RESILIENCE AND ATTENTIONAL BIASES:

WHAT YOU SEE MAY BE WHAT YOU GET

by

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Abstract

Research suggests that, during stress, resilient individuals use positive emotion regulation strategies and experience a greater number of positive emotions than those who are less resilient. Therefore, differences could be expected in attentional biases towards emotional stimuli based on resilience. The current study investigated attentional biases towards neutral, negative and positive images in response to varying levels of resilence and mood induction conditions (neutral, negative and positive). Sixty participants viewed a series of pre and post-mood induction slides in order to measure attentional biases to emotional stimuli. The study provided evidence for the presence of trait and state congruent attentional biases. More resilient individuals demonstrated an initial bias towards positive stimuli and once emotion was aroused, the bias was away from negative stimuli. Additionally, mood congruent attentional biases were observed for participants induced into positive and negative mood states. Implications as they apply to research and clinical practice are discussed.

Keywords

Resilience, attentional biases attention, eye tracking, eye movements

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Introduction

Emotions serve many functions (Plutchik, 1980) and have the capacity to focus attention and direct action depending on situational demands and contexts (Reeve, 2005). Emotions have also been used to explain or partially explain many psychological processes, such as decision-making (Wieczorek Hudenko, 2012), relationship satisfaction (Levenson, Carstensen, & Gottman, 1994), and individual differences associated with optimistic and pessimistic traits (Perterson, 2000). In this study, positive emotion regulation strategies, specifically the ways in which resilient individuals maintain and increase their experience of positive affect, are proposed as a key component in explaining the mechanism of resilience. Emotions have been found across all populations, regardless of culture, language or nationality (Ekman, 1972). Emotions and the ability to recognize emotions are considered innate, universal and unlearned. The literature in emotion research has failed to provide a converging definition of the construct. Fox (2008) defined emotions as the momentary coordination of neural, autonomic and behavioural changes that initiate a reaction to a personally significant external or internal event. Despite the difficulties in defining emotions, agreement that emotions are multidimensional phenomena that consist of many components is rarely disputed. Three major components of emotions include subjective report, physiological response and cognitive appraisal (Fox, 2008).

Given the broad range of emotions that one can experience, it is not surprising that the purpose and function for each emotion is varied (Plutchik, 1980). For example, the emotion of fear signals a threat situation, evoking a fight or flight response, which is a function of protection. Additionally, the emotion of surprise signals the presence of a novel object or experience, evoking a stopping or alerting response, which is a function of orientation. Although the outcome of protection and orientation are vastly different, they both direct attention and

channel behaviour in a manner that is adaptive for the individual given their environment. Damasio (1994) presents evidence that emotions function as a part of system that allows species to survive and thrive. Understanding the function and adaptive purpose of emotions has been thoroughly investigated. Although many theories and hypothesized models have been developed to provide insight and shed light on the functionality of emotions, the focus of the majority of the research that has been conducted applies to "negative emotions" such as fear, anger, disgust and sadness rather than "positive emotions" such as happiness, love and contentment. A model that emerged to explain "positive emotions" such as joy, interest, contentment and love is the Broaden and Build theory (Fredrickson, 1998).

The Broaden and Build Theory

The Broaden and Build theory (Fredrickson, 1998) proposes that positive emotions serve a functional purpose beyond the mere absence of "negative emotions". Two assumptions attributed to the purpose of emotions that are refuted by the model are that 1) emotions only produce urges to act in a specific manner and that 2) emotions provide motivation for only specific physical action.

The model counters the first assumption by indicating that positive emotions activate non-specific rather than specific action tendencies, similar to free activation (Fredrickson, 1998). Prior to the Broaden and Build theory, free activation was theorized as the specific action tendency of joy (Frijda, 1986). Unlike emotions such as fear, anxiety and sadness, which produce specific actions tendencies, such as avoidance, inhibition, and deactivation, joy was theorized to initiate non-specific action tendencies (Frijda, 1986). Non-specific action tendencies initiated by joy are not associated with explicit goals and behavioural responses. Individuals experiencing free activation are not completely absorbed and focused on a specific task, event or stimuli and

can engage in non-goal directed behaviours and thoughts. The Broaden and Build theory expands on the notion of free activation beyond the emotion of joy and applies free activation to broader categories of positive emotions.

Additionally, Fredrickson (1998) rejects the second assumption that was theorized to explain the functional nature of emotions, indicating that it fails to comprehensively explain positive emotions. The premise that emotions can only evoke the response for physical action was expanded by the Broaden and Build theory by stating that emotions can also yield tendencies for cognitive activity (Fredrickson, 1998). More specifically, the Broaden and Build model proposes that positive emotions generate non-specific thought-action tendencies that serve to broaden the momentary thought-action repertoire. According to the theory, negative emotions narrow the thought-action repertoire by generating specific action tendencies such as fight or flight, whereas positive emotions broaden the thought-action repertoire by generating a process of free activation.

The momentary broadening of the thought-action repertoire, allows for an individual to build physical, cognitive and social resources, which can be drawn upon at a later date. For example, children that experience joy are more likely to engage in play behaviour such as running, climbing and social interaction, which in turn develops social skills and fine and gross motor skills (see Pellegrini & Smith, 1998, for summary). Therefore, joy allows for the broadening of the momentary thought-action repertoire through the facilitation of play, which develops skills that can be useful and accessed at a later time. Another example of this process was provided by Fredrickson (1998), in contextualizing the positive impact of interest. Interest, which has been classified as a *knowledge emotion,* with other emotions such as confusion, surprise and awe (Silvia, 2008), requires a degree of cognitive appraisal. Given that interest

activates the action tendency for orientation (Frijda, 1986), a person experiencing interest is more likely to explore their surroundings and to familiarize themselves with their environment. The knowledge acquired as a result of experiencing interest can be accessed at a later date, regardless of what type of affect the individual is experiencing (positive or negative) to problem solve and generate creative solutions. In summary, the broaden component of the theory is that positive emotions allow and encourage individuals to use novel and creative action, whereas the build component of the model emphasizes applying the newly acquired resources learned during the broaden stage at a later time.

Research supporting the Broaden and Build theory. Empirical support for the Broaden and Build theory has been growing since the framework was first proposed. Gasper and Clore (2002) conducted a study that investigated the impact of mood on attention. The researchers hypothesized that individuals that experienced happier moods would be more likely to use global concepts and individuals with sadder moods would be more likely to use local concepts with regard to reproducing a picture. The researchers induced either a positive or sad affective state by asking participants to write about a personal life event that evoked either sadness or happiness. The participants were then asked to reproduce a drawing, which was later assessed for global and local features. Results of the study found that individuals in the negative mood induction condition were less likely to produced drawings that used global features suggesting that affect can influence attentional scope. This supports the framework proposed by the Broaden and Build theory that positive emotions can broaden an individual's thought-action repertoire evidenced in that negative mood induction resulted in greater attention to local features, whereas positive mood induction resulted in greater attention towards global features.

