EMOTIONAL AND COGNITIVE PROCESSING
OF TRAFFIC SAFETY MESSAGES

A Thesis
presented to
the Faculty of the Graduate School
at the University of Missouri-Columbia

In Partial Fulfillment
of the Requirements for the Degree
Master of Arts

by
ANTHONY ALMOND

Dr. Paul D. Bolls, Thesis Supervisor

JULY 2013
The undersigned, appointed by the dean of the Graduate School, have examined the thesis entitled

EMOTIONAL AND COGNITIVE PROCESSING

OF TRAFFIC SAFETY MESSAGES

presented by Anthony Almond,

a candidate for the degree of master of arts,

and hereby certify that, in their opinion, it is worthy of acceptance.

____________________________________
Professor Paul Bolls

____________________________________
Professor Glenn Leshner

____________________________________
Professor Kevin Wise

____________________________________
Professor Timothy Trull
DEDICATION

This thesis project is dedicated to my family and friends.

Thank you to my mom, Carla Almond, and sister, Natalie Almond, for their love and constant support.

Thank you to Paul, Kevin, and Glenn for giving me the opportunity to work in the PRIME Lab and pushing me to be the best scholar possible.

Thank you to Paul and Val Bolls for the home cooked meals during my time in the graduate program.

I would especially like to thank my dad, Talmadge Almond, for encouraging me to pursue my dreams and attain the best education possible. You taught me I could do anything I set my mind to. You are my guardian angel and I miss you every day.
I would like to thank the PRIME Lab directors for allowing me to conduct this experiment using their supplies and facilities. I also want to thank my committee members for their advice and support throughout the entire process. I especially want to thank Dr. Paul Bolls for his constant support as my committee chair. If it were not for Dr. Bolls, I would be studying in a completely different field.

Thank you to the Missouri School of Journalism for providing me with the knowledge and skills to accomplish the task of completing a master’s degree. I would also like to thank Martha Pickens, Ginny Cowell, and Kathy Sharp for their help and support in making this project run as smoothly as possible.
TABLE OF CONTENTS

ACKNOWLEDGEMENTS ................................................................................................ ii
LIST OF ILLUSTRATIONS ............................................................................................. iv
LIST OF TABLES ........................................................................................................ v
ABSTRACT ................................................................................................................... vi

Chapter

1. INTRODUCTION .....................................................................................................1
2. LITERATURE REVIEW .......................................................................................... 4
3. METHODOLOGY .................................................................................................. 18
4. RESULTS ............................................................................................................... 25
5. DISCUSSION ......................................................................................................... 42

APPENDIX

1. TABLES OF MEASURES USED .......................................................................... 50

BIBLIOGRAPHY .............................................................................................................. 54
LIST OF ILLUSTRATIONS

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Interaction between message frame, empathy, and time on heart rate</td>
<td>26</td>
</tr>
<tr>
<td>2.</td>
<td>Main effect of empathy on heart rate</td>
<td>27</td>
</tr>
<tr>
<td>3.</td>
<td>Interaction between message frame and empathy on heart rate</td>
<td>28</td>
</tr>
<tr>
<td>4.</td>
<td>Interaction between message frame and time on heart rate</td>
<td>28</td>
</tr>
<tr>
<td>5.</td>
<td>Interaction between empathy and time on heart rate</td>
<td>29</td>
</tr>
<tr>
<td>6.</td>
<td>Interaction between message frame, empathy, and time on skin conductance</td>
<td>30</td>
</tr>
<tr>
<td>7.</td>
<td>Main effect of message frame on skin conductance</td>
<td>31</td>
</tr>
<tr>
<td>8.</td>
<td>Interaction between message frame and empathy on skin conductance</td>
<td>32</td>
</tr>
<tr>
<td>9.</td>
<td>Interaction between message frame and time on skin conductance</td>
<td>32</td>
</tr>
<tr>
<td>10.</td>
<td>Interaction between message frame, empathy, and time on zyogmaticus major and orbicularis oculi muscle region activity</td>
<td>33</td>
</tr>
<tr>
<td>11.</td>
<td>Interaction between empathy and time on zyogmaticus major and orbicularis oculi muscle region activity</td>
<td>34</td>
</tr>
<tr>
<td>12.</td>
<td>Interaction between message frame, empathy, and time on corrugator supercilii muscle region activity</td>
<td>35</td>
</tr>
<tr>
<td>13.</td>
<td>Main effect of empathy on corrugator supercilii muscle region activity</td>
<td>36</td>
</tr>
<tr>
<td>14.</td>
<td>Interaction between empathy and time on corrugator supercilii muscle region activity</td>
<td>36</td>
</tr>
<tr>
<td>15.</td>
<td>Interaction between message frame and empathy on attitude toward the message</td>
<td>38</td>
</tr>
<tr>
<td>16.</td>
<td>Interaction between message frame and empathy on behavioral intentions</td>
<td>39</td>
</tr>
<tr>
<td>17.</td>
<td>Interaction between message frame and empathy on perceived effectiveness</td>
<td>41</td>
</tr>
</tbody>
</table>
### LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Items and Subscales of Trait Empathy Scale</td>
<td>50</td>
</tr>
<tr>
<td>2. Items and Subscales of Impulsivity Scale</td>
<td>51</td>
</tr>
<tr>
<td>3. Items and Dimensions of the State Empathy Scale</td>
<td>53</td>
</tr>
<tr>
<td>4. Items of the Attitude Toward the Ad Scale</td>
<td>53</td>
</tr>
<tr>
<td>5. Items of the Behavioral Intentions Scale</td>
<td>53</td>
</tr>
<tr>
<td>6. Items of the Perceived Effectiveness Scale</td>
<td>53</td>
</tr>
</tbody>
</table>
This study examines the role of framing and empathy in persuasive messages. Twenty professionally produced traffic safety public service announcements (PSAs) were used as stimuli in a 2 (frame: gain v. loss) x 2 (empathy: high v. low) x 5 (message) repeated measure experiment. The 53 participants were instructed to watch each PSA presented in a random order while psychophysiological measures were recorded to index real-time cognitive and emotional processes engaged while viewing the messages along with various self-report items. Results show that viewers allocate the most cognitive resources to gain-framed high empathy messages followed by loss-framed high empathy messages. Loss-framed high empathy messages are the most arousing, while gain-framed high empathy messages are the least arousing suggesting a difference in how these types of messages are processed. Implication for the study of mediated empathy and the construction of traffic safety messages are discussed.
Introduction

The field of health communication presents many challenges in the design of media messages targeted at persuading individuals to make potential lifesaving decisions. In particular, one specific challenge is determining the type of emotional content that will lead to the enhancement of the cognitive and emotional processing of the message. More often than not, this comes down to using either positive or negative emotional content or the decision to use a gain or loss frame. Researchers in this area have developed a large body of research on the effects of emotional content such as fear (Leshner, Vultee, Bolls, & Moore, 2010), humor (Weinberger & Gulas, 1992), and empathy (Shen, 2010a) as well as the effects of gain versus loss frames (Rothman, Bartels, Wlaschin, & Salovey, 2006) on persuasion. It has been shown that empathy in message processing contributes both directly and indirectly to the persuasive effects of media messages, by reducing psychological reactance and facilitating involvement (Bae, 2008; Shen, 2010a) while literature on the cognitive processing of gain and loss frames is not yet fully developed. Additionally, research in health persuasion examining the intersection between gain and loss message frames and empathy is lacking. Moreover, research that is firmly grounded in theories of basic human motivational and emotional processes that are engaged when individuals mentally process and respond to this emotional content is missing. This kind of research would be able to provide insight into how individuals process various health messages during exposure as well as responses to the message leading to a more in-depth understanding of the persuasion process in health communication. This study is designed
to address this specific gap in the knowledge of how individuals process health messages and evaluate the effectiveness of message frame and empathy for using emotional content in health persuasion. The following general research question is investigated.

How do message frame and message empathy impact motivated processing of the message and outcomes related to health persuasion of traffic safety messages?

