Discrete Emotion and Motivation: Relative activation in Appetitive and Aversive Motivational System as a Function of Anger, Sadness, Fear, and Joy embedded in the Content of Televised Information Campaigns.

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Submitted to the faculty of the University Graduate School
in partial fulfillment of the requirements
for the degree
Doctor of Philosophy
in the Department of Telecommunications,
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March 2007

Accepted by the Graduate Faculty, Indiana University, in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

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February 28, 2007

To my wife, Seung-Sook Song

ACKNOWLEGEMENTS

I owe a debt of thanks to my committee. The chairperson of my committee, Professor Annie Lang, has been a hard working and dedicated guiding force. She assisted me in initially structuring my very vague and elusive ideas. With her assistance I turned the muddled ideas into good scientific research. Annie is a mentor of the highest rank. She taught me how to think like, and how to be, a good scientist. Professor Julia Fox is an inspiring researcher and her presence on my committee has given me enthusiasm about my research. Professor Robert F. Potter helped the study for various things, experimental equipments, statistical problems, theoretical challenge, and etc. Professor Walter Gantz was kind enough to give his time. His insightful remarks helped me adjust a number of gaps in my research questions and methods.

I could not finish the experiments without help from my colleagues in the ICR lab. I want to give special thanks to James Angelini, Bryan Wilson, Zheng Wang, Sungkyung Lee and Satoko Kurita, each of whom dedicated dozens of hours in preparing and running the experiments. I want to thank all the ICR lab colleagues, especially Byungho Park, Sam Bradley, Johnny Sparks, and Narine Yegiyan, for giving me many happy and inspiring moments.

The support I have received from my family, especially from my mother Sungyou Lee and my wife Seungsook Song has been crucial to my education. My mother has been a substantial support throughout my whole life. She has always respected my decisions and given me a trustful look. My wife is an amazing person. She had to take care of my mother and son without me for several years. We only met once a year. It has been a harsh time, but she has always believed in me. If it were not for Seungsook my entire life

would have come to a standstill waiting for something to happen. She encouraged me to go abroad and challenge a new academic life. My son, Yoonseo, has done the greatest thing for my achievement. He has grown to a kind and joyful boy. I left Korea when he was 7 months old. I have been a bad father, but he has become a great kid. To me my son is an endless source of joy and pride.

Seungjo Lee

Discrete Emotion and Motivation: Relative activation in Appetitive and Aversive Motivational System as a Function of Anger, Sadness, Fear, and Joy embedded in the Content of Televised Information Campaigns.

The goal of this study was to examine whether predictable motivational activation in the appetitive and aversive systems underlies the production and experience of discrete emotions (anger, sadness, joy, and fear) experienced while viewing televised PSAs. The current study was conducted from the perspective of LC4MP which theorizes that conscious emotional experience is evoked by the activated motivational systems.

This study used self-reports and physiological measures in order to index motivational activation and emotional experience. In joy condition, physiological data provide moderate support for strong appetitive activation and no support for aversive inhibition while self-reported data provided good evidence for both. In fear condition, the self-reported data supported the predictions of strong aversive and inhibited appetitive activation during fear. The physiological data provide strong support for a highly activated aversive system but no support for an inhibited appetitive system. In sadness condition, the self-reported and physiological data support the prediction that sadness is a moderately activated aversive condition and that it may involve some low level appetitive activation. In anger condition, the self-report data show strong reciprocal activation that is people report feeling most negative and least positive. The physiological data strongly support the contention that anger is a coactive state with both aversive and appetitive activation. And the results suggest that individual differences influence the experience of discrete emotion.

This study suggests that research in the discrete emotion domain can benefit from using the findings of the dimensional approach to provide a systematic tool to reveal subjective and physiological patterns of discrete emotional experience.

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CHAPTER 1

Introduction

Public service announcements (PSAs) have been widely delivered through television, radio, and the web by non-profit and governmental organizations (O'Keefe & Reid, 1990). PSAs aim to promote socially desirable issues and induce appropriate beliefs, attitudes, and behaviors in the audience (Bator & Cialdini, 2000). The common topics for media campaigns are nearly ubiquitous, dealing with anti-smoking, anti-alcohol, prevention of drug abuse, traffic safety, nutrition, child and animal abuse, violence, and so on (Bator & Cialdini, 2000; Beaudoin, 2002; Galst, 1980; Hanneman, McEwen, & Coyne, 1973; Harrington et al., 2003).

In spite of the widespread use of PSAs, controversy and uncertainty about the efficacy of PSAs coexists with its history. Some field research has provided evidence that PSAs succeeded at influencing people in terms of awareness, knowledge acquisition, attitude and, possibly, behavior (Goldman & Glantz, 1998; Palmgreen et al., 2001). Others, however, found that PSAs might not be an effective way to deliver information to audiences or to persuade them to take action (Wallack & Corbett, 1987). One of the reasons brought up to account for the ineffectiveness of PSAs, is that many messages were too poorly designed to achieve the expected effects. David, Cappella, & Fishbein (2004) evaluated the effectiveness of various campaigns and found that some PSAs might not only be less effective than expected, but actually have unintended boomerang effects brought about by ineffective claims that increased the counter-arguing aimed at the prevention messages.

Arguments have been made that much of this poor message design comes from purposely ambiguous strategies used to target multiple audiences (Dejong, Wolf, & Austin, 2001). Aware of this problem, researchers have recommended the practitioners adopt scientific and theoretical principles to develop appropriate content aimed specially at the target audience when designing PSAs (Everette & Palmgree, 1995; Fishbein & Yzer, 2003; A. Lang, 2006a; Slater, 1996). Past research has successfully demonstrated that PSAs produced based on scientific research and theories are indeed effective at changing awareness, memory, attitudes and behaviors (Palmgreen et al., 2001; Vaughan & Rogers, 2000). Research on how to design PSAs demonstrates that it is imperative that producers understand the characteristics of the target audience and what kind of strategy should be adopted to reach and impact them. The target audience may vary from a very general population of people who range across age and cultural backgrounds to a narrowly specified group of people (A. Lang, 2006a). This requires researchers to comprehensively identify message components and attributes that are most likely to produce the desired effects on the selected target audience.

Emotional appeal has frequently been used as a strategy for PSA designs. According to content analysis studies, about two-thirds of the PSAs produced attempts to evoke emotional responses with or without rational thinking (Beaudoin, 2002; Johnson, Flora, & Rimal, 1997). Past research suggests that the content contained in PSAs using emotional appeals should be carefully designed for the target audience. For instance, fear appeals have not been found to be effective with young audiences (Hale & Dillard, 1995; Irwin & Millstein, 1986). Young people appear to view the threat of death and disease as unlikely. Fear appeals, however, are effective in persuasive health messages targeted toward adults (Mongeau, 1998; Witte, 1995). This implies that emotional tone as a content feature or type should be selected by taking into consideration characteristics of the target audience.

A. Lang (2006a) suggested that when creating an effective persuasive message one should be able to answer the questions associated with the message goal, the target market, the medium, and the motivational/personal relevance. Within this frame, this study focuses on how different emotional tones (fear, anger, sadness, and joy) in PSAs interact with motivational activation in individuals.

Purpose of the Current Study

This study investigates whether predictable motivational activation in the appetitive and aversive systems underlies the production and experience of discrete emotions experienced when viewing televised PSAs. Many researchers have studied emotion using a multiplicity of theoretical and methodological approaches. Two general theoretical approaches dominate this research. One approach views emotion as a system of discrete categories (Frijda, 1987; Plutchik, 1980; Lazarus, 2001). Research in this approach focuses on primary emotional states such as anger, fear, sadness, and joy and examines the appraisal of these discrete states.

Another approach is to examine the underlying dimensions associated with the generation of emotions (P.J. Lang, 1984; Cacioppo & Gardner, 1999). In the dimensional approach, emotional experience – that is the conscious feeling of emotion - is seen as composed of primarily two factors, one of direction (i.e., towards or away) and the other of intensity (i.e., calm or aroused). Theoretically, this approach postulates two independent motivational systems (i.e. approach towards the appetitive stimuli and avoidance from the aversive objects) underlying the experience of emotion which have different functional activations (Cacioppo & Berntson, 1994; Cacioppo & Gardner, 1999). The systems are the functional foundation for producing the positive (or pleasant) and negative (or unpleasant) emotional experiences. Cacioppo and colleagues categorize the relationship between activation in the appetitive and aversive systems as being in one of three categories 1) reciprocal activation, which means that if one system activates the other is inhibited, 2) uncoupled which means activation in one system is not affecting activation in the other system or 3) coactivation – which means both systems are activated in concert (Cacioppo, Gardner, & Berntson, 1999).

All of these theoretical approaches consider emotion to have evolutionary adaptive functionality. Emotion denotes adaptive solutions to environmental challenges and opportunities and functions to help secure physical and social survival (Keltner & Gross, 1999; Lazarus, 1991a). Roseman (2001) addressed how discrete emotions are related to motivational state. For instance, joy is associated with “move toward it”, fear with “prepare to move away or to stop moving toward it”, sadness with “stop moving toward it” and anger with “move against other”. Using Cacioppo’s notion of emotional experience being the result of activation levels in the motivational systems, one might conceptualize joy as the result of high activation in the appetitive system, fear as high levels of activation in the aversive system, sadness as weak activation in the aversive system, and anger as coactivation of the appetitive and aversive systems. This study examines whether this conceptualization has merit by measuring activation of the appetitive and aversive motivational systems as a function of anger, fear, joy, and sadness elicited by television informational campaigns such as PSAs.

This study also examines if individual variation in motivational system activation and reactivity influences the conscious experience of emotion. A. Lang (2006a) constructed the Limited Capacity Model of Motivated Mediated Message Processing (LC4MP) as a theoretical frame for research on the mental processing of mediated messages. This model provides the Motivational Activation Measurement (MAM), which is designed as an indicator of resting activation in the appetitive system (positivity offset) and reactivity in the aversive system (negativity bias) (A. Lang, Shin, & Lee, 2005). Research within the frame of the LC4MP has demonstrated that these values vary normally across individuals and predict appropriate physiological indices of motivational activation. This study is designed to examine whether individual variation in positivity offset and negativity bias influences the emotional experience of anger, fear, joy and sadness while viewing television messages.

For the purpose of examining various combinations of motivational activation in the appetitive and aversive system and the related emotional experiences and resource allocation, various measurements are employed including self-reported evaluations and physiological responses such as heart rate, skin conductance, and facial electromyography based on the LC4MP.

Theoretical and Methodological Importance of the Study

Even though there have been attempts to describe discrete emotional states as a region of a dimension coordinated space (Russell & Mehrabian, 1977; Vrana & Rollock, 2002), few studies have tried to locate the discrete emotions into the dimensional space created by the bivariate approach advocated by Cacioppo and colleagues. Positive and negative emotion have commonly been treated as if they were opposite, as the extremes placed at the other ends of a single structure (Bentler, 1969; Green, Salovey, & Truax, 1999; Thurston, 1931; Watson, Wiese, Vaidya, & Tellegen, 1999). That is, the valence dimension has been often defined as bipolar, for example, “pleasure is a continuum ranging from extreme pain or unhappiness at one end to extreme happiness or ecstasy at the other hand.” (Russell & Mehrabian, 1977, p274). According to this view, bipolarity has an economic benefit which is adaptive for making conscious and quick decisions related to behavioral outputs (Russel & Barrett, 1999). Though this definition has benefit for economically explaining behavioral output when responding to an emotional event, it contains weakness in that the bipolar approach cannot manifest the complex processing related to an emotional experience. For instance, a happy feeling can invite a fearful expectation as “the favorable conditions provoking our happiness will soon end, so we engage in anticipatory coping to prevent this from happening.” (Lazarus, 2001, p63).

Contrary to the bipolar approach, the bivariate approach suggests that the motivational systems (appetite and aversive) are separable and combine to process the evaluation (positive and negative emotions) of an event and to compute the weights for action readiness (Cacioppo & Bernston, 1994). The bivariate approach elaborates on the complex processing from initial exposure to the motivationally relevant event up to the point at which the output is produced by mingling and weighting activities of the motivational systems. The evaluation process determining the appetitive and aversive features of an event involves potentially parallel activation of the systems (Cacioppo, Gardner, & Bernston, 1997). Efforts to locate the discrete emotions into the dimensional space constructed by the bivariate approach may help contribute to understanding and explaining what kind of combinations of motivational system activation underlies discrete emotional experience.

The theoretical predictions and the accumulated findings about how physiological responses are associated with activation of the motivational systems may provide clues for revealing physiological response patterns of discrete emotions. A large number of the empirical studies on discrete emotion have relied on self-reported evaluations for dependent measures (e.g. Roseman, Antoniou, & Jose, 1996; Shaver, Schwartz, Kirson, & O'Connor, 1987). This may be because the theoretical principles of discrete emotional theory are developed based on the notion that cognitive evaluation, often called 'appraisal', precedes and elicits distinct emotional experience. Discrete emotion researchers have concentrated on specifying appraisal factors (e.g. coping potential), which may discriminate among the emotions (Frijda, 1986; Lazarus, 1991b; Roseman, Spindel, & Jose, 1990; Scherer, 1999; Smith & Ellsworth, 1987). Discrete emotion researchers, however, have also addressed the possibility that emotional experiences in response to an event may be the result of the multiple integration of conscious feeling and the biological responses occurring in the central and peripheral system (Scherer, 2001). Nevertheless, physiological measures have not been pervasively exploited in research on discrete emotion.

Indeed, the question of whether discrete emotions are associated with different patterns of physiological activity has long been a hard task somewhat lacking in plausible predictions and explanations. Decades of research have reported physiological change patterns are seemingly linked to specific emotions (Ekman, Levenson, & Friesen, 1983; Tsai, Levenson, & Carstensen, 2000). Those studies primarily focused on attempting to document the existence of a specified physiological pattern for each discrete emotion, or the universal existence of that pattern across age, profession and culture. The existence of any pattern, however, was not enough to reveal why a certain emotion should be associated with a specific physiological activation and through what mechanism the unique patterns are produced. It is because, as Pecchinenda (2001) pointed out, most of the research was not conducted in response to a set of theory-based predictions.

In contrast, emotion research using the dimensional approach has accumulated theory-based arguments and findings explaining the relationship between emotional processing and physiological responses (Cacioppo, Petty, Losch, & Kim, 1986; Ito, Cacioppo, & P. J. Lang, 1998; P. J. Lang, Bradley, & Cuthbert, 1997). As previously mentioned, an emotional experience can be explained as the result of a mixture of the appetitive and aversive systems. Studies within the dimensional approach have reported that motivational activation in the separate systems can be associated with distinct physiological activity. For instance, Cacioppo et al. (1986) found that specific muscle groups covaried with either self reported -positive or -negative emotion and activation in the relevant muscle reflected the intensity level. Startle response is another physiological response reportedly modulated by the motivational systems as an activated aversive system potentates the response and an activated appetite system attenuates it (Cuthbert, M. M. Bradley, & P. J. Lang, 1996). Skin conductance activity has been reported not to be differentially modulated by the positive-negative valence of information, but to be associated with the self-reported emotional arousal information (P. J. Lang, Greenwald, Bradley, & Hamm, 1993; Winton, Putnam, & Krauss, 1984). It may be that by using these measures, predictable patterns of physiological response may be revealed which will place each discrete emotion within the dimension coordinated space.

Additional area of relevant theoretical importance is related to the suggestion that motivational activation level may vary across individuals (A. Lang, 2006a). Discrete emotion researchers have suggested that inclusion of inter-individual differences must be considered in order to develop a proper understanding of emotion (Lazarus, 1991a). In normal life, we see many different types of people, for example, in a given situation, some get angry while others get sad. Even though the importance of individual differences in understanding discrete emotional experience has been addressed, there has been little research, using a systematic tool, examining how individual differences influence the experience of discrete emotion.

Another reason the LC4MP is adopted is that the model is constructed from extensive research and data collected while using mediated messages. It is well known that the context in which an emotional experience is elicited influences the physiological response. For instance, Stemmler, Heldmann, Pauls, & Scherer (2001) reported that real-life and imagery contexts inducing fear and anger resulted in different physiological responses even though similar self-reports were made. Methods used in eliciting discrete emotion have been, with only a few exceptions, directed facial mimicking or recall. These methods rely on imagery activity, being forced to make certain emotional facial expressions or to imagine a past event related to a certain emotion (Levenson, 1992; Ekman, Levenson, & Friesen, 1983).

The physiological responses in these contexts may be different from those in mediated message processing. The studies in the LC4MP have reported that slower heart rate is associated with allocating more mental resources to external stimuli in mediated message processing (A. Lang et al., 2000). Bolls, A. Lang, & Potter (2001) found faster heart rate is accompanied by high imagery stimuli inducing inward oriented thinking. This implies that the previous findings about physiological response in discrete emotion research should be interpreted in different way. By adopting the LC4MP, it is possible to interpret the physiological responses in a systematic way.

Recent research suggests that people have different activation strengths in the motivational systems, and thus have varying tendencies when seeking new experiences and/or enduring negative stimuli (A. Lang, Shin, & Lee, 2005). The primary goal of this study is to examine whether individual differences in motivational activation also play a role in defining specific patterns of physiological responses related to the experience of discrete emotional states.

Practical Importance of the Study

Practically, it is hoped that this study may provide helpful information to PSA producers who is planning to adopt an emotional appeal strategy. PSA producers may make decisions about adopting a certain emotional appeal on the basis of their own experiences and intuitions. As previously mentioned, however, a design based on folk knowledge and experiences might not be just ineffective but may actually evoke unanticipated negative effects in the audience. For this reason, extensive knowledge about emotion is required to properly design a PSA with the emotional tone needed to obtain the intended effects. Thus, it is hoped that this study will contribute to providing theory based knowledge about how the experience of discrete emotions is related to motivational activation while processing television PSAs which, in turn, will provide guidelines on the use of emotional appeals to achieve specific cognition (attention, awareness, memory), attitudinal, and behavioral changes.

Research has demonstrated that some socially unacceptable behaviors and desires are associated with motivational activation in individuals. For instance, high sensation seekers show tendencies prone to take risk-taking behaviors such as drug abuse and unsafe sex (Dahlen, 2005; Desrichard & Denarié, 2005; Jack & Ronan, 1998; Johnson & Cropsey, 2000). It has been suggested that sensation seeking is associated with activation in the appetitive motivational system (Zuckerman, 1990). The high sensation seeker has a tendency to move forward and explore novel and intense stimuli while the low sensation seeker shows a preference for ignoring or evading them. Past research has found that the messages properly designed to embrace high sensation values such as novelty, intense music, and fast-pacing are indeed effective with high sensation seekers (Donohew, Lorch, & Palmgreen, 1991; McNamara & Ballard, 1999; A. Lang et al., 2005).

In the same vein, this study hopes to provide information about whether motivational activation is related to discrete emotion and how individual differences in motivational activation moderates the experience of discrete emotion. This information will both provide theoretical knowledge, which can be used to bridge the gap between dimensional and categorical theories of emotion, and provide practical knowledge about how to select the proper emotional appeal to construct an effective PSA for a specific target audience.

CHAPTER 2

Review of Literature

How to study emotion

There can be numerous ways to study emotion because "we immediately see why there is no limit to the number of possible different emotions which may exist, and why the emotions of different individuals may vary indefinitely, both as to their constitution and as to objects which call them forth" (James, 1983, p1069). Diverse approaches exist to study the potentially limitless number of emotional experiences. They range from the most specific approach of treating all emotional experiences as individually unique (e.g. Lutz, 1988) to the most general approach of considering emotion to be a single dimension (i.e. arousal, Duffy, 1962). Within these approaches, scientific research has focused on the questions - 'how do you dissect indefinite emotional events' and 'what mechanisms underlie an emotional experience'.

We can find an early form of these questions in *Rhetoric* (Aristotle, 1984). He argues that three components are necessary to arrange and understand emotions; "(1) in what frame of mind, (2) with what persons, and (3) on what grounds people grow (an emotion)" (Aristotle, 1984, p94). The components imply that we need to organize the emotions into different boundaries (frame of mind) and to reveal the mechanism by which the organized form is evoked and developed (objects and contexts) in order to study emotions.

Contemplation of these requests has led to two general and dominant theoretical approaches in science. One approach examines and treats emotion as a system of several categories (Frijda, 1987; Plutchik, 1980; Lazarus, 2001). Another approach is to examine the underlying mechanisms associated with the generation and experience of emotions (P.J. Lang, 1984; Cacioppo & Gardner, 1999). In the following sections, the two approaches will be briefly introduced.

Discrete Emotion

Discrete emotion research categorizes emotion into several groups such as anger, happiness, grief, etc., which originated from everyday language and folk knowledge (Averill, 1994). This area put effort into establishing the universal existence of the categories and defining the evaluative factors that precede each categorized emotion (Ekman, Friesen, & Ellsworth, 1972; Izard, 1971; Levenson, Ekman, Heider, & Friesen, 1992; Scherer, Wallbott, Matsumodo, & Kudoh, 1988).

The evaluative factors, often called appraisal, are assumed to elicit and differentiate distinct emotion in this area. Even though appraisal theorists have debates about the definition of cognition (Frijda, 1986), all of them tend to agree that “emotions are elicited by cognitive evaluations (appraisals) of events and situations” (Roseman & Smith, 2001, p3). According to them, the same appraisal pattern in response to a situation or event results in the same emotional category. The appraisal has been described to primarily reflect adaptive values to survive and abound in social environments (Lazarus, 2001; Plutchik, 1980).

Though appraisal theories cover a wide spectrum and provide diverse appraisal components, commonly used factors can be extracted such as motivation (goal relevance, goal congruence, and pleasantness), social relationship (accountability, legitimacy, ego involvement and social norm), and controllability (certainty and coping potential. For review, Roseman & Smith, 2001). Appraisal theories involve diverse social values such as self-esteem, norms, and justification based on the belief that human emotion is different from animal emotion (Lazarus, 1991b).

Self-reports have provided some evidence that appraisal theories can successfully predict and differentiate emotional experiences (e.g. Scherer et al., 1988). However, most of the studies looking for physiologically specific patterns of responses associated with discrete emotions including facial expression and autonomic reactions have not taken the appraisal factors into consideration. For this reason, physiological research often reached conclusions only about the existence of some pattern or the lack of a pattern rather than producing a systematic explanation for any or many specific patterns.

