speed was recorded in miles per hour. Incline was recorded in 0.1% increments.

3.5.5.3 Stairs vs. Elevator.

Participants’ elevator or stair use between the experimental and exercise phase of the study was recorded. This recording was made by the experimenter who observed participants either pushing the elevator button or entering the stairwell- a procedure used in previous health messaging studies (Boutelle, Jeffery, Murray, & Schmitz, 2001; Kwak, Kremers, van Baak, & Brug, 2007). For participants who did both (i.e., waited for the elevator and then decided to take the stairs), their first behaviour was recorded. Participants’ behaviours were observed by the experimenter from a nearby location out of sight from participants’ view.
3.6 References


Chapter 4

Analysis

4.1 Data Treatment

Statistical analyses were performed using the Statistical Package for Social Sciences (SPSS Version 20) and the INDIRECT macro for mediation (Preacher & Hayes, 2008b). Prior to analyses all data were inspected for outliers and all outliers were reduced to 3 standard deviations of the mean (Field, 2009). For measures of self-reported physical activity, individuals who did not indicate the duration of any particular activity (i.e., refused to answer or did not know) were excluded from related analyses. Assumptions of each analysis were tested and violations of any assumptions are discussed below (Field, 2009).

4.3 Statistical Analyses

4.3.1 Descriptive Statistics.

Frequency and descriptive statistics were calculated to examine participant characteristics. Analysis of variance (ANOVAs) were conducted to ensure that there were no pre-existing differences between groups in terms of physical activity levels, intentions, attitudes and age. Comparison of other demographic factors including ethnicity, primary language and vision (i.e., whether or not participants had perfect vision or required corrective lenses) were conducted using chi-squares. For ethnicity, there were some cell counts less than 5 therefore all ethnicities other than Caucasian were classified into one category (Field, 2009). Similarly, for language, all individuals who did not speak English as their first language were grouped together. For education, only two categories were present and could not be collapsed across
groups even though some cell counts were less than 5. Thus, a chi-square test was not computed for measures of education (Field, 2009).

4.3.2 Hypothesis testing.

Given that the first objective of the study was to examine how message frame impacts each output measure of the CBC model (McGuire, 1989), separate comparisons were conducted for continues data including attention, self-reported physical activity, recall, attitudes, decisions (intentions), and ratings of perceived exertion. Specifically, an ANOVA was conducted for recall measures and separate ANCOVAs were conducted for self-reported physical activity, attitudes and decisions (intentions), controlling for baseline measures of each respectively. These baseline measures were controlled for because baseline behaviour, attitudes and intentions have been shown to be significant predictors of future behaviour, attitudes and intentions respectively (Armitage, 2005). For measures of ratings of perceived exertion, treadmill speed was used as covariate because previous research has shown that the speed at which an individual works out at can influence their perception of the intensity (Smutok, Skrinar, & Pandolf, 1980). Treadmill incline was not used as a covariate because it violated the assumption of homogeneity of regression slopes (Field, 2009) and therefore was excluded from the analysis. Additionally, for measures of attention both the number of fixations and dwell time directed towards the control ads were used as covariates for ad fixation and dwell time measures respectively to account for individual differences in participants’ reading speed and eye movement patterns.

Effects sizes (Cohen’s $d$) of ANOVAs and ANCOVAs were calculated. Effect sizes of 0.2, 0.5, and 0.8 classified as small, medium and large respectively (Cohen, 1992). For categorical data including behaviour (whether or not participants used the stairs vs. elevator) and decisions (open gym sign-up measures), binary logistic regressions were conducted to examine
the relationship between the two categorical variables. For each binary logistic regression, message frame was entered as a predictor. For measures of sign-up, baseline intentions were controlled for because past intentions or decisions have been shown to influence future decisions (Armitage, 2005).

4.3.2.1 Mediation.

To examine message outputs as mediators of framing effects on behaviour (the second objective of the study), simple mediation models evaluating each output variable as a mediator between message frame and the subsequent output measure in the CBC model were conducted. Although the most commonly used approach for examining statistical mediation is the causal steps approach (Baron & Kenny, 1986) this approach has been shown to have low power, thus missing true effects (MacKinnon, Lockwood, West, & Sheets, 2002). Preacher and Hayes (2004) have suggested that the Sobel Test (Sobel, 1982) which uses the product of coefficients of the mediator pathways (path a and b) is a statistically more rigorous test (Preacher & Hayes, 2004).

In this simple mediation model (illustrated in Figure 4.1) the simple relationship between X (independent variable) and Y (dependant variable) is called the total effect, denoted by pathway c (Preacher & Hayes, 2004; Preacher & Hayes, 2008a). In this model, path a denotes the effect of the independent variable (i.e., message frame) on the mediator, and path b is the effect the mediator has on the dependant variable. All path effects are represented by unstandardized regression coefficients. The indirect effect of X on Y is defined as the product of paths a and b (ab) (Preacher & Hayes, 2004; Preacher & Hayes, 2008a). The direct effect (denoted by c’) is the effect of X on Y after controlling for the mediator (M). Therefore the indirect effect (ab) represents the difference between c (the X-Y relationship not controlling for the mediator) and c’ (the X-Y relationship after controlling for the mediator) (ab = c – c’). To
test for significant mediation, a critical ratio of the indirect effect (ab) to the standard error of \( ab \) is computed (Preacher & Hayes, 2004; Preacher & Hayes, 2008a). This critical ratio is then compared with a critical value from a standard normal distribution at an alpha level of .05. Mediation is confirmed if this critical value is significant. However, in order to conduct this test, a normal distribution of indirect effects must be assumed, requiring a large sample size (Preacher & Hayes, 2004; Preacher & Hayes, 2008a). Thus, Preacher and Hayes, (2008), suggest using a bootstrapping approach when possible to avoid violations of this assumption risking type I error.

Bootstrapping is a non-parametric approach to effect size estimations and does not assume normal distribution of the product of coefficients used to test mediation (Preacher & Hayes, 2004). Confidence intervals for the bootstrapping data were used to test if mediation was present. If the confidence intervals do not contain 0 then mediation is confirmed (Preacher & Hayes, 2004). According to the recommendations made by Wehrens, Putter, & Buydens, (2000) which suggests using the highest possible number of bootstraps without compromising computing time, 10 000 bootstrap samples were used for each analysis. To test each simple mediation model, the INDIRECT macro using a bootstrapping procedure outlined by Preacher & Hayes, (2008a) was used. In this model, indirect effects (product of coefficients) were calculated by adjusting all paths for covariates.

Measures of attention, recall, attitudes and decision to be physically active were analyzed as mediators of the relationship between messages frame and the subsequent output measures of in the CBC model. For instance, attention was examined as mediator between message frame and attitudes (Figure 5.1 a, b), attitudes were examined as mediators affecting recall (Figure 5.1 c), recall was examined as a mediator affecting decisions (Figure 5.1 d, e) and decisions were examined as mediators influencing behaviour (Figure 5.1 f, g, h, i). Because dichotomous
mediators are not compatible with the INDIRECT mediation macro (Hayes, 2011), only intentions were used as mediators for measures of decision making (excluding the measures of sign-up). Mediation effects of message frame on intentions and measures of stair vs. elevator use were conducted despite finding no significant differences between groups, because significant total effects of an independent variable on a dependant variable are not necessary for mediation to occur (Preacher & Hayes, 2008a).
Figure 4.1. Simple mediation model (Preacher & Hayes, 2004)
4.4 References


Chapter 5

Results

5.1 Participant Drop Out

Of the 60 participants who completed the in lab component of the study, 3 participants did not complete the follow-up measures of self-reported physical activity or message recall. Two of those participants were from the loss-framed group and one was from the gain-framed group. Due to low dropout no demographic comparisons were conducted.

5.2 Baseline Characteristics

To ensure effective randomization, participants’ baseline self-reported physical activity, attitudes and intentions were compared between groups. Univariate ANOVAs, indicated that there were no significant differences between the gain- and loss-framed groups for either of these baseline measures ($p$s $> .05$). There were also no significant differences between groups for age ($p > .05$). Additionally, chi-square tests revealed no significant differences between groups for measures of primary language, ethnicity and vision.

5.3 Attention

As seen in Table 5.1, separate univariate ANCOVAs comparing the total fixations and total dwell time, controlling for fixations and dwell time spent on the control ads respectively, revealed that the gain-framed ads had significantly more fixations per word, $F(1,57) = 5.228$, $p = .03$, $\eta^2 = .084$ and longer dwell times per word, $F(1,57) = 4.495$, $p = .04$, $\eta^2 = .073$, than the loss-framed ads.
### Table 5.1. ANOVAs and ANCOVAs Comparing Gain- and Loss-Framed Messages for Outputs of the CBC Model.