Lang’s (2009) limited capacity model of motivated mediated message processing (LC4MP) lays the theoretical framework for investigating this question. This model describes basic human motivational processes engaged while individuals are exposed to various media content that influence cognitive and emotional processing. Using the LC4MP, this study attempts to investigate how message empathy and gain/loss framed messages interact on how people process traffic safety messages. An experiment was conducted in which participants viewed gain- and loss-framed traffic safety public service announcements (PSAs) selected to vary in the level of empathy, either high or low. A team of researchers rated videos to determine what messages are high in empathy and low in empathy. The videos selected were categorized into four groups, gain framed high empathy messages, gain framed low empathy messages, loss framed high empathy messages, and loss framed low empathy messages. During exposure to the videos, psychophysiological measures were used to index cognitive resources allocated to encoding, arousal, positive emotional responding, and negative emotional responding. Self-report measures of perceived effectiveness, attitudes, and behavioral intentions were collected after each video as indices of message persuasiveness. The following paragraphs review the literature on empathy and message frames in health.
communication. This is followed by a review of the relevant aspects of the LC4MP and an application of the model to form the hypotheses of the study.
Message Framing

Message framing has been used as an important focus in health communication messages as a way to emphasize the gains and losses related to a particular health behavior as well as to enhance the persuasiveness of the message. Framing refers to “the way an issue is posed” (Myers, 2009, p. 381) or the specific way in which information is presented in order to guide an individual’s processing and perceptions of a message (Entman, 1993). Gain-framed messages emphasize the benefits or advantages of adopting a certain behavior. These messages portray the likelihood of gaining something by doing the recommended behavior. For example, a traffic safety PSA that shows someone arriving home alive because they used a sober driver after drinking. Loss-framed messages emphasize the costs or disadvantages of the behavior. These messages portray the likelihood a person will lose something or not be successful if the recommended behavior is not adopted (Gallagher & Updegraff, 2012; Rothman & Salovey, 1997). For example, a PSA that shows the negative consequences of drinking and driving.

Initial research into the effectiveness of message framing led researchers to conclude that loss-framed messages were more effective than gain-framed messages. Maheswaran and Meyers-Levy (1990) examined message framing in the context of acquiring coronary heart disease and the use of diagnostic blood test to identify their cholesterol level and thus the individual’s risk of heart disease. In the gain-framed condition, participants read a booklet that told them they would have an increased chance
of determining their risk of getting heart disease. In the loss-framed condition, participants read a booklet that told them they would lose important health information about their risk for heart disease and would have a decreased chance of knowing if they are at risk. They found that participants in the loss-framed condition had more favorable attitudes toward taking the diagnostic blood test. Similarly, Meyerowitz and Chaiken (1987) examined message framing in breast self-examination messages. In the loss-framed condition participants were given a pamphlet that said they would have a decreased chance of finding a tumor if they did not engage in detection behaviors, while in the gain-framed condition, the pamphlet told them they had an increased chance of finding a tumor if they perform the breast self-exam. Like the previous study, they found participants in the loss-framed condition had more positive attitudes toward performing breast self-examinations. These studies led scholars to establish that loss frames are more effective than gain frames.

However, Rothman and Salovey (1997) suggested that the relative effectiveness of a gain- or loss-framed message depends on whether a behavior serves an illness-detecting or health-affirming function. Schneider et al. (2001) argue that detection behaviors (e.g. cholesterol testing, breast cancer screenings, HIV testing) generally involve risk and uncertainty and that loss-framed messages help to create a willingness to deal with the outcome, whereas prevention behaviors (e.g. smoking cessation) have little uncertainty and risk and that gain-framed messages would help to motivate individuals to engage in the prevention behavior. They found that in the context of cigarette smoking, gain framed messages are indeed more effective. The research that followed
demonstrated that gain-framed messages were more effective for the more risk-averse prevention behaviors, while loss-framed messages were more effective for the more risk-seeking detecting behaviors (Banks et al., 1995; Rothman et al., 2006; Salovey & Williams-Piehota, 2004).

In order to resolve opposing facts and discrepancies in the framing literature, researchers began focusing on detailed message processing and cognitive processing of information in regards to message frames. For example, Maheswaran and Meyers-Levy (1990), tested the influence of message framing and issue involvement with heart disease detection behaviors. They used gain- and loss-framed messages that promoted getting cholesterol blood tests and found that loss-framed messages may be more persuasive when issue involvement is high, but gain-framed messages are more effective with issue involvement is low. The loss messages were more effective because they were encouraging a risky behavior. On the other hand, Millar and Millar (2000) tested the effects of message framing and issue involvement on safe driving information and found that when issue involvement was high, gain-framed messages were more effective than loss-framed messages. Here, the gain-framed messages were more effective because they were encouraging a cautious behavior. This difference in results can be explained by prospect theory (Kahneman & Tversky, 1979), from which framing is based on, which suggests people are risk seeking when presented with a choice involving a loss, such as in Maheswaran and Levy’s study, and risk averse when presented with a choice involving a gain, such as in Millar and Millar.
The current study seeks to extend the literature on gain and loss frames on prevention behaviors, specifically safe driving, and test the effect message empathy has on framing. The following paragraphs review relevant research on empathy and how its potential effects on framing.

**Empathy**

The study of empathy in communication research can be categorized along two dimensions: (1) trait versus state empathy (Omdahl, 1995; Stiff, Dillard, Somera, Kim, & Sleight, 1988) and (2) empathy in message production (Bylund & Makoul, 2005; Egbert & Parrott, 2003; Williams, 1990) versus in message processing (Bagozzi & Moore, 1994; Campbell & Babrow, 2004). Trait empathy refers to an inherent ability to feel empathy, while state empathy refers to empathy experienced in response to a stimulus or event. Message production in empathy research refers to how the message is put together and presented, while message processing refers to studying processes and effects that occur as a result of viewing the message. Early studies of empathy tend to focus on trait empathy in message production; few attempt to understand state empathy in message processing. To best understand the role of empathy in health persuasion, this study will focus on state empathy in message processing.

The term empathy describes a multidimensional phenomenon that has not yet been fully conceptualized or explicated. Within the existing research literature that spans research fields from philosophy and evolutionary biology to social psychology and neuroscience, empathy has been defined as a variety of different emotional responses. The most commonly agreed upon dimensions of empathy include both affective and
cognitive components (Davis, 1980; Decety, 2011; Escalas & Stern, 2003; Niedenthal, Krauth-Gruber, & Ric, 2006; Preston & de Waal, 2002). Cognitive empathy refers to recognizing and understanding another person’s perspective; thus, cognitive empathy can be explicitly described as the “successful estimation of other’s people thoughts and feelings” (Davis, 1994; Dethier & Blairy, 2012, p. 371), whereas affective empathy comprises the sharing of another person’s feelings (Bandura, 2002; Davis, 1980; Zillmann, 2006). These two components of empathy are closely related and constitute “an interdependent system in which each influences the other” (Davis, 1980, p. 86).

Therefore, empathy involves the understanding, or recognition, of another person’s situation and the sharing, or experiencing, of his or her feelings. For example, one may feel sad for a person who was injured as a result of unsafe driving without understanding his or her perspective, thoughts, and emotions. Alternatively, one may understand the situation, thoughts, and feelings of an individual who was injured and feel concerned for that person but not share the other’s feelings. That would be sympathy. Empathy involves both. It is not feelings about or for another who practices unsafe driving habits, but rather feeling with that other person based on a connection with that person’s situation.

The affective component of empathy refers to the experience of affective responses to another person’s experience and emotional expression. This involves the sharing of emotion (Decety & Jackson, 2006; Lazarus, 1991; Smith, 2006; Zillmann, 2006). This component only refers to the sharing of emotion at a larger valence level: sharing of positive or negative emotions, rather than specific discreet emotions (Mehrabian & Epstein, 1972). The majority of research in the area of empathy has
focused on the sharing of negative emotions (e.g. pain and suffering, distress, etc.), but it is important to note that the affective component refers to sharing both positive and negative emotional experiences (Jabbi, Swart, & Keysers, 2007; Preston & de Waal, 2002). It is also important to understand that this component of empathy is not a discrete emotion itself in that it can include the sharing of multiple emotions (e.g. fear and anger or happiness and surprise), rather than just one at a time (Lazarus, 1991).