Additional support for the Broaden and Build theory was found in a study conducted by Isen, Johnson, Mertz and Robinson (1985). The researchers conducted a study to investigate the relationship between affect on creative word associations. Participants were randomly assigned to either a positive, negative or neutral affect group and were required to complete a word association task. Each participant was given a booklet containing words, for which a word association task was required. The first ten words in each booklet were either rated as positive, neutral and negative and the final ten words were rated as neutral. Participants were asked to write down their first associations to each word in the booklet. Associations the participant made for the final ten neutral words were rated for uniqueness based on normative data from a word association frequency tool. Pleasantness and familiarity in affective words was determined based on norm referenced word lists to ensure that conditions were equally matched. Word associations were rated as unique if the word association that was matched to the original word was used by less than 5% of the population in the normative data or less than 2.5% of the participants in the study.

Results of the study found that those in the positive affect condition had significantly more word associations categorized as unique compared to the neutral condition. There was no significant effect for the negative condition. Another study that shares similar findings was conducted by Rowe, Hirsh and Anderson (2007), who found that positive affect leads to more word associations for familiar words and a greater attentional scope in participants. Additional studies have supported that positive affect can lead to better test performance (Fodor & Greenier, 1995; Isen, Daubman, & Nowicki, 1987), and a greater variety in product selection (Kahn & Isen, 1993). Evidence that supports that positive emotion broadens cognitive resources and encourage novel and creative problem solving has also been found in children populations.

Renninger, Hidi and Krapp (1992) found that children who experience the emotion of interest, had a wider range and more variations of play behaviour, as well as longer play episodes than children that were not experiencing interest. The above studies support the Broaden and Build model of positive emotions by highlighting that positive emotions broaden cognitive resources, which subsequently allows for the use of novel, unique and creative problem-solving strategies. The Broaden and Build theory is a valuable model that has been instrumental in explaining the adaptive nature of positive emotions.

The Broaden and Build Theory and Resilience

In addition to expanding the field of emotions, the Broaden and Build theory has been used to further understand several constructs studied in psychology. Processes such as student engagement (Lewis, 2010), cross cultural empathetic responding (Nelson, 2009), and worker productivity (Wright, 2005) have used components of the Broaden and Build theory to understand properties of the construct such as mechanisms and aetiology. One specific area that has used the Broaden and Build theory as a theoretical base is resilience. Resilience is defined as a set of personal characteristics that facilitate positive adaptation even in the face of adversity (Connor & Davidson, 2003). Resilience was once believed to be a trait, only observed in a small subset of the population. However, after conducting thorough reviews, both Bonanno (2004) and Masten (2001) challenged this belief and argued that demonstrating resilience when faced with adversity is more common than once estimated. There has been a significant amount of research that has focused on protective factors that contribute to an individual's level of resilience. Protective factors can be divided into three major areas: individual characteristics, family influences and community influences (Masten & Coatsworth, 1998). Several studies have been conducted to examine both risk factors and protective factors that might contribute to resilience

(see Luthar & Zigler, 1992 for review). Given that there are many protective factors that contribute to resilience, many methods have been developed to measure and operationally define resilience.

Measurement of Resilience

Several methods have been utilized in the both classification and quantification of resilience. Many researchers have used self-report tools and questionnaires, such as the Ego Resilience Scales (Block & Kremen, 1996) and the Dispositional Resilience Scales (Tugade & Fredrickson, 2004), to assess resilience. In addition to self-report measures, researchers have also used observational methods to measure resilience in the face of adversity and stress. In certain circumstances, observational measures of resilience have used the absence of maladaptive functioning and antisocial behaviour as an indicator of resilient functioning. Observational methods have also used presence of adaptive functioning to define resilience. More specifically, researchers have defined resilience as the absence of PTSD symptoms following traumatic events (Bonanno & Galea, 2007; Werner and Smith, 1982), the absence of prior mental health diagnoses or the absence of history with mental health agencies (Kilmer, Cook, Taylor, Kane, & Clark, 2008), and/or absence of a criminal record (Kandel et al., 1988). Another observational criterion that has been used to measure resilience is academic success. This has been measured in terms of the retention and successful program completion despite surviving traumatic and unsupportive experiences suggesting greater levels of resilience (Fergusson & Horwood, 2003).

An alternative method for measuring resilience is through third party information such as parent, teacher, peer (Cumberland-Li, Eisenberg & Reiser, 2004), or clinician reports (Higgins, 1994). Although third party reports are advantageous because they reduce the impact of self-report bias, they can still be influenced by reporter bias, which can be a research confound. A

method that is not influenced by reporter bias is the physiological measurement estimates of resilience. For example, Tugade and Fredrickson (2004) used a self-report measure of resilience and correlated it with participant's physiological data. The researchers used six different methods of physiological measurement including heart rate, finger pulse amplitude, pulse transmission times to the finger, pulse transmission time to the ear, and diastolic, as well as systolic blood pressure. Results of the study indicated that physiological measures such as stress resistance and stress recovery successfully predicted levels of resilience. Therefore, physiology could be used as a valid measure of resilience; however, these measures should be used in conjunction with other non-physiological measures until further research can validate physiological measures on their own.

Mechanism of Resilience

As mentioned, the Broaden and Build theory has been used as a framework to explain the mechanism of resilience. Tugade and Fredrickson (2007) explain that emotional regulation processes, regulation defined as "the occurrence of processes the function of which is to modify other processes – actions, experiences-elicited by the given stimuli" (Frija, 1986), include both automatic and controlled strategies. Automatic skill acquisition, in this case positive emotional regulation, is the result of frequent and consistent pairing of internal reactions to external stimuli (Bargh & Chartrand, 1999). The researchers argue that positive emotional regulation during stress requires less conscious effort for resilient individuals than for those with lower levels of resilience. Thus while resilient individuals may initially use controlled strategies to foster positive emotions when coping, their repeated use of such strategies is associated with the automaticity of the positive coping process. Essentially, using consistent and frequent positive

emotional regulation will eventually require less effort, therefore initiating an automatic activation.

Furthermore, research supports the notion that, in addition to experiencing less negative emotions (Ong, Bergeman, Bisconti, & Wallace, 2006), people who have higher levels of resilience tend to experience more positive emotions (Tugade, & Fredrickson, 2004) compared to those with lower levels of resilience. Biological evidence has found that brain regions such as the anterior insula (associated with processing affective stimuli and anticipatory anxiety) and the orbitofrontal cortex (associated with emotional regulation and producing expectancies) have been associated with resilience (Waugh, Wager, Fredrickson, Noll, & Taylor, 2008). Given that both the anterior insula and the orbitofrontal cortex are related to emotional stimuli and emotional regulation, the proposed theory explaining resilience using the Broaden and Build theory as a framework and neurological evidence suggests the mechanism of resilience may be associated with affective processing and regulation.

When integrating principles of the Broaden and Build theory to the mechanism of resilience, not only do resilient individuals have greater access to positive emotions, but the activation process appears more automatic. More precisely, resilient individuals have greater access to positive emotions, which allows for novel and creative problem solving approaches and cognitive strategies to be used during stressful situations. Additionally, the increased ease of automatic activation enables additional cognitive resources to be applied to challenging situations thus building resilience. For example a resilient individual faced with a stressful task will have access to a broader amount of cognitive strategies due to positive emotional regulation. Furthermore, because positive emotional regulation is more automatically activated for resilient

individuals, they will use less cognitive resources attempting to regulate their emotions, which can be used to deal with the demands of the stressful situation.