For instance, Ekman, Levenson, & Friesen, (1983) examined differences in heart rate and finger temperature when experiencing anger, fear, sadness, happiness, surprise, and disgust. They used two methods, the directed facial task and the relived emotion task. In the directed facial task, participants were instructed to contract certain muscles which would result in certain emotional expression but they were not asked to produce the emotional expression. In the relived emotion task, subjects were asked to recall and relive a past emotional experience related to each of the six emotions. Findings were consistent across tasks and they found that anger and fear produced faster heart rates than happiness while anger produced higher finger temperatures than happiness.

Other studies by Levenson and colleagues consistently demonstrated faster heart rates for anger compared to disgust, for fear compared to disgust, and for sadness compared to disgust. Anger resulted in higher finger temperature than fear (for review, Levenson, 1992). These differences were found consistently across age, gender and culture (Levenson, Carstensen, Friesen, & Ekman, 1991; Levenson, Ekman, & Friesen, 1990; Levenson, Ekman, Heider & Friesen, 1992; Levenson et al., 1991).

Levenson (1994) compared physiological differences found between specific pleasant and unpleasant emotions. He found that anger produced faster heart rates than happiness, fear produced faster heart rates than happiness, fear produced larger skin conductance response than happiness, and disgust produced larger skin conductance response than happiness. These studies have provided evidence that different discrete emotions produce significantly different levels of physiological responses. However, the studies were not conducted to reveal any relationship between discrete emotions and the potential mechanisms (e.g. appraisal factors). The conclusions, in general, only address the existence of potential physiological specificity, "the fact that emotion-specific autonomic activity occurred is of fundamental theoretical importance, no matter what the underlying mechanisms may turn out to be (Ekman, Levenson, & Friesen, 1983, p1210)"

There have been some efforts to directly measure the influence of appraisal factors on physiological responses. For instance, a computer game study was conducted to study whether physiological reactions can be differentiated by two appraisal factors, goal conduciveness and intrinsic pleasantness (Reekum et al., 2004). Results showed that goal conduciveness was significantly related to physiological responses (heart rate, skin conductance, and finger temperature) whereas intrinsic pleasantness did not affect these responses. The result is controversial in that the manipulated events were assumed to be appraised as intended. Goal conduciveness (success or failure to gain the target) is directly related to game activities whereas pleasantness was manipulated through peripheral cues (random presentation of a pleasant or an unpleasant sound). The relationship of these stimuli to the game activity might have produced the differences, rather than the different appraisals.

Actually, the game study (Reekum et al., 2004) demonstrates many of the problematic issues involved in appraisal theories. First, the appraisal factors suggested by the appraisal theories may be highly inter-correlated and may not represent independent dimensions. For example, Lazarus (1991a) expressed an objection to including pleasantness as an appraisal factor insisting that pleasantness is a response, not an appraisal. These arguments imply that goal conduciveness and pleasantness might be highly correlated or have a causal relationship. Because different appraisal theorists provide different sets of appraisal factors, these factors have served more as obstacles rather than clues to the basic mechanisms underlying discrete emotional experience.

Second, the game study (Reekum et al., 2004) suggests that the dimensional approach might be helpful for predicting and interpreting the physiological responses of emotional experiences. They point out that little attention has been given to the physiological responses of valence-related components within the appraisal approaches. Most of the appraisal studies on physiological response focused on coping-related appraisals (e.g. coping potential and certainty), which ignored effects of valence which may be more fundamental. They suggest that physiological studies in the appraisal domain need to consider findings of the dimensional approach such as changes of heart rate and skin conductance relative to valence and arousal. This implies that when examining physiological responses to discrete emotion as stimuli one might benefit from the dimensional approach.

Emotional dimension

Emotional phenomena involve complex blendings of feelings, thoughts, autonomic change, and behaviors. The dimensional approach, however, suggests, "this response complexity is orchestrated by simpler, underlying motivational parameters" (P. J. Lang, 1995, p 372). In this approach, emotion is generally defined as an action tendency (Cacioppo, Gardner, & Berntson, 1997). The possible action tendencies in a primitive organism are simple, forward and backward (Schneirla, 1959). Survival in a natural environment relies on how well an organism moves towards something good and away from bad things. This simple strategy is embedded in the human genes even though human culture has progressed to create complicated social and technological environments (Reeves & Nass, 1996). Emotion could be characterized as motivationally arranged states of readiness to move towards or away. Life-promoting or -threatening stimuli activate the motivational systems, and emotion is experienced according to the relative force (A. Lang, 2006a).

In the dimensional approach, emotional experience consists of primarily two dimensions, one of direction (valence) and the other of intensity (arousal). The valence dimension represents pleasantness (positive vs. negative) arranged by appetitive or aversive motivation. Positive emotion is usually thought to be generated as a result of appetitive activation elicited by a desired goal (e.g. food, mating). Negative emotion is associated with the activation of the aversive system (e.g. fearful animal).

The valence dimension was often treated as bipolar representing each extreme end of the same system (Russel & Barrett, 1999). In contrast to the bipolar viewpoint, Cacioppo and his colleagues postulate that valenced emotion is produced by two potentially independent motivational systems (i.e. the approach or appetitive system and the avoidance or aversive system) underlying the experience of emotion (Cacioppo & Berntson, 1994; Cacioppo & Gardner, 1999). Arousal, as a dimension of emotional experience, represents not a separate substrate but a larger organism's overall level of activation which is associated with the total activation in the appetitive and aversive systems (P.J. Lang, 1995).

This bivariate approach was constructed based on conflict theory (Brown, 1948; Miller 1959). Brown (1948) trained a group of harnessed rats to run to food and another group to run away from an electronic shock in a short alley. The rats were stopped at a point in the alley and their strength in pulling their harnesses was measured. From these data, gradients for approach and avoidance were constructed with distance from food or shock as the x-axis and strength of pull as the y-axis. The results showed that (1) the tendency to approach food or avoid a shock is stronger when they are closer to the subjects, (2) the gradient of avoidance is steeper than that of approach (negativity bias), and (3) the intercept of the approach system was higher compared to that of the avoid system (positivity offset). In continuing studies, Miller created a conflict situation in which hungry rats were given a shock when faced with food (Miller, 1951; Miller, 1961). He found that when the two incompatible responses are in conflict, the stronger one would occur behaviorally.

Based on the findings, two concepts, negativity bias and positivity offset, were developed (Cacioppo & Gardner, 1999). Positivity offset is the tendency of the organism to approach in a neutral environment. Negativity bias is the tendency of the aversive activation system to respond more quickly and sharply than the appetitive system. Ito, Cacioppo and P. J. Lang (1998) examined positivity, negativity and arousal ratings of 472 slides from the International Affective Picture System. They divided the slides into two groups, positive and negative. Mean arousal ratings were used as an indication of intensity levels for each evaluative system. They found a higher intercept value of the regression line for the set of positive slides and a steeper slope for the negative set of slides. The results demonstrate the theoretical potential of the negativity bias (intense and quick response to harmful objects) and the positivity offset (a little positive feeling in neutral environment).

In addition, Cacioppo and colleagues categorize the relationship between activation in the appetitive and aversive systems as being in one of three categories 1) reciprocal activation, which means that if one system activates the other is inhibited, 2) uncoupled which means activation in one system is not affecting activation in the other system or 3) coactivation – which means both systems are activated in concert (Cacioppo, Gardner, & Berntson, 1999). The relationships manifest dynamic combinations of the appetitive and aversive systems in experiencing an emotion. By embracing the theoretical constructs and findings, the LC4MP suggests that the dimensional approach can be of great use for the studies that examine the information processing of the mediated messages.

Limited Capacity Model of Motivated Mediated Message Processing

The Limited Capacity Model of Motivated Mediated Message Processing (LC4MP) was developed based on the extensive research conducted by A. Lang and colleagues (For review, A. Lang, 2000; A. Lang, 2006a; A. Lang, 2006b). The LC4MP is the expanded version of its predecessor, the Limited Capacity Model of Mediated

Message Processing (A. Lang, 2000) which includes motivational activation as a fundamental mechanism of mediated message processing.

The LC4MP assumes that the human capacity available for information processing at any one time is limited (Geiger & Newhagen 1993; A. Lang, 2000) and provides a basic tool for examining how mediated messages would be processed relative to the limited capacity (A. Lang, Borse, Wise, & David, 2002; A. Lang, Dhillon, & Dong, 1995; Potter, 2000).

The LC4MP explains and predicts the dynamic relationship among medium, content, structure, motivation, and personal relevance for awareness, paying attention, knowledge gain, memory, persuasiveness and behavioral change. The LC4MP has assumptions about cognition, motivation, media, time, and communication (A. Lang, 2006a). The assumption for cognition is that mental capacity to process mediated messages at one point is limited as previously mentioned. It also accepts the notion that cognitive processing (thinking) is physically embodied indicating that brain and body are inseparable and physiology measures are highly useful in order to examine mental processing. The second assumption is that human beings have two motivational systems, the appetitive and aversive system. These motivational systems underlie the dynamic emotional experiences of consuming the mediated messages of the diverse media. The third assumption is that media have multiple channels which include many different visual and auditory components. The fourth assumption is that the mental processing of mediated message varies over time, representing moment-to-moment change with the dynamic interaction among before, now, and after. And the last assumption is that communication is a continuous, dynamic, and embodied interaction occurring over time between the motivated cognitive processing system and the communication message.

The LC4MP suggests that there are three sub-processes in cognitive processing, encoding, storage, and retrieval. Encoding is a selection process by which the receiver can internally represent the external stimuli. Human beings cannot encode all the details of the information included in stimuli. The most prominent information is selected according to the content and structural features of the mediated message. Encoding can be indexed by recognition. Storage is a linking process. When a bit of information is encoded, the relevant information will be activated and the newly encoded information will be associated with currently activated information from the past. Storage is indexed by cued recall. The third process is retrieval. Retrieval is activation of previous information in order to make sense of newly encoded information. During mental processing, human beings need to recall some information already stored to understand the received information in deciding whether the information fits to the person's needs. Retrieval is indexed by free recall.

The subprocesses do occur not in a linear pattern but in simultaneous and concurrent mixtures. The pool of resources available to subprocesses is limited, thus they have to share resources, which creates diverse interactions. When there are not sufficient resources available to fully process a mediated message, cognitive overload will occur affecting either all of the subprocesses or only some of the subprocesses. For example, if someone allocated many resources to encoding, there might be insufficient resources available for the other subprocesses (storage and concurrent retrieval).

Information processing can occur through both automatic and controlled mechanisms. To some extent, an audience member controls message processing as a function of his goals and interests. A person may allocate more resources to what he/she likes or needs. The mediated message also controls processing by eliciting the automatic allocation of resources through the use of content and structural features. In mediated message processing, many content and structural features have been shown to evoke automatic processing such as arousing content, movement, scene changes, camera changes, graphics, voice changes, music onsets and sound effects (Fox et al, 2004; Reeves et al., 1985; A. Lang, 1991; A. Lang, Geiger, Strickwerda, & Sumner, 1993; Potter, 2000; Potter, A. Lang, & Bolls, 1998).

The orienting response is an important mechanism for automatically allocating resources to a stimulus (i.e. encoding). The orienting response, often called the 'what is it' response, keeps us aware of significant changes in the environment (Graham, 1979; Sokolov, 1963). Automatic allocation elicited by orienting responses means that the organism cannot consciously prevent the resources being allocated to the cognitive processes (Potter, 2000). The orienting response is regarded as a component of exploratory behavior and it leads to the collecting of information regardless of its usefulness (Sokolov, Spinks, Naatanen, & Lyytinen, 2002). Orienting responses are elicited by two types of stimuli, novel and signal. Novel stimuli are things which are new in the current environment. For example, when you listen to music in a room, a sudden noise from outside will be new to the situation. Signal stimuli are things you have learned as important such as your name.

Emotional content has been also found to elicit the automatic allocation of mental resources. For instance, A. Lang et al. (2002) found that only motivationally relevant content evoked orienting responses when messages were presented on a computer screen. According to the LC4MP, mediated messages containing motivationally relevant content activate the appetitive and/or aversive system (A. Lang, 2006a). Activated motivational systems bring about on-line physiological and behavioral responses. Shortly after the onset of a motivation-eliciting message (i.e. 600 to 750 milliseconds), the motivationally activated body and brain evoke the conscious experience of an emotional feeling (A. Lang, 2006b). LC4MP considers motivation as “the very beginning of a causal chain of responses that leads from a stimulus to an emotional feeling or experience” (A. Lang, 2006b, p 245). While the initial motivational activation happens quickly and unconsciously in response to some stimulus, once that has occurred human beings’ conscious emotional experience is dynamic, context dependent and interactive involving cognitive evaluations (e.g. appraisal), physiological responses, behavioral activity, and the on-going variation in activation of the motivational systems.

The emotional feeling is a subjective experience which means that it is influenced by a person’s previous experiences as well as by current context. Horrifying scenes from a movie can activate the aversive system which elicits on-line physiological and behavioral responses like hunching and eye closure. However, during media viewing, higher order cognitive processes will remind us that this is not real. Therefore viewers can continue to and even enjoy watching. In spite of the inhibition of activation elicited by higher order processes during media viewing, the LC4MP suggests that the motivational activation and accompanying physiological responses are nonetheless playing a role in both the emotional experience and the information processing of the mediated messages. The motivational activation is fundamental maintaining and sustaining conscious emotional experience (A. Lang, 2006a).

The LC4MP also predicts how motivational activation impacts cognitive processing of mediated messages (A. Lang, 2006a). A human being has to deal with demands from the environment in order to survive. One way in which these demands from the environment are met is through the activation of the motivational system. Thus, the thinking process is modulated by motivational activation which carries the demands from the environment. Motivational systems activated by certain content and/or structure of a mediated message modulate the pattern of mental resource allocation during processing. Motivationally relevant stimuli have a greater potential to be encoded compared to other types of messages (A. Lang, 2006a).

Research within the LC4MP perspective has constructed measures to index individual differences in positivity offset and negativity bias (A. Lang, Shin, & Lee, 2005). This is called the Motivational Activation Measure (MAM, A. Lang, Wang, Bradley, 2004). Research demonstrates that MAM is related to sensation-seeking scores (A. Lang, Shin, & Lee, 2005). A great deal of research has shown that high sensation seeking people pursue high-risk activities such as drug abuse, heavy alcohol consumption, risky driving, unprotected sexual relationships, etc (Dahlen, 2005; Desrichard & Denarié, 2005; Jack & Ronan, 1998; Johnson & Cropsey, 2000; Kalichman, Cain, Allan, & Swain, 2003; Yanovitzky, 2005). It has been suggested that sensation seeking is associated with individual variation in the activation level of the appetitive and/or the aversive systems. Zuckerman (1996) argues that high, compared to low, sensation seekers have biologically overactive appetitive systems based on evidence of high reactivity in the dopamine system and more weakly reactive aversive system based on low reactivity in the serotonin system to novel and intense situation.

A. Lang and her colleagues have shown that high, compared to low, positivity offset individuals (measured by MAM), who are expected to be greater risk takers, show more approach activation while viewing mediated messages, including PSAs, indexed by longer looking time, slower heart rates, more self-reported positive feelings, smaller startle responses, and larger zygomatic responses regardless of stimuli type (positive or negative, A. Lang, S. D. Bradley, & Sparks, 2004; Lee & Park, 2006; Yegiyan, S. D. Bradley, & A. Lang, 2005). Similarly low, compared to high, negativity bias people, expected to be low risk takers, show more aversive tendencies to negativity-ridden messages (A. Lang, S. D. Bradley, & Sparks, 2004; Yegiyan, S. D. Bradley, & A. Lang, 2005). Overall, individuals with different appetitive and aversive motivational system activation characteristics exhibited different mediated message processing patterns.

This study will attempt to examine whether mediated messages portraying and eliciting specific discrete emotions – joy, sadness, anger, and fear – activate the motivational systems variably and predictably and how the activated appetitive and/or aversive system modulate subjective emotional experience and cognitive processing. In the following sections, the discussions and research related to the specific emotions of joy, sadness, fear and anger will be addressed relative to motivational activation.

Discrete Emotions (Joy, Sadness, Fear, and Anger)

Joy

In this study, joy is thought to be associated with a highly activated appetitive system based on the discussions and research related to joyful experience. Joy is often used interchangeably with happiness or regarded as a strongly happy emotion (Lazarus, 1991a). Positive or pleasant emotions, often called happiness or joy, are differentiated by their level of activation or arousal while negative emotions are generally identified by several different categories (Ekman, 1992; Izard, 1977). Positive emotions can be arranged from states of low activation to states of high activation. Words for low activated positive emotions are contentment, pride, peacefulness, etc and words for highly activated are joy, cheer, delight, etc (Averill & More, 2000; Ellsworth & Smith, 1988b).

Emotional theorists have described 'joy' as experiencing the context of obtaining considerable progress toward a desirable goal (Lazarus, 1991a; Ortony, Clore, & Collins, 1988). Desirable goals for human beings are achievable, though challenging, pursuits related to survival in the environment (Locke & Latham, 1990; Bandura, 1997). An undesirable goal may result in jealousy, fear or feeling overwhelmed. A joyful feeling is elicited from when an important goal is achieved, either expectedly or unexpectedly, which then evokes excitements.

The positive emotions elicited by goal achievement have been also found to be helpful for achieving another task. Frederickson (1988) suggests that positive emotions including joy increase an individual's thought-action supplies of resources for attention, memory, learning, and sociability which are helpful for producing flexible and adjustable behaviors adaptive to different contexts. For instance, Bryan and his colleagues found a brief positive mood induction (thought of one minute of a happy moment) elicited better performance on math problems, short-term memory tasks, and learning words with normal and mentally disabled students compared to neutral condition (T. Bryan & J. Bryan, 1991; T. Bryan, Mathur, & Sullivan, 1996; Yasutake & T. Bryan, 1995). Masters, Barden, & Ford (1979) found four-year-old children showed better performance on a shape discrimination task in the positive mood condition compared to the neutral and negative mood conditions.

When groups of people express joy, “the psychological distance from others appears to decrease. There is an impulse to celebrate the meaningfulness of the meeting and to include others in this celebration.” (De Rivera, Possel, Verette, & Weiner, 1989, p 1016). Joyful interactions with the mother are important for an infant’s survival. Joyful interactions such as smiles boost the strength of the mother-infant attachment which is fundamental to the infants’ survival (Izard, 1977). The degree to which the interaction is built up, the child feeling free leads to explore the society around him (Tomkins, 1984).

Joyful expressions are in general associated with obtaining satiation and invulnerability which produce feeling of freedom (Frijda, 1986). Feeling of freedom in joy elicits behaviors of excitement. Frijda (1986) addresses that joyful response and excitement share considerable commonalities and thus may be indivisible in many situations. Joyful behaviors have often been described as aimless or superfluous excitement (Frijda, 1986). Darwin (1965) describes joyful behavioral expression as highly aroused such as “various purposeless movements-to dancing about, clapping the hands, stamping, and to loud laughter” (p. 196). We often see athletes punching the sky to express satisfaction with winning. It has been suggested that these behavioral responses are the expressions of freedom (Frijda, 1986; Izard, 1977). A hunter who has just obtained his quarry may shout and jump into the air. This, at a glance, purposeless behavior is thought to express freedom from starvation and from the risks confronting hunter.

The feelings of freedom from harm which are a part of feeling joyful may help to make a person feel safe and therefore motivate them to explore. Strategy or action tendencies involved in joy should be 'moving toward something' (Roseman, 2001). From the perspective of the LC4MP, joy can be thought of a positive emotional state with a highly activated appetitive system. In joy the aversive system should be inactive or even inhibited.

Sadness

In this study, sadness is thought to be associated with a moderately to weakly activated aversive system based on the discussions and research related to sad experience. Sadness is produced contextually from loss of objects of interest (Frijda, 1987; Lazarus, 1991a). Sadness is felt when the situation, which elicited the loss, may have been reversible whereas resignation is felt when the situation is perceived to be irreversible (Ellsworth & Smith, 1988a). When experiencing sadness, people accept the loss, as the outcome of a once but no longer reversible event (Stein & Levine, 1990). A man who is disappointed in love feels sad if he accepts that the situation is no longer reversible as the girl is married to someone else thus she is lost. Frijda, Kuipers, & Schure (1989) reported that people perceive sadness as a result of experiencing negative events which are uncontrollable.

It has been observed that sad people tend to retreat from the outside world (Tomkins, 1963). Bowlby (1980) suggested that the retreat associated with sadness is explicable by 'defensive exclusion'. A sad person attempts to divert him or herself from the events or people which evoked the sadness. This results in systematic (mental and physiological) reduction of input (both thoughts and feeling) from outside. This results in a state of inactivity which slows down mental and physical processing. Sadness has been described as an 'absence of interest' or as a 'null state' (Frijda, 1987). Some theorists argue that feeling sad is not just a 'null state' but leads the person focus on self (Stein & Jewett, 1986). It has been suggested that sadness is associated with blaming one's self whereas anger is related to blaming an external cause (Hochschild, 1983).

Experiencing sadness has been figured as two stages. Stein & Jewett (1986) suggest that the initial cognitive processing associated with sadness is to accept the loss and abandon the specific goal which has been irrevocably lost. In the second phase, the sad person attempts to change the state by diverting thoughts towards wishful thinking about other opportunities. A man who lost a girl feels sad at first and then tries to recover from the loss by thinking about another girl. The slowing of mental processes in sadness may function to enable more elaboration about 'what happened and how it happened' and produce careful reflection on the performance that brought failure (Tomkins, 1963). The deliberate elaboration of the self associated with circumstances in sadness may allow the individual to pay deeper attention to the pursuit of the goal and to obtain a new perspective about the future plan (Stein & Jewett, 1986).

The mental and physical processing in sadness has been shown to be contagious producing helping intentions and concern for others. The sad expression may signal a terrible situation from which a person suffers (Izard, 1977). The sad expression is carried over to other people who encounter and motivates others to try to reduce that person's suffering (Eisenberg, 1991). Sadness has been considered to be most effective in appealing for help where the person is unable to cope effectively with the situation (Ellsworth &Smith, 1988). Sad feelings elicited by watching someone's sad situation may produce a helping motivation from either self-identification (an emotional signal of oneness or merging, Cialdini et al., 1997) or, just altruistic feelings beyond self-interest (Baston et al., 1997).