The cognitive component on the other hand refers to perspective taking or recognition of another person’s point of view. The perspective taking involved in empathy encompasses the sharing of various cognitive appraisals of a person’s situation and environment (Lazarus, 1991). These shared appraisals then elicit the shared emotions. A study of empathy must include both the cognitive and affective components of empathy, as the sharing of affect without cognition is simply mimicry, while the sharing of cognition without affect is sympathy (Eisenberg & Miller, 1987; Goldie, 1999).

Empathy has to be distinguished from similar concepts such as sympathy and personal distress. The experience of empathy can lead to personal distress if it is too intense and/or aversive. Personal distress is characterized as a self-focused – in contrast to the other-focused reactions of empathy and sympathy – and aversive reaction to another person’s emotion, like anxiety or discomfort (Davis, 1980; Decety, 2011; Eisenberg, 2002). Sympathy stems from the understanding of another person’s state; however, it does not necessarily encompass shared feelings, but rather consists of feelings of compassion for the other person and is also referred to as empathic concern (Davis,
1980; Decety, 2011; Eisenberg, 2002). It does not have to be congruent with the feelings of others but is a rather specific negative affective state of compassion or concern with a clear distinction between the self and the other (Eisenberg & Fabes, 1990; Gruen & Mendelsohn, 1986; Preston & de Waal, 2002). On the other hand, empathic responses involve a matching of affect between an observer and an observed person, including both positive and negative valenced emotions, with no self/other distinction (Mehrabian & Epstein, 1972; Preston & de Waal, 2002).

When individuals process a health message, such as a traffic safety PSA, the message may either be a message that is classified as a high empathy message, a low empathy message, or somewhere in between. For the purposes of this study, only high and low empathy messages will be considered. Shen (2010a, 2010b) classified messages into high and low empathy messages by having a team of researchers rate television PSAs based on three criteria: (1) how much pain, suffering, and/or distress is portrayed by the characters, (2) how realistic the message is, and (3) to what degree the message is affect laded. Shen selected the top five as the high empathy messages and the bottom five as the low empathy messages. Though this may not represent all the factors that go into making a message a high or low empathy message, it gives an example of what these types of messages look like. Low empathy messages would not contain a character’s emotional response or have no characters at all (e.g. text only or video without people), be unrealistic (e.g. animation, overly dramatic portrayals), and would likely use facts and not appeal to people’s emotions. On the other hand, high empathy messages would be just the opposite. They would have characters that show some sort of emotional response,
either positive or negative, be true to life, and would make a strong appeal to the viewer’s emotions.

**Framing in Studies of Empathy and Persuasion**

As stated earlier, empathy can be the sharing of both positive and negative affect. However, the vast majority of literature on empathy is heavily focused on the sharing of negative affect. Shen (2010a) examined the role empathy plays in mitigating psychological reactance in persuasive messages. Participants viewed negatively valenced antismoking or drunk driving public service announcements that varied in the level of empathy. Shen found that state empathy in processing messages contributes both directly and indirectly, by reducing psychological reactance and facilitating involvement, to persuasive effects of media messages. Results indicated that state empathy has a unique contribution to predicting persuasion outcomes such as perceived message effectiveness and attitude and that state empathy had an indirect effect on persuasion by mitigating psychological reactance. Higher levels of state empathy significantly predicted better perceived effectiveness and better attitudes and reduced psychological reactance to the messages. Even fewer studies have looked at the sharing of positive emotions. For example, Jabbi et al. (2007) exposed participants to food-related disgust, pleased, and neutral faces during functional magnetic resonance imaging and measured participant’s self-reported empathy. They found that empathy scores were predictive of activation in the part of the brain associated with empathy for both positive and negative stimuli. Finally, empathy research examining the use of positive messages in a persuasive context is nearly non-existent. Not all persuasive health messages portray the outcome of a
particular behavior in a negative manner, making it important to consider how a message is framed when studying empathy and persuasion.

A theoretical perspective useful in examining how message frames and message empathy may impact processing of persuasive messages, specifically traffic safety messages, is the limited capacity model of motivated mediated message processing (LC4MP) as described by Lang (2009). A review of the relevant aspects of the model is described below.

**Limited Capacity Model of Motivated Mediated Message Processing**

The strength of this perspective is that it was specifically developed to investigate the real-time processing of mediated messages and is applicable to a variety of media types and messages, such as traffic safety PSAs. The LC4MP is useful in understanding what people attend to and remember after interacting with a media message. Within this model, humans have a limited amount of cognitive resources available to allocate to processing, understanding, and remembering information they encounter in their environment. Specific mental tasks that are activated during information processing include encoding, storage, and retrieval. These tasks are continuously and concurrently performed over time. The human cognitive system selects which information is to be encoded into working memory and stored into working memory based on the information’s motivational relevance. While this happens, information already stored in long term memory is retrieved. The limited cognitive resources are not necessarily equally divided between these three tasks, but are rather transferred between encoding,
storage, and retrieval depending on the needs of the cognitive system at a given moment in time (Lang, 2009).

Not only is the LC4MP useful in understanding information processing, it is also a great model for understanding motivational and emotional processes engaged during mediated message processing. Processing of information is driven by basic motivational systems of the brain: the appetitive and aversive systems (P. J. Lang & Bradley, 2010). While appetitive activation motivates greater attention or allocation of resources toward encoding a media message, the activation of the aversive system causes an initial automatic allocation of resources, followed by withdrawal from a media message should the message become too aversive (Bradley, Codispoti, Cuthbert, & Lang, 2001; Leshner, Bolls, & Thomas, 2009). The principal job of the brain is to identify the motivational relevance of stimuli encountered in the environment and carry out adaptive responses through motivational activation (P. J. Lang & Bradley, 2010). These adaptive responses can include variation in cognitive resources allocated to encoding, storage, and retrieval, affective feelings, and behavioral responses (A. Lang, 2009; Yegiyan & Lang, 2010).

Emotional content requires more resources to be processed than non-emotional message content (Lang et al 1999, Lang et al 1995, Newhagen & Reeves, 1992). One way of assessing processing resources is through the use of heart rate to index cognitive resources allocated to encoding. Heart rate decelerates as a person allocates more cognitive resources to encoding information from the environment (A. Lang, 1994). Previous research by Bolls, Lang, & Potter (2001) has indeed shown that heart rate deceleration signifies more resources allocated to encoding of a mediated message. Since
the messages involve prevention behaviors, gain framed messages should elicit more
cognitive resources to encoding than loss-framed messages. Also, if high empathy
messages are more emotional and arousing, then high empathy messages should elicit
more cognitive resources to encoding. This leads to the following hypothesis:

H1: Gain-framed high empathy messages will result in greater resources allocated to
encoding as evidenced by heart rated deceleration than either gain-framed low
empathy messages, or any of the loss-framed messages.

Not only does emotional content require more resources to be processed, it is also
more motivationally relevant than non-emotional content (Lang, 2009). Skin conductance
has been extensively used to gain insight into the impact of media on psychological
arousal (Lang, Chung, Lee, Schwartz, & Shin, 2005; Ravaja, 2009). Activity in the
sympathetic nervous system, as indicated by skin conductance, is positively related to
motivational activation (Dawson, Schell, & Filion, 2007). So, due to a negativity bias, if
loss-framed messages activate the aversive system, then loss-framed messages should be
more motivationally relevant. Also, if high empathy messages are more arousing, then
higher empathy messages should be more motivationally relevant as well. This leads to
the following hypotheses:

H2: Loss-framed high empathy messages will result in greater psychological arousal
than either the loss-framed low empathy messages, or any of the gain-framed
messages as evidenced by higher skin conductance level.
H3: Gain-framed high empathy messages will result in greater psychological arousal than gain-framed low empathy messages as evidenced by higher skin conductance level.