Resilience and Attentional Biases

Although the Broaden and Build model provides insight in explaining the mechanism of resilience, a specific topic that has not been systematically explored is the presence of attentional biases in resilient individuals. Differences could be expected in biases towards emotional stimuli given that resilient individuals experience greater levels of positive affect defined by greater happiness, interest and scores on a positive emotionality index (Tugade and Fredrickson, 2004). As an example, differences have been noted for constructs such as optimism (Isaacowitz, 2005), and anxiety (Mogg, Millar, & Bradley, 2000) in attentional biases towards emotional related stimuli. More specifically, previous research conducted in the area of optimism has found that differences between optimists and pessimists were evident in attentional biases towards negative emotional stimuli (Isaacowitz, 2005). In the study, optimists and pessimists were provided with three different types of stimulus; skin cancer images, schematic line drawings of the cancer images with the cancer removed and neutral faces. Eye tracking technology was used to record visual biases and found that optimists looked less at skin cancer images than did pessimists. Furthermore, research in the area of anxiety has noted that individuals with generalized anxiety disorder tended to demonstrate greater attentional biases towards threatening faces than neutral faces when compared to a control group (Mogg et al., 2000). To date limited research has been conducted that investigates whether resilience directly influences attentional biases towards emotional stimuli.

Although there is limited research exploring the direct relationship between resilience and attentional biases in emotional stimuli, there is a body of literature that supports the idea that

an indirect relationship is possible (Stein, Campbell-Sills, & Gelernter, 2009; Kwang, Wells, McGeary, Swann, & Beevers, 2010). Recent developments have determined a genetic basis for resilience (Stein et al, 2009). Although this type of research is still in its infancy, promising results have correlated self-reported resilience scores with genetic variations of the serotonin transporter gene, otherwise known as 5HTTLRP (Stein et al., 2009). Stein et al. (2009) found that allele variations, more specifically a homozygous long (ll) combination rather than a homozygous short (ss) combination or a heterozygous combination (ls/sl) in the 5HTTLRP gene, was associated with greater resilience. Additionally, research has been conducted that investigated differences in 5HTTLRP gene variations and attentional biases (Kwang et al., 2010). In the study, it was found that individuals with the homozygous long (ll) allele variation in the 5HTTLRP demonstrated attentional biases away from negative emotional stimuli as evidenced by a dot probe task. The genetic studies and the research that suggests that attentional biases have been found in other personality constructs as optimism and anxiety, indicate that a direct relationship may exists between resilience and attentional biases. Although the relationship between resilience and attentional biases has never been tested directly, there is indirect evidence suggesting that a relationship may exist.

Mood Induction

Given that the Broad and Build theory provides a framework to further understand emotion and affect, it is not surprising that research that has been conducted to test aspects of the model, have included a variety of mood induction techniques (Gasper & Clore, 2002; Isen et al.,1985). Gerrands-Hesse, Spies and Hesse (1994) identified four types of techniques used in research to induce mood: pre-experimental classification, comparing non-clinical subjects with clinical populations, utilizing naturally occurring emotions, and experimental mood induction.

The pre-experimental classification consists of assessing and using the participant's emotional state at the beginning of the study. Another procedure is to create a subject variable by selecting non-clinical subjects and comparing them with clinical populations such as depressed individuals. In these clinical populations, specific emotional states can be attributed to each group. Utilizing naturally occurring emotions involves assessing and using daily events as mood markers to infer mood such as performance on academic or vocational tasks or the nature of social interactions throughout the day. The final procedure is experimental mood induction, which involves using standardized techniques to manipulate specific mood states.

Mood induction procedures, such as experimental classification, comparing non-clinical subjects with clinical populations and naturally occurring emotions, have certain limitations that could compromise the validity of the research. Potential confounds due to quasi-experimental designs and difficulties arising from lack of ability in standardizing conditions could influence and bias study results. Benefits of experimental mood induction are that the study retains internal validity as a result of standardized procedures that ensure that all participants are receiving the same level of mood induction.

Westermann, Spies, Stahl, & Hesse, (1996) conducted a meta-analysis that identified several experimentally manipulated mood induction procedures (MIP) that have been cited in a variety of research contexts. Results of the meta-analysis found that film/story MIPs that included instruction for the participants to emotionally incorporate themselves into the scenario yielded the largest effect sizes for both positive (r=0.726) and negative (r=0.743) moods, suggesting that the film/story MIP is valid and effective in successful induction of mood states. There are many methods that can be used to induce mood; however through empirically

supported research it is now possible to tailor the best mood induction strategy to meet the specific goals, hypotheses and designs of each study.

When considering mood induction for experimental purposes it is important to consider what constructs can influence, inhibit or interact with mood manipulation. For example, certain individuals may be prone to experience elevated or decreased baseline levels of either positive or negative affect, which could impact the strength of mood induction at a subjective level. Diener and Seligman (2002) found that individuals who scored in the upper ten percent on happiness measures reported experiencing positive feelings most of the time and only occasional negative moods, which supports that idea that personality traits can influence baseline differences in affect. Furthermore, the researchers found that the happier group had higher scores on scales measuring extraversion, agreeableness and lower scores on neuroticism when compared to the less happy group. Research has been conducted that has investigated how personality factors can influence susceptibility to mood induction procedures. Findings indicated that extroverted individuals had higher reactivity to positive rather than negative mood induction procedures, whereas neurotic individuals had higher reactivity to negative rather than positive mood induction procedures (Larsen & Ketelaar, 1989). Given the impact of personality on affect baseline and reactivity to mood induction procedures, personality constructs should be carefully considered in order to reduce the potential for confounding results.

Another personality factor that may influence affective reactivity is affect intensity, defined as the emotional strength and variation individuals' experience. A person who has high levels of affect intensity would experience strong and variable emotions, whereas a person who has low ratings of affect intensity would experience less emotional variability and strength (Larsen & Buss, 2009). Given that affect intensity impacts the degree to which an individual can

experience an emotion, careful considerations should be made to control for the influence of affect intensity when experimentally attempting to induce emotions.

Hypotheses

The goal of the present study is to test the direct relationship between resilience and attentional biases with regards to emotional visual stimuli. As research indicates that resilient individuals experience greater positive emotions than individuals with lower levels of resilience (Tugade & Fredrickson, 2004), an attentional bias is suspected towards positive stimuli for resilient individuals. As such, the first hypothesis postulates that individuals with higher levels of resilience will demonstrate an attentional bias towards positive stimuli and away from negative stimuli when compared to individuals with lower levels of resilience at baseline.

The second hypothesis predicts affect induction will increase attentional biases towards mood congruent image types. Specifically, we predict negative mood induction will increase attentional biases towards negative stimuli and away from positive stimuli regardless of resilience levels. We further predict that positive mood induction will prime an attentional bias towards positive image types and away from negative image types. Mood induction is a controlled manipulation of affect. This hypothesis is based on the premise that affective states can influence attentional biases (Wadlinger & Isaacowitz, 2006).

The third hypothesis is that there will be an interaction between resilience and image type following the mood induction. We predict that attentional biases towards specific image types will persist despite the mood induction procedure. Individual demonstrating higher levels of resilience will continue to demonstrate attentional biases towards positive images and away from negative image regardless of their assigned mood induction condition. Conversely, individuals with lower levels of resilience will continue to demonstrate attentional biases towards negative

images and away from positive images following the mood induction. Research has indicated that indirect attentional biases have been found in resilient individuals (Kwang et al., 2010; Stein et al., 2009) and that affective states can influence attentional biases (Wadlinger & Isaacowitz, 2006).