People experiencing sadness have been observed to be physically and behaviorally immobilized. The action disposition of sadness is generally thought to be one of no action or inaction (Lazarus, 1991a; Roseman, 2001). In a study by Termine & Izard (1988), nine-month-old infants watched their mothers' facial and vocal expressions of sadness. They found that that mother's sad expressions decreased the exploratory play and interest of the infants in four sets of toys. Sadness was also reported to elicit a preference for inactivity. Rucker & Petty (2004) found that participants in a sad mood showed a preference for a vacation resort advertised as a place to relax over one advertised as a place to engage in active pursuits. From this, it can be posited that sadness is a relatively calm emotion. Sadness has been regarded as a moderately intense unpleasant feeling (Russell & Barrett, 1999).

Roseman (2001) characterizes the strategy or action tendency involved in sadness as 'stop moving toward something'. From the LC4MP perspective it is reasonable to think of sadness as being a moderately to weakly activated aversive motivational state.

The appetitive system is likely to be inactive (early in sadness) or activated at a low level (at later stages of wishful thinking).

Fear

In this study, fear is thought to be associated with a strongly activated aversive system based on the discussions and research related to fearful experience. Fear has been described as experienced in the context of imminently upcoming danger or harm (P. J. Lang, Davis, & Öhman, 2000; Lazarus, 1991a). This context should produce the impulse to avoid the threatening objects, and likely activates the aversive system at a high level.

Arrindell et al. (1991) categorized four factors provoking fear, “interpersonal event or situation”, “death, injuries, illness, blood, and surgical procedures”, “animals”, and “agoraphobic fears”. Interpersonal fear occurs in social interactions such as critical evaluation, conflicts, social threats, etc. Fear can be evoked by objects or events which potentially threaten harm or destruction to physical health. Fearful objects are not only threatening predators but also creeping and crawling animals such as spiders and snakes. Agoraphobic fear indicates the fearful experience of entering open public areas, traveling alone, or being left in closed spaces such as the elevator (Arrindell et al., 1991).

Fear is often described as associated with uncertainty because it is an emotion about an upcoming event as in “a pain or disturbance due to a mental picture of some destructive or painful evil in the future” (Aristotle, 1984, p103). Past research has found that fearful events are evaluated as those with uncertain outcomes that were not expected to occur (Frijda, Kuipers, & Schure, 1989; Roseman, Antoniou, & Jose, 1996). Ellsworth & Smith (1988a) address how the uncertainty in fear might be characterized in detail. According to them, uncertainty in fear is more likely to be related to one’s coping potential, or whether the person is able to deal with the upcoming threat by escaping or gaining help from others. A person in a dead-end alley, for example, will feel more fearful encountering a stranger at night compared to one in an open-ended alley.

In uncertain situations, fear may involve taking precautions against the potentially dangerous objects. Fearful responses are mixtures of vigilance for identification, and cautious inhibition of action in the context of confronting the risks (Frijda, 1987). P. J. Lang and colleagues suggested the defense cascade theory demonstrates how fearful experiences develop (M. M. Bradley, Cuthbert & P. J. Lang, 1999). The defense cascade suggests that when the intensity of a negative stimulus is low to moderate, a pattern of approach responses, primarily oriented attention, is reported: larger skin conductance, heart deceleration, and inhibited startle reflexes. For instance, Cuthbert, M. M. Bradely & P. J. Lang (1996) found that while startle responses elicited several seconds after onset of a picture are largest for the most arousing, unpleasant pictures. For moderately unpleasant pictures startle responses were inhibited by the attentional engagement. This suggests that when an organism confronts a potentially dangerous object, the organism needs to figure out how much danger there is in order to be prepared to cope with the threat.

In a situation of imminent and obvious harm, fear is accompanied by strongly defensive behaviors such as “forceful eye closure, frowning by drawing the eyebrows together, bending the head, hunching the shoulders, bending the trunk and knees” (Frijda, 1986, p16). Fear is generally considered to be associated with a strongly activated avoidance motive (Lazarus, 1991a). “If there were no restraints, internal or external, fear would support the action of flight” (Öhman, 2000a, p 574). This should accompany quick responses with a highly aroused state.

When confronting an intensively fearful stimulus, the mental and physiological systems quickly become ready to defend or avoid. From the perspective of the LC4MP, fear is thought of an emotional state associated with a highly activated aversive system. In fear the appetitive system may be inactive or even inhibited.

Anger

In this study, anger is thought to be associated with activation in both the appetitive and aversive systems based on to the extent research and theory about the experience of anger. Anger has generally been considered to be an emotional state in which the innate action disposition is to attack the blameworthy object (Frijda, 1986; Lazarus, 1991a, Tomkins, 1963). Anger is the feeling of being curbed from attaining what is intensely desired because of an unjust obstacle. "If the barrier really prevents the attainment of a highly desirable goal or some aspect of self-expression, anger is almost certain to occur eventually" (Izard, 1977).

Anger is an emotion associated with fight or attack. The proposed function of anger is to prepare and motivate the person to remove an obstacle to his or her own well being from the environment. Izard (1977) addresses that anger makes a person able to "mobilize one's energy and defend oneself with great vigor and strength" (p 333). Some researchers focus on the maladaptive function of anger arguing that anger evokes social conflict. For instance, it was found that adolescents could learn maladaptive anger expression styles in a family which are then associated with dating violence (Wolf & Foshee, 2003). However, it has been suggested that anger has adaptive functions for increasing mental and physical health. Through anger, one can build up strength (e.g. self-confidence) to stand up against harassment and abuse. Clinical and experimental data show that failure to express anger can result in cognitive, physiological, and social disorders (for review, Holt, 1970).

Due to the antagonistic feeling caused by the setback of a goal, anger has been considered to be a negative emotion (P. J. Lang, 1995). Russel & Barret (1999) placed anger very close to fear in their circumplex model, with both representing unpleasant emotions. Anger has been considered to be an outcome or extension of the mingling of unpleasant emotions because "any kind of negative affect, sadness as well as depression agitated irritability, will produce aggressive inclinations and the primitive experience of anger before the higher order processing goes into operation" (Berkowitz, 1989, p71).

Other emotion researchers, however, have paid attention to features of anger that are related to approach tendencies and might involve positive feelings. Anger has been considered to be unique among the negative emotions in that during anger a person is prone to move towards the opponent instead of away. Anger is associated with antagonistic inclination such as assault even though it is related inwardly with unpleasant feelings (Frijda, Kuipers, & Schure, 1989). Often anger is accompanied by widened eyes which are thought to be associated with a forward action tendency rather than retreat (Frijda, 1986).

Even though an angry person feels pain, he or she will impetuously seek revenge for an obvious slight, perceived as unjustified, directed at self or friends (Aristotle, 1984). In addition, angry people may experience a certain pleasure which arises from the expectation of revenge. An angry person might become excited by the mental picture of sweet revenge. Aristotle (1984) cites a phrase from the *Iliad* in which he describes anger as “sweeter it is by far than the honeycomb dripping with sweetness, and spreads through the hearts of men” (p92).

The unique quality of anger has captured the attention of some researchers. Harmon-Jones and colleagues have conducted a series of electroencephalography (EEG) experiments and reported that anger could be associated with the approach system. Many EEG studies have demonstrated that left frontal activity is associated with positive emotions and that right frontal activity is associated with negative emotions (Davison, 1995; Harmon-Jones et al., 2004; Silberman & Weingartner, 1986). Harmon-Jones & Allen (1998) found that greater left frontal activity during resting periods was positively correlated with trait anger while induced anger resulted in relatively greater left frontal compared to right frontal activity (Harmon-Jones, 2003). Increased relative left frontal activity occurred concurrently with increased self-reported anger and behavioral aggression (Harmon-Jones & Sigelman, 2001). Increased left frontal cortical activity is also greater when individuals expect the target object (i.e. the source of anger) to be approachable (Harmon-Jones, Sigelman, Bohlig, & Harmon-Jones, 2004). When the source of anger is perceived as unapproachable, the subjects did not show an increase in left frontal activity.

Indeed, evidence suggests that anger may be driven by both the appetitive and aversive systems. In other words, anger is likely to be a coactive feeling state. In a study by Roseman, Spindel, & Jose (1990), anger was rated as moderate between joy and fear on the motivational state scale. The motivational scale was composed of three 9-point scales, which ranged from aversive motivations (1) to appetitive motivations (9). This result provides indirect support for the hypothesis that anger is experienced as function of coactivation of both the appetitive and aversive systems.

Carver (2004) used individual tendency measures of the behavioral approach system (BAS) and the behavioral inhibition system (BIS) in order to examine how anger is related to them. High scores in the BAS indicate more sensitivity to momentary positive affect and approach behavior. High scores in the BIS represent more sensitivity to momentary anxiety and avoidance (Carver & White, 1994). Carver (2004) found that two subscales - drive and reward responsiveness - predicted reports of greater anger in response to various anger scenarios including the terrorist attacks of September 11. The BIS also significantly predicted greater anger. This study provides evidences that anger might be associated with both the approach and avoidance system.

Emotional theorists agree that the experience of anger is associated with a brutal explosion and then maintenance of energy at a high level. According to Izard & Ackerman (2000), no other emotions can compete with anger's ability to sustain a high level of arousal. Aristotle (1984) described anger as the opposite of calm. He addressed that "growing calm may be defined as a settling down or quieting of anger" (Aristotle, 1984, p 97). We often see an action hero in a movie with congested muscles and clenched fists staring at the opponent who kidnapped his daughter. During anger people demonstrate antagonistic expressions, "the mouth is generally closed with firmness, showing fixed determination, and the teeth are clenched or ground together" (Darwin, 1965, p 239). These descriptions represent a high, mentally and physically, arousing state of anger.

Based on the previous discussions, from the perspective of the LC4MP, anger can be thought of as an emotional state associated with activation of both the appetitive and aversive systems. The level of the activation in the appetitive system during anger is likely to be lower than that experienced during joy because anger is not an obviously pleasant emotion. The level of activation in the aversive system during anger is likely lower than that experienced during fear because anger requires approach. However, the overall level of arousal experienced during anger may be higher than that experienced during either joy or fear due to the combined activation of the appetitive and aversive systems.

Hypotheses

This study was designed to test the overall hypothesis from the LC4MP that the experiences of the discrete emotions of joy, sadness, fear, and anger are associated with (indeed are perhaps caused by) predictable patterns of activation in the motivational systems. Joy is thought to be the result of strong appetitive activation and aversive inhibition. Fear is thought to be the result of strong aversive activation and appetitive inhibition. Sadness is thought to be the results of moderate aversive activation and inactive or weak appetitive activation. Anger is thought to be the results of moderately strong aversive and appetitive activation. It should be noted that specific levels of motivational activation do not necessarily equal a discrete emotion. For instance, moderate aversive activation and inactive or weak appetitive activation could produce an emotional experience that a person might label anxiety instead of sadness depending on the evaluation of the context. Labeling each discrete emotion is not only associated with the motivational activation but also with evaluative factors, cultural experiences and the language forms.

In order to test the hypotheses, it is necessary to be able to measure appetitive and aversive activation. Research has demonstrated that there are predictable patterns of emotional and physiological responses associated with states of appetitive and aversive activation. Several of these are reviewed below and will be used in this study as indicators of the activation in the motivational systems.

Self Reported Emotional Experience

Emotional responses have been widely measured using data from three different sets of response systems; self-reports of affective experience, physiological patterns, and behavioral responses (P. J. Lang, 1988). In general, as mentioned previously, motivational activation is thought to be a major mechanism underlying sustained conscious emotional experience (A. Lang, 2006a). Thus, people should report feeling more positive during appetitive activation and more negative during aversive activation.

Self-report measure often use many words related to the emotion which is to be measured. Mehrabian & Russell (1974) proposed 18 bipolar adjective pairs representing three emotional dimensions (pleasure, arousal, and dominance). In this measure, six adjective pairs are assigned to each of the three dimensions. For instance, the valence dimension includes unhappy-happy, annoyed-pleased, unsatisfied-satisfied, melancholic-contented, despairing-hopeful, and bored-relaxed.

P. J. Lang and colleagues questioned the usefulness of the measure because the subjects had to rate a cumbersome number of questions and sought for a simpler measurement system. The Self-Assessment Manikin (SAM) was developed for this purpose (P. J. Lang, 1980; M. M. Bradley & P. J. Lang, 1994). SAM is a nonverbal, pictorial depiction of nine points along each dimension (valence, arousal, and dominance). For valence rating, SAM ranges from a smiling, pleasant figure to a frowning, unpleasant figure. M. M. Bradley & P. J. Lang (1994) compared SAM with the 18 adjective measures used by Mehrabian & Russell (1974) and found almost perfect correlations between two measures especially with valence and arousal showing 95 to 99 percent correlations.

SAM has been proven to be a reliable and valid measure of emotional experience in studies of mediated messages (A. Lang, Bolls, Potter, & Kawahara, 1999; A. Lang, Dhillon, & Dong, 1995). However, there is a problem with this measure for research using the LC4MP because SAM was constructed as bipolar measure (M. M. Bradley & P. J. Lang, 1994). Thus, a person can only report positive or negative feeling, not both. Because this study posits the appetitive and aversive system are independent, it is necessary for the positive and negative valence dimensions to be measured separately. To do this, SAM was split at the neutral position to create two nine-point scales, one ranging from neutral to extremely negative and another ranging from neutral to extremely positive.

This study posits that fearful content should activate the aversive system at a high level and inhibit the appetitive system. Sad content should activate the aversive system at a moderate level and the appetitive system at a low level. Joyful content should activate the appetitive system at a high level and inhibit the aversive system. Angry content should activate both the appetitive and aversive systems at moderate levels. Based on these notions, the following hypotheses are offered about participant's subjective feelings of positivity and negativity when experiencing fear, sadness, joy, and anger respectively.

H1. Participants will self-report feeling the most positive feelings during joyful messages followed by angry, followed by neutral and sad, and followed by fearful messages.

H2. Participants will self-report feeling the most negative during fearful messages followed by angry and sad, followed by neutral, and followed by joyful messages.

Although self-reports are often used to measure affective responses, they can be distorted by biases such as social desirability (Vanman, Paul, Ito, & Miller, 1997). In addition self-report measures capture a global response after stimulus presentation. Television messages unfold across time and emotional, cognitive and physiological responses vary according to the content and structural changes. Emotional states such as joy, anger, fear and sadness in viewers fluctuate during the message, grow and decline. "Even in the case of uniformly positive or negative messages, the overall experience of watching television is rarely representative of a single emotional state" (A. Lang & Friestad, 1993, p 654). It is likely that only a small portion of a television message elicits a pure form of each discrete emotional state. Given this issue, the current study attempts to isolate and examine the time period most representative of each discrete emotion during the whole message.

Another problem with self-reports is that they capture only the conscious experience of emotion. While this experience is thought to be related to motivational activation it is not a measure of motivational activation. In addition to self-reports this study will also use physiological data, thought in some cases to actually indicate and in other cases to be correlated with motivational activation. These physiological measures also have the advantage of being collected over time and can therefore reflect the dynamic nature of both motivational experience and the interaction between mediated emotional content and motivational activation. Among the measures related to appetitive activation are the varying patterns of activation found in the facial muscles – which are associated with the various facial expressions experienced during the emotions described previously. Activation in the zygomatic and orbicularis oculi muscle groups is associated with positive expressions and appetitive activation. Activation in the corrugator muscle group is associated with negative facial expressions and aversive activation.

Orbicularis Muscle Activation and Motivational Activation

Facial EMG activity over the orbicularis oculi and zygomatic muscle group is known to be associated with positive emotional experience and is thought be an indicator of appetitive activation (Bolls, A. Lang, & Potter, 2001; S. D. Bradley, 2005; Park, 2006; Ravaja et al., 2004). The zygomatic muscle group is located along the cheek just above the both sides of the lip (Bolls, A. Lang, & Potter, 2001) and the orbicularis oculi muscle group is located underneath the eyes (Ekman, Davidson, & Friesen, 1990). Both muscle groups are related to smiling, contracted to draw up the corner of the eyes (orbicularis oculi) or the lip (zygomatic) when one smiles.

This study will use the orbicularis oculi rather than the zygomatic activity as an indicator of appetitive activation for two reasons. First, the zygomatic muscle group is in a particularly crowded region of the face and overlaps with other muscle groups (Larsen, Norris, & Cacioppo, 2003). P. J. Lang, Greenwald, Bradley, & Hamm (1993) reported that the zygomatic muscle group can be activated by some highly aversive stimuli. Second, the orbicularis oculi has been shown to discriminate between real pleasure (spontaneous smiles) and faked joyful expressions (posed smiles) (Ekman, Davidson, & Friesen, 1990; Ravaja et al., 2004). Darwin (1965) first mentioned the potential importance of the orbicularis oculi during smiling. Darwin showed a picture of an old man provided by Dr. Duchenne to twenty-four subjects. The old man in the picture strongly contracted only the region of zygomatic muscles. The subjects evaluated the old man's smile as clearly unnatural. Darwin attributed "the falseness of the expression altogether to the orbicular muscles of the lower eyelids not being sufficiently contracted" (Darwin, 1965, p 202). Ekman, Davison, & Friesen (1990) empirically tested this hypothesis and found support for this hypothesis.

From this discussion, the activity of orbicularis oculi muscle groups should be highly correlated with the activity of the appetitive system. Thus,

H3. Participants will have the largest orbicularis oculi activation during joyful messages followed by angry, followed by neutral and sad, and followed by fearful messages.

Corrugator Muscle Activation and Motivational Activation

Activation in the corrugator muscle group located just over the eyebrows has been shown to be responsible for frowning (Bolls, A. Lang, & Potter, 2001; M. M. Bradley & P. J. Lang, 2000). Past research has observed a strong and reliable linear effect of valence on corrugator activity, with the least corrugator activity during pleasant and the most corrugator activity during unpleasant stimuli (P. J. Lang, Greenwald, M. M. Bradley, &

Hamm, 1993; Cacioppo, Petty, Losch, & Kim, 1986) suggesting that corrugator activation is highly associated with aversive activation and appetitive inhibition. Thus,

H4. Participants will have the greatest corrugator activation during fearful messages followed by angry and sad, followed by neutral, and followed by joyful messages.

Startle Responses and Motivational Activation

The startle response has been shown to be a good indicator of both aversive and appetitive activation because it is potentiated during aversive activation and inhibited during appetitive activation.

Activation of the appropriate motivational system is considered to be preparatory to undertaking an appropriate action to deal with the situation. It is proposed that this preparation plays a role in priming the "association, representation, and action programs that are linked to the engaged motivational system" (P. J. Lang, M. M. Bradley, & Cuthbert, 1997, p 110). Priming results in representations associated with the engaged system being more accessible compared to representations associated with the non-engaged system. Activation of the engaged system should strengthen responses to cues associated with it. Similarly, activation of the engaged system should attenuate responses associated with the non-engaged system. Thus, when the aversive system is engaged, the response to a fearful event will be primed and easily accessed, and the response to a pleasant event will be inhibited (P. J. Lang et al., 1999).

Much research has examined the existence of emotional priming with unconditioned reflexes. It appears that an activated aversive system primes startle potentiation (M. M. Bradley, Cuthbert & P. J. Lang, 1999). Startle is a reaction to an intense stimulation. Moderately intense stimulation would elicit an orienting response, not a startle response (Graham, 1979). Startle responses involve various movements that can flow throughout the body. Those movements are "blinking of the eyes, head movement forward, a characteristic facial expression, raising and drawing of forward of the shoulders, abduction of the upper arms, bending of the elbows, pronation of the lower arms, flexion of the fingers, forward movement of the trunk, contraction of the abdomen, and bending of the knees." (Landis & Hunt, 1939, p21).

Startle responses appear to be a series of chained defensive behaviors (e.g. eye blinking) that function as protection by avoiding organ damage (Graham, 1979). Eye blinking has been shown to be the most reliable and valid component of startle (Graham, 1975). The rapid rise of a loud and sharp acoustic stimulus is an effective startle eliciting stimulus and has been used in many studies (Brown, Kalish, & Farber, 1951; Flesher, 1965; P. J. Lang, M. M. Bradley, & Cuthbert, 1990). Mediated messages such as pictures, television messages, and video games – have all been used to elicit foreground priming of the motivational systems and modulate the startle response (S. D. Bradley, 2005; P. J. Lang, M. M. Bradley, & Cuthbert, 1990; Park, 2006; Sparks, 2006).

In addition to the significant results of the existence of the priming, the startle reflex has been found to be modulated by the motivational systems. Brown, Kalish, and Farber (1951) compared startle responses between the neutral and pain conditions. Rats in the pain condition showed significantly larger startle response than did those in the neutral condition. Vrana, Spence, and P. J. Lang (1998) reported that the startle magnitude could be modified by positive and negative states in human beings. Eyeblink startle responses are largest during negative stimuli and smallest during positive ones. In addition, modulatory effects on the startle reflex appear to increase according to the intensity of the activation in each motivational system. Cuthbert, M. M. Bradley & P. J. Lang (1996) found that startle potentiation is largest with the most arousing, unpleasant pictures, whereas startle inhibition is largest with the most arousing, pleasant pictures.

As previously mentioned, the experience of fear should result from strong activation in the aversive system. Sadness is thought to be results from a moderate level of aversive activation and perhaps some very slight appetitive activation. Anger is thought to be caused by a moderate level of aversive activation and a moderate level of appetitive activation. During joy the aversive system is thought to be inhibited. Therefore, fear should elicit the largest startle – corresponding to the most active aversive system with no appetitive activation followed by sadness. Anger should come next with moderate aversive activation and simultaneous appetitive activation, and finally, joy should produce very small, inhibited startles. This leads to Hypothesis 5:

H5. Participants will have the largest startles during fearful messages followed by sad and angry, followed by neutral, and followed by joyful messages.