Facial electromyography (EMG) has been used to index emotional valence of mediated messages. Overall, the corrugator muscle region has been used to index the strength of negative emotional responding to media (Bolls, Miles, & Zhang, 2006; Leshner, Bolls, & Wise, 2011; R. Potter, LaTour, Braun-LaTour, & Reichert, 2006). Moreover, activity in this region is related to negative emotional responding across time (Tassinary & Cacioppo, 2000). Likewise, the zygomaticus major and orbicularis oculi muscle regions have been used to index the strength of positive emotional responding to media (Bolls, Lang, & Potter, 2001; Larsen, Norris, & Cacioppo, 2003; Ravaja, Saari, Kallinen, & Laarni, 2006). Activity in these facial muscles is also positively related to positive emotional responding across time (Tassinary & Cacioppo, 2000). Co-activation of these two facial regions has been termed the Duchenne smile (Ekman, 1989). In order to truly reflect pleasantness, both muscle regions are recorded. This leads to the following hypotheses:

H4: Gain-framed high empathy messages will result in the greatest positive emotional response as evidenced by zygomaticus major and orbicularis oculi muscle region activity followed by gain-framed low empathy messages, loss-framed low empathy messages, and then loss-framed high empathy messages resulting in the least positive emotional response.
H5: Loss-framed high empathy messages will result in the most negative emotional response as evidenced by corrugator supercili muscle region activity followed by loss-framed low empathy messages, gain-framed low empathy messages, and then gain-framed high empathy messages resulting in the least negative emotional response.

Incorporating meaningful self-report measures of psychological states emerging from embodied motivated processing of media messages in experimental research significantly increases knowledge of how the mind processes specific kinds of messages (R. F. Potter & Bolls, 2011). This is clearly the case in advertising and health communication research where self-report measures are extensively used to index responses believed to be related to persuasion. Several message perceptions thought to be involved in determining the effectiveness of health messages are indexed here. These include perceived effectiveness, attitude toward the ad, and behavioral intentions. The following hypotheses are proposed:

H6a: Gain-framed high empathy messages will result in the most favorable attitudes followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.

H6b: Gain-framed high empathy messages will result in the most reported behavioral intentions to drive safe followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.
H6c: Gain-framed high empathy messages will result in the greatest effectiveness followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.

In this experiment the impact of message framing and message empathy on these message perceptions variables will be tested and any relationships with embodied motivated processing of these health messages will be discussed.

To investigate the hypotheses presented, the following methodology is proposed.
Methodology

Study Design and Participants

The data for this study were collected in an experiment that employed a 2
(Empathy: high vs. low) × 2 (Message Frame: gain vs. loss) × 5 (Messages) × 4 (Order)
mixed design. Empathy and Message Frame was manipulated within-subjects. Message
was a with-in subjects replication factor. Order was between-subjects factor and the four
order conditions were organized randomly and without placing videos in the same spot or
order more than once. Order was a between subjects factor with participants being
randomly assigned to view the messages in one of the four orders. Clips used as stimulus
material were selected from public service announcements revolving around various
traffic safety issues such as drinking and driving, texting and driving, and safety belt use.
The clips were manipulated based on the level of Empathy, either high or low, as well as
the Message Frame, which refers to whether or not the PSA is a gain-framed or loss-
framed message.

A power analysis using G*Power (Faul, Erdfelder, Lang, & Buchner, 2007) was
conducted to determine the necessary sample size needed for this study. Parameters
chosen for the power analysis were selected based on the statistical test with the least
power, this being a repeated measures ANOVA for the self-report questions. If the
sample size is met for this test, then all other statistical test should be sufficiently
powered using the same sample size. Using the ANOVA: repeated measures, within
factors statistical test with an effect size of $f = 0.15$, $\alpha = 0.05$, power $= 0.9$, four groups,
and 20 measurements, the results indicated that a total sample size of 32 is necessary.

Fifty-three participants were recruited from the general population via mass e-mail. There were 34 women and 19 men ($M_{age} = 33.75, SD = 11.86$). Forty participants identified themselves as White or Caucasian, five as Black or African American, three as Hispanic, four as Asian, and one as “other”. Participants were offered twenty dollars as compensation for participating in the study.

**Stimulus Materials**

Stimuli were selected from a collection of traffic safety PSAs produced in English. A total of 20 messages were shown. Stimuli varied in message framing and empathy. Overall, there were four messages in each of the four conditions, high empathy gain-framed messages, high empathy loss-framed messages, low empathy gain-framed messages, and low empathy loss-framed messages. MediaLab and DirectRT software was used for stimulus presentation.

**Independent Variables**

Message framing is conceptualized as the specific way in which information in a message is presented, either as a gain or a loss. Gain-framed messages used copy and visuals to show the benefits or advantages of engaging in a certain behavior while loss-framed messages used copy and visuals to show the cost or disadvantages of engaging in the specified behavior such as not texting and driving, not drinking and driving, seat belt use, and going the speed limit.

Empathy is conceptualized as a specific way a message is produced in order to cause the viewer to empathize with the characters portrayed in the message. Shen’s
(2010a) method of classifying messages as high or low empathy was replicated. A team of six researchers rated a pool of 60 traffic safety videos, 30 gain-framed and 30 loss-framed, on the following four categories: (1) to what degree the message showed a character’s emotional response, (2) to what degree the message was realistic, (3) to what degree the message is emotional, and (4) to what degree the message portrays a character’s point of view. Twenty ads were chosen as the stimuli for this study based on responses to the four questions. The top five messages within each message frame were selected as high empathy messages, and the bottom five as low empathy messages. The high empathy ads, $M = 6.21$ $SE = 0.42$, were significantly different from the low empathy ads, $M = 3.69$ $SD = 0.53$; $F(1, 5) = 83.22$, $p = .001$.

**Dependent Variables**

Cognitive resources allocated to encoding is conceptualized as mental effort invested in forming a short term working memory representation of information contained in the videos. This was measured by obtaining an electrocardiogram (ECG) on participants by recording electrical activity of the heart. The ECG will be recording heart rate as the length and time between R spikes in the QRS complex of the ECG waveform. Heart rate will be recorded for a 5 second baseline period prior to the onset of each message, as well as time locked to message exposure. The signal will be obtained by utilizing a Lead I placement of 8 mm Ag/AgCl disposable electrodes on the left and right forearms and left wrist. The signal will be amplified using a gain setting of 5K, a low pass filter will be set to 35 Hz, a high pass filter will be set to 0.5 Hz, and the signal will be sampled at 500 Hz.
Psychological arousal/motivation activation is conceptualized as the intensity of evoked sympathetic arousal during exposure to the messages. This dependent variable will be indexed by recording participants’ galvanic skin conductance level for a 5 second baseline period prior to the onset of each message, as well as time locked to message exposure. Skin conductance will be recorded utilizing a bipolar placement of 8 mm Ag/AgCl disposable electrodes on the palmer surface of the participant’s non-dominant hand. A 0.5 V, DC excitation voltage will be generated from a skin conductance coupler for signal recording. The signal will be amplified using a gain setting of 5 µΩ/V, a low pass filter will be set to 10 Hz, and the signal will be sampled at 500 Hz.

Positive emotional experience is defined as variation in emotional activity in the positive valence dimension of emotion. It will be indexed by recording the facial EMG signal from the zygomaticus major and orbicularis oculi facial muscle regions. Negative emotional experience is defined as variation in emotional activity in the negative valence dimension of emotion. It will be indexed by recording the facial EMG signal from the corrugator facial muscle region. The facial EMG signals will be recorded utilizing a bipolar placement of 4 mm Ag/AgCl shielded, floating electrodes filled with electrolyte gel for a 5 second baseline period prior to the onset of each message, as well as time locked to message exposure. The signals will be amplified using a gain setting of 5K, a low pass filter will be set to 500 Hz, a high pass filter will be set to 10 Hz, and the signals will be sampled at 500 Hz.

Attitude toward the message was measured by three 7-point Likert-type scale items (Bruner, 2009). The items making up this scale are displayed in Table 4.
Cronbach’s alpha by condition were, 0.83 (gain-frame, high-empathy), 0.77 (gain-frame, low-empathy), 0.86 (loss-frame, high-empathy), and 0.85 (loss-frame, low-empathy).

Behavioral intentions was measured to assess how likely the participant would be to adopt the recommended health behavior of the message (Bruner, 2009). The items making up this scale are displayed in Table 5. Cronbach’s alpha by condition were, 0.91 (gain-frame, high-empathy), 0.94 (gain-frame, low-empathy), 0.91 (loss-frame, high-empathy), and 0.93 (loss-frame, low-empathy).

Perceived effectiveness was measured by two 7-point Likert-type scales (Bruner, 2009). Items making up this scale are displayed in Table 6. Cronbach’s alpha by condition were, 0.78 (gain-frame, high-empathy), 0.81 (gain-frame, low-empathy), 0.82 (loss-frame, high-empathy), and 0.86 (loss-frame, low-empathy).