Method

Participants

The participants in the study consisted of undergraduate and graduate students (N= 60) enrolled at Laurentian University. Participants were granted partial course credit for their participation, and were treated in accordance with the Laurentian University Research Ethics Board's Tri-Council Policy Statement guidelines (See appendix A for Ethics Certificate). A detailed breakdown of the demographic characteristics, by condition and for the overall sample, is presented in Table 1. No significant baseline differences ($p > .05$) were noted across mood induction conditions on any of the study's demographic variables.

Table 1

Demographic Characteristics

	Mood Condition			
Characteristic	Neutral *n*=20	Negative *n*=20	Positive *n*=20	Overall *N*=60
Gender				
Male	*n*=5 (25.0%)	*n*=2 (10.0%)	*n*=1 (5.0%)	*N*=8 (13.3%)
Female	*n*=15 (75.0%)	*n*=18 (90.0%)	*n*=19 (95.0%)	*N*=52 (86.7%)
Age	21.75 (3.0) range 19-30	21.90 (4.0) range 19-37	21.50 (4.7) range 18-40	21.72 (3.9) range 18-40
Ethnicity				
Caucasian	*n*=8 (90.0%)	*n*=18 (90.0%)	*n*=18 (90.0%)	*N*=54 (90.0%)
Other	*n*=2 (10.0%)	*n*=2 (10.0%)	*n*=2 (10.0%)	*N*=6 (10.0%)
Program of study				
SS - Psychology	*n*=14 (70.0%)	*n*=11 (55.0%)	*n*=14 (70.0%)	*N*=39 (65.0%)
SS – Other	*n*=2 (10.0%)	*n*=5 (25.0%)	*n*=0 (0%)	*N*=7 (11.7%)
Education	*n*=2 (10.0%)	*n*=0 (0%)	*n*=1 (5.0%)	*N*=3 (5.0%)

Science	*n*=2 (10.0%)	*n*=3 (15.0%)	*n*=2 (10.0%)	*N*=7 (11.7%)
Business	*n*=0 (0%)	*n*=1 (5.0%)	*n*=1 (5.0%)	*N*=2 (3.3%)
Other	*n*=0 (0%)	*n*=0 (0%)	*n*=2 (10.0%)	*N*=2 (3.3%)
Year of study	2.75 (.85)	2.95 (.76)	2.80 (.77)	2.83 (.79)
1st year	*n*=0 (0%)	*n*=1 (5.0%)	*n*=1 (5.0%)	*N*=2 (3.3%)
2nd year	*n*=10 (50.0%)	*n*=3 (15.0%)	*n*=5 (25.0%)	*N*=18 (30.0%)
3rd year	*n*=5 (25.0%)	*n*=12 (60.0%)	*n*=11 (55.0%)	*N*=28 (46.7%)
4th year	*n*=5 (25.0%)	*n*=4 (20.0%)	*n*=3 (15.0%)	*N*=12 (20.0%)
Status				
Full-time	*n*=19 (95.0%)	*n*=18 (90.0%)	*n*=19 (95.0%)	*N*=56 (93.3%)
Part-time	*n*=1 (5.0%)	*n*=2 (10.0%)	*n*=1 (5.0%)	*N*=4 (6.7%)

Note. n = number of participants included in the condition. *N* = total number of participants included in the study. % = the proportion of the listed characteristic for participants. Age and year of study values represent means and standard deviations. The range represents the lowest and highest reported age of participants. SS = social sciences. Status = student registration status.

Materials

Picture stimuli. Images were selected from the International Affective Picture System (IAPS) database (Lang, Bradley, & Cuthbert, 1999). IAPS images are standardized emotional stimuli designed for experimental purposes and have been used in studies that investigate emotion and attention. The images contained a wide range of semantic themes and are not limited to facial images. The images from the IAPS database are rated on three dimensions including pleasantness, arousal and dominance. Pleasantness for each image is rated on a 9 point likert scale, with 1 representing a low pleasantness rating and 9 representing a high pleasantness rating. Images rated from 1 to 4 were considered negative images, images rated from 4 to 6 were considered neutral images, and images rated from 6 to 9 were considered positive images. Consistent with past research (Charles, Mather, & Carstensen, 2003; Ersner-Hershfield, Carvel & Isaacowitz, 2009; Xing & Isaacowitz, 2006), image type was operationalized based on three types of visual stimuli; 1) images with high ratings (scores above 6) on the pleasantness scale, images with low ratings (scores below 4) on the pleasantness scale and 3) neutral images (ratings between 4 and 6) on the pleasantness scale. Consistent with other studies that have use IAPS

images (Ersner-Hershfield et al., 2009), the effect of image arousal was controlled by selecting images rated as neutral (scoring between 4 and 6) on the IAPS arousal dimension. See appendix B for a Sample Slide of Images.

Mood induction. Mood induction procedures consisted of three film clips accompanied by instructions. The instructions appeared on the computer screen prior to the commencement of the film clip and requested that the participant mentally incorporate themselves into the situations described and experienced by the characters in the film. The three film clips consisted of either a negative, positive and neutral theme.

Films clips were selected based on research conducted by Gross and Levenson (1993). The study's aim was to investigate a variety of film clips that could be used to induce a range of emotions for research purposes. A series of film clips were viewed by undergraduate students and rated for emotion elicitation on eight different themes (amusement, anger, contentment, disgust, fear, neutral, sadness and surprise). Gross and Levenson (1993) conducted an analysis that compiled mean rating for the target emotion and hit rate. The mean rating for the target emotion is based on a likert scale ranging from 0-8, with 0 representing no elicitation of the target emotion and 8 representing the most the target emotion has ever been experienced during one's lifetime. The hit rate is the percentage of participants that experienced the target emotion during the viewing of the film clip.

For the current study the positive film clip used to induce positive emotion is a clip from the film "When Harry Met Sally", and featured a discussion of an orgasm. The length of the clip was 2 minutes and 35 seconds, the hit rate for this clip was 93.1% and the mean rating for the target emotion was 5.54 (target emotion is amusement). The film clip used to induce negative emotion is a clip from the film "The Champ", where a boy cries when his father dies. The length

of the clip was 2 minutes and 51 seconds, the hit rate for this clip was 94.2% and the mean rating for the target emotion was 5.71 (target emotion is sadness). The film clip used to induce a neutral mood state is video lesson of a man installing a door with a length of 2 minutes and 52 seconds. The neutral clip consists of a man giving a step-by-step demonstration of how to install a door, which is narrated by a female voice. The positive, negative and neutral film clips were matched based on duration and content (exposure to people).

Apparatus for eye-movement monitoring. Stimuli were displayed on a 21-inch VIEW-Sonic CRT monitor. Eye movements were measured through infrared eye tracking using an SR Research Ltd. Eyelink II system (SR 520 lens, monocular). This Eyelink II system has a high accuracy (<0.5 degrees) and a high sampling rate (500 Hz). The eye tracker apparatus has two small cameras that are mounted onto a padded headband. The two cameras are located below the eyes of the participant and are used to measure the position of the eyes on the display screen in two ms intervals. For the present purposes, these cameras allowed the easy selection of the participant's dominant eye. Furthermore, an infrared sensor, which is located directly in the headband, tracks the participant's point of gaze by tracking precise head movements.