<u>Arousal and Level of Motivational Activation</u>

Arousal, in dimensional emotion theory, is the dimension manifesting strength or intensity of the emotional experience. It is thought to be associated with "activation of either the appetitive or aversive system, or the coactivation of both systems" (P.J. Lang, M. M. Bradley, & Cuthbert, 1997, p101). Arousal, measured by self-report and physiological response, tends to increases as either positivity or negativity increase (P. J. Lang, Bradley, & Cuthbert, 1997).

Self-reports of emotional arousal have been shown to be correlated with physiological measures of activation in the sympathetic nervous system. In particular, physiological arousal experienced during media use is often indexed by skin conductance. Skin conductance measures the activation of electrodermal system which is innervated only by the sympathetic nervous system (Dawson, Schell, & Filion, 2000; Hopkins, & Fletcher, 1994). It has been widely supported that skin conductance is a useful measure of physiological arousal (P. J. Lang et al, 1993; A. Lang et al, 1999). P. J. Lang et al. (1993) reported that the amount of skin conductance activity increased as the self-rated arousal of an emotional picture increases. Over 80% of the subjects demonstrated a positive correlation between arousal self-reports and skin conductance response for both positive and negative pictures.

As mentioned previously, joy should result from a high level of activation in the appetitive system, fear from a high level of activation in the aversive system, sadness from moderate activation of the aversive system, and anger from coactivation of both systems at a moderate level. This view may predict that anger will elicit the most arousing experience because both systems are activated whereas other emotions are likely to involve only one system. On the other hand, extreme activation of one system may be much more arousing than moderate activation of both depending on the shape of the activation functions.

As a beginning point, this study will predict that coactivation of the motivational systems during television viewing should evoke more arousing responses than activation of a single system. Two reasons support this decision. First, television messages rarely elicit extremely emotional responses in viewers even though the types of risky messages seen in health campaigns are likely to be more arousing than some other types of messages (A. Lang, Schwartz, Chung, & Lee, 2004). One reason for this is that viewers realize that the situation is happening on television, and thus activation of either the appetitive or aversive system is limited compared to a real situation. Second, a coactive feeling state like anger may involve conflict which will influence arousal. Coactivation of both motivational systems has been shown to produce conflict in animals. For instance, Miller created a conflict situation in which hungry rats were given a shock when faced with food (Miller, 1951; Miller, 1961). The conflict was solved behaviorally by choosing the direction (approach or avoid), which was most strongly activated (Miller, 1961). However, during the conflict, cognitive and physiological responses should be more intense compared to the context without conflict. Thus, this study argues that anger should elicit more arousing responses compared to fear or joy which leads to hypothesis 6.

H6. Participants will self-report feeling the most aroused and have the most skin conductance activity during angry messages followed by fearful and joyful, followed by sad, and followed by neutral messages.

<u>Motivational Activation, Emotional Experience and Encoding</u>

LC4MP argues that cognitive resources are automatically allocated to the process of encoding motivationally relevant stimuli, either positive or negative (A. Lang, 2006a; A. Lang, 2006b). As previously mentioned, encoding is a selection process by which the receiver can internally represent the external stimuli. The activation of the approach system elicits allocation of resources to external stimuli as an organism explores the environment and seeks to obtain desirable objects. For instance, the behavioral expression of joy involves “delighted gazing at the object” (Frija, 1986, p36). On the other hand, high levels of activation of the avoidance system involve defensive or protective responses that minimize the contact with undesirable objects. However, when there is no imminent danger, in other words below the threshold, activation of the defense system also accompanies increased resource allocation to external stimuli (M. M. Bradley, 2000).

According to the LC4MP (A. Lang, 2006a), during appetitive activation, increases in arousing content should be positively and quite linearly related to increases in resources allocated to encoding. During aversive activation, increases in arousing content initially result in an increase in resources allocated to encoding followed by a decrease at very high levels of activation associated with actual withdrawal and protective behavior. This phenomenon is explained by the defense cascade theory described earlier (P. J. Lang, Bradley, & Cuthbert, 1997).

Televised messages are generally not strong enough to evoke the flight level of activation of the aversive system. Thus, this study posits that during negative messages resource allocation to encoding will likely be related to arousal level and be greater for more arousing messages because fearful messages are unlikely to be arousing enough to elicit flight like responses and the corresponding decrease in resource allocation to encoding. LC4MP predicts that more resources are allocated to positive compared to negative messages at low levels of arousing content due to the positivity offset. More resources are allocated to encoding negative compared to positive messages at moderate levels of arousing content due to negativity bias. More resources are allocated to encoding positive compared to negative messages are very high levels of arousing content.

In the LC4MP (A. Lang, 2006a), encoding is indexed by recognition. Past research has reported that more arousing messages were remembered better (Bolls, A. Lang, & Potter, 2001; M. M. Bradley, Greenwald, Petry, & P. J. Lang, 1992; A. Lang, Dhillon, & Dong, 1995). This study posits that recognition will be greatest for the most arousing messages and least for the least arousing messages. During angry content, which is likely to be most arousing, both the appetitive and the aversive systems are moderately activated and will be allocating resources to external stimuli, thus, angry messages should receive the most resources. Joyful message should elicit strong appetitive activation which should result in many resources being automatically allocated to encoding. Fearful message should elicit strong aversive activation which should result in many resources being automatically allocated to encoding. Whether the joyful or the fearful messages receive the more resources for encoding depends on the arousal level, if it is low moderate, fear should be recognized better than joy, if it is high moderate they should be equal, if it is very high, joy should have more resources than fear. Sad content will follow since the aversive activation level is lower and neutral will be the least since there is no motivational activation.

Thus hypothesis 7 predicts:

H7. Participants will show the highest recognition during angry messages followed by fearful and joyful (equal or different depending on arousal), followed by sad, and then neutral messages.

Motivational Activation, Emotional Experience and Cognitive effort

Cognitive effort is defined (in LC4MP) as the total resources allocated to all processing tasks by a viewer during message processing as a result of both automatic and controlled allocation mechanisms (A. Lang et al., 2006). Research in the LC4MP has used heart rate as an indicator of overall cognitive effort expended during message processing.

Research shows that heart rate is related to processing of external stimuli. Heart rate acceleration is associated with the rejection of environmental input, a situation called sensory rejection (J. I. Lacey, Kagan, B. C. Lacey, & Moss, 1963) while heart rate deceleration indicates that efficient processing of external stimuli, designated as sensory intake (J. I. Lacey & B. C. Lacey, 1970). The heart is under the dual control of the sympathetic and parasympathetic nervous system. Sympathetic activation speeds up the heart race while parasympathetic activation slows it down (A. Lang, 1994). When attending to the outside world, somatic activity is reduced resulting in a slower heart rate in order to process relevant information efficiently (Obrist, 1976). Sympathetic activation prepares the organism to react to the outside world by speeding up the physiological systems (Öhman, 2000b). Similarly, increased heart rate is related to an inward focus of attention while decreased heart rate is related to the outward attention (A. Lang, Bolls, Potter, & Kawahara, 1999; Wright, Contrada, & Patane, 1986).

Heart rate has been used to operationalize cognitive efforts to media messages in numerous studies (A. Lang, 1990; A. Lang, Newhagen and Reeves, 1996). These studies consistently reported that slower heart rate indicates sustained or increased cognitive efforts to an external stimulus even when the stimuli are arousing.

This study posits the greatest cognitive effort will be allocated to messages which are the most arousing, thus, heart rates will be slowest for the most arousing messages and fastest for the least arousing messages. Angry content, which is likely to be most arousing, should elicit the slowest heart rates. Fearful message should elicit strong aversive activation which should result in many increased cognitive effort – though – at very high levels of activation, when withdrawal behavior actually occurs, heart rate should increase to facilitate escape from the negative stimulus. Joyful message should also elicit strong appetitive activation which should result in high cognitive effort. If fearful and joyful messages have relatively equal arousal, and the fearful messages are below the threshold for actual withdrawal behavior, the fearful messages will likely elicit slower heart rates than the joyful ones due to negativity bias and the notion that negative stimuli are more important for survival and thus organisms are hardwired to process negative stimuli (Shoemaker, 1996; Zajonc, 1984). Previouis research has reported that negative stimuli elicited slower heart rates than did positive stimuli when arousal was controlled at moderately high levels (Bolls, A. Lang, & Potter, 2001). Sad content will follow since the aversive activation level is lower and neutral will elicit the fastest heart rates. This leads to the following hypothesis.

H8. Participants will show slowest heart rates during angry followed by fearful, followed by joyful, followed by sad, and followed by neutral messages.

Dominance and Discrete Emotions

Most dimensional attention theories also include a third dimension of emotion in addition to valence and arousal that generally accounts for an additional 10-15% of the variance in emotional responses (Osgood, 1952, Mehrabian & Russell, 1974). This dimension is called dominance (M. M. Bradley & P. J. Lang, 1994; P. J. Lang, 1988). Dominance manifests as a feeling of being controlled or in control which is associated with the interactive relationship between an emotional event or context and the perceiver. High dominance represents that the perceiver has maximum control of the situation (M. M. Bradley & P. J. Lang, 1994). It has been found that dominance plays a key role in discriminating anger from other negative emotions such as fear and sadness. Fear and sadness are rated low on dominance while anger is rated high (Mehrabian & Russell, 1974). This suggests that dominance may be important in cognitive evaluation (i.e.appraisal) even though previous research has not found reliable physiological correlates of dominance and no hypotheses about physiology and dominance were offered in this study.

Appraisal theorists used a similar factor, coping potential, when discriminating anger from other negative emotions (Lazarus, 2001; Scherer, 2001). Coping potential indicates evaluations about whether 'There is anything I could do about the situation' (Roseman, 2001). "Coping potential arises from the personal conviction that we can or cannot act successfully to ameliorate or eliminate a harm or threat or bring to fruition a challenge or benefit" (Lazarus, 2001, p 44). Suggestions have been made that coping potential is associated with anticipated control over the event or its consequences which indicates the judged or perceived relative power of the perceiver to adjust the outcome (Scherer, 2001). It has been found that coping potential is rated relatively high for joy and anger whereas it is evaluated relatively low for sadness and fear (Scherer, 2001). There is a slight difference between the two concepts, dominance and coping potential. Coping potential is more likely associated with evaluated aspects of the antecedents or consequences of the emotion whereas dominance is treated as a dimension of the emotion per se. However, we can see the possibly overlapping domains of the two concepts.

Dominance might also be related to a PSA's efficacy. For instance, a drug user trying to quit might feel less dominant (feeling vulnerable) than a drug user who tends to counter-argue against a PSA. Thus, dominance may be an important index yielding information about the receptiveness to persuasion of the person receiving the message.

In general, research shows that pleasant stimuli elicit more dominant feelings compared to negative stimuli (Aguilar de Arcosa et al., 2005; M. M. Bradley & P. J. Lang, 1994). From this, it can be posited that dominance is also influenced by the relative activation of the appetitive and aversive motivational system. From this notion,

H9. Participants will self-report feeling the most dominant during joyful messages followed by angry, followed by neutral, followed by sad and finally fearful messages.

Individual Difference in Motivational Activation and Discrete Emotion

A. Lang and colleagues have developed a measure of positivity offset and negativity bias as an individual difference (Kurita, Potter, & A. Lang, 2006; A. Lang, Shin, & Lee, 2005; A. Lang, Wang, & S. D. Bradley, 2004). Positivity offset is the tendency of an organism to approach in a neutral environment (Cacioppo & Gardner, 1999). Negativity bias is the tendency of the aversive activation systems to respond more quickly and sharply than the appetitive system.

From a series of studies, A. Lang and colleagues have shown that individuals high in positivity offset are more likely to display exploratory responses to their environment. For instance, A. Lang, Shin, & Lee (2005) reported that participants with high positivity offsets spent more time looking at arousing pictures whereas those with low positivity offsets changed little in the amount of viewing time across arousal levels. In addition, reports have been made that those with high positivity offset paid more attention, indexed by greater heart rate deceleration and faster STRTs, performed better at recognition tasks and felt more positive when viewing various types of mediated stimuli (A. Lang, S. D. Bradley, Sparks, & Lee, in press; Shin, 2006; Yegiyan, Bradley, & Lang, 2005; A. Lang, Bradley, & Sparks, 2004). Park (2006) found that the high positivity offset participants enjoyed playing a video game more than low. This evidence suggests a greater appetitive tendency of individuals high in positivity offset compared to those low in positivity offset. Thus,

H10. During all content, participants high in positivity offset will show greater activation in the appetitive motivational system, indexed by increased orbicularis oculi and increased self-reported positive emotion.

By contrast, it is suggested that negativity bias, representing aversive activation, is related to protection of the organism (A. Lang, 2006a). A. Lang, Shin, & Lee (2005) found participants with high negativity bias spent less time looking at negative pictures compared to those with low negativity bias. This suggests that people with higher negativity bias tend to activate protective mechanisms faster than people with lower negativity bias, resulting in shorter viewing times. It was also found that people with high negativity bias paid less attention to drug prevention PSAs (Yegiyan, Bradley, & A. Lang, 2005)

A. Lang et al. (in press) found that high negativity bias people showed larger startle potentiation and more corrugator activation during negative slides compared to people with low negativity bias at low to moderate levels of arousal while at high levels there was no difference. This finding suggests that, during negative content, the difference between high and low negativity bias people is largest at low to moderate levels of aversive activation but disappears at high level of arousal. This makes sense, since it would not be an evolutionary advantage to be slow to avoid highly arousing negative events. This means that differences between high and low negativity bias people will be seen at moderate levels of arousing content more than at high.

As previously mentioned, television information campaigns would not activate the aversive system at an extreme level. Thus,

H11. During sad and fearful messages, participants high in negativity bias will show more activation in the aversive motivation system, indexed by increased corrugator activation, a facilitated startle reflex, and increased self reported negative emotion.

During anger, both the appetitive and aversive system will be activated producing a coactive feeling state. This suggests that experiencing anger might be associated with both positivity offset and negativity bias. But the impact may be smaller than the reciprocally activated feelings such as sad and joy because, during anger, a system (appetitive or aversive) might inhibit activation of the other system to some extent. From this notion,

H12. During angry messages, even though participants high in negativity bias will show greater activation in the aversive motivational system, the difference between individuals high and low in negativity bias will be smaller compared to that exhibited during fearful and sad messages.

H13. While viewing angry messages, even though participants high in positivity offset will show greater activation in the appetitive motivational system, the difference between individuals high and low in positivity offset will be smaller compared to that seen during joyful messages.

As mentioned previously research shows that pleasant stimuli elicit more dominant feelings compared to negative stimuli (Aguilar de Arcosa et al., 2005; M. M. Bradley & P. J. Lang, 1994). However, it is not clear how dominance is associated with the level of activation of the appetitive and aversive systems in individuals.

Dominance is supposed to measure judgments based on the relationship between the receiver, in this study, message viewers, and the stimuli, in this study television PSAs. There could be a confounding when viewers rate dominance based on feelings of the characters in the messages. In order to avoid this situation, there was an instruction to rate "whether you feel dominant or dominated by the message".

So far there have been no reports about the relationship between the experience of dominance and motivational types (MAM). Hence, a research question will be explored.

R1. Will there be a relationship between motivational activation (MAM) and self-reported dominance during the experience of discrete emotions?

CHAPTER 3

Method

Design

The design for this experiment was a Discrete Emotion (5) X Positivity Offset (2) X Negativity Bias (2) X Message (4) X Order of Presentation (4) mixed factorial design. Discrete emotion and message were within-subject factors whereas positivity offset, negativity bias and order of presentation were between-subject factors.

Discrete emotion had five levels, represented by the five types of specific emotional content: neutral, joy, fear, sadness, and anger. The message factor is made up of the four different messages at each discrete emotion level. Positivity offset and negativity bias has two groups, high and low determined by a median split. The order of presentation factor was included to control order effects. Participants were randomly assigned to one of the four presentation orders.

Stimulus materials

The stimuli for this study were initially selected from a pool of television PSAs used in previous studies (A. Lang, Schwartz, Chung, & Lee, 2004; A. Lang et al., 2005; Yegiyan, Bradley, & A. Lang, 2005). From the pool, the researcher selected six to eight television messages that were believed to be exemplars of the four discrete emotion types (fear, anger, sadness, and joy) as well as the neutral or non-emotional state. After the initial selection, a graduate student watched the selected PSAs separately and discussed with the researcher which PSAs were and were not appropriate for each condition. Only the PSAs that both colleagues agreed were appropriate for each condition were included in the pretest. There were not enough stimuli representing anger and neutral in the pool of preexisting stimuli. So, the researcher searched for more messages on the Internet and found six more messages which both colleagues agreed represented the anger and neutral conditions.

A total of 30 television messages (six messages in each condition) were included in the pretest. All messages were 30-seconds long and the content was limited to public information campaign messages (i.e. PSAs). Thirty-three college students participated in the pretest. Up to five subjects completed the experiment at a time on laptop computers in a research room belong to the Institute for Communication Research. Subjects were separated by partitions to prevent interference effects.

All the stimuli were digitized files presented by MediaLab software (Javis, 2004). While viewing each clip, subjects completed continuous response measures (CRM) presented by the Media Lab. The CRM includes a sliding scale placed underneath the screen. The scale ranges from zero (none) to 100 (very much) and is moved by either the mouse or the arrows on the keyboard. MediaLab software automatically presents the scale on the middle (i.e. 50). Participants are instructed, at the start of each message, to move the cursor to zero before beginning to rate.

Participants rated each message on one of five possible scales (how angry do you feel, 'how frightened do you feel', 'how joyful do you feel', 'how sad do you feel' and 'how emotional do you feel (neutral condition)'). Participants rated six messages on each scale. Before each message, there was an instruction indicating which rating participants should make. The reason self-report is used in the pretest is that self-report represents the result of appraisal. Discrete emotion has been considered to be differentiated by cognitive evaluation (i.e. appraisal) and thus self-report has been used to identify the existent of a discrete emotional state (Lazarus, 1991; Roseman, 2001). The stimuli and ratings were mixed up and randomly presented to subjects.

The CRM provides an overtime rating of the experience of the discrete emotion elicited by each message for each individual. For each message, the continuous ratings were averaged over each second creating an average response curve. Using this information, the four PSAs which best represented each discrete emotion type were chosen. Next, the eight seconds of each message that best exemplified the assigned discrete emotion in each message in the category were identified. As previously mentioned only a portion of each message may contain a relatively pure form of each emotion. Visual inspection of the response curves confirmed this conjecture. With the exception of the neutral condition, all the response curves showed a linearly increasing tendency which peaked and then declined towards the end of the PSAs as shown in Figure 3-1, 3-2, 3-3, and 3-4. The 8 best seconds were taken from the peak area. For the neutral condition, messages which showed a low level of emotional experience throughout the message were selected.

Figure 3-1. Joy Level Continuous Response Ratings

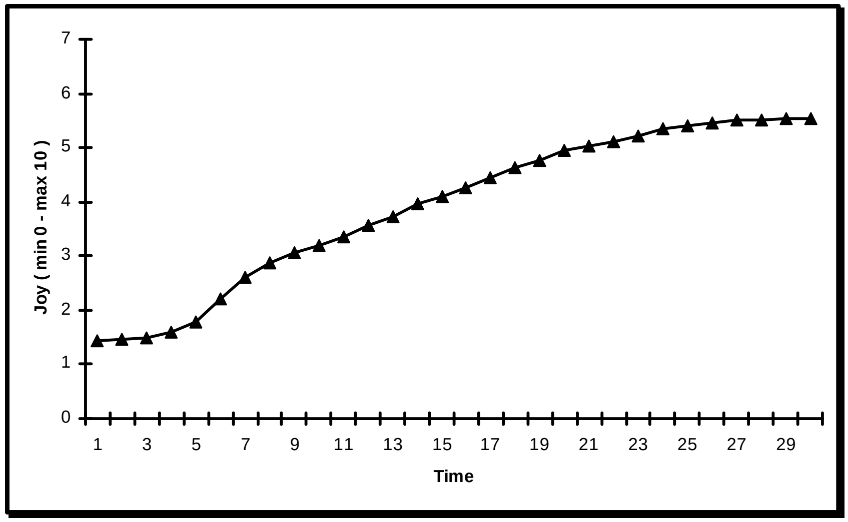


Figure 3-2. Anger Level Continuous Response Ratings

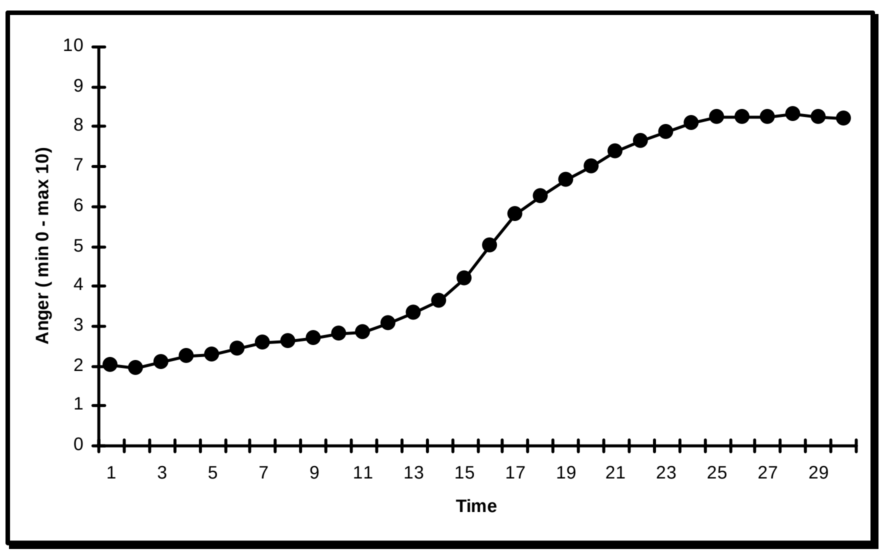


Figure 3-3. Sadness Level Continuous Response Ratings

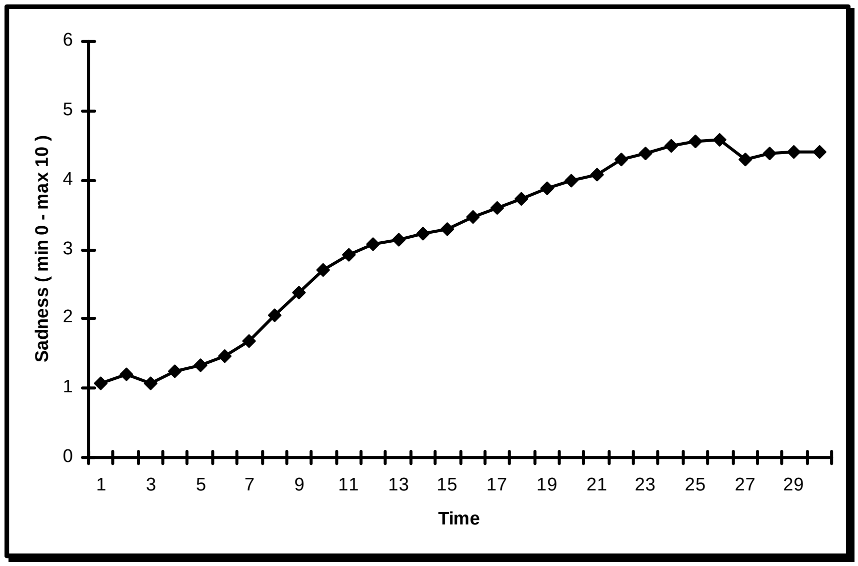
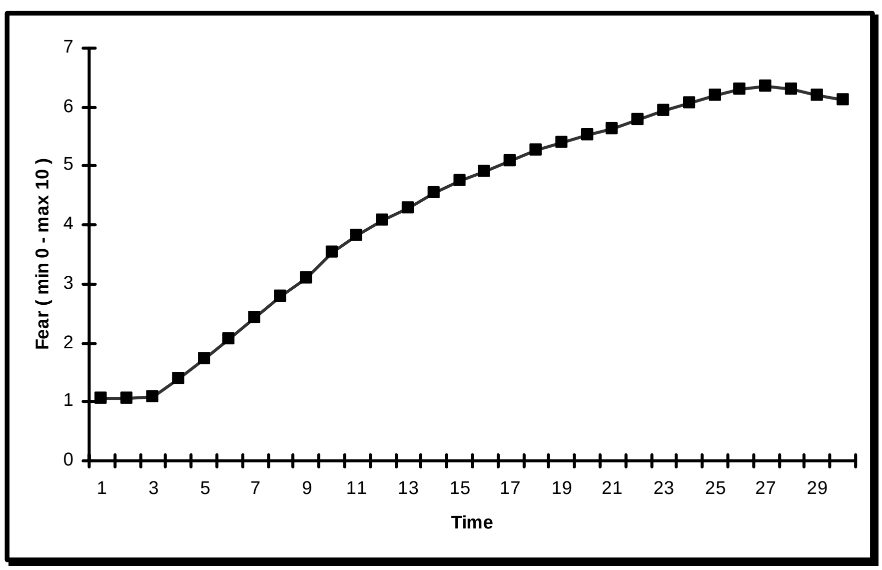


Figure 3-4. Fear Level Continuous Response Ratings



Independent variables

Discrete Emotion

Content representing four discrete emotions - anger, fear, joy, and sadness – was selected for this study. The four emotions are included in most of the works of the discrete emotion researchers (Frijda, 1986; Lazarus, 1991a). And the four emotions are known to be elicited by television PSAs (Dillard and Peck, 2001). The neutral condition was included so as to provide baselines for the activation level of the motivational systems.