State empathy is conceptualized as the level of empathy evoked by a message. State empathy was measured using an eight item 7-point Likert-type scale. The scale is divided further into two subscales with four items making up cognitive empathy and four items making up affective empathy. The items that comprise this scale are displayed in Table 3 (Shen, 2010b). Cronbach’s alpha by condition were, 0.92 (gain-frame, high-empathy), 0.92 (gain-frame, low-empathy), 0.93 (loss-frame, high-empathy), and 0.95 (loss-frame, low-empathy) for cognitive empathy and 0.88 (gain-frame, high-empathy), 0.93 (gain-frame, low-empathy), 0.92 (loss-frame, high-empathy), and 0.94 (loss-frame, low-empathy) for affective empathy.

Covariates
Trait empathy is conceptualized as a trait level of empathy an individual is capable of feeling. This is being measured to control for individual differences in empathy. Trait empathy was measured using twenty-eight 7-point Likert-type items with four subscales: perspective taking, empathic concern, personal distress, and emotional contagion. Cronbach’s alpha for the entire scale was 0.82. For each of the four subscales, Cronbach’s alpha was 0.73 (perspective taking), 0.79 (empathic concern), 0.83 (personal distress), and 0.82 (emotional contagion).

Trait impulsivity is conceptualized as how impulsive an individual is. This is being measured to control for any individual difference in how impulsive individuals may be. Impulsivity was measured using forty-five 4-point Likert-type items with four subscales: lack of premeditation, urgency, sensation seeking, and lack of perseverance. Cronbach’s alpha for the entire scale was 0.84. For each of the four subscales, Cronbach’s alpha was 0.78 (lack of premeditation), 0.89 (urgency), 0.86 (sensation seeking), and 0.79 (lack of perseverance).

**Procedure**

This experiment was conducted in the PRIME Lab, a media psychophysiology lab, at the University of Missouri. Participants completed the experiment one at a time while seated in a reclining chair positioned approximately 5 feet from a high definition LCD television set. Sensors for facial EMG data collection were filled with recording gel 5 minutes prior to the participant arriving to allow the gel to settle into the electrode cup. The researcher welcomed the participant and had him or her read and sign an informed consent form outside of the room where the experiment took place. While the participant
completed the informed consent process, the researcher moved into an adjacent room until the participant was ready. Once signed and completed, the informed consent form was filed away into a study binder for safekeeping. The researcher then instructed the participant to wash their hands with warm water and soap to prep the skin for the collection of skin conductance data. Sensors for the collection of skin conductance data were placed on the participant’s non-dominant hand. Once the participant returned, he or she was seated in the reclining chair and the remaining sites where electrodes are to be placed were prepped. The researcher wiped the areas of the face and arms where heart rate and facial EMG sensors were placed with rubbing alcohol, then the areas on the face were gently abraded using an abrasive skin prep pad. After placing all electrodes, the researcher checked impedance levels of the facial EMG recording sites to note whether or not low levels of electrical impedance is obtained to validly record muscle activity. If impedance was not low enough (greater than 30 Ωs), the sensors were removed, the site re-prepped, and electrodes reapplied. Any high impedance levels were recorded in the study notebook. Each participant then viewed a two-minute nature clip to allow him or her to relax and get accustomed to the laboratory environment. While the participant viewed the clip, the researcher visually inspected the electrode waveforms for signal clarity. After this clip, the participant began viewing the clips, completing self-report measures in between each video. After completing the self-report measure for the last video, they were disconnected from the physiological recording equipment and debriefed. Finally the participant was compensated, thanked, and dismissed.
Results

Data cleaning and reduction

Data obtained from the psychophysiological measures used in this experiment was extracted from the analog waveforms recorded during message exposure. This was done by averaging the data over one second intervals for each segment of physiological recording in AcqKnowledge. The physiological data was also screened for movement artifact, outliers, and non-responders. Movement artifacts and outliers were cleaned by replacing the bad data point with the data point one second prior. If the participant was a non-responder or if any data that was unable to be cleaned in this manner, the data was removed from the file and not used in the analysis. Once extracted, the data were combined into a master file in SPSS for further data analysis.

Analysis

Change scores for each psychophysiological measure were computed by subtracting mean physiological activity recorded during the 5 seconds of the baseline period for each video from each second of physiological activity recorded during message exposure. The hypotheses for this experiment were tested by submitting the change scores obtained from each of the psychophysiological measures to a 2 (empathy) X 2 (message frame) X 4 (message) X 30 (time) repeated measures ANOVA. Additionally, data from self-report measures were submitted to a 2 (empathy) X 2 (message frame) X 4 (message) repeated measures ANOVA. Correlation coefficients between the individual difference variables and dependent variables, both physiological
and self-report measures, were not significant, \( p > .05 \), therefore, the individual
difference variables were not included as covariates in the analyses. Data analysis also
revealed that for all physiological main effects and interaction terms with time the
sphericity assumption was violated, thus, Greenhouse-Geisser degrees of freedom
adjustments were made.

**Hypothesis 1**

Hypothesis 1 stated that gain-framed high empathy messages will result in greater
resources allocated to encoding as evidenced by heart rate deceleration than either gain-
framed low empathy messages, or any of the loss-framed messages.

Hypothesis 1 was supported. There was a significant three-way interaction
between message frame, empathy, and time on heart rate \( F(11.218, 560.879) = 5.210, p <
0.001, \eta^2_p = 0.094. \)

**Figure 1.** Interaction between message frame, empathy, and time on heart rate.
There was a significant main effect of empathy on heart rate, $F(1, 50) = 9.235, p = 0.004, \eta_p^2 = 0.156$, such that high empathy messages resulted in greater cardiac deceleration ($m = -4.155, se = 0.388$) than low empathy messages ($m = -3.056, se = 0.378$).

**Figure 2.** Main effect of empathy on heart rate.

There was a significant interaction between message frame and empathy on heart rate, $F(1, 50) = 4.704, p = 0.035, \eta_p^2 = 0.086$, such that gain-framed, high empathy messages resulted in the greatest cardiac deceleration ($m = -4.578, se = 0.513$) followed by loss-framed, high empathy messages ($m = -3.731, se = 0.392$), loss-framed, low empathy messages ($m = -3.409, se = 0.530$), then gain-framed, low empathy messages ($m = -2.703, se = 0.425$) with the least cardiac deceleration.
Figure 3. Interaction between message frame and empathy on heart rate.

![Frame x Empathy](image)

There was a significant interaction between message frame and time on heart rate  
\[ F(10.391, 519.563) = 3.148, \ p = 0.001, \ \eta^2_p = 0.059. \]

Figure 4. Interaction between message frame and time on heart rate.

![Frame x Time](image)
There was a significant interaction between empathy and time on heart rate

\[ F(8.808, 440.382) = 5.302, p < 0.001, \eta_p^2 = 0.096. \]

**Figure 5.** Interaction between empathy and time on heart rate.

**Hypotheses 2 and 3**

Hypothesis 2 stated that loss-framed high empathy messages will result in greater psychological arousal than either the loss-framed low empathy messages, or any of the gain-framed messages.

Hypothesis 2 was supported. There was a significant three-way interaction between message frame, empathy, and time on skin conductance \[ F(3.629, 188.715) = 5.744, p < 0.001, \eta_p^2 = 0.099. \]
Figure 6. Interaction between message frame, empathy, and time on skin conductance.

Hypothesis 3 stated that gain-framed high empathy messages will result in greater psychological arousal than gain-framed low empathy messages as evidenced by higher skin conductance level. Hypothesis 3 was not supported.

There was a significant main effect of message frame on skin conductance, $F(1, 52) = 10.470, p = 0.002, \eta^2_p = 0.168$, such that gain-framed messages resulted in lower skin conductance level ($m = 0.009, se = 0.036$) than loss-framed messages ($m = -0.089, se = 0.034$).
There was a significant interaction between message frame and empathy on skin conductance, \( F(1, 52) = 7.226, p = 0.010, \eta_p^2 = 0.122 \), such that loss-framed, high empathy messages resulted in the highest skin conductance level \((m = 0.048, se = 0.044)\) followed by loss-framed, low empathy messages \((m = -0.029, se = 0.044)\), gain-framed, low empathy messages \((m = -0.049, se = 0.033)\), then gain-framed, high empathy messages \((m = -0.130, se = 0.048)\) with the lowest skin conductance level.
Figure 8. Interaction between message frame and empathy on skin conductance.  