<table>
<thead>
<tr>
<th></th>
<th>Gain-Frame M (SD)</th>
<th>Loss-Frame M (SD)</th>
<th>F</th>
<th>p</th>
<th>Partial eta²</th>
<th>Cohen's d</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ad Fixations/word (#)</td>
<td>2.65 (0.46)</td>
<td>2.37 (0.46)</td>
<td>5.23</td>
<td>.03</td>
<td>.08</td>
<td>0.59</td>
</tr>
<tr>
<td>Ad Dwell/word (msec)</td>
<td>560.26 (80.25)</td>
<td>516.29 (80.25)</td>
<td>4.50</td>
<td>.04</td>
<td>0.07</td>
<td>0.55</td>
</tr>
<tr>
<td><strong>Attitudes</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>5.46 (0.70)</td>
<td>5.66 (0.70)</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Time 2</td>
<td>5.93 (0.46)</td>
<td>5.70 (0.45)</td>
<td>3.70</td>
<td>.06</td>
<td>0.06</td>
<td>0.50</td>
</tr>
<tr>
<td><strong>Recall</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Message Recall (%)</td>
<td>57.41 (17.55)</td>
<td>39.23 (17.55)</td>
<td>14.21</td>
<td>.00</td>
<td>0.22</td>
<td>1.04</td>
</tr>
<tr>
<td><strong>Intentions</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time 1</td>
<td>5.38 (1.44)</td>
<td>5.67 (1.44)</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Time 2</td>
<td>6.05 (0.76)</td>
<td>5.80 (0.76)</td>
<td>1.61</td>
<td>.21</td>
<td>0.03</td>
<td>0.33</td>
</tr>
<tr>
<td><strong>Behaviour</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MET-min/week (Time 1)</td>
<td>2309.83 (1230.24)</td>
<td>2279.90 (1230.24)</td>
<td>-</td>
<td>-</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>MET-min/week (Time 2)</td>
<td>3898.61 (1774.29)</td>
<td>2606.03 (1775.31)</td>
<td>5.60</td>
<td>.02</td>
<td>0.12</td>
<td>0.73</td>
</tr>
<tr>
<td>RPE (10 min)</td>
<td>12.06 (1.74)</td>
<td>11.14 (1.74)</td>
<td>4.27</td>
<td>.04</td>
<td>0.07</td>
<td>0.53</td>
</tr>
<tr>
<td>RPE (20 min)</td>
<td>12.81 (2.06)</td>
<td>12.31 (2.06)</td>
<td>0.87</td>
<td>.36</td>
<td>0.02</td>
<td>0.24</td>
</tr>
</tbody>
</table>

*Note. F values correspond to ANOVAs and ANCOVAs. aControlled for fixations directed to the control ads. bControlled for dwell time directed towards the control ads. cControlled for attitudes at Time 1. dControlled for intentions at Time 1. eControlled for IPAQ scores at Time 1. fControlled for treadmill speed. * p < .05 **p < .001*
5.4 Attitudes

As indicated in Table 5.1, the univariate ANCOVA comparing attitudes at Time 2, controlling for attitudes at Time 1, revealed that gain-framed ads resulted in more positive attitudes than the loss-framed ads following message exposure. However, the difference between groups did not reach standard levels of significance. The resulting effect was medium in size, \( F = 3.70, d = 0.50 \) (Cohen, 1992).

5.5 Message Recall

As shown in Table 5.1, participants in the gain-framed group recalled a significantly greater percentage of messages than those in the loss-framed group \( F(1,51) = 14.21, p < .001, \eta^2 = 0.22 \).

5.6 Decision

5.6.1 Open Gym Sign Up.

A binary logistic regression testing message frame as a predictor of whether or not participants signed up for the open gym session in the following week, controlling for prior intention to engage in physical activity in the following week, was significant \( \chi^2 (2, n = 60) = 6.43, p < .05 \). In this model, message frame did not reach standard levels of significance. However, there was a trend for participants in the gain-framed group to sign-up more often than those in the loss-framed group. As observed in Table 5.2, participants who received a gain-framed message were 2.7 times more likely to sign up for an open gym session than those who received a loss-framed message (OR=2.72 95% CI: 0.90-8.21, Wald=3.14, \( p = .08 \))
5.6.2 Intentions.

As seen in Table 5.1, the univariate ANCOVA comparing intentions at Time 2, controlling for intentions at Time 1, revealed no significant differences between groups ($p$s>0.05). However, the effect was small-medium in size, $F = 1.61$, $d = 0.33$ (Cohen, 1992).

Table 5.2. Binary Logistic Regression Model Predicting Decisions (Open Gym Sign-Up) and Stair vs. Elevator Use.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sign-Up</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Intentions (Time 1)</td>
<td>$\chi^2(1)=3.15$</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>1.39 (0.96-2.03)</td>
</tr>
<tr>
<td>Step 2</td>
<td></td>
</tr>
<tr>
<td>Message Frame</td>
<td>$\chi^2(2)=6.43*$</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>2.72 (0.90-8.21)</td>
</tr>
<tr>
<td>Stairs vs. Elevator</td>
<td></td>
</tr>
<tr>
<td>Step 1</td>
<td></td>
</tr>
<tr>
<td>Message Frame</td>
<td>$\chi^2(1)=0.07$</td>
</tr>
<tr>
<td>OR (95% CI)</td>
<td>1.05 (0.41-3.21)</td>
</tr>
</tbody>
</table>

Note. *$p<.05$, **$p<.01$, OR = Odds Ratio, 95% CI = 95% Confidence Interval. The loss-framed group was set as the reference group (0) for the message frame variable while gain-framed was coded as 1. For outcome variables, stair use and not signing up for the open gym session were coded as 0, and elevator use and signing up for an at least one open gym session were coded as 1.

5.7 Behaviour

5.7.1 Self-Reported Physical Activity.

A univariate ANCOVA comparing IPAQ scores of participants in the gain- and loss-framed groups at Time 2 controlling for their IPAQ scores at Time 1 was conducted. As illustrated in Table 5.1, participants in the gain-framed group reported significantly more MET-min/week of physical activity compared to the loss-framed group one week following message exposure, $F(1,40)=5.60$, $p = .02$, $\eta^2 = 0.12$. 

58
5.7.2 Ratings of Perceived Exertion (RPE).

Separate univariate ANCOVAs controlling for treadmill speed were conducted. No differences were found between groups for measures of RPE at the 20 minute time point (ps > .05). However at 10 minutes into their workout, participants in the gain-framed group had significantly higher RPEs compared to the loss-framed group, $F(1,57) = 4.27, p = .04, \eta^2 = 0.07$.

5.7.3 Stairs vs. Elevator.

A binary logistic regression predicting whether or not participants took the stairs or elevator between the experimental and exercise phase of the study was conducted. Message frame was entered as a predictor. The model was not significant, $\chi^2 (1, n=60) = 0.07, p > .05$ indicating that message frame did not significantly predict whether or not participants took the stairs or elevator. Participants were equally likely to take the elevator, regardless of whether or not they received a gain- or loss-framed messages (OR=1.05 95% CI: 0.41-3.21, Wald = 0.07, $p = .793$) (see Table 5.2).

5.8 Mediation

As observed in Table 5.3, the mediation models revealed no significant indirect effects of attention, recall, attitudes or decision for any of the models described (ps > .05). When bootstrapping was applied, no mediating effects were found as indicated by the bias corrected, bias corrected and accelerated and percentile confidence intervals (all containing 0). As illustrated in Figure 5.1, models a, b and d demonstrate significant a paths ($b = -0.12, p < .05$, $b = -0.11, p < .05$, $b = -0.47, p < .001$ respectively). Additionally, path a approached significance in model c ($b = -0.16, p = .06$). Together these results indicate that message frame significantly predicts changes in the mediators (dwell, fixations, recall, and attitudes). However path b was not
significant in any of the mediation models ($ps < .05$) indicating that changes in the mediator was not significantly related to changes in the subsequent output variable, thus failing to produce any significant mediating effects.
Figure 5.1. Mediating role of attention, recall, attitudes and decisions on subsequent message outputs of the communication behaviour change model. Note. *p < .05, **p < .01, ***p < .001. Standardized beta path coefficients are shown. Covariates included in each model respectively are a) control ad dwell time, attitudes (Time 1) b) control ad fixations, attitudes (Time 1) c) attitudes (Time 1) d) intentions (Time 1) e) intentions (Time 1), f) intentions (Time 1), MET-min/week (Time 1), g) intentions (Time 1), speed h) intentions (Time 1). Adapted from “SPSS and SAS Procedures for Estimating Indirect Effects in Simple Mediation Models” by K.J.Preacher and A.F. Hayes, Behaviour Research Methods, 36, p.718. Copyright 2004 by the Psychonomic Society, Inc.
Table 5.3. *Independent Mediation Effects of Attention, Recall, Attitudes and Decisions on Subsequent Message Outputs of the CBC Model.*