The sad condition includes messages describing 1) a lonely kid without brothers, sisters, and friends, 2) a used-to-be-good kid now thrown out of his house, 3) a sad mom with a drug using daughter, and 4) a band that lost everything by using drugs. The fearful condition includes messages describing 1) playing hockey without a protective gear, 2) labatory rats dying of repeated drug use, 3) a person's hallucination of a roach crawling in his eye, and 4) a person's body being penetrated by a huge needle. The anger condition includes messages describing 1) a mom screaming at a son for no good reason, 2) sexual harassment, 3) a boss's violent response without provocation, and 4) a customer's unprovoked violent response. The joyful condition includes messages describing 1) a boy turning down a drug offer, 2) a basketball player saying he couldn't have done it on drugs, 3) a set of gifted young people full of hope for the future, and 4) kids who can make their dreams come true by staying drug free. The neutral condition included messages in which people talk about drugs, animal abuse, and literacy in a calm way.

Positivity Offset

Positivity offset is a between-subjects variable which represents how active the appetitive system is. Positivity offset was measured using mini-MAM a short version of the Motivational Activation Measure (MAM). MAM has been developed to measure individual differences in activation in the motivational systems. MAM has been validated with self-report, behavioral, and physiological indicators of appetitive and aversive system activation (A. Lang, Shin, & Lee, 2005). Studies with the MAM showed that positivity offset is positively correlated with sensation seeking and negativity bias is negatively correlated with sensation seeking (Wang, S. D. Bradley, & A. Lang, 2004; Kurita, Potter, & A. Lang, 2006) as would be expected given Zuckerman's argument that sensation seeking reflects the level of activation in the motivational systems with high sensation seeking resulting from a highly active appetitive system and a less active aversive system (Zuckerman, 1990).

MAM consists of 90 pictorial images selected from the International Affective Picture System based on international emotional response norms (A. Lang, Wang, & Bradley, 2004). Mini-MAM is constructed by using only the 35 pictures used in the actual MAM calculations. Thus there are 15 low arousal pictures (7 positive, 7 negative and 1 neutral), 14 negative pictures at arousal level 4 and 5, and 7 positive pictures at arousal level 6 (Kurita, Potter, & A. Lang, 2007). The most recent version was used in the current study.

The formula for calculating positivity offset based on MAM is shown below (A. Lang, Wang, & S. D. Bradley, 2004).

Positivity offset = (Average Positivity Ratings of Positive Pictures at Arousal Level 6) - (Average Positivity Ratings of all Pictures at Arousal Level 1)

In order to answer questions of whether individual differences in positivity offset level affect processing of mediated messages, participants' data were divided into two groups based on a median split with their positivity offset score (high PO vs. low PO). A t-test was conducted to confirm the difference and it was significant (t (78) = -12.518, p < .001). To find any abnormality for the distribution of the positivity offset scores, comparison was made with the previous studies (Kurita, Potter, & A. Lang, 2007; Park, 2006) as shown in Table 3-1. The comparison shows that the current study contains a very similar distribution of PO scores as has been found in previous studies. The frequency distribution of positivity offset has a normal curve and is shown in Figure 3-5.

Negativity Bias

Negativity bias is a between-subjects variable which represents how active the aversive system is. The formula for calculating negativity bias based on the MAM is shown below (A. Lang, Wang, & S. D. Bradley, 2004).

Negativity bias = (Average Negativity Ratings of Negative Pictures at Arousal Level 3 and 4) − (Average Negativity Ratings of all Pictures at Arousal Level 1)

In order to answer questions of whether individual differences in negativity bias level affect processing of mediated messages, participants' data were divided into two groups based on a median split with their negativity bias score (high NB vs. low NB). A t-test was conducted to confirm the difference and it was significant (t (78) = -11.253, p < .001). To find any abnormality for the distribution of the negativity bias scores, comparison was made with the previous studies (Kurita, Potter, & A. Lang, 2007; Park,

2006) as shown in Table 3-1. The comparison shows that the current study contains a very similar distribution of negativity bias scores as found in previous studies. The frequency distribution of negativity bias was a normal curve and is shown in Figure 3-6.

Figure 3-5. Frequency distribution of participants' positivity offset

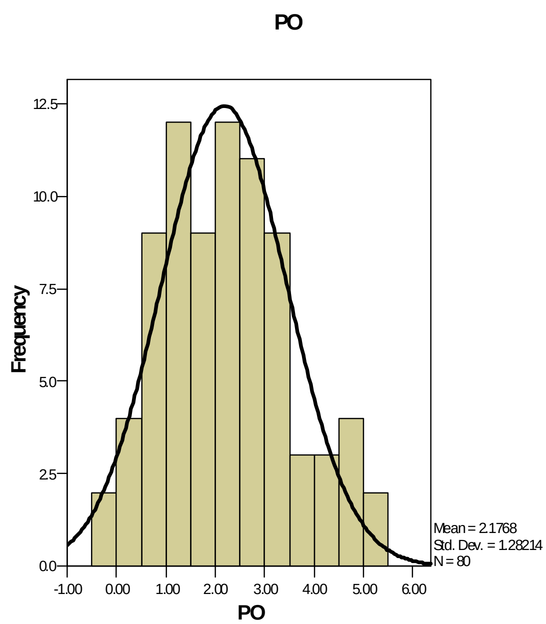


Figure 3-6. Frequency distribution of participants' negativity bias

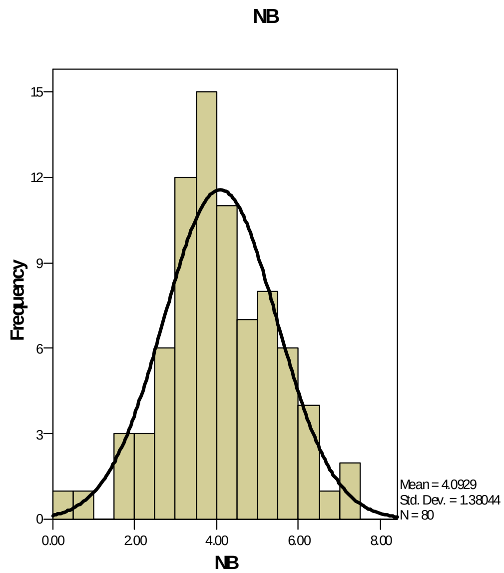


Table 3-1. Comparison of the distribution of participants' positivity offset and negativity bias from this study and other studies using Mini-MAM

	Kurita el al. (2007).	Park (2006)	Current study
Positivity Offset			
Mean	2.46	2.35	2.18
Range(Min/Max)	-1.14/6.57	-.786/5.285	-.29/5.36
Percentile			
25	1.36	1.21	1.21
50	2.32	2.64	2.04
75	3.50	3.43	3.00
Negativity Bias			
Mean	4.14	3.82	4.09
Range(Min/Max)	-1.64/6.79	.57/6.14	.29/7.21
Percentile			
25	3.21	2.80	3.21
50	4.14	3.93	3.93
75	4.86	4.84	5.07

Dependent Variable

Emotional Experience

Conscious emotional experience was indexed by self-report measures. Valence was measured on a modified nine-point SAM scales for positivity and negativity respectively. The modified SAM scales on poistivity and negativity includes nine points. Arousal and dominance were rated using the SAM scale. The SAM scales on arousal and dominance are composed of nine point scales (M. M. Bradley & P. J. Lang, 1994).

One possible concern with the self-report data collected in the experiment is that it is a global evaluation of the entire PSA but it is being compared to physiological data collected only for the portion that was most representative of the assigned discrete emotion. Thus, it is possible to argue that the self-report data and the physiological data are indexing different entities. However, previous research has found that global self-report evaluations are also highly associated with the representative part of a message.

Kahneman (1999) has argued that the retrospective representation of an emotionally fluctuating message is predicted by a function of the peak experience and the experience recorded just before the end of the episode (i.e. the peak-end rule). For example, in one study (Fredrickson & Kahneman, 1993), subjects were exposed to aversive and pleasant film clips that varied in duration and emotional intensity. The experimental group ranked the films from memory; the control group was asked to make evaluations on-line (i.e. during viewing). Duration didn't matter for viewers' evaluation from memory. However, there were high correlations between global evaluations from memory and the average of the evaluations of the peak and the end for real time evaluations. The correlations were .78 for pleasant films and .69 for unpleasant films.

From these findings, it is possible to posit that the physiological data and self-report data should not represent totally different entities but be correlated, even though the association might occur in a loose way.

Physiological Data

The physiological data collected in this study, including facial EMG, heart rate, and skin conductance, were collected during a five-second baseline preceding each message and for the entire duration of each message. The startle data were collected from a single point (300 ms) during the peak point in each message. Obicularis oculi and corrugator facial EMG data were collected in this study.

Activation of the Appetitive System

Facial EMG was used to measure on-line activation of the motivational systems - appetitive and aversive - in response to television messages. Facial EMG measures "the electrical signal generated by the occurrence of action potentials across a group of muscles dedicated to moving particular parts of the face" (Bolls, Lang, & Potter, 2001, p632). Measurement of the facial EMG activity is known to be associated with emotional expression and has been used as an index of positive or negative emotions (P. J. Lang, M. M. Bradley, & Cuthbert, 1997). The orbicularis oculi muscle group circles the eye and is being used as a measure of positive emotional experience and activation of the appetitive system. Research shows that the activation of this muscle group represents a genuine sign of positive emotion which cannot be faked (Ekman, Davidson, & Friesen, 1990). Activation in this muscle is used can be used to distinguish between fake and real smiles.

To collect orbicularis oculi activity two Silver-Silver Chloride electrodes filled with non-saline conducting gel were placed over the muscular tissue beneath the left eye designated as orbicularis oculi. An electrode is composed of a 4 mm diameter sensor, an 11 mm housing and 2 mm deep gel cavity. The researcher scrubbed the skin with an alcohol pad to clean the area before placement. Then, a very small amount of non-saline conducting gel was applied to the surface in order to obtain the high enough conductivity level to pick up the EMG signals.

A first sensor was placed directly below the pupil under the lower eyelid over the orbicularis oculi muscle grope. A second sensor was placed close, but not touched, to the first on the right side. The EMG data of orbicularis oculi muscle group were sampled at 50 Hz using a Coulbourn system.

<u>Activation of the Aversive System</u>

The activation of the aversive system was indexed by facial EMG obtained from the corrugator muscle groups. The corrugator muscle, associated with frowning, is grouped over the brow just off the bridge of the nose (Fridlund & Izard, 1983). The increase of negative responses to a message covaries with increasing activity in corrugator muscle activity (Bolls, A. Lang, & Potter, 2001).

Two Silver-Silver Chloride electrodes were placed over the muscle group right above the left eyebrow designated as corrugator supercilii. An electrode is composed of a 4 mm diameter sensor, an 11 mm housing and 2 mm deep gel cavity. The researcher scrubbed the skin with an alcohol pad to clean the area before placement. A very small amount of non-saline conducting gel was applied to the surface in order to obtain the high enough conductivity level to pick up the EMG signals.

A first sensor was placed around the left end of the left eyebrow over the corrugator muscle grope. A second sensor was placed close, but not touched, to the first on the right side. The EMG data of corrugator muscle group were sampled at 50 Hz using a Coulbourn system

The magnitude of eyeblink startle reflex was also used to index the activation of the aversive system. It has been found that the startle reflex increases in amplitude when the aversive system is activated and is reduced in amplitude when the appetitive system is activated showing motivational modulation (P. J. Lang, 1995).

An acoustic startle probe, which is a 100-decibel white noise, was administered for each message to measure electric potentials associated with reflexive muscle contraction in the orbicularis oculi muscle group.

The data were collected using the same sensors as for orbicularis oculi. The startle reflex occurs around 45-50ms after the probe. Activity was sampled at 50 Hz until 50ms before the startle probe at which time sampling was increased to 1,000 Hz for 300 milliseconds.

The startle probe was administered in each message during the last two seconds of an eight second period rated through the pretest to be most representative of its discrete emotion. The sampling rate for activity in the orbicularis oculi muscle group was at 50 Hz for 50 ms before startle probe at which point sampling was increased to 1000Hz for 300 milliseconds. Startle probes were generated by a Coulbourn Instruments V85-08 noise generator and amplified with an integrated stereo amplifier. The startle probe was heard through headphones, though which participants also heard audio from the stimulus.

The startle response data were scored offline with an algorithm that converted each trial into a magnitude score using analog-to digital units (Globisch, Hamm, Schneider, & Vaitl, 1993). For analysis, the magnitude scores were standardized to T-score with a mean of 50 and standard deviation of 10 (Sparks, 2006).

Level of Activation of the Motivational System

Arousal was indexed by the skin conductance level. Skin conductance measures activity in the eccrine sweat glands (Dawson, Schell, & Filion, 2000 which are solely innervated by the sympathetic nervous system (Dawson, Schell, & Filion, 2000; Hopkins, & Fletcher, 1994). Skin conductance has been used as a measure of sympathetic nervous system arousal (P. J. Lang et al, 1993; A. Lang et al, 1999; Dawson, Schell, & Filion, 2000; Stern, Ray, & Quigley, 2001). It is believed that sympathetic nervous system activation is related to activation in the motivational systems. Hence, skin conductance will be used here as an indicator of activation in the motivational systems.

Skin conductance was collected with a pair of standard Beckman Ag-AgCI electrodes. The electrode is composed of 8mm diameter sensor, 16 mm diameter housing, and 2 mm deep gel cavity. Before attachment, participants' skin was cleaned with a paper towel moistened with distilled water to control hydration and remove dead cells. Then the electrodes were attached on the palm of the participant's non-dominant hand. The electrodes were filled with an electrically neutral medium as suggested by Dawson, Schell, & Filion (2000). The analog signal from the electrodes was sampled at 50 Hz and passed to a Coulbourn skin conductance module and from there to the analog input of the A/D board. The signals were digitized and averaged over a second offline.

Cognitive Effort

Heart rate was measured as an indicator of the tonic level of cognitive effort being allocated to external stimuli. This operationalization has been adopted in many studies

(A. Lang, 1990, A. Lang, Newhagen & Reeves, 1996). These studies consistently report that slower heart rate indicate increased cognitive effort allocated to an external stimulus in the media environment.

The procedure for collecting heat rate involved abrading participants' skin with cotton balls moistened with rubbing alcohol. Then attached were three Ag-AgCI electrodes which have the same size with the electrodes used for skin conductance. One electrode was attached to the left forearm of the participants and one to the right forearm. A ground electrode was place on their non-dominant forearm. To support the amplification of the signal, the heart rate electrodes were filled with cardiac electrode jelly manufacture by Med Associates, Inc. Heart rate was recorded as milliseconds between beats and converted to heart rate per minute (BPM) and averaged over a second interval for analysis.

Resources Allocated to Encoding

Recognition was used to assess resource allocation to encoding. It was measured using yes-no choice tests with three target statements and three foils statements per message. The foil was created by changing at least two words of the target with semantically similar terms. The length of the target and foil ranges from 2 seconds to 4 seconds. Words which occurred during the startle probe were not included in the recognition questions.

Signal detection theory was used for the analysis (Shapiro, 1994). The parametric measures of sensitivity (*d'*) were used as indices of memory strength (Fox, 2004; Shapiro, 1994). Memory sensitivity (*d'*) is calculated using the following formula:

$$d' = z(H) - z(F)$$

where *H* is the ratio of hits and *F* is the ratio of false alarms (Macmillan & Creelman, 1991, *p*.9). Memory sensitivity with larger *d'* value is an indication of the ability to discriminate target and foil items is better, or, more sensitive. In order to avoid missing values, 0 was converted to 1/ (2n) and 1 was converted to 1-1/2(2N) according to the suggestions made in previous studies (MacMillan, & Creelman, 1991; Shapiro, & Fox, 2002). All targets and foils were recorded by a native English speaker creating short audio snippets and then presented to participants using MediaLab software.

Apparatus

All the stimuli were digitized files (DV-AVI format) and presented using MediaLab software (Javis, 2002). The stimuli include five seconds of black screen in the beginning to collect physiology data as baseline. The MediaLab software was also used to collect participants' responses to self-report questions (arousal, positivity, negativity and dominance). The stimuli were played on a 17-inch computer monitor with a resolution of 1024X 768. The monitor was positioned approximately 2 feet from an armchair where the subject sat.

Physiological data (heart rate, skin conductance, and facial EMG) were collected from the participants while they were viewing the stimuli on a Gateway E-3400 computer (with 996MHz Pentium III CPU, 512MB main memory, and Windows XP Professional operating system). This computer was connected to a Coulbourn LabLinc V system and a generic Pentium Celeron computer (with 1.1 GHz Pentium Celeron CPU, 256MB main memory, and Windows Millennium Edition operating system) which runs VPM 12.2 (Cook, 2003) that collects the physiological data. The stimulus presentation computer, controlled by MediaLab, sent a transistor-transistor-logic (TTL) signal to the other computer, controlled by the VPM software, via the Parallel port to trigger the start and the end of collecting physiological data.

Participants

Eighty college students were recruited from telecommunications courses at a major Midwest University. They were given extra or required credits for their participation. The participant pool (*N* = 80) consisted of 37 males and 43 females with a mean age of 20.84 years.

Procedure

Participants completed the experiment individually. On arrival, participants were greeted and asked to sign a consent form. After signing the form, participants were seated in front of a computer monitor and mini-MAM was presented by MeidaLab to measure individual differences in motivational activation level. Then, electrodes were attached to their forearms, non-dominant hand, below the left eye and above the left eyebrow. They were told to watch the 20 message clips the entire time they were on the computer screen. The experimenter briefly explained how participants should rate responses and then asked if the participants had any questions. The following specific instructions regarding the startle probe were given:

"During each message, you will hear a short and loud noise. Please ignore the noise and concentrate on viewing each message."

When the participants were ready, the experiment started. Participants' heart rates, skin conductance, facial electromyography (EMG) were measured while they are watching the messages. Following each message the video clip was stopped and participants rated the messages on the arousal, positivity, negativity, and dominance scales presented by MediaLab.

After all messages are viewed, the participants were disconnected from the physiological equipment and taken to the next room to complete the recognition test on a desktop computer. First they took part in a memory distraction task in which they watched a ten-minute documentary about mammals. For the recognition test, they were instructed to click yes if they heard the words while viewing the PSAs and to click no if they did not hear the words.

Finally, participants were asked to report their age, race, and gender. After participants are done, they were thanked and dismissed.

Analysis

Physiological data (heart rate, skin conductance, and facial EMG) were analyzed as phasic responses. The data for the first six seconds out of the eight seconds most representative of each condition were analyzed. The last two seconds were used for analysis of the startle data. The data were averaged over the six-second period and submitted to a 5 (Discrete Emotion) X 2 (Positivity Offset) X 2 (Negativity Bias) X 4 (Message) X 4 (order) repeated measures ANOVA. This analysis was used to index phasic responses at the point most representative of each condition. The startle potentiation data were scored offline using an algorithm that transfers each trial into a magnitude score. It was submitted to 5 (Discrete Emotion) X 2 (Positivity Offset) X 2 (Negativity Bias) X 4 (Message) X 4 (order) repeated measures ANOVA.