An interaction between message frame and time on skin conductance approached significance, $F(3.384, 175.970) = 2.3445, p = 0.067, \eta^2_p = 0.043$.

Figure 9. Interaction between message frame and time on skin conductance.
Overall, loss-framed high empathy messages were the most arousing. H2 was supported. However, gain-framed high empathy messages were less arousing than gain-framed low empathy messages. H3 was not supported.

**Hypothesis 4**

Hypothesis 4 stated that gain-framed high empathy messages will result in the greatest positive emotional response as evidenced by zyomaticus major and orbicularis oculi muscle region activity followed by gain-framed low empathy messages, loss-framed low empathy messages, and then loss-framed high empathy messages resulting in the least positive emotional response.

There was a significant three-way interaction between message frame, empathy, and time on zyomaticus major and orbicularis oculi muscle region activity $F(5.284, 269.476) = 2.909, p = 0.012, \eta^2_p = 0.054$. Hypothesis 4 was not supported.

**Figure 10.** Interaction between message frame, empathy, and time on zyomaticus major and orbicularis oculi muscle region activity.
There was a significant interaction between empathy and time on zygomaticus major and orbicularis oculi muscle region activity $F(7.021, 358.047) = 3.202, p = 0.003, \eta^2_p = 0.059$. 

**Figure 11.** Interaction between empathy and time on zygmaticus major and orbicularis oculi muscle region activity.

**Hypothesis 5**

Hypothesis 5 stated that loss-framed high empathy messages will result in the most negative emotional response as evidenced by corrugator supercilii muscle region activity followed by loss-framed low empathy messages, gain-framed low empathy messages, and then gain-framed high empathy messages resulting in the least negative emotional response.
A three-way interaction between message frame, empathy, and time on corrugator supercilii muscle region activity approached significance, $F(6.365, 324.599) = 1.992, \ p < 0.062, \ \eta_p^2 = 0.038$. Hypothesis 5 was not supported.

**Figure 12.** Interaction between message frame, empathy, and time on corrugator supercilii muscle region activity.

There was a significant main effect of empathy on corrugator supercilii muscle region activity, $F(1, 51) = 7.241, \ p = 0.010, \ \eta_p^2 = 0.124$, such that high empathy messages resulted in higher muscle activity ($m = 1.206, \ se = 0.369$) than low empathy messages ($m = 0.581, \ se = 0.329$).
**Figure 13.** Main effect of empathy on corrugator supercilii muscle region activity.

There was a significant interaction between empathy and time on corrugator supercilii muscle region activity $F(6.363, 324.496) = 7.824, p < 0.001, \eta^2_p = 0.133$.

**Figure 14.** Interaction between empathy and time on corrugator supercilii muscle region activity.
Self-Report

The self-reported data lends additional insight into the nature of framing and message empathy. There was a significant main effect of empathy on affective empathy, $F(1, 52) = 310.65, p < 0.001, \eta_p^2 = 0.857$, such that high empathy messages resulted in higher reported affective empathy ($m = 5.199, se = 0.124$) than low empathy messages ($m = 3.927, se = 0.137$). There was a significant main effect of empathy on cognitive empathy, $F(1, 52) = 242.35, p < 0.001, \eta_p^2 = 0.823$, such that high empathy messages resulted in higher reported cognitive empathy ($m = 5.795, se = 0.087$) than low empathy messages ($m = 4.631, se = 0.128$). There were no significant effects of frame or a significant interaction on state empathy.

Attitude toward the message

Hypothesis 6a stated that gain-framed high empathy messages will result in the most favorable attitudes followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.

There was a significant interaction between message frame and empathy on attitude, $F(1, 52) = 13.982, p < 0.001, \eta_p^2 = 0.212$, such that gain-framed high empathy messages ($m = 5.264, se = 0.123$) resulted in the most favorable attitudes, followed by loss-framed high empathy ($m = 5.106, se = 0.132$), loss-framed low empathy ($m = 4.669, se = 0.134$), and gain-framed low empathy ($m = 4.196, se = 0.134$). A post hoc analysis revealed all means were significantly different from each other ($p < 0.05$) except for gain-frame high empathy and loss-frame high empathy. Hypothesis 6a was not supported.
Figure 15. Interaction between message frame and empathy on attitude toward the message.

Additionally, there was a significant main effect of message frame on attitude, \( F(1, 52) = 4.709, p = 0.035, \eta^2_p = 0.083 \), such that loss-framed messages resulted in more favorable reported attitudes \( (m = 4.914, se = 0.118) \) than gain-framed messages \( (m = 4.730, se = 0.104) \). There was a significant main effect of empathy on attitude, \( F(1, 52) = 72.893, p < 0.001, \eta^2_p = 0.584 \), such that high empathy messages resulted in more favorable reported attitudes \( (m = 5.212, se = 0.117) \) than low empathy messages \( (m = 4.433, se = 0.108) \).

Behavioral Intentions

Hypothesis 6b stated that gain-framed high empathy messages will result in the greatest reported intent to drive safe followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.
There was a significant interaction between message frame and empathy on behavioral intentions, \(F(1, 52) = 8.092, p = 0.006, \eta_p^2 = 0.135\), such that gain-framed high empathy messages (\(m = 5.955, se = 0.125\)) resulted in the highest behavioral intentions, followed by loss-framed high empathy (\(m = 5.946, se = 0.132\)), loss-framed low empathy (\(m = 5.470, se = 0.153\)), and gain-framed low empathy (\(m = 5.057, se = 0.161\)). A post hoc analysis revealed all means were significantly different from each other (\(p < 0.05\)) except for gain-frame high empathy and loss-frame high empathy. Hypothesis 6b was not supported.

**Figure 16.** Interaction between message frame and empathy on behavioral intentions.

Additionally, there was a significant main effect of message frame on behavioral intentions, \(F(1, 52) = 6.142, p = 0.016, \eta_p^2 = 0.106\), such that loss-framed messages resulted in higher reported behavioral intentions (\(m = 5.708, se = 0.130\)) than gain framed messages (\(m = 5.506, se = 0.135\)). There was a significant main effect of empathy on behavioral intentions, \(F(1, 52) = 71.068, p < 0.001, \eta_p^2 = 0.577\), such that high empathy
messages resulted in higher reported behavioral intentions ($m = 5.950$, $se = 0.122$) than low empathy messages ($m = 5.264$, $se = 0.142$).

**Perceived Effectiveness**

Hypothesis 6c stated that gain-framed high empathy messages will result in the greatest perceived effectiveness followed by loss-framed high empathy messages, loss-framed low empathy messages, and then gain-framed low empathy messages.

There was a significant interaction between message frame and empathy on perceived effectiveness, $F(1, 52) = 5.977$, $p = 0.018$, $\eta^2_p = 0.103$, such that loss-framed high empathy messages ($m = 5.487$, $se = 0.119$) resulted in the highest reported effectiveness, followed by gain-framed high empathy ($m = 5.349$, $se = 0.117$), loss-framed low empathy ($m = 4.560$, $se = 0.162$), and gain-framed low empathy ($m = 4.011$, $se = 0.144$). A post hoc analysis revealed all means were significantly different from each other ($p < 0.05$) except for gain-frame high empathy and loss-frame high empathy. Hypothesis 6c was not supported.
Additionally, there was a significant main effect of message frame on perceived effectiveness, $F(1, 52) = 16.262, p < 0.001, \eta^2_p = 0.238$, such that loss-framed messages resulted in higher reported effectiveness ($m = 5.024, se = 0.1213$) than gain framed messages ($m = 4.680, se = 0.117$). There was a significant main effect of empathy on perceived effectiveness, $F(1, 52) = 127.464, p < 0.001, \eta^2_p = 0.710$, such that high empathy messages resulted in higher reported effectiveness ($m = 5.418, se = 0.109$) than low empathy messages ($m = 4.286, se = 0.135$).
Discussion