<table>
<thead>
<tr>
<th>Model</th>
<th>Total Effect (c)</th>
<th>SE</th>
<th>Indirect Effect (ab)</th>
<th>Direct Effect (c')</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effect</td>
<td>SE</td>
<td>Effect</td>
<td>SE</td>
</tr>
<tr>
<td>a)</td>
<td>0.22</td>
<td>0.12</td>
<td>0.02</td>
<td>0.04</td>
</tr>
<tr>
<td>b)</td>
<td>0.23</td>
<td>0.12</td>
<td>0.02</td>
<td>0.03</td>
</tr>
<tr>
<td>c)</td>
<td>18.74***</td>
<td>4.96</td>
<td>-0.04</td>
<td>1.34</td>
</tr>
<tr>
<td>d)</td>
<td>1.19*</td>
<td>0.61</td>
<td>-0.20</td>
<td>0.47</td>
</tr>
<tr>
<td>e)</td>
<td>0.27</td>
<td>0.19</td>
<td>-0.12</td>
<td>0.12</td>
</tr>
<tr>
<td>f)</td>
<td>1331.63*</td>
<td>549.94</td>
<td>142.51</td>
<td>141.97</td>
</tr>
<tr>
<td>g)</td>
<td>0.93*</td>
<td>0.45</td>
<td>-0.09</td>
<td>0.13</td>
</tr>
<tr>
<td>h)</td>
<td>0.05</td>
<td>0.54</td>
<td>0.13</td>
<td>0.17</td>
</tr>
</tbody>
</table>

*Note. *p < .05, **p < .01, ***p < .001, SE = Standard Error. Unstandardized regression coefficients are shown. Covariates included in each model respectively are a) control ad dwell time, attitudes (Time 1) b) control ad fixations, attitudes (Time 1) c) attitudes (Time 1) d) intentions (Time 1) e) intentions (Time 1), f) intentions (Time 1), MET-min/week (Time 1), g) intentions (Time 1), speed h) intentions (Time 1).*
5.9 References


Chapter 6

Discussion

6.1 Summary of findings

The current study examined the message frame-behaviour relationship by looking at how message frame influences output variables outlined in the CBC model and their mediating effects on behaviour. As illustrated in Figure 6.1, a significant gain-framed advantage was found for message outputs of the model including attention, recall, and behaviour. A marginally significant trend favouring gain-framed messages was found for measures of attitudes and decisions. Taken together, these findings support the first hypothesis that gain-framed messages would be more effective than loss-framed messages at the measured output steps of the model. Although, a consistent gain-framed advantage was found at all of the examined levels of the CBC model, no mediating effects of any of the output variables were found (i.e., attention, attitudes, recall, decisions and behaviour). Thus, the second hypothesis was not supported. In the subsequent sections, these results are discussed along with study limitations and both the practical and the theoretical implications of the findings.
### Figure 6.1. McGuire's communication behaviour change model and summary of findings.

*Note. *Marginally Significant, **Significant

#### 6.1.1 Attention.

The CBC model states that manipulating the message component of a communication should first affect a viewer’s attention (McGuire, 1989). Our results demonstrated that the gain-framed messages attracted greater amounts of attention than the loss-framed messages as indicated by a larger number of fixations and longer dwell times directed towards the gain-framed ads. These results are consistent with the findings by Bassett, Latimer, & Martin Ginis, (in press) who found that gain-framed physical activity messages attracted greater amounts of...
attention than the loss-framed messages when examining measures of dwell time. Additionally, these results reflect the same pattern of findings as O'Keefe & Jensen (2008) who found that gain-framed messages elicited greater amounts of message processing. This finding is important because greater amounts of attention reflect greater message processing (Greenwald & Leavitt, 1984) and message processing is an important determinant of message persuasiveness (O'Keefe & Jensen, 2008). Therefore, the greater attention directed to gain-framed messages suggests that gain-framed messages may be more persuasive.

### 6.1.2 Attitudes.

Gain-framed messages also produced more favourable attitudes towards physical activity following message exposure compared to the loss-framed messages. Although only marginally significant, a medium effect size (Cohen’s $d = 0.5$, Cohen, 1992) was found which is contrary to the findings by Gallagher & Updegraff, (2011). They reported virtually no consistent effect of framed messages on attitudes for prevention behaviours in their meta-analysis of 94 message framing studies. However, the review did not look at attitudes within physical activity behaviour specifically.

Other possible explanations for the marginally significant effect may have been due to participants’ involvement with the messages. For instance, Muehling & Laczniak, (1988) found that for individuals who were not involved in the message, no significant influence of attitudes were found when measured immediately following ad exposure, but in those who were more involved, effects on attitudes were found. Because message involvement was not measured, it
cannot be confirmed if the marginally significant findings were due to low message involvement among some participants.

6.1.3 Recall.

The gain-framed advantage continued with the message recall results. The greater recall of gain- versus loss-framed messages is consistent with the findings by O’Malley et al.(in press) who found that gain-frame osteoporosis messages were recalled more accurately than loss-framed messages. If messages are better remembered then they can be stored in memory and later retrieved to be acted upon. Thus facilitating greater amounts of behaviour change (McGuire, 1989). However, the results from the current study differ from the findings by Bassett et al. (in press) which assessed recall of physical activity messages and found no significant differences between gain- and loss-framed groups. This difference in findings may have been due to the different recall assessments where the current study used picture prompts to aid in message recall, while the study by Bassett et al. (in press) did not. Previous research has shown that combining pictures with text can increase the recall of health education information compared to the text alone (Houts, Doak, Doak, & Loscalzo, 2006).

6.1.4 Decision Making.

Sign up for the open gym session was used as an indicator of participants’ decisions to become active in the following week. Results indicated a trend where individuals who received a gain-framed message were more likely to express interest in attending an open gym session than those who received a loss-framed message. Interestingly, this pattern of effects did not carry over to participants’ intentions to be active as no significant differences between groups were found.
regarding intentions to be physically active in the following week. Given that behaviour change occurred in the current study, the lack of concordant change in intentions is unexpected and contrary to many prominent behaviour change theories, including the theory of planned behaviour, where intentions are predictors of behaviour (Azjen, 1991). Moreover, several message framing studies have demonstrated that gain-framed messages have greater effects on intentions to be active than loss-framed messages (Hsiao, 2002; Latimer et al., 2008; Van't Riet, Ruiter, & Werrij, 2010). The lack of significant findings in the current study may have been because participants were recruited based on their intentions to increase their physical activity resulting in relatively high baseline intentions (M = 5.53 out of 7). Higher baseline levels of intentions leave limited room for improvement and thus reducing the variability of results making it more difficult for message frame to differentially impact intentions (Azjen, 2012).

The difference in findings between the sign-up and intention measures may have been due to differences in the level of commitment required for the decisions being made and thus influencing participants perceived level of control. For instance, sign-up indicated participants’ decisions to attend either one or two, hour long open-gym sessions in the following week (maximum 120 minutes of physical activity). On the other hand, intentions measured participants’ decision to meet Canada’s physical activity guidelines in the following week, which includes 150 minutes of aerobic activity plus strength straining two times per week. Committing to meeting the physical activity guidelines is a much larger commitment that individuals may feel they have less control over. Previous research has shown that an individual’s perceived

78
behavioural control can influence their decision or intentions to perform the behaviour (Azjen, 1991).

6.1.5 Behaviour Change.

Consistent with the meta-analysis by Gallagher and Updegraff (2011) the gain-framed messages resulted in significantly greater amounts of physical activity behaviour than the loss-framed messages one week following message exposure. The messages also had immediate effects on participants’ physical activity behaviour as indicated by their ratings of perceived exertion midway throughout their workouts. Ratings of perceived exertion (RPE) have been shown to correlate with both heart rate and workload suggesting that a higher RPE is indicative of greater amounts of physical activity and thus greater health benefits (Skinner, Hutsler, Bergsteinova, & Buskirk, 1973). However these differences in RPE were only found 10 minutes into their workout. The lack of significant differences between groups at the 20 minute time point (despite significant differences at 10 minutes) may have been due the fact that participants who were less exerted in the middle of the workout (because of a lower speed chosen) were now equally exerted as those who chose a higher speed due to the duration of the workout as duration of exercise has been shown to positively correlate with RPE (Noakes, 2004).