Measures

The Affect Intensity Measure (AIM). Affect intensity was measured with the AIM (Larsen, 1984). The scale consists of 40 items, and uses a 6-point scale (1-6) representing levels of personal agreement with each statement that varies from never to always. Items on the questionnaire included "I feel pretty bad when I tell a lie" and "When I'm happy, I feel as if I am bursting with joy". Questionnaire items included both positive and negative affect and items that require reversed scoring. Larsen (1984) investigated reliability by using an undergraduate student sample with three different lapses in time (one month, two months and three months) from first

test administration to the second test administration. There was acceptable test retest reliability of the AIM with a test retest coefficient of 0.80 after one month, 0.81 after two months and 0.81 after three months (Larsen, 1984). Correlations between the AIM and a daily measure of affect indicated that the AIM demonstrated acceptable (r = .52) convergent validity (Larsen, 1984). See appendix C for the Affect Intensity Measure.

International Personality Item Pool (IPIP). Personality factors were measured with the IPIP (Goldberg, 1999). The scale consisted of 50 items measuring five domains; extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience. The self-report measure used a 5-point scale ranging from very inaccurate to very accurate, with higher scores on the scales representing a greater endorsement of the respective trait. Alpha reliability coefficients demonstrated good reliability for the scales: neuroticism, .86; extraversion, .87; openness, .84; agreeableness, .82; and conscientiousness, .79. The scale demonstrated good discriminant validity and acceptable convergent validity with the NEO-Five Factor Inventory (Lim & Ployhart, 2006). Lim and Ployhart (2006) found that an American sample of university students had the following means and standard deviations respectively: neuroticism (M = 3.10, SD = *.69*), extraversion (M = 3.31, SD = *.77*), openness (M = 3.61, SD = *.57*), agreeableness (M = 3.94, SD = *.53*), and conscientiousness (M = 3.28, SD = *.52*). See appendix D for the International Personality Item Pool.

Connor-Davidson Resilience Scale (CD-RISC). Resilience was measured with the CD-RISC (Connor & Davidson, 2003). The scale consists of 25 items, and uses a 5-point scale (0-4), with higher scores representing higher levels of resilience. Scores on the CD-RISC range from 0-100, with a general population mean of 80.4 and a standard deviation of 12.8 (Connor & Davidson, 2003). Although there is limited research with regard to normative properties of the

CD-RISC in student samples across Canada and North America, there is research that has investigated the psychometric properties of the CD-RISC in student populations in Iran. Khoshouei (2009) found that Iranian undergraduate students scores (*M* = 68.3, *SD* = 17.5) on the CD-RISC differed from those collected with the general population in the United States. There was acceptable test retest reliability of the CD-RISC (time 1, *M* = 52.7, *SD* = 17.9, time 2, *M* = 52.8, *SD* = 19.9) and a test-retest coefficient of 0.87 three weeks following the initial administration of the test.

Research by Connor and Davidson (2003) noted that the scale correlated positively with other scales measuring similar constructs, such as the Kobasa Hardiness Measure and the Sheehan Social Support Scale, indicating convergent validity. Additionally, the CD-RISC correlated negatively with scales measuring conflicting constructs such as the Sheehan Stress Vulnerability Scale, the Perceived Stress Scale, and the Sheehan Disability Scale, indicating discriminant validity. Factor analytic work by these same authors has produced five factors of the CD-RISC; the notion of personal competence, high standards, and tenacity (factor 1); emotional and cognitive control under stress (factor 2); adaptability and ability to bounce back (factor 3); control and meaning (factor 4), and spiritual influences (factor 5). In the current study, level of resilience was determined by CD-RISC scores, with higher scores reflecting higher levels of resilience. See appendix E for the Connor-Davidson Resilience Scale.

The Ego Resiliency Scale (ER89). An additional measure of resilience used was the ER89 (Block & Kremen, 1996). The scale consists of 14 items, and uses a 4-point scale (1-4), with higher scores representing higher levels of resilience. Scores on the ER89 range from 14-56. Reliability for the measure was good with a coefficient of alpha reliability of 0.79 in a study of 18 and 23 year olds living in urban areas (Block & Kremen, 1996). A study using an

undergraduate student population reported participant ER89 scores ranging from 28 to 54, with a *M* = 42 and a *SD* = 6.41 (Tugade & Fredrickson, 2004). See appendix F for the Ego Resiliency Scale.

The Positive and Negative Affect Schedule (PANAS). The success of the mood manipulation was assessed using change scores from pre to post mood induction on the Positive and Negative Affect Schedule. The PANAS consists of 20 items, 10 items measuring positive affect and 10 items measuring negative affect (Watson, Clark, & Tellegen, 1988). The PANAS uses a 5-point scale (1-5), with higher scores reflecting a greater degree of experiencing of a target emotion at the present moment. Sample words to describe feelings or emotions are irritable, upset, strong, and proud. The scale has good internal reliability .89 for positive affect items and .85 for negative affect items. Momentary test-retest coefficients suggest acceptable sensitivity to momentary affect change as the reliability value does not exceed .54. See appendix G for the Positive and Negative Affect Schedule.

Procedure

Participants were recruited from undergraduate classrooms at Laurentian University to participate in a study investigating attentional responses to digitally presented images. Interested participants were asked to provide appropriate contact information via a sign-up sheet (See appendix H for the Recruitment Form). Participants were then contacted by the lab recruiter in order to schedule a testing time in the Cognitive Health Research Laboratory at Laurentian University. Upon arrival, participants were accompanied into a sound-proof booth where the testing took place. Participants signed a consent form (See appendix I for the Consent Form) and began the testing by completing the AIM, the IPIP, the CD-RISC, the PANAS and the ER89. The participants were then seated 60cm from the computer monitor (measured from the monitor to the edge of the table on which the monitor was located) to view the IAPS images. Prior to

viewing the images, the Eyelink device was placed on the participant's head and the researcher calibrated and validated the device. Participants were given the opportunity to ask any questions with respect to the study and the equipment used in the study.

Next, the experimenter explained to the participant that they would be required to look at each image presented on the computer screen. Three IAPS images were be presented side by side on the computer screen. Each set of IAPS images included a positive, negative and neutral image and the order in which the images were shown were counterbalanced throughout the series of presentations. The series of images remained on the computer screen for 8 seconds and were followed by a blank screen for a period lasting two seconds. Each participant was required to view a total of 36 slides. The initial viewing session was used to establish a baseline of attentional biases.

Participants were randomly assigned to one of three mood induction conditions; 20 participants were assigned to the neutral condition, 20 participants were assigned to the negative condition, and 20 participants were assigned to the positive condition. Before viewing the film, participants were asked to mentally incorporate themselves into the situations described and experienced by the characters in the film. At this point, participants began viewing the movie clip designed to induce an affective state. Following the movie clip, participants completed the PANAS. The researcher informed the participant that they would be viewing another series of images and would be required to view the images naturally as if they are watching television. The procedure for this viewing was the same as in the baseline, however a different series of 36 slides were presented to the participants.

Eye tracking interest zones were predetermined by the researcher in order to identify specific target emotions in the images and slides. Following the testing, participants were

debriefed on the purpose of the study (See appendix J for the Debriefing Form). All interested participants were given the opportunity to leave their email address if they wanted to receive a summary of the results of the study.