Signal detection theory was adopted to analyze the recognition data. Signal detection has been known to be a more sensitive measure of memory than simply comparing the ratio of correct answers from the subjects (Fox, 2004; Shapiro, 1994; Shapiro & Fox, 2002). The data for sensitivity (*d'*) and were submitted to 5 (Discrete Emotion) X 2 (Positivity Offset) X 2 (Negativity Bias) X 4 (Message) X 4 (order) repeated measures ANOVA.

The self-report emotional experience data were submitted to a 5 (Discrete Emotion) X 2 (Positivity Offset) X 2 (Negativity Bias) X 4 (Message) X 4 (order) repeated measures ANOVA.

CHAPTER 4

Result

Hypothesis 1

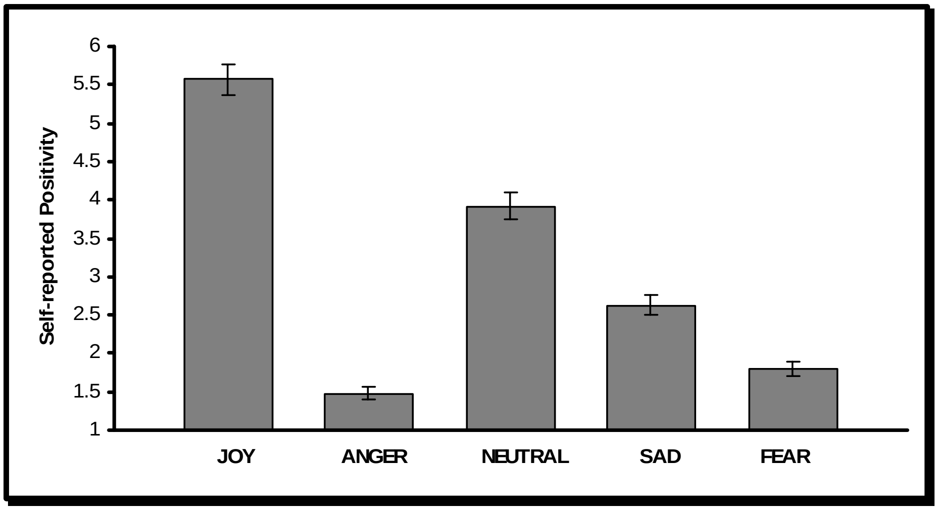
This hypothesis predicted that participants would self-report feeling the most positive during joyful messages followed by angry, neutral, sad and fearful messages. The main effect of Discrete Emotion on self-reported positivity was significant, (F (4, 316) = 214.634, p < .001, partial η = .73) and as shown in Table 4-1 and Figure 4-1. Throughout the results, the tables and figures in this section will always present the discrete emotions in the order specified by the hypothesis being tested from the discrete emotion predicted to elicit the largest response to the one predicted to produce the smallest response. As predicted, participants reported the most positive feelings in response to joyful messages. These were followed in order by neutral, sad, and fearful messages. Contrary to the prediction, however, anger messages were reported as the least positive. Throughout the results mean differences were determined by paired-sample t-tests. All the mean differences between conditions were significant at the .05 level.

Table 4-1. Self-reported positivity for each discrete emotion condition.

Discrete Emotion on Positivity	M	S.E.
JOY	5.575	.199
ANGER	1.478	.086
NEUTRAL	3.916	.171
SAD	2.622	.128
FEAR	1.806	.096

Note. Paired T-tests were conducted for planned comparisons. All the mean differences between the conditions were significant at the .05 level.

Figure 4-1. Self-reported positivity for each discrete emotion condition.



Hypothesis 2

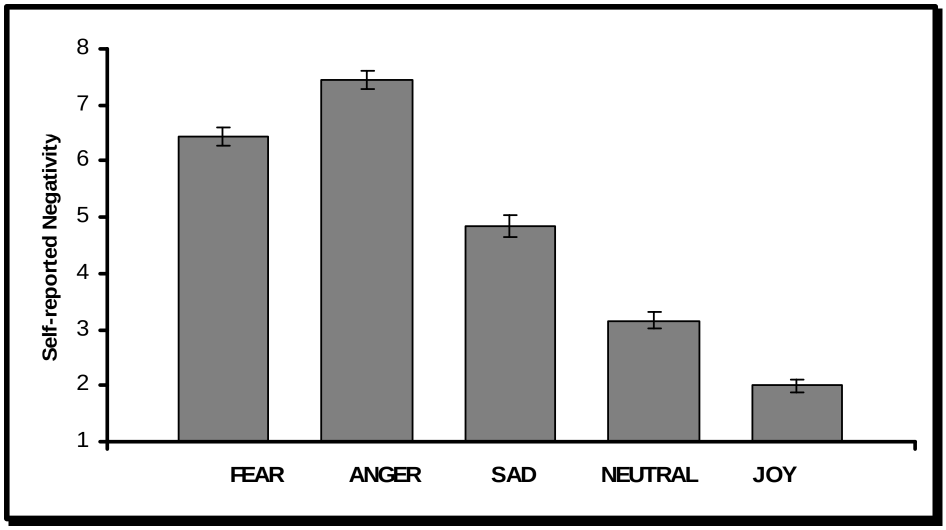
This hypothesis predicted that participants would self-report feeling the most negative during fearful messages followed by angry, sad, neutral and joyful messages. The main effect of the Discrete Emotion on self-reported negativity was significant, (F (4, 316) = 374.439, $p < .001$, partial η = .82) as shown in Table 4-2 and Figure 4-2. Contrary to the prediction, participants reported the most negative feelings in response to angry messages. The result, however, was as predicted for joyful, neutral, sad and fearful messages. All the mean differences between conditions were significant at the .05 level.

Table 4-2. Self-reported negativity for each discrete emotion condition.

Discrete Emotion on Negativity	M	S.E.
FEAR	6.441	.172
ANGER	7.444	.163
SAD	4.841	.180
NEUTRAL	3.156	.149
JOY	1.994	.110

Note. Paired samples T-tests were conducted for planned comparisons. All the mean differences between conditions were significant at the .05 level.

Figure 4-2. Self-reported negativity for each discrete emotion condition



Hypothesis 3

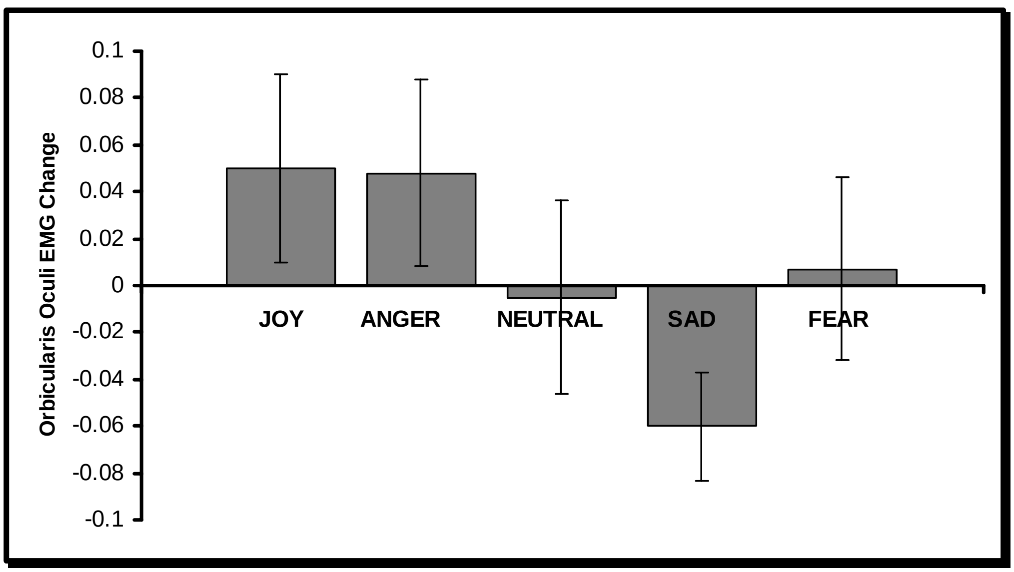
This hypothesis predicted that participants would have the largest orbicularis oculi activation during joyful messages followed by angry, neutral, sad and fearful messages. The main effect of Discrete Emotion on the orbicularis oculi data approached significance (F (4, 304) = 1.715, p = .15). The result is shown in Table 4-3 and Figure 4-3. As predicted, joyful messages elicited the largest activity. These were followed by angry, fearful, neutral, sad messages. Paired-samples t-test between each condition revealed only two mean differences were significant; the mean difference between joy and sadness (t (1, 76) = 2.487, p = .015) and between anger and sadness (t (1, 76) = 2.691, p < .01). Joyful and angry messages elicited significantly larger activity on orbicularis oculi than sad messages.

Table 4-3. Discrete emotion condition on Orbicularis Oculi EMG.

Discrete Emotion on Negativity	M	S.E.
JOY	.050	.040
ANGER	.048	.040
NEUTRAL	-.005	.041
SAD	-.060	.023
FEAR	.007	.039

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Joy-Sadness* and Anger-Sadness**
* $p < .05$. ** $p < .01$.

Figure 4-3. Discrete emotion condition on Orbicularis Oculi EMG.



Hypothesis 4

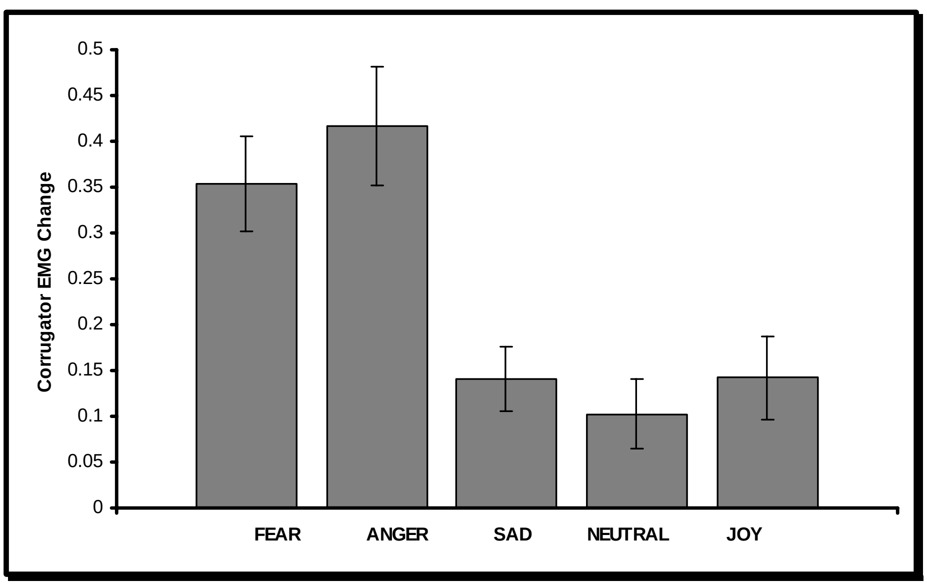
This hypothesis predicted that participants would have the greatest corrugator activation during fearful messages followed by angry, sad, neutral and joyful messages. The main effect of the Discrete Emotions on the corrugator supercilii data was significant, (F (4, 304) = 17.310, p < .001, partial η = .18) as shown in Table 4 - 4and Figure 4 - 4. Contrary to the prediction, anger messages elicited the largest activation in the corrugator supercilii muscle group followed by fearful, joyful, sad, and neutral messages. All the means differ significantly from one another except for joyful and neutral (*t* <1), joyful and sadness (*t* <1), sad and neutral (*t* <1), and fear and anger (*t* (1, 76) = 1.398, *p = .166*). Overall fearful and angry message elicited significantly larger corrugator responses than did sad, neutral, and joyful messages.

Table 4-4. Discrete emotion condition on Corrugator EMG.

Discrete Emotion on Corrugator	M	S.E.
FEAR	.353	.052
ANGER	.417	.065
SAD	.140	.035
NEUTRAL	.102	.038
JOY	.142	.045

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Fear-Sadness**, Fear-Anger (*p* = .166), Fear-Neutral**, Fear-Joy**, Anger-Sadness**, Anger-Neutral**, and Anger-Joy**.
$^{*}p < .05$. $^{**}p < .01$.

Figure 4-4. Discrete emotion condition on Corrugator EMG.



Hypothesis 5

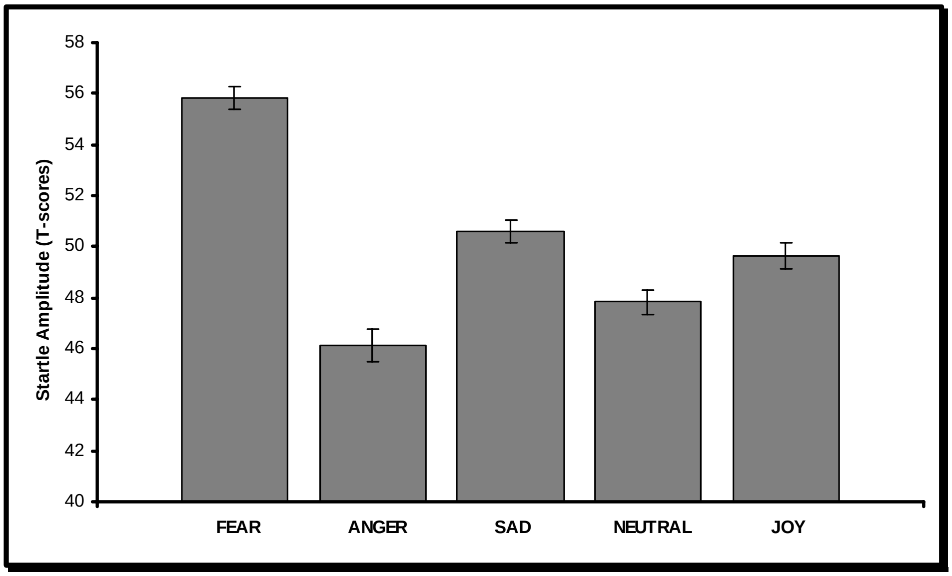
This hypothesis predicted that participants would show the most startle potentiation during fearful messages followed by angry, sad, neutral and joyful messages. The main effect of the Discrete Emotion on the startle data was significant, (F (4, 96) = 42.088, p < .001, partial η = .35) as shown in Table 4-5 and Figure 4-5. As predicted, fearful messages elicited the largest startle response. These were followed by sad, joyful, neutral, and angry messages. All the mean differences are significant at the .05 level except the mean difference between sadness and joy, (t (1, 74) = 1.307, p = .195).

Table 4-5. Discrete emotion condition on Startle Potentiation

Discrete Emotion on Negativity	**M**	**S.E.**
FEAR	55.815	.628
ANGER	46.133	.439
SAD	50.570	.452
NEUTRAL	47.834	.481
JOY	49.649	.509

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Fear-Anger**, Fear-Sadness**, Fear-Neutral**, Fear-Joy**, Anger-Sadness*, Anger-Neutral*, Anger-Joy**, Sadness-Neutral*, Sadness-Joy (p = .195), and Neutral-Joy*.
*p < .05. **p < .01.

Figure 4-5. Discrete emotion condition on Startle Potentiation



Hypothesis 6

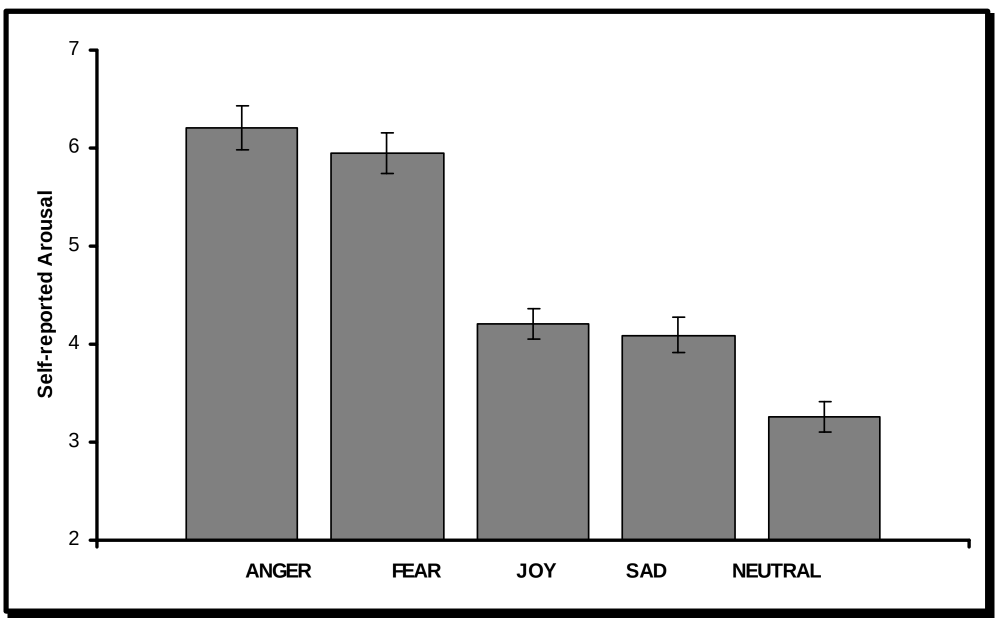
This hypothesis predicted that participants would report feeling the most aroused and have the most skin conductance activity during angry messages followed by fearful, joyful, sad, and neutral messages. The main effect of the Discrete Emotion on self-reported arousal was significant, (F (4, 316) = 158.261, p < .001, partial η = .73) as shown in Table 4-6 and Figure 4-6. As predicted, participants reported most feeling the most aroused in response to anger messages. These were followed by fearful, joyful, sad, and neutral messages. All the mean differences were significant except for joy and sadness, (t (1, 79) = 1.023, p = .310).

Table 4-6. Self-reported arousal for each discrete emotion condition

Discrete Emotion for Arousal	M	S.E.
ANGER	6.209	.220
FEAR	5.953	.205
JOY	4.206	.161
SAD	4.094	.174
NEUTRAL	3.253	.153

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Anger-Fear*, Anger-Joy**, Anger-Sadness**, Anger-Neutral**, Fear-Joy**, Fear-Sadness**, Fear-Neutral**, and Joy-Neutral**.
*$p < .05$. **$p < .01$.

Figure 4-6. Self-reported arousal for each discrete emotion condition



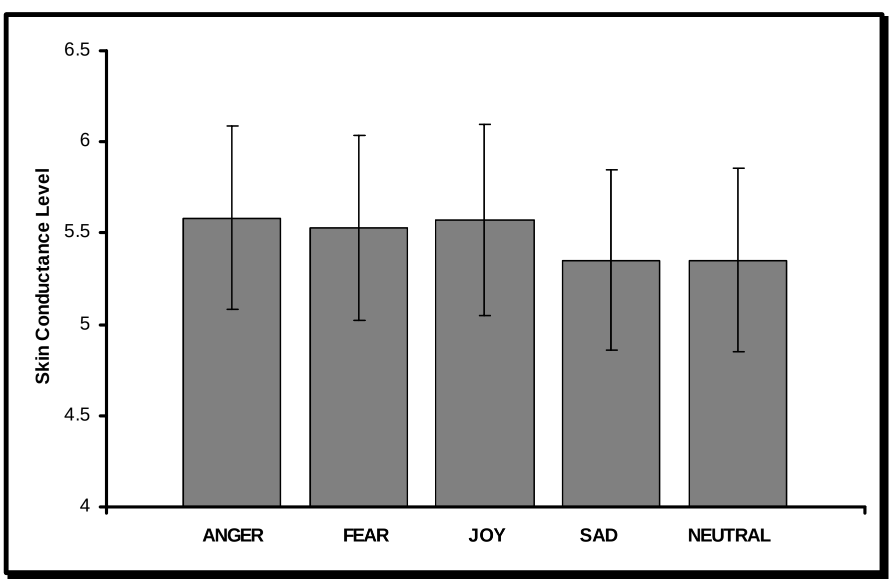
Next, the analysis was done for the skin conductance data. The main effect of the Discrete Emotion on the skin conductance data was significant, (F (4, 304) = 2.985, p = .019, partial η = .038) as shown in Table 4-7 and Figure 4-7. As predicted, angry messages elicited the highest skin conductance level. Contrary to the self-reported results, the skin conductance level during joyful messages was larger than it was during fearful messages. All Significant mean differences at the .05 level were between joy and sadness (t (1, 74) = 2.753, $p < .01$), between fear and sadness (t (1, 74) = 2.124, $p = .037$), between anger and sadness (t (1, 74) = 2.900, $p < .01$), and between neutral and anger (t (1, 74) = 2.266, $p = .026$). Joy and neutral (t (1, 74) = 1.878, $p = .064$) and fear and neutral (t (1, 74) = 1.470, $p = .146$) approached significant differences. Overall angry, joyful and fearful messages elicited significantly larger skin conductance level than did sad and neutral messages.

Table 4-7. Discrete emotion condition on skin conductance level

Discrete Emotion for Arousal	M	S.E.
ANGER	5.585	.502
FEAR	5.532	.508
JOY	5.572	.528
SAD	5.352	.493
NEUTRAL	5.352	.500

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Anger-Sadness**, Anger-Neutral*, Fear-Sadness*, Fear-Neutral ($p = .146$), Joy-Sadness**, and Joy-Neutral ($p = .064$).
*$p < .05$. **$p < .01$.