The second immediate effect of physical activity behaviour was the messages’ impact on stair versus elevator use. Message frame had no effect on whether or not participants took the stairs or the elevator and may have been influenced by a number of factors. For instance, the lack of differences between groups may have been due to a lower dose of messaging where only two of the 20 ads presented targeted this particular behaviour. Previous research has shown that
message dose can impact behaviour change. For example, Latimer et al., (2008) demonstrated that greater doses of framed messages resulted in differences in physical activity behaviour, whereas lower doses did not, suggesting that the low dose of stair use messages may have accounted for our lack of significant findings. Participants’ past behaviour may have also influenced these findings. Although all participants were taken up to the lab using same mode of transportation (i.e., elevator), some participants may have been habitual stairs users while others were habitual elevator users which may have influenced their behaviour during the experiment. Ouellete & Wood (1998), suggest that behaviours that are performed more frequently become habitual and are less likely to be changed. However, past behaviour for stair use was not measured and therefore could not be controlled for. Lastly, previous research has shown that ethnicity can influence stair use, as Caucasian individuals have been shown more likely to take the stairs (Anderson, Franckowiak, Snyder, Bartlett, & Fontaine, 1998). However, there were no ethnic differences between groups making it unlikely that ethnicity influenced these results.

Lastly, as hypothesized greater amounts of self-reported behaviour change were reported in the gain-framed group compared to the loss-framed group one week following message exposure. This finding is consistent with previous research that has used self-reported physical activity as an indicator of message effectiveness (Latimer et al., 2008) and support Rothman’s inference that prevention behaviours such as physical activity should be better promoted by gain-framed messages (Rothman et al., 1993; Rothman & Salovey, 1997a). Overall, aside from measures of stair versus elevator use, the gain-framed messages were more effective at producing behaviour change as indicated by self-reported behaviour and RPE at 10 minutes.
6.2 Mechanism of Message Framing

Because a consistent pattern was found among all measured output variables of the CBC model, it was expected that there would be a relationship between all mediating outcomes. However, our analyses revealed no mediating effects of attention, attitudes, recall or decisions within the message frame-behaviour relationship.

The first mediation analysis revealed no mediating effects of attention on attitudes. This may have been due to the way in which attention was measured. Although the quantity of attention was measured, the quality of this attention and message processing was not. Some participants may have been merely looking at the ad, without actively processing what they were seeing, thus preventing the messages from influencing their attitudes. Previous research using thought-listing as a measure of message processing found no relationship between attention towards a message and processing, suggesting that the quantity of attention may not be related to message processing (Bassett et al., in press).

Additionally, greater amounts of attention may not necessarily result in greater attitudes because there may be moderators of this relationship including the strength of the argument. Indeed, personal relevance has been shown to influence attention (Wingenfeld et al., 2006). Previous research has shown that argument strength moderated the relationship between personal relevance and attitudes where stronger arguments resulted in more positive attitudes when the relevance (and thus attention) is high, while for weaker arguments attitudes decreased as the relevance (and thus attention) increased (Rothman & Updegraff, 2011). Therefore, if an argument is weak and personally relevant, then paying more attention might further decrease
ones attitudes rather than increase them. On the other hand, if an argument is strong and personally relevant, paying more attention to the ad may further increase attitudes.

In the second mediation analysis attitudes may not have been a mediator of recall because the consistency of prior attitudes with the arguments presented in the messages may have moderated the relationship between attitudes and recall. It has been suggested that arguments which are consistent with an individual’s prior attitudes may not be better recalled than those that are inconsistent with attitudes because arguments that contradict their attitudes may be more novel and salient thus facilitating recall (Ross, McFarland, & Fletcher, 1981).

Recall also did not mediate the relationship between message frame and individuals’ decision to be active. Although message frame significantly influenced participants’ recall of the messages, greater recall may not have translated into their decisions because although they recalled the messages, they may not have been persuaded by it.

Lastly, decisions were not found to be mediators of behaviour because in order to establish mediation, the independent variable must have a significant effect on the mediator (path \( a \)) (Baron & Kenny, 1986). Because message frame did not significantly affect decisions (for reasons described above) no mediating effects could occur. Additionally, this finding was unexpected as decision-related constructs such as intentions are positioned as a determinant of behaviour in several behaviour change theories (Azjen, 1991; Schwarzer, 2008). However, few studies have found evidence supporting decision-related constructs as a mediator of intervention effects on behaviour (Rhodes & Pillaffi, 2010) suggesting that there may be alternative mediators to consider in the context of physical activity behaviour change.
Failure to find significant mediating effects at each level of the CBC model may also be due to the influence of an additional common mediator. One potential mediator that has been shown to impact message framing at a number of output steps of the CBC model is affect. Affect has been shown to influence attention, attitudes, recall and decision biases regarding persuasive messages and therefore may be a potential mediator within the CBC model. For example, Kou, Hsu, & Day, (2009) suggest that the frame of a message may influence an individual’s affective state which influences cognitive effort (as measured by attention) and in turn produces a framing effect. Additionally, an individual’s affective state, which could be induced by a framed message (Kou et al., 2009), has been shown to relate to individuals ability to recall a persuasive message as well as their resulting attitudes (Van't Riet, Ruiter, Werrij, Candel, & de Vries, 2010; Worth & Mackie, 1987). Lastly, previous research has shown that framing effects are associated with amygdala activity (an emotion processing area of the brain) suggesting that emotion or affect may be related to decision biases (De Martino, 2006). Together these studies demonstrate that the affect of an individual may play a role in framing effects and therefore may be influencing the relationships among the sub-steps of the CBC model, explaining our failure to find a relationship between them.

In addition to common mediators, there may also be a common moderator influencing path b of the mediation models. For instance, in the current study, significant effects of path a were found in almost all mediation models tested, however no significant effects of path b were found. This suggests that frame elicits change in an initial output (i.e., attention, recall, attitudes,
decision) (path $a$) but, as illustrated in Figure 6.2, an additional moderator may be influencing the ability to translate change in the first output into change in the subsequent output (path $b$).

![Diagram of mediation model]

*Figure 6.2. The influence of moderators on path $b$ of the mediation model.*

Because all outcomes measured were cognitive, it is possible that the type of cognitive processing an individual engages in may be moderating each of these outcomes. The elaboration likelihood model (Petty, Priester, & Brinol, 2002) describes two separate routes of processing including the central and peripheral route. The central route to persuasion occurs when individuals activate full cognitive activity to carefully scrutinize the information being presented. When individuals follow the central route of processing, attitude change is more resistant to counter-persuasion and is also more predictive of behaviour (Petty, Priester, & Brinol, 2002). The second route of processing is the peripheral route of processing which occurs when ones’ motivation or ability to process the message is low. In this route persuasion occurs through simple peripheral cues, which are susceptible to counter persuasion and not predictive of
behaviour. Therefore, the persuasiveness of a framed message may be dependent on whether a message is processed through the central or peripheral route of processing (Wegener, Petty, & Klein, 1994) and thus may be moderating the relationship between outputs of the CBC model.

For instance, message processing may moderate the relationship between attention and attitudes. Centrally processed messages that receive greater amounts of attention should result in greater attitudes because the messages are carefully thought out and deeply processed. In contrast, peripherally processed messages that receive greater amounts of attention, may not necessarily translate into greater attitudes because the messages that were attended to may be superficially processed and not fully scrutinized. If messages are attended to, but are not fully processed, then they may not be as persuasive, thus failing to impact attitude change. Therefore, the type of processing used (central or peripheral route) may be a moderator of framing effects.

6.3 Limitations

Although the results of this study provide evidence of the effects of message frame on the outputs of the CBC model as well as identify the lack of relationship between these outputs, there are number of limitations to be considered. First of all, because the sample was limited to low or moderately active female students, these results may not be generalizable to other segments of the population including men, as previous research has shown that gender may be a moderator of message framing effects (Kiene, Barta, Zelenski, & Cothran, 2005; Rothman et al., 1993). Additionally, although physical activity is generally perceived to have low risk, older populations including seniors may perceive physical activity to have greater risks (fearing
injuries, loss of balance etc), and therefore may be better promoted by loss-framed messages (Kahneman & Tversky, 1979) producing framing effects though different mechanisms.

Another limitation that is important to note is that although the gain- and loss-framed messages were created to match as closely as possible, the images within the gain and loss-framed conditions differed in order to preserve the ecological validity of the ads as most ad messages occur in the context with a picture. Therefore it is unclear whether or not framing effects were a result of the images or the messages in the ads. To address this issue, future research should examine both of these components in isolation. However this would undermine the ecological validity of the study as most health messages occur in combination with a corresponding image.

Additionally, physical activity was examined through measures of self-report. Even though the IPAQ has been shown to be a valid measure of physical activity (Craig et al., 2003; Ekelund, Sepp, Brage, Becker, & Jakes, 2005), participants in the gain-framed condition may have perceived the messages to be more persuasive, feeling compelled to reflect this in their physical activity report as a result of social desirability. Future research should examine physical activity using more objectives measures (such as a pedometer or accelerometer use).

As well, past behaviour of stair or elevator use was not examined and may have contributed to our lack of findings for measures of transport. For instance, past behaviour has been shown to be a strong predictor of future behaviour (Azjen, 1991) and even though all participants were taken up to the first lab using the same mode of transportation, their prior tendencies may have affected the mode of transportation (stairs versus elevator) that they used.
Future research using stair and elevator use as a behavioural outcome should assess past behaviour in order to control for its influence on future behaviour.