Results

Sample Characteristics

Means relative to established norms. As expected, CD-RISC means (see Table 2) indicated that, relative to existing norms, the participant scores in this sample were comparable to student norms available in published and unpublished literature. More specifically, mean scores on the CD-RISC in the current study were $M = 66.5$, $SD = 12{,}73$, whereas previous research using student demographics had a score of $M = 68.3$, $SD = 17.54$ (Khoshouei, 2009). It is important to note that the norms reported in the Khoshouei study used an Iranian student sample, which may result in inherent differences due to cultural factors. Although there are no published norms using a North American sample, an unpublished study using a similar demographic of students in a Northern Ontario University had a mean CD-RISC score of 70 (Valcheff & Searight, 2010).

Baseline differences across groups. A series of ANOVA's were conducted to determine if any of the mood induction groups (neutral, negative, positive) differed statistically on any of the measures of resilience (CD-RISC, ER89), affect intensity (AIM), and personality (IPIP) at baseline. Results indicated that resilience scores measured using the CD-RISC; $F(2, 57) = 1.136$, $p = .328$ and the ER89; $F(2, 57) = .400$, $p = .672$, were not significantly different across mood induction groups. Measures of global affect intensity, $F(2, 57) = 1.018$, $p = .368$; negative, $F(2, 57) = 2.288$, $p = .111$ and positive affect, $F(2, 57) = .708$, $p = .497$; and of the big five personality factors, that is extraversion, $F(2, 57) = .000$, $p = 1.00$; agreeableness, $F(2, 57) =$

2.120, p = .129; conscientiousness, $F(2, 57) = .363$, p = .697; emotional stability, $F(2, 57) = 1.992$, p = .146; and openness, $F(2, 57) = .863$, p = .427; also did not differ significantly across mood induction conditions. Table 2 includes a breakdown of scale means and standard deviations both by mood induction condition and for the sample as a whole.

Table 2

Means and Standard Deviations by Condition

	Mood Condition			
Characteristic	Neutral *n*=20	Negative *n*=20	Positive *n*=20	Overall *N*=60
Resilience				
CD-RISC	65.8 (10.96)	69.8 (12.63)	63.8 (14.31)	66.5 (12.73)
ER89	43.10 (4.66)	43.8 (5.46)	42.3 (5.75)	43.1 (5.26)
PANAS				
Negative	12.5 (2.14)	13.65 (4.42)	15.35 (5.46)	13.8 (4.33)
Positive	29.8 (7.97)	30.15 (6.1)	27.5 (8.65)	29.2 (7.61)
Affect Intensity				
Global	3.6 (.63)	3.8 (.39)	3.9 (.50)	3.8 (.52)
Negative Intensity	3.1 (1.04)	3.7 (.70)	3.8 (.93)	3.5 (.93)
Negative Reactivity	3.9 (.92)	4.4 (.63)	4.2 (.87)	4.2 (.83)
Positive Affect	3.8 (.68)	3.9 (.67)	3.9 (.74)	3.9 (.69)
Personality Inventory				
Extraversion	32.2 (8.56)	32.2 (7.82)	32.2 (7.51)	32.2 (7.84)
Agreeableness	36.5 (5.39)	39.5 (4.45)	38.9 (4.83)	38.3 (5.00)
Conscientiousness	36.7 (6.92)	37.8 (5.61)	36.2 (6.11)	36.9 (6.17)
Emotional Stability	30.6 (7.47)	29.8 (4.08)	27.0 (5.86)	29.1 (6.06)
Openness	34.6 (5.24)	36.8 (5.84)	36.3 (5.45)	35.9 (5.50)

Note. CD-RISC = Connors and Davidson Resilience Scale. ER89 = Ego Resiliency Scale. Affect Intensity = Affect Intensity Scale (AIM). Personality Inventory = International Personality Inventory Pool (IPIP). Mean values are provided with standard deviations in parentheses.

Scale Psychometrics for the Current Sample

A reliability analysis was conducted to assess the internal consistency of all relevant scales and subscales included in the study. All measures evidenced acceptable reliability, with alpha coefficients exceeding the recommended cut-off of .70 (Nunnally & Bernstein, 1994). The only

exception to this was for the negative reactivity scale of the AIM that had an alpha of .681. A summary of reliability analysis values is presented in Table 3.

Table 3

Reliability Analysis (at pretest) of All Scales and Subscales Used in the Study

Scales or subscales	Cronbach's Alpha	Number of Items
Resilience		
CD-RISC	.894	25
ER 89	.772	14
Affect Intensity		
Global Score	.891	40
Negative Intensity	.778	6
Negative Reactivity	.681	6
Positive Affectivity	.877	15
Personality Inventory		
Extraversion	.873	10
Agreeableness	.751	10
Conscientiousness	.813	10
Emotional	.870	10
Openness	.791	10
Measured Affect		
Positive Affect	.900	10
Negative Affect	.841	10

Note. CD-RISC = Connors and Davidson Resilience Scale. ER89 = Ego Resiliency Scale. Affect Intensity = Affect Intensity Scale (AIM). Personality Inventory = International Personality Inventory Pool (IPIP). Measured Affect = Positive and Negative Affect Schedule (PANAS).

Mood Induction Manipulation

The effectiveness of the mood induction manipulation (neutral, negative, positive) was examined using a change score (post-pre) derived from the positive and negative affect scores on the PANAS. Using a one way analysis of variance, a significant effect of mood induction condition on the negative affect PANAS scores, $F(2, 57) = 11.209$, $p < .001$, was noted. Follow-up analyses indicated that the negative mood induction condition experienced a significant increase in negative affect (3.5 point increase on the negative affect PANAS scale), when

compared to the neutral (-.40 decrease on the negative affect PANAS scale) and positive (-2.6 decrease on the negative affect PANAS scale) mood induction conditions (see Figure 1). Differences between the neutral and positive mood induction conditions were not statistically significant on the negative affect measure.

Positive affect change scores on the PANAS were statistically different across all mood induction conditions $F(2, 57) = 23.725$, $p < .001$ (see Figure 2). The neutral group experienced the greatest decrease in positive emotions following the mood induction procedure (-12.15 decrease on the positive PANAS affect scale), followed by the negative group (-6.25 decrease on the positive PANAS affect scale), whereas the positive group (-.20 decrease on the positive affect PANAS scale) experienced minimal change in positive affect scores.

Figure 1

Impact of Mood Induction on Negative Affect Change

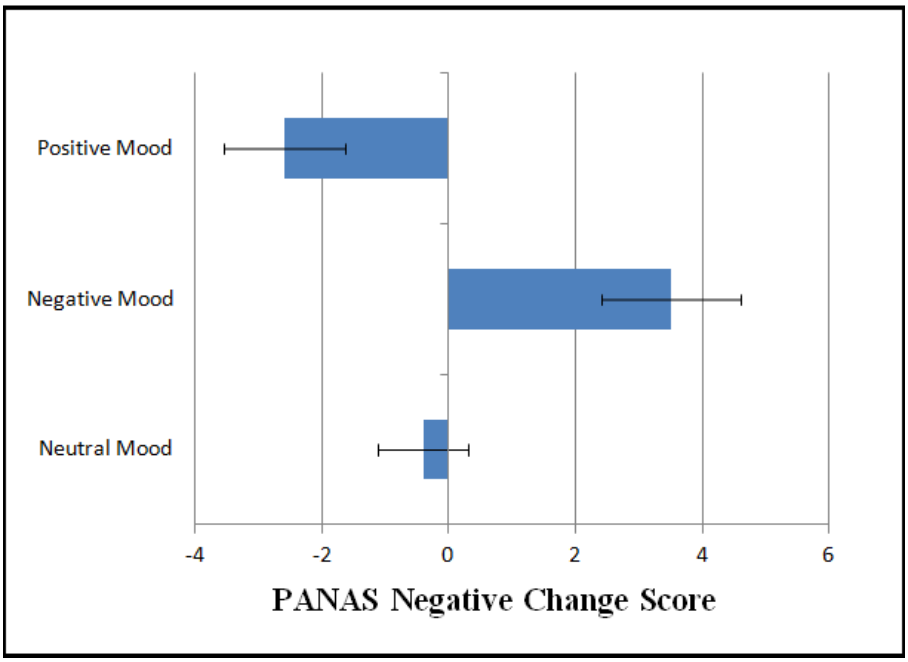

Figure 1. Results from the mood induction manipulation check. Change scores were calculated by subtracting pre scores from post scores on the negative affect subscale of the PANAS. Error bars included in the figure represent standard error values.