This study investigated the effect of message frame and empathy on embodied motivated processing of traffic safety PSAs. Situated in the LC4MP, which proposes that processing of a media message is an ongoing process driven by emotion and motivational relevance, the current study hypothesized that more motivationally relevant messages would lead to better processing of the message, such as more resources allocated to encoding the message, compared to those messages with less motivational relevance. Stimuli that are motivationally relevant are those related to survival such as food, sex, and danger (Lang, 2006). These types of messages are those that activate either or both the aversive or appetitive systems. The physical characteristics of these stimuli make them motivationally relevant or because they have been learned to be relevant (Lang, 2009). In this study, the more motivationally relevant messages are those that have more emotional content. Though both loss-framed and gain-framed messages use emotional content, loss-framed messages should be more motivationally relevant since they are more likely to activate the aversive system. Additionally, high empathy messages should be more motivationally relevant due to a greater emotional content. To measure message processing of these messages, the current study recorded heart rate as a measure of cognitive resources allocated to encoding, skin conductance as a measure of psychological arousal, corrugator supercilii muscle region activity as a measure of negative emotional response, and zygomaticus major and orbicularis oculi muscle region
activity as a measure of positive emotional response while viewing the traffic safety
PSAs. Additionally participants were asked to respond to various self-report questions
regarding various health persuasion outcomes including state empathy, attitude toward
the message, behavioral intentions, and perceived effectiveness.

As described by Lang (1994) heart rate deceleration is an indicator of an increase
in cognitive resources allocated to encoding. An analysis of the heart rate data showed
that high empathy messages elicit more cognitive resources than low empathy messages.
What is more interesting is that loss-framed messages initially have a steeper
deceleration, but midway through message exposure, gain-framed messages begin to
elicit more cognitive resources to encoding the message. Looking at the interaction
between message frame and empathy across time, it can be seen that gain-framed high
empathy messages elicit the most attention, followed by loss-framed high empathy, loss-
framed low empathy, and then gain-framed low empathy messages. Additionally, in the
loss- and gain-framed high empathy messages, after an initial deceleration, toward the
end of the message there is a slight acceleration in heart rate. H1 was supported, gain-
framed high empathy messages elicit the most cognitive resources to encoding. It’s these
messages that viewers allocate the most of their limited resources to. According to the
LC4MP, as aversive activation increases more resources are allocated to encoding in
order to identify potential danger. Once identified, if activation in the aversive system
continues resources then are shifted away from encoding toward decision making and
problem solving. This is the case for both the loss- and gain-framed high empathy
messages. The messages activate the aversive system causing viewers shift resources to
encode the message to facilitate identification, as can be seen by the initial cardiac
deceleration, then once viewers identify the message they begin to shift mental resources
away from encoding, as can be seen by the cardiac acceleration in the last few seconds of
message exposure. Overall in terms of cognitive resources allocated to encoding, it is the
high empathy messages that cause viewers to allocate the greatest amount of their limited
resources.

H2 stated that loss-framed high empathy messages would be the most arousing
and as the data show, loss-framed high empathy messages produce the greatest skin
conductance level in viewers, showing they are the most arousing. H2 was supported. H3
stated that within the gain-framed messages, high empathy messages would be more
arousing than low empathy messages. A significant frame x type x time interaction was
found for skin conductance which shows this in not the case. H3 was not supported. This
interaction shows that loss-framed high empathy messages are the most arousing,
followed by loss-framed low empathy, gain-framed low empathy, then gain-framed high
empathy as the least arousing. The role of message empathy likely plays a role in how
arousing these messages are. Overall, these findings support previous research. Since
loss-framed messages are more likely to activate the aversive motivational system than
gain-framed messages they should be more arousing and as the results show, they are.
Loss-framed high empathy messages are the most motivationally relevant compared to
the other messages. As viewers watch, since the loss-framed high empathy messages are
the most relevant in terms of motivation activation, it is those messages that elicit the
most automatic resource allocation.
The heart rate and skin conductance data together tell an interesting story about how viewers process high empathy messages. Both gain-framed high empathy messages and loss-framed high empathy messages have the greatest cardiac deceleration compared to the other messages. These two types of messages elicit the greatest allocation of cognitive resources to encoding information contained in the message. However, where these two types of messages differ is in skin conductance level. Loss-framed high empathy messages are the most arousing of all the messages, while gain-framed high empathy messages are the least arousing of all the messages. The increase in cognitive resources allocated to encoding for loss-framed high empathy messages is likely due to the arousing nature of the loss frame; the messages are more arousing causing an increase in the allocation of resources. However, this is not the case for the gain-framed high empathy messages. It is here where we see a difference in processing of the messages. Although these messages elicit just as much cognitive resources to encoding as the loss-framed high empathy messages, this is not due to their arousing nature. Further research is needed to tease out the differences in how these two types of messages are processed, however, one potential reason for this difference in process could be due to the nature of empathy. As stated earlier, empathy is the sharing of both positive and negative affect and a sharing of cognitive appraisals. The messages that were selected to be high empathy messages do have significantly higher reported levels of self-reported state empathy, on both the affective and cognitive components, compared to the messages selected to be low empathy messages. So it is likely that this difference in state empathy could be the driving force that causes viewers to allocate more mental effort to processing
the message. The definition of empathy lends insight into why this may have occurred; empathy is the understanding and sharing of another person’s situation and emotions. It is closely related to other concepts such as transportation. The high empathy messages cause viewers to become transported into the story and connected with the characters causing the viewer’s shift mental resources to encoding. As one of few studies that have investigated state empathy as a mental process, limited information about its processes and effects are available. Future research in this area should investigate how people receive, process, and respond to messages that vary in their level of empathy, how those messages affect state levels of empathy, and what how that affects message processing.

H4 was not supported. Low empathy messages resulted in more a more positive emotional response than high empathy messages. It is believed this is due to the negative nature of the stimuli. Empathy is the ability to feel what others are feeling, so it makes sense that the high empathy messages would be less positive since the stimuli involved negative consequences of driving. H5 was not supported. There were no significant results for message frame on negative emotional responding. High empathy messages did result in a significantly more negative response than low empathy messages. However, this difference in empathy is likely driven by the fact that the loss-framed high empathy messages are the most arousing. While watching the traffic safety PSAs, viewers experienced the most negative response and the least positive response when the message was high in empathy. As viewers process the high empathy messages there is an increase in negative emotion and a decrease in positive emotion which is intuitive seeing as the messages were all negatively valenced.
The self-report data also lends insight into the complex phenomenon occurring during message exposure. With all self-report measures, attitude, behavioral intentions, and perceived effectiveness, loss-framed messages and high empathy messages always had the best attitudes, the most likely to make a participant want to drive safe, and the messages that were seen as the most effective. It is these messages that viewers find the most credible and least exaggerated which as stated earlier, high empathy messages should be realistic. However, when looking at the interaction between frame and empathy, there is no statistical difference between gain-framed high empathy and loss-framed high empathy messages.

The findings lend support to message designers trying to decide how best to present a message to their audience. At least in the realm of traffic safety, message designers should use gain-framed, high empathy messages, in other words, show the consequences of safe driving and design the message in such a way that viewers can emotionally connect with the characters. Message designers must be certain to use a high empathy message type or they run the risk of their message not being effective communicated to their audience.

One limitation of this study is that the amount of time it takes for the mental experience of feeling empathy to unfold is unknown and may last longer than the length of the message. Steps were taken to try and control this by having participants answer questions between each message and view a ten second black screen, but it is still possible to have carryover effects from one message to the next. It may be useful to use a between-subjects design instead in order to control for this. Additionally, there was no
significant variation in trait empathy or impulsivity of the participants. Future research could collect a more diverse sample in terms of these two variables to investigate if differences in processing occur, specifically those individuals lacking in trait empathy. Finally, no recognition data was collected. Having this information would aid in determining interpreting the information encoded to distinguish between few resources allocated or overload/withdrawal.

This study focused on the effects of message frame and empathy on adult viewers' cognitive and emotional processing of traffic safety messages. Future research should look at other potentially important variables such as message outcome extremity as well as measure other cognitive processes such as storage and retrieval. In addition, this study lays a foundation for studying the mental experience of mediated empathy and is an attempt at investigating its effects. Further research could investigate empathy in other health related topics such as antismoking or cancer detection and prevention, but should also move beyond health communication and be studied in all types of mediated communication. One interesting area would be to test the effects of mediated empathy on other audiences, such as those who vary more widely in trait empathy, impulsivity, or other potentially meaningful individual difference variables. Similar studies using participants with low trait empathy levels may reveal distinct differences in processing media that contains empathic content.