Two other methodological limitations include the length of the follow-up as well as the sample size. The one week follow-up allowed for the assessment of changes in physical activity but was not long enough to assess maintenance of this newly changed behaviour. Previous research examining framing effects on behaviour have demonstrated that at two weeks following message exposure message framing did not have any significant effects on behaviour (Latimer et al., 2008). Thus, the shorter one week follow-up assessment may not be reflective of the long terms effects of message framing. Another methodological limitation to consider is the smaller sample size. Although the study was adequately powered to detect significant effects for measures of attention and behaviour (the first and last outputs of the CBC model), this sample size may not have been large enough to detect effects for other outputs within the model such as attitudes or intentions which have been shown to have extremely small effects ($r = 0.039$, $r = 0.028$ respectively, (Gallagher and Updegraff, 2011). Thus, failure to detect significant differences among groups for measures of attitudes and intentions may have been due to low power.

Lastly, not all constructs of the CBC model were examined leaving gaps in the model that limit our ability to fully understand the mechanisms through which framing occurs.
6.4 Future Directions

The current study provides evidence of consistent (gain-framed) effects on mediators of the CBC model. However, where the research gap remains is in understanding the effects these mediators have on behaviour (Rothman & Updegraff, 2011). Future research should focus on identifying possible moderators of these mediating effects, specifically identifying which moderators are influential, the role they play in mediator effects on behaviour, as well examining the context in which they are occur.

Because no relationship between any of the output variables of the CBC model were found, thus challenging the tenants of the CBC model, future research should also consider investigating alternative communication models which may better explain the mechanism through which message framing impacts behaviour. Future research should also examine other types of prevention behaviours such as healthy eating, sun protection or flossing to examine if the same gain-framed pattern holds true. Detection behaviours should also be examined to identify if the gain-framed advantage is universal to all health behaviours or if a loss-framed advantage for detection behaviours is found as suggested by Rothman and Salovey (1997)

Additionally, the current study only manipulated the message input (message frame) of the CBC model. However, combining the effects of additional inputs such as manipulating the source or channel through which the message is provided may influence framing effects. Future research should examine how different input manipulations interact to influence framing effects on behaviour as well as the other outputs of the CBC model.
Lastly, alternative measures of each output can be examined including different measures of attention. For instance, future research should examine not only the quantity of attention directed towards the ad, but also of but also how an individual looks at an ad, examining viewing patterns and specific components within the ad that capture the most attention. Some components may be more effective at capturing attention than others and by examining the quality of attention being directed towards the ads, rather than the quantity, the effective components which may be contributing to framing effects can be identified.

Alternative eye tracking measures can also be used, including saccade duration (time spent transitioning between fixations), pupil monitoring and fixation durations (Rayner, 1998). Irwin, (1998) argued that some lexical processing occurs during saccades and may provide additional information on the amount of processing that is occurring when reading messages. Fixation durations have also been used as a common measure of attention (Rayner, 1998) and pupil monitoring can be used to assess pupil diameter which has been used as an indicator of processing while viewing a stimulus, and therefore may provide insight into the processing taking place during ad viewing (Kahneman & Beatty, 1966).

6.5 Theoretical Implications.

The current study is the first in framing research to examine the relationship between message processing and subsequent behaviour. Previous research identified framing effects on attention and recall (two indicators of message processing) but failed to identify the role this message processing plays in changing behaviour (Bassett et al., in press; O’Malley & Latimer, in
press). By examining behaviour in addition to these potential mediators, the current study is the first to identify that these mediators are not related to behaviour.

Additionally, previous research has often looked at a number of different mediators of the framing effects on behaviour individually. This is the first study to attempt to link all of these mediators together providing a new perspective within the framing literature of how these mediators may or may not be linked. Thus, the current study contributes to the message framing literature by examining both the effects on behaviour as well as the possible mediators of the relationship at a number of different output levels. Although no link between these mediators was found, the consistent pattern among findings provides further evidence supporting the fact that prevention behaviours such as physical activity are better promoted by gain-framed messages and suggests that there may be alternative mechanisms linking these effects together.

The type of behaviour examined is also unique to the field of message framing. Most framing studies have measured the delayed effects of message framing on physical activity behaviour by measuring behaviour through self-report after an extended period of time. However, by giving participants the opportunity to engage in physical activity immediately following messages exposure (i.e., workout on a treadmill and stair use), the acute effects of framing on behaviour were examined, which have not previously been investigated.

The study also contributes to the development and improvement of the CBC model as this was the first known study to have tested the CBC model and the proposed relationships between the mediating outcomes. While relationships among these outcomes were expected, no relationships were found thus challenging the sequence of outputs within the model and their
proposed relationships, allowing for future research to examine alternative ways through which messages influence behaviour.

6.6 Practical Implications.

Lastly, the results of the current study have practical implications for campaign designers who use health messages to target behaviour change. By providing further support that gain-framed messages are more effective at changing behaviour compared to loss-framed messages, practitioners should attempt to create their health messages highlighting the benefits of the behaviour rather than the costs when promoting physical activity. Furthermore, by identifying a gain-framed advantage throughout the output levels of the CBC model that extends beyond behaviour, future campaign designers can better create their messages to target all of these output levels knowing the effect that message framing has on them.

Additionally, due to the lack of evidence supporting meditational relationships between outcomes, it may be beneficial for practitioners to be strategic in developing messages that target a specific CBC output as targeting one of the outputs (e.g., attitudes) may not necessarily influence subsequent outputs (e.g., recall). For instance, in order to further enhance recall of gain-framed messages, practitioners should employ strategies to enhance message recall that do not entail attitude change. Rather, they might opt to create messages that are more salient or provide the messages through a credible source because these factors have been shown to influence recall directly (Hammond, 2011; Jones, Robert, & Courneya, 2003).
6.7 Conclusion

The current study examined the effects of message frame on the output variables of the CBC model as well as the mediating effects of these outputs in the message frame-behaviour relationship. The results provide evidence supporting a gain-framed effect of message frame on several potential mediators demonstrating that message framing has multiple benefits. For instance, gain-framed messages resulted in greater amounts of attention, better recall, more positive attitudes, better decisions and greater amounts of behaviour. However, no evidence was found supporting mediator effects within the message frame-behaviour relationship. These results provide increased evidence supporting the effectiveness of gain-framed messages for promoting physical activity and confirm the need for future research to examine additional mediators and potential moderators of these mediating effects. By contributing to the message framing literature it is hoped that the findings from this study will aid in health communication initiatives and help practitioners better promote physical activity among inactive adults.

6.8 References


Appendix A
Recruitment Materials

Recruitment Email

Hi,

You are being contacted because you have expressed interest in participating in one of our past eye tracking research studies.

We now have a NEW study underway and would like to invite you to participate.

The study, located on campus (Kinesiology Building KHS), will take approximately 1 hour to undertake. Upon completion, you’ll be given $20 to thank you for your time.

We will be conducting the experiment over the next few weeks. If you would like to be a research participant, please reply to this email and we can provide you with additional information.

In order to participate you must be a female, Queen’s student between the ages of 18-35, and have normal to corrected normal vision (contact lenses are fine, but please no glasses).

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

Erin Berenbaum
Principal Researcher
LOOKING FOR FEMALE PARTICIPANTS

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 fitness advertising

If you’re:

• Queen’s student
• aged 18-35
• female
• have normal to corrected-normal vision
  (ie: perfect vision, or wear contact lenses)

YOU’RE ELIGIBLE TO BE PART OF THIS STUDY!

As a participant, you’ll not only be helping to advance science,
but you’ll also receive $20 for your time (1 hour)

To become a research participant, and to find out more about the study
please contact eyetracking2012@gmail.com
Appendix B

Letter of Information

Hello,

Thank you for volunteering to participate in our research study involving eye tracking technology, advertisements and physical activity. This study is designed to assess what young adults pay attention to in advertisements. The study is being conducted by Assistant Professor, Dr. Amy Latimer, and MSc. candidate, Erin Berenbaum, 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 1 hour) meeting. The meeting will be held in the KHS building, room 402.

As a research participant, you will first complete a short questionnaire and will 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 several advertisements. The ads will be displayed on a special computer screen that tracks eye movements. 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. After completing the questionnaire, you will be asked to do a 20 minute bout of exercise on a treadmill at your own pace. One week following your session, you will be contacted for an online follow-up questionnaire.

If you choose to participate in this study, you may refuse to answer any questions or withdraw at anytime without any consequences. 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 $20 to thank you for your time. Participants who complete the follow-up questionnaires will be entered into a draw to win a $50 gift card to Lululemon.