Figure 2

Impact of Mood Induction on Positive Affect Change

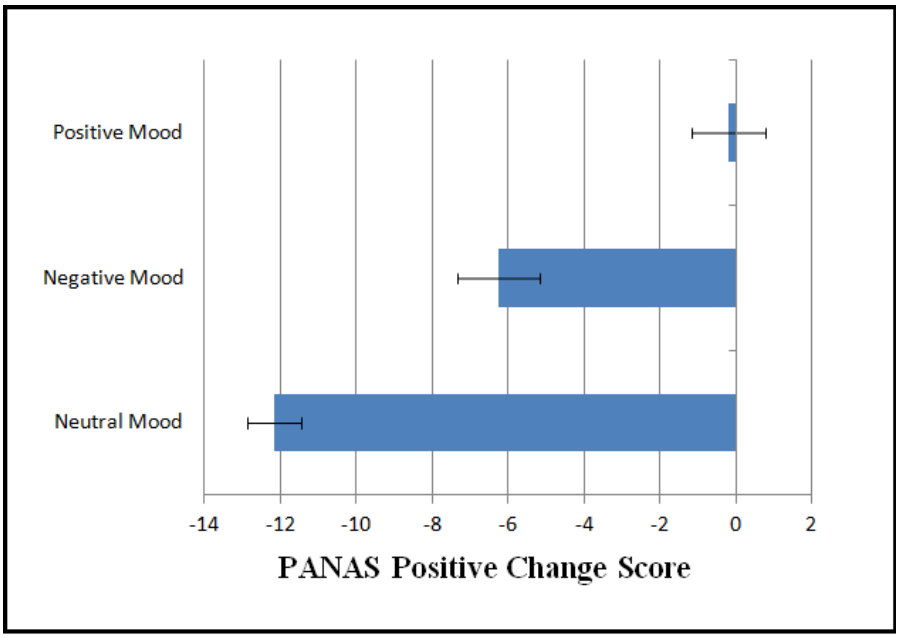

Figure 2. Results from the mood induction manipulation check. Change scores were calculated by subtracting pre scores from post scores on the positive affect subscale of the PANAS. Error bars included in the figure represent standard error values.

Eye Tracking Descriptives for the Current Sample

Attentional biases were measured using data collected and coded from the eye tracker. Data files were automatically generated using SR Research Eyelink Data Viewer version 1.11.1 software. In order to capture eye movements for specific image zones, standardized zone templates were imported for each trial. Upon initial visual inspection, many eye movements were marginally located outside the borders of image zones. Eye movements recorded outside the image zones were not single data points but rather clusters of eye movements that overflowed from outside the zone borders. Given the frequency and clustering pattern of eye movements located within close proximity to the zone parameters, this was determined to be eye tracker calibration error. Zone templates were modified in order to capture the eye movements that were marginally located outside the image zones by increasing the top and bottom borders of each

zone for all trials. Given that modifications were made to all of the zones used in the study, all image types (neutral, negative, positive) would have similar advantages and disadvantages resulting from the modification procedure. See Figure 3 to view sample eye tracker data output, original image zones, and modified image zones.

Figure 3

Eye Movements and Zone Templates

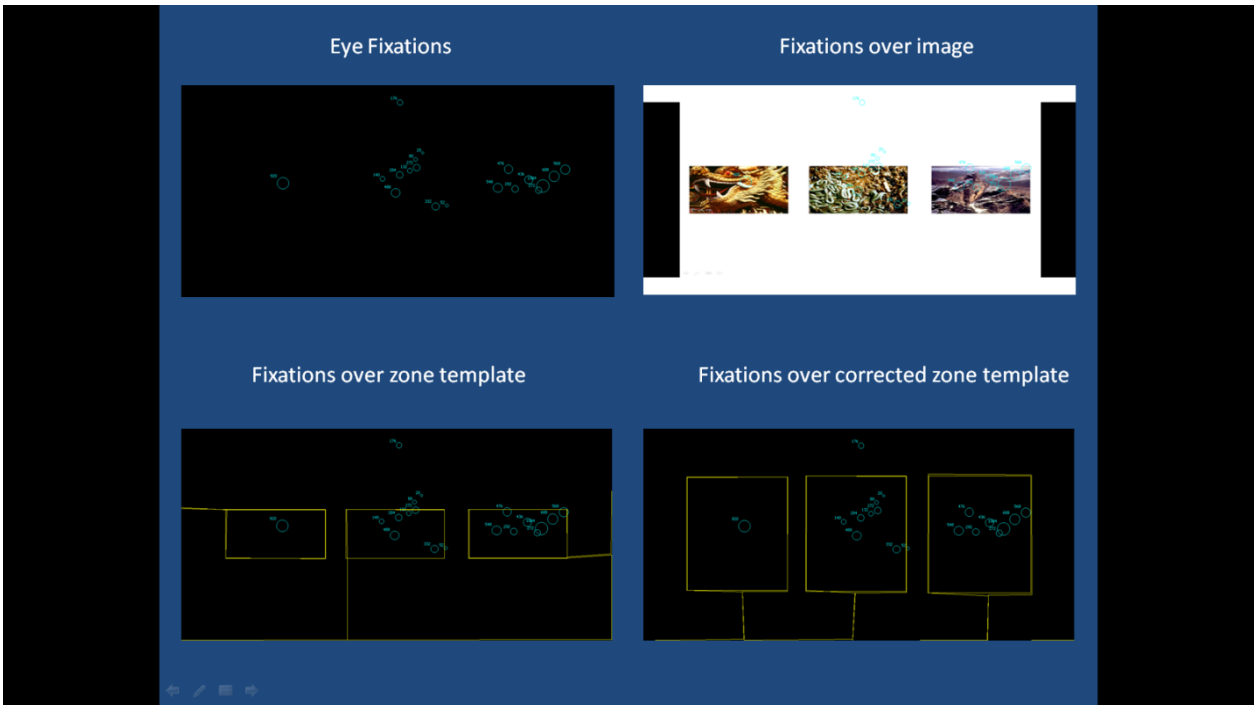

Figure 3. The image on the top left represents raw eye tracking data. The image on the top right represents trial images viewed by participants. The image on the bottom left represents unadjusted zone templates. The image on the bottom right represents adjusted zone templates.