The data showed that there were significant differences in how message frames were processed for high empathy messages by examining cognitive resources allocated to encoding and psychological arousal together. Such findings suggest that these two factors
play an important role in how messages are processed. Further research into why this difference in processing occurred as well as further research into mediated empathy would be useful from both a theoretical and applied perspective. In conclusion, message frame and empathy in traffic safety PSAs are important factors that need to be considered together when designing safe driving advertising campaigns.
Appendix

Tables of measurement scales used

Table 1  Items and Subscales of Trait Empathy Scale

<table>
<thead>
<tr>
<th>Subscale</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perspective-Taking</td>
<td>1. Before criticizing somebody, I try to imagine how I would feel if I were in their place.</td>
</tr>
<tr>
<td></td>
<td>2. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments. (r)</td>
</tr>
<tr>
<td></td>
<td>3. I sometimes try to understand my friends better by imagining how things look from their perspective.</td>
</tr>
<tr>
<td></td>
<td>4. I believe that there are two sides to every question and try to look at them both.</td>
</tr>
<tr>
<td></td>
<td>5. I sometimes find it difficult to see things from the &quot;other guy's&quot; point of view. (r)</td>
</tr>
<tr>
<td></td>
<td>6. I try to look at everybody's side of a disagreement before I make a decision.</td>
</tr>
<tr>
<td></td>
<td>7. When I'm upset at someone, I usually try to &quot;put myself in his shoes&quot; for a while.</td>
</tr>
<tr>
<td>Empathic Concern</td>
<td>8. When I see someone being taken advantage of, I feel kind of protective toward them.</td>
</tr>
<tr>
<td></td>
<td>9. When I see someone being treated unfairly, I sometimes don't feel very much pity for them. (r)</td>
</tr>
<tr>
<td></td>
<td>10. I often have tender, concerned feelings for people less fortunate than me.</td>
</tr>
<tr>
<td></td>
<td>11. I would describe myself as a pretty soft-hearted person.</td>
</tr>
<tr>
<td></td>
<td>12. Sometimes I don't feel sorry for other people when they are having problems. (r)</td>
</tr>
<tr>
<td></td>
<td>13. Other people's misfortunes do not usually disturb me a great deal. (r)</td>
</tr>
<tr>
<td></td>
<td>14. I am often quite touched by things that I see happen.</td>
</tr>
<tr>
<td>Personal Distress</td>
<td>15. When I see someone who badly needs help in an emergency, I go to pieces.</td>
</tr>
<tr>
<td></td>
<td>16. I sometimes feel helpless when I am in the middle of a very emotional situation.</td>
</tr>
<tr>
<td></td>
<td>17. In emergency situations, I feel apprehensive and ill-at-ease.</td>
</tr>
</tbody>
</table>
18. I am usually pretty effective in dealing with emergencies. (r)
20. When I see someone get hurt, I tend to remain calm. (r)
21. I tend to lose control during emergencies.

<table>
<thead>
<tr>
<th>Emotional Contagion</th>
</tr>
</thead>
<tbody>
<tr>
<td>22. I often find that I can remain cool in spite of the excitement around me. (r)</td>
</tr>
<tr>
<td>23. I tend to lose control when I am bringing bad news to people.</td>
</tr>
<tr>
<td>24. I tend to remain calm even though those around me worry. (r)</td>
</tr>
<tr>
<td>25. I cannot continue to feel ok if people around me are depressed.</td>
</tr>
<tr>
<td>26. I don't get upset just because a friend is acting upset. (r)</td>
</tr>
<tr>
<td>27. I become nervous if others around me are nervous.</td>
</tr>
<tr>
<td>28. The people around me have a great influence on my moods.</td>
</tr>
</tbody>
</table>

Table 2 Items of the UPPS Impulsive Behavior Scale
1. I have a reserved and cautious attitude toward life.
2. I have trouble controlling my impulses.
3. I generally seek new and exciting experiences and sensations.
4. I generally like to see things through to the end.
5. My thinking is usually careful and purposeful.
6. I have trouble resisting my cravings (for food, cigarettes, etc.).
7. I'll try anything once.
8. I tend to give up easily.
9. I am not one of those people who blurt out things without thinking.
10. I often get involved in things I later wish I could get out of.
11. I like sports and games in which you have to choose your next move very quickly.
12. Unfinished tasks really bother me.
13. I like to stop and think things over before I do them.
14. When I feel bad, I will often do things I later regret in order to make myself feel better now.
15. I would enjoy water skiing.
16. Once I get going on something I hate to stop.
17. I don't like to start a project until I know exactly how to proceed.
18. Sometimes when I feel bad, I can't seem to stop what I am doing even though it is making me feel worse.
19. I quite enjoy taking risks.
20. I concentrate easily.
21. I would enjoy parachute jumping.
22. I finish what I start.
23. I tend to value and follow a rational, "sensible" approach to things.
24. When I am upset I often act without thinking.
25. I welcome new and exciting experiences and sensations, even if they are a little frightening and unconventional.
26. I am able to pace myself so as to get things done on time.
27. I usually make up my mind through careful reasoning.
28. When I feel rejected, I will often say things that I later regret.
29. I would like to learn to fly an airplane.
30. I am a person who always gets the job done.
31. I am a cautious person.
32. It is hard for me to resist acting on my feelings.
33. I sometimes like doing things that are a bit frightening.
34. I almost always finish projects that I start.
35. Before I get into a new situation I like to find out what to expect from it.
36. I often make matters worse because I act without thinking when I am upset.
37. I would enjoy the sensation of skiing very fast down a high mountain slope.
38. Sometimes there are so many little things to be done that I just ignore them all.
39. I usually think carefully before doing anything.
40. Before making up my mind, I consider all the advantages and disadvantages.
41. In the heat of an argument, I will often say things that I later regret.
42. I would like to go scuba diving.
43. I always keep my feelings under control.
44. I would enjoy fast driving.
45. Sometimes I do impulsive things that I later regret.
Table 3  Items and Dimensions of the State Empathy Scale

<table>
<thead>
<tr>
<th>Dimensions</th>
<th>Items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective Empathy</td>
<td>1. The character’s emotions are genuine.</td>
</tr>
<tr>
<td></td>
<td>2. I experienced the same emotions as the character when watching this message.</td>
</tr>
<tr>
<td></td>
<td>3. I was in a similar emotional state as the character when watching this message.</td>
</tr>
<tr>
<td></td>
<td>4. I can feel the character’s emotions.</td>
</tr>
<tr>
<td>Cognitive Empathy</td>
<td>5. I can see the character’s point of view.</td>
</tr>
<tr>
<td></td>
<td>6. I recognize the character’s situation.</td>
</tr>
<tr>
<td></td>
<td>7. I can understand what the character was going through in the message.</td>
</tr>
<tr>
<td></td>
<td>8. The character’s reactions to the situation are understandable.</td>
</tr>
</tbody>
</table>

Table 4  Items of the Attitude Toward the Ad Scale

While watching/looking at this commercial/advertisement…

1. I found it interesting.
2. I found it credible.
3. I found it exaggerated. (r)

Table 5  Items of the Behavioral Intentions Scale

Based on the message you just saw, how likely are you to adopt the recommended behavior?

1. unlikely / likely
2. improbable / probable
3. unwilling / willing

Table 6  Items of the Perceived Effectiveness Scale

Based on the message you just saw, how likely are you to adopt the recommended behavior?

1. How effective do you think this video is at persuading drivers similar to yourself to practice safe driving behavior?
   Not effective / effective
2. I think people different from me would find this video persuasive.
   Disagree / agree
Bibliography


Bandura, A. (2002). Reflexive empathy: On predicting more than has ever been observed. Behavioral and Brain Sciences, 25(01), 24–25. doi:10.1017/S0140525X0226001X


Potter, R., LaTour, M., Braun-LaTour, K., & Reichert, T. (2006). The impact of program context on motivational system activation and subsequent effects on processing a