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 Erin Berenbaum at 9eb31@queensu.ca or the primary Faculty Investigator, Dr. Amy Latimer at 613-533-6000, ext. 78773 or amy.latimer@queensu.ca. This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen’s policies. If you have any questions regarding your rights as a research participant, you may contact the Chair of the General Research Ethics Board 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,
Erin Berenbaum, MSc. Candidate
Dr. Amy Latimer, Assistant Professor
Appendix C

Pre-Screening Survey

The study is being conducted by Assistant Professor, Dr. Amy Latimer, Master’s student Erin Berenbaum, within the School of Kinesiology and Health Studies at Queen’s University.

This brief survey includes 20 questions. Your responses to these questions will determine whether you are eligible to participate in a study examining effective elements of advertisements. This survey will take 3 minutes to complete.

There are no known risks associated with completing this survey. You are free to withdraw at any time for whatever reason without penalty by just exiting the survey before the end. You are not obliged to answer any questions that you find objectionable. So that we can follow-up with you, your responses will not be anonymous. However, once we determine whether you are eligible to participate in the study, your responses to the screening survey will be given a code to keep your information anonymous.

If you have any questions or concerns about this research study, please feel free to contact Erin Berenbaum at 9eb31@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 Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

This study has been granted clearance according to the recommended principles of Canadian ethics guidelines, and Queen's policies.

Thank you again for your participation,

Erin Berenbaum, and Amy Latimer

If you consent to participate in this study, click “Next.” Otherwise, you may exit the study.

1. Name (please include first and last name)

2. Email Address (Note: This will not be shared with any other organization).

3. For confidentiality purposes, each participant will be identified using an ID code. Please create an ID code for yourself. Your ID code should include your initials followed by the last 4 digits of your cell phone number.(ie. EB3747)
Like most people, it is likely that you do not exercise as much as you would like. In fact, even the most disciplined people have difficulties doing as much exercise as they would wish to because of family demands, fatigue at the end of the working day, unexpected situations, etc. We need to understand how much exercise people are really doing. Please tell us what you are actually doing. Don't worry if you have not exercised as much as you wish you had. We need to know what is really happening, not what you think we 'want to hear'.

CANADA’S NEW PHYSICAL ACTIVITY GUIDELINES RECOMMEND THAT:

● Adults accumulate at least 150 minutes of moderate- to vigorous intensity aerobic exercise per week in bouts of 10 minutes or more.
● It is also beneficial to add muscles strengthening exercises using major muscle groups at least 2 days per week.

Note: This is exercise that you do during your spare time NOT something you have to do at work or around the house.

4. Think about your exercise in terms of Canada’s physical activity guidelines
Now, please tell me which of the following statements best describes you:

☐ A.) Yes, I have been doing the recommended amount of exercise EVERY week for MORE than 2 months.

☐ B.) No, I am not doing the recommended amount of every week but I do exercise and I DO NOT intend to make any changes to my weekly exercise in the next 2 months.

☐ C.) No, I am not doing the recommended amount of every week but I do exercise and I intend to start increasing my weekly exercise in the next 2 months.

☐ D.) No, I am not doing any exercise but I intend to begin doing exercise in the next 2 months

☐ E.) No, I am not doing the recommended amount of exercise and I do NOT intend to increase my exercise in the next 2 months.

☐ F.) None of these statements describe me.

Please answer the following questions regarding your ability to participate in physical activity.

5. Has your doctor ever said that you have a heart condition and that you should only do physical activity recommended by a doctor?

☐ Yes ☐ No
6. Do you feel pain in your chest when you do physical activity?
   ☐ Yes
   ☐ No

7. In the past month, have you had chest pain when you were not doing physical activity?
   ☐ Yes
   ☐ No

8. Do you lose your balance because of dizziness or do you ever lose consciousness?
   ☐ Yes
   ☐ No

9. Do you have a bone or joint problem (for example, back, knee or hip) that could be made worse by change in your physical activity?
   ☐ Yes
   ☐ No

10. Is your doctor currently prescribing drugs (for example, water pills) for your blood pressure or heart condition?
    ☐ Yes
    ☐ No

11. Do you know of any other reason why you should not do physical activity?
    ☐ Yes
    ☐ No

12. What is your age?

13. What is your gender?
    ☐ Male
    ☐ Female
    ☐ Other
14. Do you wear corrective lenses (i.e. glasses or contact lenses)?
   C  Yes
   C  No

15. Do you have contact lenses that you can wear during participation in the study?
   C  Yes
   C  No

16. Do you have any vision problem (other than near or far sightedness) that might prevent you from participating in an eye tracking study?
   C  Yes
   C  No
   If Yes, Please Explain

17. Are you currently a Queen’s University student?
   C  Yes
   C  No
   If No, Please specify

18. What level of education are you currently pursuing?
   C  Undergraduate degree
   C  Master’s degree
   C  PhD
   Other (please specify)

19. What is your program of study?

20. What is your mother tongue (first/primary language)?
   □  English
   □  French
   □  Spanish
   □  Arabic
   Other (please specify)
21. What is your ethnicity?

☐ Caucasian/White
☐ Black
☐ Asian
☐ Arabic
☐ Hispanic or Latino
☐ Indigenous or Aboriginal
☐ Multiracial
☐ Would rather not say

Other (please specify)

22. If you are not eligible to participate in this research project, can we contact you again in the future for other projects?

☐ Yes
☐ No

Thank you for completing the screening survey. If you are eligible we will contact you in the next week or so to set up an appointment. If you do not receive a follow-up email it means that you have not met one of the following eligibility criteria:

● Female
● Age 18-35
● Have contact lenses that you can wear during the experiment if you require corrective lenses
● No other vision problems
● No problems with physical activity
● Not meeting Canada’s physical activity guidelines (or not currently doing any exercise) but intend to increase their physical activity in the next 2 months

If you have any questions or concerns please do not hesitate to contact the researcher (Erin Berenbaum) at 9eb31@queensu.ca.

Thank you.
Appendix D
Consent Form

Dear participant,

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

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

PROCEDURES
As volunteer for this study, you have been asked to come into the laboratory for one, approximately one-hour session. The laboratory is located on the Queen’s campus in the Kinesiology and Health Studies Building (KHS), Room 402, Socio-cultural Studies and Health Promotion Lab.

Now at the lab you are asked to first complete a short questionnaire and will 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 several advertisements. The ads will be displayed on a special computer screen that tracks eye movements. 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. After completing the questionnaire, you will be asked to do a 20 minute bout of exercise on a treadmill at your own pace. One week following your session, you will be contacted for an online follow-up questionnaire. Participants who complete the follow-up questionnaires will be entered into a draw to win a $50 gift card to Lululemon.

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. If you choose to participate in this study, you may refuse to answer any questions or withdraw at anytime without any consequences.

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 the research study. The study has received ethics approval from the Queens’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 KHS 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 experience little if any pain or discomfort resulting from the eye tracking procedure. The eye tracker is self-contained and non-invasive. During the eye tracking procedure you will be asked to place your chin on a padded chin rest (limiting head movement) while looking at a computer screen. Doing so may result in dry eyes and, in the worst cases, a headache. However these symptoms pass quickly after the test and you may remove your head from the chin rest at any point during the experiment to relieve these symptoms if they occur.

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 $20 for your time. If you complete the follow-up questionnaires you also will be entered into a draw to win a $50 gift card to Lululemon. 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 Erin Berenbaum at 9eb31@queensu.ca or the primary Faculty Investigator, Dr. Amy Latimer at 613-533-6000, ext. 78773 or amy.latimer@queensu. If you have any questions regarding your rights as a research participant, you may contact the Chair of the General Research Ethics Board 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.