Figure 4-7. Discrete emotion condition on skin conductance level



Hypothesis 7

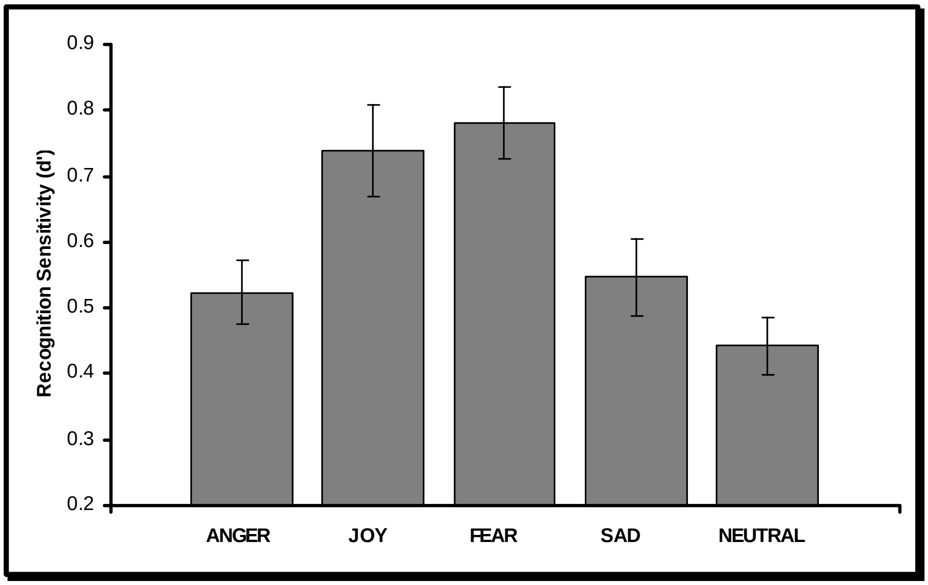
This hypothesis predicted participants would have the best recognition sensitivity for angry messages followed by joyful, fearful messages, sad and neutral messages. The main effect of Discrete Emotion on recognition sensitivity was significant, (F (4, 296) = 8.814, p < .001, partial η = .14) and is shown in Table 4-8 and Figure 4-8. Fearful messages had the best recognition sensitivity. These were followed by joyful, sad, angry and neutral messages. Contrary to the prediction angry messages were not recognized the best but came in between sad and neutral messages. All the mean differences were significant except those between joy and neutral (t <1), sad and anger (t <1), sad and neutral (t (1, 74) = 1.551, p = *.125*), and anger and neutral (t (1, 74) = 1.338, p = *.169*). Overall joyful and fearful messages elicited significantly better performance on recognition than did anger, sad, and neutral messages.

Table 4-8. Discrete emotion condition on recognition sensitivity

Discrete Emotion for Arousal	M	S.E.
ANGER	.524	.048
JOY	.739	.070
FEAR	.781	.055
SAD	.546	.059
NEUTRAL	.442	.044

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Anger-Joy**, Anger-Fear**, Anger-Neutral (p = .169), Joy-Sadness**, Fear-Joy*, Fear-Sadness**, Fear-Neutral**, and Sadness-Neutral (p = .125).
*p < .05. **p < .01.

Figure 4-8. Discrete emotion condition on recognition sensitivity



Hypothesis 8

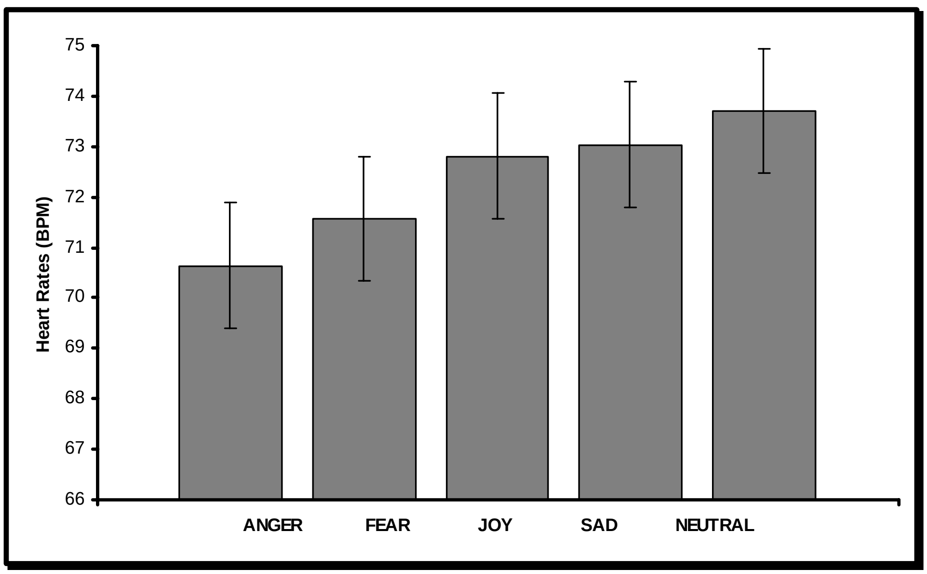
This hypothesis predicted that participants would have the slowest heart rates during angry messages followed by fearful, joyful, sad and neutral messages. The main effect of Discrete Emotion on heart rate was significant, (F (4, 288) = 21.204, $p < .001$, partial $\eta = .22$) and is shown in Table 4-9 and Figure 4-9. As predicted, angry messages elicited the slowest heart rates. These were followed by fearful, joyful, sad, and neutral messages. All the mean differences between each condition were significant at the .05 level except those between sad and joy, ($t < 1$) and sad and neutral (t (1, 72) = 1.778, p = .080).

Table 4-9. Discrete emotion condition on Heart Rates

Discrete Emotion for Heart rates	M	S.E.
ANGER	70.641	1.254
FEAR	71.565	1.220
JOY	72.813	1.237
SAD	73.028	1.248
NEUTRAL	73.707	1.220

Note. Paired samples T-tests were conducted for planned comparisons. Significant results are reported here including approaching ones. Anger-Fear**, Anger-Joy**, Anger-Sadness**, Fear-Joy**, Fear-Sadness**, Fear-Neutral**, Joy-Neutral*, and Sadness-Neutral (p = .080).
*p < .05. **p < .01.

Figure 4-9. Discrete emotion condition on Heart Rates



Hypothesis 9

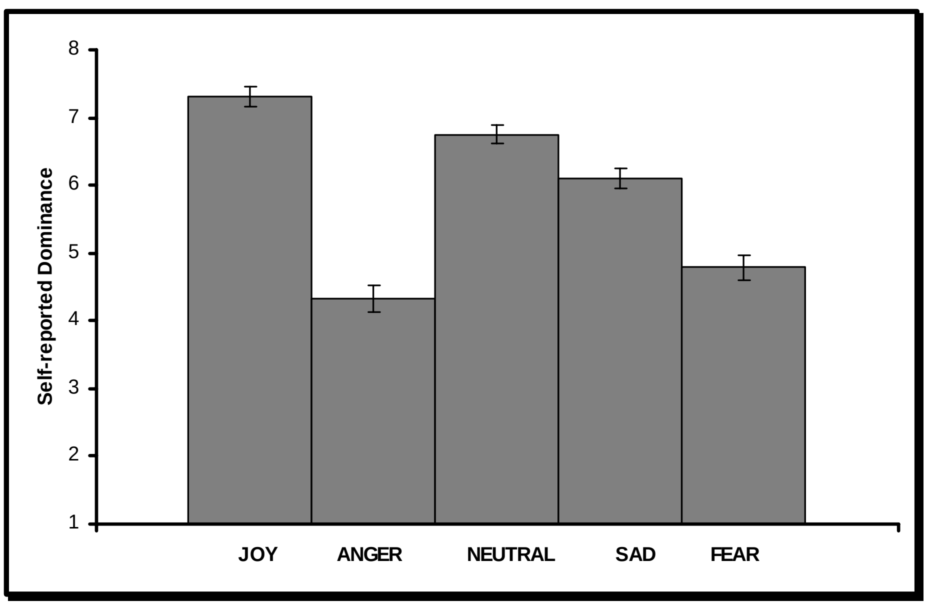
This hypothesis predicted that self-reported dominance would be highest during joyful messages followed by angry, neutral, sad, and fearful messages. The main effect of Discrete Emotion was significant, (F (4, 316) = 108.439, p< .001, partial η = .57). As predicted, self-reported dominance was highest in response to joyful messages. These were followed by neutral, sad, and fearful messages. Contrary to the prediction, self-reported dominance was lowest in response to angry messages. All the mean differences between each condition were tested by paired-samples t-tests and were significant at the .05 level.

Table 4-10. Discrete emotion condition on Self-reported Dominance

Discrete Emotion for Dominance	M	S.E.
JOY	7.303	.147
ANGER	4.331	.198
NEUTRAL	6.753	.144
SAD	6.106	.156
FEAR	4.788	.189

Note. Paired T-tests were conducted for planned comparisons. All the mean differences between the conditions were significant at the .05 level.

Figure 4-10. Discrete emotion condition on Self-reported Dominance



Hypothesis 10

This hypothesis predicted that during all content, participants high in positivity offset would show greater activation in the appetitive motivational system, indexed by increased orbicularis oculi and increased self-reported positive emotion.

The main effect of Positivity Offset on self-reported positivity was not significant (F < 1) though it was in the correct direction with individuals with high positivity offset (M = 3.156) reporting more positivity than those with low positivity offset (M = 3.003).

The main effect of Positivity Offset on the oribicularis oculi data was not significant but showed the predicted tendency (F (1, 75) = 1.959, p = .166). Individuals with high positivity offset showed larger activity (M = .036, *S.E.* = .029) compared to those with low (M = - .022, S.E. = .030).

Hypothesis 11

This hypothesis predicted that during sad and fearful messages, participants high in negativity bias would show more activation in the aversive motivation system, indexed by increased corrugator activation, a facilitated startle reflex, and increased self reported negative emotion.

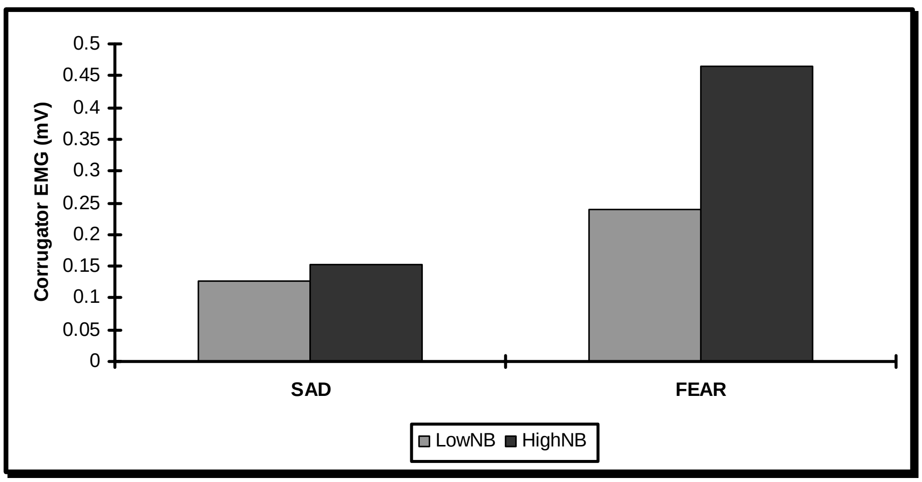
For this hypothesis, only sad and fearful messages were included in the analysis. The main effect of Negativity Bias on self-reported negativity was significant (F (1, 78) = 20.898, p < .001). Individuals with high negativity bias reported more negativity (M = 6.441, *S.E.* = .204) compared to those with low (M = 4.981, *S.E.* = .204).

The main effect of Negativity Bias on the corrugator supercilii data approached significance (F (1, 75) = 2.748, p = .102). Individuals with high negativity bias showed more activation on the corrugator muscle group (M = .308, S.E. = .053) compared to those with low (*M* = .184, S.E. = .054). The interaction of Negativity Bias X Negative Content (sad and fear) was significant (F (1, 75) = 5.180, p = .026) as shown in Table 4-11 and Figure 4-11. The difference between individuals with high and low negativity bias was larger in fear content than it was in sad content.

Table 4-11 NB x Negative Content (Fear and Sad) on corrugator

	LOW in NB, *M* (*S.E*)	HIGH in NB, *M* (*S.E*)
SAD	.127 (.050)	.153 (.049)
FEAR	.240 (.072)	. 464 (.71)

Figure 4-11 NB x Negative Content (Fear and Sad) on corrugator



The main effect of Negativity Bias on startle response was not significant (F < 1).

Hypothesis 12

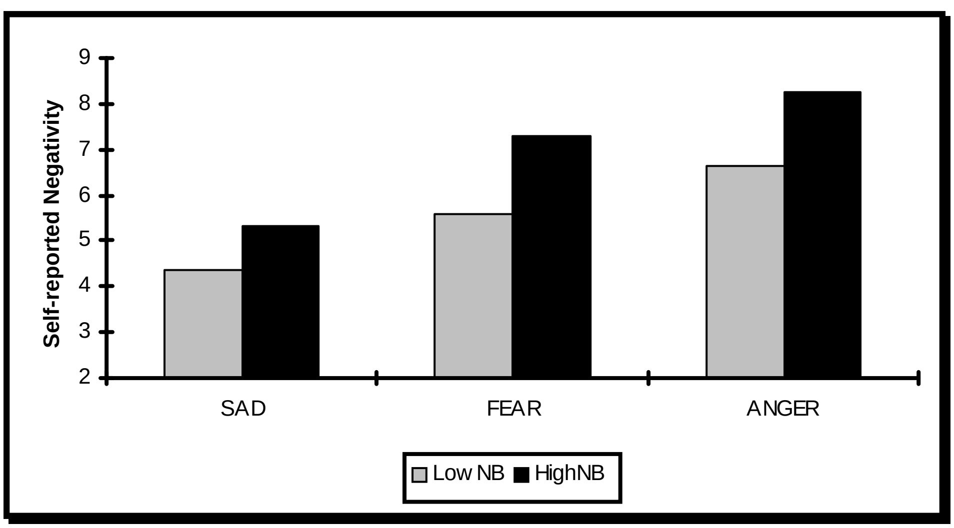
This hypothesis predicted that during angry messages, even though participants high in negativity bias would show greater activation in the aversive motivational system, the difference between individuals high and low in negativity bias would be smaller compared to that exhibited during fearful and sad messages.

For this hypothesis, only angry, sad and fearful messages were included in the analysis. The main effect of Negativity Bias on self-reported negativity was significant (*F* (2, 156) = 166.781, $p < .001$). Individuals with high negativity bias showed more activation on the self-reported negativity (*M* = 6.946, *S.E.* = .180) compared to those with low (*M* = 5.538, *S.E.* = .180). The interaction of Negativity Bias X Content (anger, sad and fear) was also significant (*F* (2, 156) = 3.984, $p = .021$) as shown in Table 4-12 and Figure 4-12. The difference in anger content between individuals with high and low negativity bias was a little smaller than that in fear content, however it was larger than that in sad content.

Table 4-12 NB x Content (Anger, Sad, and Fear) on self-reported negativity

	LOW in NB, *M* (*S.E*)	**HIGH in NB, *M* (*S.E*)**
SAD	**4.369 (.244)**	**5.313 (.244)**
FEAR	**5.594 (.204)**	**7.288 (.204)**
ANGER	**6.650 (.194)**	**8.238 (.194)**

Figure 4-12 NB x Content (Anger, Sad, and Fear) on self-reported negativity

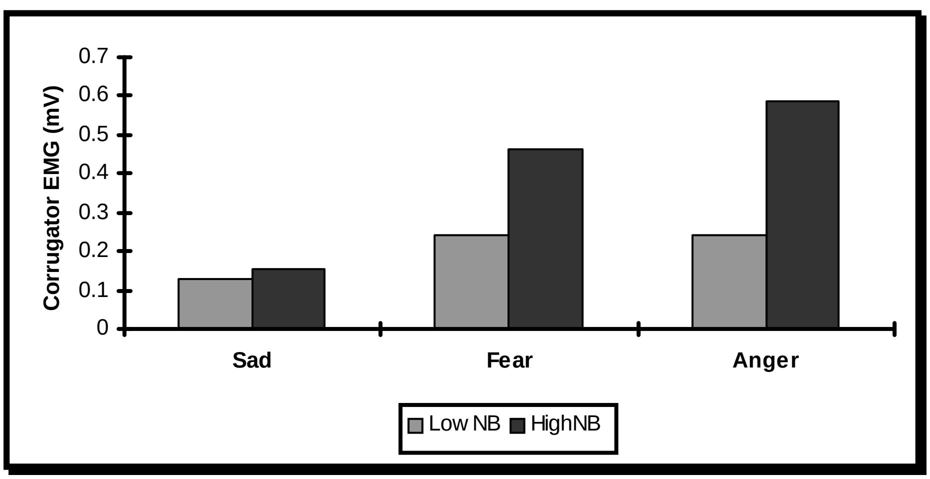


The main effect of Negativity Bias on the corrugator supercilii data was significant (F (2, 150) = 18.096, p < .001). Individuals with high negativity bias showed more corrugator activity (M = .400, *S.E.* = .060) compared to those with low negativity bias (M = .204, *S.E.* = .061). The interaction of Negativity Bias X Content (anger, sad and fear) was also significant (F (2, 150) = 5.516, p < .01) as shown in Table 4-13 and Figure 4-13. Contrary to the prediction, the difference in anger content between individuals with high and low negativity bias was larger than that seen in fear content or in sad content.

Table 4-13 NB x Content (Anger, Sad, and Fear) on corrugator

	LOW in NB, *M* (*S.E*)	HIGH in NB, *M* (*S.E*)
SAD	4.369 (.244)	5.313 (.244)
FEAR	5.594 (.204)	7.288 (.204)
ANGER	6.650 (.194)	8.238 (.194)

Figure 4-13 NB x Content (Anger, Sad, and Fear) on corrugator



Neither the main effect of Negativity Bias (F < 1) nor the interaction of Negativity Bias X Content (anger, sad and fear) (F < 1) was significant for the startle data.

Hypothesis 13

This hypothesis predicted that while viewing angry messages, even though participants high in positivity offset showed greater activation in the appetitive motivational system, the difference between individuals high and low in positivity offset would be smaller compared to that during joyful messages.

For this hypothesis, only angry and joyful messages were included in the analysis. The main effect of Positivity Offset on the self-reported positivity was not significant ($F < 1$). The interaction of Negativity Bias X Content (anger and joy) was not significant ($F < 1$).

The main effect of Positivity Offset on the orbicularis oculi data was significant (F (1, 75) = 5.704, p = .019). Individuals with high positivity offset showed more activation on the orbicularis oculi activity (*M* = .120, *S.E.* = .043) compared to those with low (*M* = -.028, *S.E.* = .045). However, the interaction of Positivity Offset with content (anger and joy) was not significant.

Research Question 1

This question asked whether there would be a relationship between motivational activation (MAM) and self-reported dominance on discrete emotions.

The main effect of Positivity Offset on the self-reported dominance was not significant ($F < 1$). The interaction of Negativity Bias X Discrete Emotion was also not significant ($F < 1$).

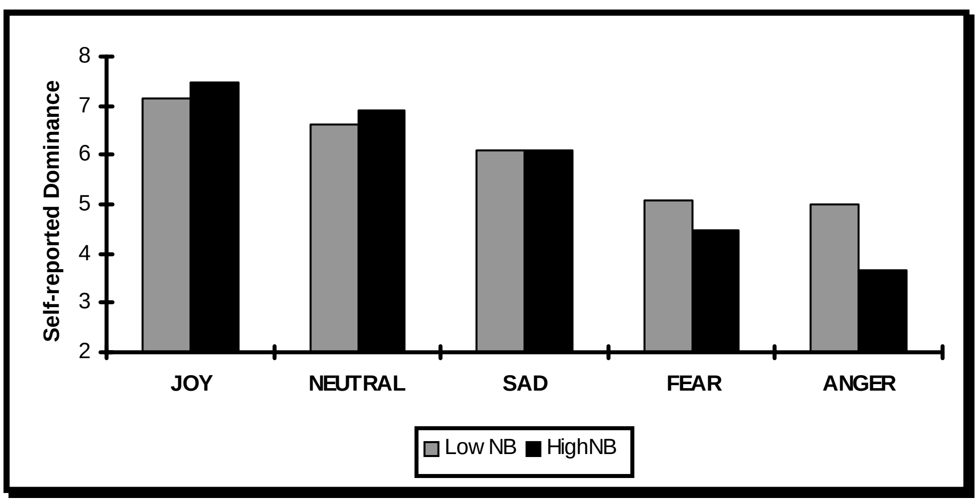
The main effect of Negativity Bias on self-reported dominance was not significant (F (1, 78) = 1.110, p = .295). However, the interaction of Negativity Bias and Discrete Emotion was significant (F (4, 312) = 1.110, $p < .001$) as shown in Table 4-14and Figure

4-14. Individuals with high negativity bias reported feeling more dominant during joyful and neutral messages than those with low. However, individuals with high negativity bias reported feeling less dominant during fearful and angry messages than those with low. During sad messages, individuals with high negativity bias reported feeling dominant at the same level with those with low.

Table 4-14. NB x Discrete Emotion on Self-reported Dominance

Rating on Dominance	Low in NB, *M* (*S.E*)	High in NB, *M* (*S.E*)
JOY	7.150 (.207)	7.456 (.207)
NEUTRAL	6.613 (.204)	6.894 (.204)
SAD	6.106 (.222)	6.106 (.222)
FEAR	5.100 (.264)	4.475 (.264)
ANGER	4.988 (.262)	3.675 (.262)

Figure 4-14. NB x Discrete Emotion on Self-reported Dominance



CHAPTER 5

Discussion

The goal of this study was to examine whether predictable motivational activation in the appetitive and aversive systems underlies the production and experience of discrete emotions experienced while viewing televised PSAs. The current study was conducted from the perspective of LC4MP which theorizes that conscious emotional experience is evoked by the activated motivational systems (A. Lang, 2006a). Overall the results imply that the theoretical predictions of LC4MP can be of great use in providing a systematic tool to examine the manifest patterns of discrete emotional responses.

One major finding in this study is that it is important to use physiological measures in order to provide non-subjective information about activation of the motivational systems, since the level of activation does not always appear to be reflected in subjective reports of emotional experience. This may be more true when examining a coactive state, such as anger, than if is for the singly active states of either the appetitive or the aversive system. This may be because a coactive emotional experience is more complex than is a singly active experience. In the following section, the results and findings related to each individual discrete emotion will be discussed.

Discrete Emotion, Emotional Experience and Motivational Activation

Joy

This study predicted that joy would be the result of strong appetitive activation and aversive inhibition. The combination of strong appetitive activation and aversive inhibition should have resulted in the highest levels of positive feeling and orbicularis oculi activity, and the lowest levels of negative feeling, corrugator activity and startle response amplitude.