____________________________________
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 E
### Ad Content

**Ad Messages**

<table>
<thead>
<tr>
<th></th>
<th>Gain-Framed</th>
<th>Loss-Framed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Every step you take the more you improve your health. Take the stairs more often.</td>
<td>Every step you don’t take the more you lose out on your health. Take the stairs more often.</td>
</tr>
<tr>
<td>2</td>
<td>Working out at a higher intensity will help improve your cardiovascular fitness.</td>
<td>Failing to work out at a high enough intensity will prevent you from improving your cardiovascular fitness.</td>
</tr>
<tr>
<td>4</td>
<td>On the right track? Staying active reduces your risk of heart disease.</td>
<td>Not on the right track? Failing to stay active increases your risk of heart disease.</td>
</tr>
<tr>
<td>5</td>
<td>A healthy body means a healthy mind. Being active can help improve cognitive functioning.</td>
<td>A lazy body means a lazy mind. Being inactive won’t help to improve cognitive functioning.</td>
</tr>
<tr>
<td>6</td>
<td>Physical activity is as beneficial to your health as quitting smoking.</td>
<td>Physical inactivity is as harmful to your health as smoking!</td>
</tr>
<tr>
<td>7</td>
<td>Make death wait. Being active can increase your lifespan.</td>
<td>Death won’t wait. Being inactive can shorten your lifespan.</td>
</tr>
<tr>
<td>8</td>
<td>Regular exercise has been shown to help reduce your risk of developing breast cancer.</td>
<td>Lack of exercise has been shown to increase your risk of developing breast cancer.</td>
</tr>
<tr>
<td>9</td>
<td>Regular physical activity can improve your overall sense of well being and can contribute to positive mental health.</td>
<td>Physical inactivity can lower your overall sense of well being and can contribute to negative mental health.</td>
</tr>
<tr>
<td>10</td>
<td>You will feel more awake and energized with regular physical activity.</td>
<td>You will feel more tired and lethargic without regular physical activity.</td>
</tr>
<tr>
<td>11</td>
<td>Taking the stairs burns 5 times more calories than taking the elevator.</td>
<td>Taking the elevator burns 5 times fewer calories than taking the stairs.</td>
</tr>
<tr>
<td>12</td>
<td>Working out at a higher intensity will rev up your metabolism, and help to burn fat easily.</td>
<td>Avoiding high intensity workouts won’t boost your metabolism making it difficult to burn off fat.</td>
</tr>
<tr>
<td>13</td>
<td>Exercising on a regular basis can help you prevent you from gaining excess weight.</td>
<td>Failing to exercise on a regular basis can cause you to gain excess weight.</td>
</tr>
<tr>
<td></td>
<td>You can help tone your body by working out.</td>
<td>You can’t tone your body without working out.</td>
</tr>
<tr>
<td>---</td>
<td>-------------------------------------------</td>
<td>------------------------------------------------</td>
</tr>
<tr>
<td>14</td>
<td>Regular exercise can reduce body fat and increase your chances of getting lean.</td>
<td>Lack of exercise can increase body fat and decrease your chances of getting lean.</td>
</tr>
<tr>
<td>15</td>
<td>Exercise contributes to a toned, beach ready body.</td>
<td>Without exercise you won’t get a toned, beach ready body.</td>
</tr>
<tr>
<td>16</td>
<td>Improve your body composition with regular exercise.</td>
<td>Without regular exercise, your body composition won’t improve.</td>
</tr>
<tr>
<td>17</td>
<td>Being active helps you burn off extra calories.</td>
<td>You can’t burn off extra calories without being active.</td>
</tr>
<tr>
<td>18</td>
<td>Physical activity helps you stay in shape.</td>
<td>It’s hard to stay in shape without physical activity.</td>
</tr>
<tr>
<td>19</td>
<td>It’s easy to lose weight and attain that slim toned body with regular exercise.</td>
<td>It’s difficult to lose weight and attain a slim toned body without regular exercise.</td>
</tr>
<tr>
<td>20</td>
<td>Run like the wind. (running shoes ad)</td>
<td>Make a move.</td>
</tr>
<tr>
<td>21</td>
<td>Sweat it out. (workout clothes ad)</td>
<td>Stretch your limits. (yoga apparel)</td>
</tr>
<tr>
<td>22</td>
<td>Raise the bar.</td>
<td>Control Messages</td>
</tr>
<tr>
<td></td>
<td>Ad Images</td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>--------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------</td>
</tr>
<tr>
<td>1</td>
<td>Every step you take, the more you improve your health.</td>
<td>Every step you don’t take, the more you lose out on your health.</td>
</tr>
<tr>
<td>2</td>
<td>Working out at a higher intensity will improve your cardiovascular fitness.</td>
<td>Failing to work out at a high enough intensity will prevent you from improving your cardiovascular fitness.</td>
</tr>
<tr>
<td>3</td>
<td>Active today. Stronger Tomorrow.</td>
<td>Inactive today. Weaker Tomorrow.</td>
</tr>
<tr>
<td></td>
<td>On the right track?</td>
<td>Not on the right track?</td>
</tr>
<tr>
<td>---</td>
<td>---------------------</td>
<td>------------------------</td>
</tr>
<tr>
<td>4</td>
<td>Staying active reduces your risk of heart disease.</td>
<td>Failing to stay active increases your risk of heart disease.</td>
</tr>
<tr>
<td>5</td>
<td>A healthy body means a healthy mind. Being active can help improve cognitive functioning.</td>
<td>A lazy body means a lazy mind. Being inactive doesn’t help to improve cognitive functioning.</td>
</tr>
<tr>
<td>6</td>
<td>Physical activity is as beneficial to your health as quitting smoking.</td>
<td>Physical inactivity is as harmful to your health as smoking.</td>
</tr>
<tr>
<td>7</td>
<td>Being active can increase your lifespan.</td>
<td>Being inactive can shorten your lifespan.</td>
</tr>
<tr>
<td>8</td>
<td><img src="126x564.png" alt="Image" /></td>
<td>Regular exercise has been shown to reduce your risk of developing breast cancer.</td>
</tr>
<tr>
<td>----</td>
<td>----------------------</td>
<td>---------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>9</td>
<td><img src="127x419.png" alt="Image" /></td>
<td>Regular physical activity can improve your overall sense of well-being and can contribute to positive mental health.</td>
</tr>
<tr>
<td>10</td>
<td><img src="124x271.png" alt="Image" /></td>
<td>You will feel more awake and energized with regular physical activity.</td>
</tr>
<tr>
<td>Page</td>
<td>Image 1</td>
<td>Image 2</td>
</tr>
<tr>
<td>------</td>
<td>---------</td>
<td>---------</td>
</tr>
<tr>
<td>11</td>
<td>Taking the stairs burns 5 times more calories than taking the elevator.</td>
<td>Taking the elevator burns 5 times fewer calories than taking the stairs.</td>
</tr>
<tr>
<td>12</td>
<td>Working out at a higher intensity will rev up your metabolism and help to burn fat easily.</td>
<td>Avoiding high intensity workouts won’t boost your metabolism, making it difficult to burn off fat.</td>
</tr>
<tr>
<td>13</td>
<td>Exercising on a regular basis can help prevent you from gaining excess weight.</td>
<td>Failing to exercise on a regular basis can cause you to gain excess weight.</td>
</tr>
<tr>
<td><strong>14</strong></td>
<td><img src="image1" alt="Image of a person exercising" /></td>
<td><strong>15</strong></td>
</tr>
<tr>
<td>--------</td>
<td>----------------------------------------</td>
<td>--------</td>
</tr>
<tr>
<td>You can help tone your body by working out.</td>
<td>You can't tone your body without working out.</td>
<td>Regular exercise can reduce body fat and increase your chances of getting lean.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>16</strong></th>
<th><img src="image3" alt="Image of a toned, beach-ready body" /></th>
<th><strong>17</strong></th>
<th><img src="image4" alt="Image of a person measuring body composition" /></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exercise contributes to a toned, beach-ready body.</td>
<td>Without exercise, you won't have a toned, beach-ready body.</td>
<td>Improve your body composition with regular exercise.</td>
<td>Without regular exercise, your body composition won't improve.</td>
</tr>
</tbody>
</table>
Being active helps you burn extra calories.

You can't burn extra calories without being active.

Physical activity helps you stay in shape.

It's hard to stay in shape without physical activity.

It's easy to lose weight and attain a slim toned body with regular exercise.

It's difficult to lose weight and attain a slim toned body without regular exercise.

Run like the wind.
22 Sweat it out.

23 Stretch your limits.

24 Make a move.

25 Raise the bar.
Appendix F

Questionnaires

Attitudes and Intentions

For the following questions ‘being physically active’ is defined as ‘engaging in at least 150 minutes of moderate- to vigorous-intensity aerobic physical activity per week in bouts of 10 minutes or more and strength training two times per week’ Please refer to this definition when completing the questionnaire. Please circle the number that corresponds with your response.

Attitudes

Being physically active next week would be:

<table>
<thead>
<tr>
<th>Bad</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Good</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>6</td>
<td>7</td>
</tr>
</tbody>
</table>

Beneficial

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Worthless

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Un-enjoyable

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Pleasant

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Interesting

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Relaxing

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Intentions

I intend to be physically active next week.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Likely

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Unlikely

I will try to be physically active next week.

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Definitely true

<table>
<thead>
<tr>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
</table>

Definitely false
International Physical Activity Questionnaire (IPAQ)

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the last 7 days. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the vigorous activities that you did in the last 7 days. Vigorous physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

1. During the last 7 days, on how many days did you do vigorous physical activities like heavy lifting, digging, aerobics, or fast bicycling?
   
   _____ days per week

   [ ] No vigorous physical activities ➡️ Skip to question 3

2. How much time did you usually spend doing vigorous physical activities on one of those days?
   
   _____ hours per day
   _____ minutes per day

   [ ] Don’t know/Not sure

Think about all the moderate activities that you did in the last 7 days. Moderate activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal. Think only about those physical activities that you did for at least 10 minutes at a time.