Self-reported positivity data showed the highest positive and lowest negative feelings during joyful messages as predicted. Joy elicited the largest activity of orbicularis oculi, but this difference only approached significance. And the planned comparisons revealed that orbicularis oculi activity during joy was only significantly different from that found during sad messages. Thus, the orbicularis data provided moderate evidence for the highest appetitive activation in joy. The corrugator data did not show the predicted aversive inhibition in joy. The corrugator activity during joy was at the same level as that found during sad and neutral messages, though it was smaller than that found during fear and anger. The startle data also failed to support the inhibition hypothesis producing startle amplitudes of about the same size as those found during sad messages and significantly larger than those found during neutral messages. Though, as with corrugator, the startle responses were smaller than those found during fear and anger.

Overall the physiological data provide moderate support for strong appetitive activation and no support for aversive inhibition while self-reported data provided good evidence for both. A possible reason for this is the theme of the joyful messages. All of the joyful messages were related to preventing drug abuse. The theme itself might have influenced activation of the motivational systems. Even though the messages were delivered with joyful visuals and audios participants were well aware that the messages were related to drug use prevention which is not a joyful topic. In addition, college students' attitudes towards drug use and towards persuasive messages on the topic may have interfered with their experience of joy or, perhaps more likely given that they self-report feeling joyful, interfered with the inhibition of the aversive system, perhaps by mildly activating it.

Fear

This study predicted fear would be the result of strong aversive activation and appetitive inhibition. The combination of strong aversive activation and appetitive inhibition should have resulted in the highest levels of negative feeling, corrugator activity and startle response amplitude, and the lowest levels of positive feeling, orbicularis oculi activity.

Self-reported emotional experience data showed that the fearful messages were the second most negative (after anger) and the second least positive (also after anger) In addition, fearful messages were rated as less positive than neutral providing some support for the inhibition hypothesis. The corrugator activity during fear was at the same level as that found during anger and seriously larger than that found during sad, neutral, and joy. The startle data shows the largest amplitude during fear and they are significantly larger than those found during any other emotion, providing strong evidence for the highest aversive activation during fear. The orbicularis oculi activity during fear was at the same very low level as was found during neutral and sad providing evidence for inactivity of the appetitive system but not for inhibition.

Overall the self-reported and physiological data supported the predictions of strong aversive and inhibited appetitive activation during fear if one ignores the anger condition (more about that later). The physiological data provide strong support for a highly activated aversive system but no support for an inhibited appetitive system.

Sadness

This study predicted that sadness would be the result of moderate aversive activation and inactive or weak appetitive activation. The combination of moderate aversive activation and appetitive inactivation should have resulted in the second highest levels of negative feeling, corrugator activity and startle response amplitude, and the low levels of positive feeling and orbicularis oculi activity similar to the level found during neutral messages.

Self-reported positivity data showed the third highest negative feeling below anger and fear and the third lowest positive feeling below neutral but above fear and anger. The corrugator activity during sadness was smaller than that found during anger and fear and at the same level found during joy and neutral. Startle amplitude during sadness was the second highest as predicted though a planned comparison showed the mean difference between sadness and joy was not significant. The orbicularis activity during sadness was at the lowest level but shared that level with neutral and joy.

Overall the self-reported and physiological data support the prediction that sadness is a moderately activated aversive condition and that it may involve some low level appetitive activation. The physiological data tells a somewhat more complex story. Startle data do suggest that a moderate level of aversive activation exists. However, the corrugator and orbicularis oculi data do not significantly distinguish between the sad and neutral conditions. This might be related to the fact people experiencing sadness have been observed to be physically and behaviorally immobilized and that the action disposition of sadness is generally thought to be directed inward to self rather than outward to an external cause (Hoschchild, 1983; Lazarus, 1991a; Stein & Jewett, 1986).

If this is the case than sadness may not automatically evoke activity in the facial musculature. If this is the case then during sadness, self-reports may play a more important role than it does in other conditions when inferring the motivational activation.

Anger

This study predicted that anger would be the result of moderately strong aversive and appetitive activations. The combination of moderate aversive and appetitive activations should have resulted in the second highest levels of negative feeling, corrugator activity and startle response amplitude and the second highest levels of positive feeling and orbicularis oculi activity.

Contrary to the prediction that anger would be a coactive state, the self-report data show strong reciprocal activation, high aversive and inhibited appetitive activation, that is people report feeling most negative and least positive. Actually, the results confirm the previous findings that anger was rated as a negative feeling (Russell & Mehrabian, 1977). The current study used two uni-polar scales for valence instead of a bipolar scale often used in the previous studies. Even with the uni-polar scales, anger was still reported as a negative emotional experience, not a positive one. However, the physiological data tell a different story.

Corrugator activity during anger was equal to that found during fear and significantly larger than that found during sad, neutral, and joyful messages. This result suggests that the aversive system was highly activated. However, the startle data showed the smallest amplitude, significantly smaller than that found during neutral messages implying that there is some appetitive activation. Similarly the orbicularis oculi activity found during anger was at the same level as that found during joy and significantly larger than that in sadness. Thus the physiological data strongly support the contention that anger is a coactive state with both aversive and appetitive activation.

Anger has generally been defined as the feeling of being kept from reaching an intensely desired goal because of an unjust obstacle coupled with the feeling of wanting to attack the obstacle (Frijda, 1986; Lazarus, 1991a, Tomkins, 1963). The definition implies that negative feelings from the failure to attain the goal are caused by aversive activation while the concurrent appetitive activation is necessary to support a physical approach and attack. It explains the combination of highly negative feelings, high corrugator activity and lowest startle response shown in this study. Future research might be able to divide the experience of anger over-time into different phases by tracking the activation of the appetitive and aversive systems over time. Early on frustration and aversive activation elicited by not being able to attain the goal may dominate the experience, over time, however, the appetitive system may begin to activate and eventually a strongly activated appetitive system may provide the impetus for action as well as, eventually, producing a positive feeling such as the sweet mental picture of revenge mentioned in *Rhetoric* (Aristotle, 1984).

Indirect evidence exists for this suggestion about the different phases to experience anger. Harmon-Jones et al. (2004) reported that left frontal cortical activity increased only when individuals expect the target object (i.e. the source of anger) to be approachable. Obviously, when viewing television messages which elicit anger, the object of the anger is not approachable. Thus, anger elicited by television messages may be predominantly aversive and frustrating. Dominance ratings provide indirect evidence for this. It has been found that anger is rated high on dominance while fear and sadness are rated low (Mehrabian & Russell, 1974). In this study, however, anger was rated quite low on dominance implying that participants didn't feel they had control over the situation. From this, it is possible to suggest that manipulating anger in a different way might produce a more coactive feeling state.

Arousal and Resource Allocation

It was predicted that overall motivational activation would elicit arousal and that arousal would influence resource allocation. The coactive state was predicted to be the most arousing, followed by the high singly active states, then the moderate state, and then neutral. This order was found in the self report data (though all planned comparisons were not significant). Skin conductance also generally supported this prediction with anger having the highest SCL followed by joy, fear, and anger (tied), and then sadness and neutrality.

These data also line up with the cognitive effort (HR) data. Anger got the most effort, followed by fear, joy and sadness were next, and neutral received the least cognitive effort. Thus, it does appear that arousal guided overall resource allocation.

However, all of those resources were not, apparently, allocated to recognition. Fearful messages were recognized the best followed by joyful, sad, angry and neutral messages. Contrary to the prediction, angry messages were not recognized best even though they were the most arousing and apparently received the greatest amount of cognitive effort.

There are two possible explanations for this finding, one is that while many resources are allocated to processing stimuli which elicit anger, those resources are not allocated to encoding. Thus, the increase in cognitive effort may reflect more resources being allocated to retrieval and storage. The other possibility is that the angry messages resulted in overload of the encoding sub-process. Thus, despite having many resources allocated to encoding, it was not sufficient to encode the information being presented in the messages. Previous research has shown that arousing, compared to calm, messages do overload the encoding process sooner. Thus, it is possible that the extra arousal created greater demands for resources at storage and retrieval – as well as at encoding – resulting in insufficient resources being available to encode the messages. It is also possible that this may have been exacerbated by differences in information or structural complexity of the anger messages compared to the other messages. Research from the LC4MP perspective has shown that the combination of highly arousing and complex structural feature can result in cognitive overload which worsens recognition performance (A. Lang et al., 2004). This study did not control either structural or information density, thus it is possible that the angry messages required more resources to encode than did the other messages. Future research should investigate these possibilities.

The planned comparisons show that joyful and fearful messages were not recognized significantly differently from each other even though fearful messages were self-reported to be significantly more arousing. Since this study compared one positive type of messages with three negative types of messages it may have made the positive messages more salient than the negative messages and resulted in less interference.

Individual Differences

It appears that participants high in positivity offset did not show significantly greater activation in the appetitive motivational system for all stimuli in this study even though the tendency was in the direction of the predictions. When including only joyful and angry messages which were presumed to produce appetitive activation, individuals with high positivity offset showed significantly more activation in the orbicularis oculi activity compared to those with low. It suggests that those high in positivity offset may experience greater appetitive activation than those low in positivity offset.

Individuals with high negativity bias showed more activation on the self-reported negativity and corrugator activity when watching sad, fearful, and angry messages compared to those with low. It appears the influence of negativity bias was seen more during fearful and angry messages compared to sad messages. The results strongly support the predictions from LC4MP that individuals high in negativity bias will experience more aversive activation when viewing negative media messages and that the difference is greater as the content becomes more arousing.

In addition, the results showed that those with a high negativity bias reported feeling more dominant during joyful and neutral messages and less dominant during fearful and angry messages than those with a low negativity bias. These results provide the possibility that the dominance dimension is also associated with the level of motivational activation in individuals.

In this study individual differences in motivational activation especially for positivity offset did not produce statistical significance for some dependent variables. The lack of strong evidence for the effect of individual difference may be partially due to the statistical power issue caused from insufficient number of participants. In addition, this study used college students as experiment participants. College students are a fairly homogeneous group with similar ages and cultural backgrounds. On top of having a fairly homogenous group and a small sample size, this study also used median split to create two groups. This may have increased the homogeneity between the groups by having people in the middle range separated fairly arbitrarily into two different groups. Future research should use a large and different sample of participants in order to examine individual difference in motivational activation.

Theoretical Implications

This study suggests that research in the discrete emotion domain can benefit from using the findings of the dimensional approach to provide a systematic tool to reveal subjective and physiological patterns of discrete emotional experience. So far research on discrete emotion has focused on finding appraisal factors which have the potential to differentiate each discrete emotion. Most of the discrete emotion researchers have considered motivation related factors as primary and other factors as secondary (Lazarus, 2001; Roseman, Antoniou, & Jose, 1996). However, research on discrete emotional experience, especially using physiological responses, has not been guided by motivation related factors. The research has instead looked for the existence of a specific pattern associated with each discrete emotion. This has created an obstacle on the path to discovering mechanisms underlying the discrete experiences (including physiological responses such as facial EMG and autonomic responses).

This study provides evidence that discrete emotional experiences can be explained using motivational activation as the primary generator of emotion. This suggests that discrete emotional researchers should take the theoretical predictions and findings from the dimensional research into consideration. In addition, arousal as the overall activation level tends to be ignored in discrete emotional research when interpreting the results (e.g. Ekman, Levenson, & Friesen, 1983). According to LC4MP, by considering the arousal level across different emotion experiences, attentional and cognitive allocations toward emotional events can be explained more clearly. This study demonstrates the importance of the arousal in interpreting cognitive processing relative to each discrete emotional experience.

This study also suggests that considering the findings of research on discrete emotion domain would be helpful to interpret more clearly the results of the studies based on the dimensional approach. For instance, sadness has been found to be associated with physiological immobilization and inward thinking. These descriptive characteristics should be taken into consideration and integrated with motivational activation theory to better understand and predict the physiological, emotional, and cognitive consequences of sadness.

In addition, this study suggests it is necessary to have more research about coactive states in the dimensional approach. There have been only a few studies about coactive states (Sparks, 2007; A. Lang, Sanders-Jackson, & Wang, 2006). Research in the dimensional approach has generally treated valence as bipolar. This limits our ability to reveal more dynamic processing of emotional experiences. A more thorough understanding of coactivation of the motivational systems will provide a better explanation of dynamic emotional processing. In this study, it appears that anger was better explained by predicting it as a coactive state. The study also presents that the dynamic processing of a coactive state can be revealed by considering the time factor. It was suggested that anger might manifest over time. The time variable is likely of great importance as we move forward with our understanding of how motivational activation works to engender diverse emotional experiences (A. Lang, 2006a).

Practical Implications

This study provides evidence that motivational activation is related to discrete emotion and that individual differences in motivational activation appear to moderate the experience of discrete emotion. As previously mentioned, past research has successfully demonstrated that PSAs produced using the findings of scientific research and theories can be effective. Overall, this study demonstrates LC4MP may be a theory which can be of great use in designing PSAs.

If a PSA producer intends to obtain cognitive (attentional) effort from viewers, he/she should consider using angry content. However, if he/she wants the PSA to be encoded well, anger might not be a good choice unless, perhaps, the messages are produced to be structurally and informationally simple. As is already well known, fear content can be a good choice in terms of attention and memory. Joyful content also leads to good memory for messages. These results also suggest that one should use sad content with caution. Sad content may not be a good choice for eliciting attention and memory. However, it may lead to more internal processing and elaboration which may be why previous research suggests that sadness can elicit help intentions from viewers.

This study also supports the contention that individual differences in motivational activation are highly associated with the motivated processing of televised PSAs. Individuals low in negativity bias, who have been found to have a greater potential for taking risks, show less aversive activation than do individuals high in negativity bias. This might lead to two suggestions for PSA producers. One is that fear and anger may not be good choices if the goal of the message is to achieve persuasion by producing a feeling of threat in a target market that consists of many individuals with a low negativity.

Another is the fear and anger may be a good choice if PSA producers aim to prevent individuals high in negativity bias from getting involved in undesirable behaviors as it may reinforce their already high inclination to avoid these behaviors.

Limitations of the Current Study

This study provides some good evidence for the contention that motivational activation underlies the emotional experience of the discrete emotions of anger, joy, fear, and sadness. However, this study used only PSAs as stimuli. Thus, one should be cautious about generalizing the findings to other forms of mediated messages. Mediated messages are delivered through many different types of media (television, radio, game and the Internet) and different genres (news, entertainment, documentary, etc.). When using LC4MP to predict the user's processing of mediated messages, differences in te context based on a message's genre and type must be taken to consideration.

Neutral stimuli used in this study were also PSAs. PSAs might not be able to be absolutely neutral because they deal with negative topics and are designed to appeal to and persuade the audience. Indeed, the self-report data in this study show that the neutral PSAs used were somewhat emotional. It appears that the neutral PSAs elicited a weak coactive state even though they were rated at a low level on positivity and negativity. The emotional level was not at an absolute zero level, and it may have produced some confounding especially with sad messages. For many of the dependent variables used in this study, sad messages were at the same level as or even lower than neutral messages. If neutral condition is more rigorously manipulated, these phenomena may disappear. Future research should examine whether the findings in this study are the result of non-neutral neutral messages or is sadness is an extremely 'inactive' physiological state.

This study used college participants. In some ways college students are a fairly homogeneous group. However, it is relatively unlikely that the variables in this study (emotional experience and physiological reactivity) are highly restricted in this sample. None the less college students attending a large state university represent a small range of the general population. However, they are part of the target market for the stimuli used in this study. However, future research should use different samples of participants as well as different types of messages.

Directions for Future Research

LC4MP posits that structural features influence message processing and interact with the content feature. Specifically a great deal of research has examined how structural complexity and information density interact to affect the processing of mediated messages (A. Lang et al, 2004; Fox, Park, & A. Lang, 2006; Park, Sanders-Jackson, Wilson, & A. Lang, 2005; Potter et al, 2005). In these studies, structural complexity, representing allocated resources, is measured by the frequency of the structural features that elicit orienting responses, which automatically allocate resources to message encoding. Information density, representing resources required, is operationalized by how much information is introduced simultaneously with camera changes for television messages and structural onsets for radio messages. These studies found that at low levels of information density, increases in structural complexity increased available resources which resulted in better recognition performance whereas, at high levels of information density, increases in structural complexity resulted in decreases in recognition, which is an indicator of cognitive overload. It is possible that variation in information density and structural complexity may influence processing of discrete emotional content and associated motivational activation and future research should investigate this possibility.

The effectiveness of the specific claims made in PSAs may also influence the processing of discrete emotional content. Yegiyan & A. Lang (2006) demonstrated that specific claim effectiveness matters in processing PSAs. They found an interaction between emotional appeal and claim effectiveness in that arousing messages with weak claims were rated as less attention getting, less persuasive, less helpful to self or others. Whether discrete emotional content interact with claim effectiveness should be another subject for further research.

This study used PSAs aimed at preventing several types of behaviors. It would be interesting to examine discrete emotional processing and motivational activation within a specific topic (e.g. prevention of drug abuse and prevention of smoking). This might enable us to better understand how the topic of the PSA interacts with the appeal to affect motivational processing

Age has been found an important variable for the level of motivational activation in individuals (Kurita, Lee, Nadorff, & A. Lang, 2006; A. Lang et al., 2004). Research with different age groups other than college students should be conducted to expand the scenes of research about motivational activation in experiencing discrete emotions.

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Yegiyan, N., & Lang, A. (2006, June). *What you say may be what you get: Understanding the interactive effects of message production features and claim effectiveness in health messages.* Paper presented at the International Communication Association Annual Conference, Dresden, Germany

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Education

M.A. from the Department of Telecommunications, Indiana University, Bloomington, 2005.

B.A. from the Department of Mass Communication, Yonsei University, Seoul, 1991.

Employment

Associate Instructors in the Department of Telecommunications, Indiana University, Bloomington, from Fall 2001. Assisted professors in grading and supervised discussion sections.

Chief of the production and planning team in the Korean Christian TV System, Seoul, Korea, from June 1999 to August 2000.

Television director in the Korean Christian TV System, Seoul, Korea, from August 1995 to June 1999.

Television director in in the Korean Educational Broadcasting System, Seoul, Korea, from August 1994 to June 1995.

Assistant television director in the Korean Educational Broadcasting System, Seoul, Korea, from June 1992 to August 1994.

Research Experience

<u>Research Assistant</u>

Indiana University, Dept. of Telecommunications
Working with Dr. Makana Chock, August 2004

Worked with Dr. Annie Lang, August 2003
Involved in research projects that deal with the processing of public service announcements. Learned extensive skills in designing, collecting, and analyzing physiological data.

A member of the Institute for Communication Research Lab, Indiana University, June 2002 to present

Teaching Activities

<u>Assistant Instructor</u>

Indiana University, Dept. of Telecommunications, August 2003 to May 2004; August 2005 to May 2006

Led lab sections of 12-14 students for the digital television course (T283). In this class, the assistant instructors lead 2 four-hour sessions (8hours per week) of the studio and field television production with the digital equipments.

Honors

Top student paper, Information System Division, International Communication Association, **Lee, S.,** & Park, B. (2006). Effects of Motivational Activation on Processing Positive and Negative Content in Pop-up Advertisements

Top paper, Media and Disability Interest Group, Association for Education in Journalism and Mass Communication. Shin, M., **Lee, S.,** & Lang, A. (2003). Don't label me: The stigmatizing portrayal of mental illness on U.S. television.

Journal Articles

Chock, T. M., Fox, J. R., Angelini, J. R., **Lee, S.,** & Lang, A. (In press). Pacing and arousing content effects on personal impact, third person effects, and reverse third person effects of anti-smoking PSAs for smokers and non-smokers. Manuscript accepted to Communication Research.

Lang, A., Schwartz, N. C., **Lee, S.,** & Angelini, J. R. (In press). Processing Radio PSAs: Production Pacing, Arousal, and Age. Manuscript accepted to Journal of Health Communication.

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Manuscripts under review at Academic Journals

Wise, K., **Lee, S.,** & Lang, A. (under review). Responding to change on TV: How viewer-controlled changes in content differ from programmed changes in content. Manuscript submitted to Journal of Broadcasting & Electronic Media.

Manuscripts in preparation for journal submission

Lee, S., & Lang, A. The Effects of Slow Motion on Viewers: Emotional and Cognitive Processing.

Lee, S., & Park, B. Effects of Motivational Activation on Processing Positive and Negative Content in Pop-up Advertisements.

Lee, S., Park, B., & Potter, R. The Impact of Structural Complexity and Information Density on Attitudes toward Radio PSAs.

Conference Papers

Chock, T. M., Fox, J. R., Angelini, J. R., **Lee, S.,** & Lang, A. (2004, May). First person and social distance effects of anti-smoking radio PSAs. Paper presented to the Health Communication Division of the International Communication Association at its annual conference, New Orleans, LA.

Chock, T. M., Fox, J. R., Angelini, J. R., **Lee, S.,** & Lang, A. (2003, May). Pacing and Arousing Content Effects on Personal Impact, Third Person Effects and Reverse Third Person Effects of Anti-Smoking PSAs for Smokers and Non-Smokers. Paper presented to the Information Systems Division of the International Communication Association at its annual conference, San Diego, California.

Lang, A., Schwartz, N., **Lee, S.,** & Shin, M. (2003, May). Processing Radio PSAs: Production Pacing, Arousing Content, and Age. Paper presented to the Information Systems Division of the International Communication Association at its annual conference, San Diego, California.

Lee, S. (2005, May). The Effects of Slow Motion on Viewers: Emotional and Cognitive Processing. Paper presented to the Information Systems Division of the

International Communication Association at its annual conference, New York, NY.

Lee, S. (2006, August). Effects of Sensation Seeking on processing messages with Slow Motion. Paper presented to the Theory and Methodology Division of the Association for Education in Journalism and Mass Communication at its annual conference, San Francisco.

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Shin, M., **Lee, S.,** & Lang, A. (2003, August). Don't label me: The stigmatizing portrayal of mental illness on U.S. television. Paper presented to Media and Disability Interest Group of Association for Education in Journalism and Mass Communication at its annual conference, Kansas, Missouri.

Shin, M., **Lee, S.,** & Lee, S. (2003, May). Make it fast but easy: production pacing and narrative structure in processing TV commercials. Paper presented to the Information Systems Division of the International Communication Association at its annual conference, San Diego, California.