3. During the last 7 days, on how many days did you do moderate physical activities like carrying light loads, bicycling at a regular pace, or doubles tennis? Do not include walking.

   _____ days per week

   [ ] No moderate physical activities ➡️ Skip to question 5
4. How much time did you usually spend doing moderate physical activities on one of those days?
   _____ hours per day
   _____ minutes per day

   □ Don’t know/Not sure

Think about the time you spent walking in the last 7 days. This includes at work and at home, walking to travel from place to place, and any other walking that you might do solely for recreation, sport, exercise, or leisure.

5. During the last 7 days, on how many days did you walk for at least 10 minutes at a time?
   _____ days per week

   □ No walking  ➔ Skip to question 7

6. How much time did you usually spend walking on one of those days?
   _____ hours per day
   _____ minutes per day

   □ Don’t know/Not sure

The last question is about the time you spent sitting on weekdays during the last 7 days. Include time spent at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading, or sitting or lying down to watch television.

7. During the last 7 days, how much time did you spend sitting on a week day?
   _____ hours per day
   _____ minutes per day

   □ Don’t know/Not sure
## Appendix G
### Ad Recall Answer Key

<table>
<thead>
<tr>
<th>Image Number</th>
<th>Gain</th>
<th>Loss</th>
</tr>
</thead>
</table>
| 11           | **G= Taking the stairs burns 5 times more calories than taking the elevator.**  
N= Stair climbing is a great form of exercise.  
G= Improve your muscle tone by taking the stairs.  
L= Avoiding the stairs won’t improve your muscle tone.  
L= Taking the elevator burns 5 times fewer calories than taking the stairs. | **G= Taking the stairs burns 5 times more calories than taking the elevator.**  
L= **Taking the elevator burns 5 times fewer calories than taking the stairs.**  
N= You have a choice. Avoid taking the elevator.  
G= Avoid taking the elevator and get a great workout.  
L= You’ll miss out on a great workout if you take the elevator. |
| 17           | **L= Without regular exercise, your body composition won’t improve**  
G= Lose weight with regular exercise.  
L= It’s difficult to lose weight without regular exercise.  
N= Controlling your weight has never been easier. | **N= Controlling your weight has never been easier.**  
G= Improve your body composition with regular exercise.  
L= **Without regular exercise, your body composition won’t improve.** |
| G= | Improve your body composition with regular exercise.  
L= It’s difficult to lose weight without regular exercise.  
N= The sky is the limit. |
|---|---|
| **7** | G= Gain the benefits exercise has to offer. Enjoy life.  
L= Being inactive can shorten your lifespan  
N= Mortality rates are highly predicted by your activity level.  
L= Being inactive can shorten your lifespan.  
G= Being active can increase your lifespan.  
| G= Being active can reduce your rate of mortality by 50%.  
G= Being active can increase your lifespan.  
L= You can increase your risk of mortality by 50% if you are not active.  
N= Your activity level can predict your |
| **8** | L= Lack of exercise has been shown to increase your risk of developing breast cancer.  
L= Inactivity is a risk factor for breast cancer.  
G= Regular exercise has been shown to help reduce your risk of developing breast cancer.  
G= Prevent breast cancer before it’s too late. Get active today.  
N= Your activity level can predict your |
| L= Lack of exercise has been shown to increase your risk of developing breast cancer.  
L= Inactivity is a risk factor for breast cancer.  
G= Regular exercise has been shown to help reduce your risk of developing breast cancer.  
G= Prevent breast cancer before it’s too late. Get active today.  
N= Your activity level can predict your |
<table>
<thead>
<tr>
<th></th>
<th>risk of breast cancer.</th>
<th>risk of breast cancer.</th>
</tr>
</thead>
</table>
| 14 | N= Strength training should be a key component to every workout.  
    | **G= You can help tone your body by working out.**  
    | L= You can’t tone your body without working out.  
    | G= Prevent muscle weakness by adding strength training to your workout.  
    | L= Your muscles may get weaker without incorporating strength training into your workout.  
    | **G= Prevent muscle weakness by adding strength training to your workout.**  
    | L= You can’t tone your body without working out.  
    | N= Strength training should be a key component to every workout.  |
| 3  | **G= Active today. Stronger tomorrow.**  
    | L= Inactive today. Weaker tomorrow.  
    | N= Push yourself everyday.  
    | G= Improve muscle strength with regular training.  
    | L= You won’t improve muscle strength without regular training.  
    | **G= Active today. Stronger tomorrow**  
    | N= Push yourself everyday.  
    | **L= Inactive today. Weaker tomorrow.**  
    | L= You won’t improve muscle strength without regular training.  |
|   | L= Without exercise you won’t have a toned, beach-ready body.  
N= It’s almost bikini season. Get fit today.  
**G= Exercise contributes to a toned, beach-ready body.**  
G= Feel confident on the beach. Get active today.  
L= You won’t feel as confident on the beach without regular exercise. | L= You won’t feel as confident on the beach without regular exercise.  
G= Exercise contributes to a toned, beach-ready body.  
G= Feel confident on the beach. Get active today.  
N= It’s almost bikini season. Get fit today.  
**L= Without exercise you won’t have a toned, beach-ready body.** |
|---|---|---|
|   | **G= Physical activity is as beneficial to your health as quitting smoking.**  
L= Smoking and inactivity result in poor health.  
G= Quitting smoking and increasing physical activity can improve your health.  
L= Physical inactivity is as harmful to your health as smoking!  
N= Avoid smoking. Get Active. | **G= Quitting smoking and increasing physical activity can improve your health.**  
L= Physical inactivity is as harmful to your health as smoking!  
G= Physical activity is as beneficial to your health as quitting smoking.  
L= Smoking and inactivity result in poor health.  
N= Avoid smoking. Get Active. |
| 18 | **G**= Being active helps you burn extra calories.  
**N**= Make exercise a part of your daily routine.  
**L**= You can’t burn extra calories without being active.  
**L**= You won’t have as much energy without physical activity.  
**G**= Regular exercise helps you gain energy.  
**L**= Extra calories contribute to unwanted weight gain.  
**G**= Reduce the calories you consume to prevent excess weight gain.  
**L**= You can’t burn off calories without being active.  
**N**= Watch what you eat. |
|---|---|
| 19 | **L**= It’s hard to stay in shape without physical activity.  
**G**= Add strength training to your workout for increased muscle tone.  
**L**= Without including strength training, it’s difficult to increase muscle tone.  
**N**= Keep in shape.  
**G**= Physical activity helps you stay in shape.  
**G**= Physical activity helps you stay in shape.  
**G**= Avoid excess weight with regular exercise.  
**L**= It’s difficult to lose weight without regular exercise.  
**N**= Keep in shape.  
**L**= It’s hard to stay in shape without physical activity. |
Appendix H
Debriefing Form

Dear Participant,

At the start of experiment you were told that the purpose of the study was to assess what young adults pay attention to in health advertisements. However, the actual purpose of the study was to examine differences in attention directed towards gain- and loss-framed messages and how attention directed towards these messages is related to behavior. In other words, we wanted to see how positive and negative messages affect what you paid attention to in the ads, and whether or not if affected your behaviour (ie., taking the stairs or elevator up to the lab, how hard you worked on the treadmill and if you signed up for the open gym session.)

We did not tell you everything about the purpose of the study because knowing the true purpose of the study may have affected how much attention you directed towards the advertisements as well as your physical activity behavior.

You are reminded that the original consent document stated that you had the right to withdraw your consent at any time and to discontinue participation in the study without any penalty. Additionally, 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.

If you have any concerns about your participation or the data you provided in light of this disclosure, please discuss this with us. We will be happy to provide any information we can to help answer any questions about the study.

As a research participant, you have the right to withdraw your data at any time. If you are unhappy about being deceived about the purpose of the study and would like to have your data withdrawn, please contact us and we will gladly do so. If you have any concerns about your rights as a research participant, you may contact the Chair of the General Research Ethics Board at chair.GREB@queensu.ca or 613-533-6081.

To keep the true nature of this experiment disclosed, please refrain from discussing this information with others who may become potential participants in the near future.

Thank you for your participation in this study.

Sincerely,
Erin Berenbaum, MSc. Candidate (9eb31@queensu.ca)
Dr. Amy Latimer, Assistant Professor (amy.latimer@queensu.ca)
Appendix I
Ethics Approval

February 28, 2012

Dear Amy,

RE: Amendment for your study entitled: GPHE-048-08 Using Eye-Tracking Technology to Determine the Effective Elements of Visual and Textual Advertisements, Ethics ROMEO# 6005803

Thank you for making these clarifications and changes to the protocol and LOI/CF. By this email, I am asking Gail Irving, Ethics Coordinator, to place this ethic clearance information in your file. Good luck with your study.

Joan Stevenson
GREB Chair