Variables were computed for neutral, negative and positive images on four outcome variables: initial fixation percentage, initial fixation time, total number of fixations, and total fixation time. *Initial fixation percentage* represents the proportion of times each image type (neutral, negative, and positive) was the first fixation of each trial. In order to measure initial fixation percentage (based on image type), an average was calculated using the number of occasions an image type was the first fixation on an individual trial divided by the total number

of trials. Thus, the greater the value of the initial fixation percentage, then the stronger the attentional bias towards the respective image type. *Initial fixation time* was measured using the number of milliseconds that lapsed before the participant fixated on each image type in every given trial. Average participant initial orientation times were computed by calculating an average based on all trials by image type. *Total number of fixations* was calculated by summing each instance a participant fixated on a specific image type during individual trials and participant means were then calculated based on the total number of trials. *Total fixation time* was the number of milliseconds a participant spent looking at an image type during each trial and participant means were calculated in order to create an average across the total number of trials. See Table 3 for eye tracking means, with standard errors, for baseline measures prior to mood induction.

It is important to note that although eye movements were used to determine the presence of attentional biases, different eye tracking measures, such as those selected for the current study, can be used to infer either an automatic or controlled processing of stimuli. Specifically, initial fixation analyses have been proposed to reflect the initial salience of the presented stimuli, thus are considered measures of "automatic" processing (Ceballos, Komogortsev, & Turner, 2009). Alternatively, dwell time measures, such as total fixation time, represent "controlled" processing of stimuli associated with the cognitive load experienced while viewing specific stimuli (Ceballos, Komogortsev, & Turner, 2009). For the purpose of the current study, measures of "automatic" processing include the initial fixation percentage and initial fixation time variables and measures of "controlled" processing include total number of fixations, and total fixation time variables.

An ANOVA was conducted to test for differences between mood induction conditions, at baseline, on the eye tracker outcome variables. No differences were found for *initial fixation percentage*, *initial fixation time*, *total number of fixations*, and *total fixation time* before the mood induction procedure was administered (see table 4 for ANOVA test statistics, by mood condition, for baseline eye tracking measures).

Table 4

Eye Tracking Means (Standard Error) at Baseline

			Mood Group		
Image Type		Test Statistics	Neutral	Negative	Positive
Initial fixation %	Neutral	$F(2, 57)=.535$, $p=.588$	35.28 (1.11)	34.59 (.98)	33.75 (1.05)
	Negative	$F(2, 57)=2.627$, $p=.081$	30.42 (1.38)	31.68 (1.02)	34.45 (1.39)
	Positive	$F(2, 57)=1.147$, $p=.325$	33.20 (1.32)	33.2 (1.40)	30.84 (1.08)
Initial fixation time	Neutral	$F(2, 57)=.231$, $p=.794$	1430.20 (82.26)	1508.38 (97.80)	1434.97 (92.63)
	Negative	$F(2, 57)=.196$, $p=.823$	1500.70 (88.36)	1546.14 (97.46)	1465.38 (88.41)
	Positive	$F(2, 57)=.155$, $p=.857$	1474.62 (95.78)	1537.37 (96.93)	1538.61 (85.91)
Total number of fixations	Neutral	$F(2, 57)=.265$, $p=.768$	6.79 (.21)	6.69 (.21)	6.9 (.19)
	Negative	$F(2, 57)=.102$, $p=.903$	6.89 (.27)	7.03 (.33)	6.86 (.26)
	Positive	$F(2, 57)=.757$, $p=.474$	6.52 (.19)	6.94 (.28)	6.85 (.29)
Total fixation time	Neutral	$F(2, 57)=.581$, $p=.563$	2296.74 (52.49)	2216.11 (56.80)	2260.02 (49.36)
	Negative	$F(2, 57)=.223$, $p=.801$	2351.29 (61.57)	2388.57 (102.58)	2309.46 (82.22)
	Positive	$F(2, 57)=.337$, $p=.715$	2276.49 (47.49)	2356.73 (86.27)	2344.93 (83.6)

Note. Initial fixation percentage values were calculated for each image from the trial totals of all images. Values for initial fixation time and total fixation time represent trial mean in milliseconds, with standard error included in parenthesis, by image type. Total number of fixations represents the total number of fixations for each respective image.

Resilience and Attentional Biases Prior to Mood Induction

A linear mixed model was used to test for main effects of image type (categorical repeated measures variables with levels neutral, negative, and positive) and resilience (continuous), and the interaction between image type and resilience on baseline viewing

tendencies (first fixation percentage, initial fixation time, total number of fixations, and total fixation time), prior to the mood induction procedure. In order to address any issue with multicollinearity among resilience measures ($r = .682$, $p < .001$), and to allow for a more parsimonious discussion of the results, the CD-RISC was selected as the primary resilience indicator in the study. It is relevant to note however that a preliminary exploratory analysis indicated that both the CD-RISC and the ER89 shared overall statistical similarities in trends, effects, as well as in the directions of findings.

First fixation percentage prior to mood induction. The interaction between resilience and image type was not significant, $F(2, 115) = 1.290$, $p = .279$, and there was no significant effect of either image type, $F(2, 115) = .576$, $p = .564$, or resilience, $F(1, 167) = .001$, $p = .980$. $b = -0.45$ on first fixation percentage. Therefore, all participants viewed the different image types comparatively and varying levels of resilience did not appear to influence the proportion of initial orientations towards neutral, negative, or positive images prior to the mood induction procedure.

Initial fixation time prior to mood induction. There was no significant interaction between resilience and image type, $F(2, 116) = .081$, $p = .922$, and the effect of image type, $F(2, 116) = .151$, $p = .860$, was also not significant. The speed of the initial orientation towards specific image types did not vary contingent upon an individual's level of resilience and participants viewed neutral, negative and positive images comparatively. There was a significant effect of resilience, $F(1, 174) = 6.701$, $p = .010$, $b = -7.28$. It is important to note that lower values for initial orientation time indicate that less time was required to view the image, and this effect was observed regardless of image type. The negative relationship between resilience and

initial orientation time indicates that as resilience scores increase, shorter response latencies were observed for all images.

Number of fixations prior to mood induction. The interaction between image type and resilience was not significant, $F(2, 122) = 1.676$, $p = .191$, indicating that resilience did not significantly predict attentional biases, as measured by number of fixations, on neutral, negative, or positive image types. There was also no significant effect of image type, $F(2, 122) = 1.635$, $p = .199$, or resilience, $F(1, 161) = .022$, $p = .882$, $b = 0.01$ on total number of fixations. This suggests that participants viewed all image types in a similar manner regardless of image valence, and varying levels of resilience demonstrated a comparable number of total fixations once all images were collapsed.

Total fixation time prior to mood induction. The interaction between image type and resilience was significant, $F(2, 124) = 3.223$, $p = .043$, $b = 6.28$. In order to follow-up on the significant interaction, an interaction contrasts analysis by image type was conducted. Specifically, we explored the resilience by image type interaction separately for positive and negative images, positive and neutral images, and negative and neutral images. The effect of resilience differed for positive and neutral images $t(105) = -2.515$, $p = .013$, with total viewing time increasing with resilience for positive images and decreasing with resilience for neutral images. The effect of resilience did not differ for positive and negative, $t(114) = -1.040$, $p = .301$, or negative and neutral images, $t(97) = -1.108$, $p = .271$. See Figure 4 for a graph of the interaction of image type by resilience on total viewing time.

Figure 4

Total Fixation Time for Image Type and Resilience

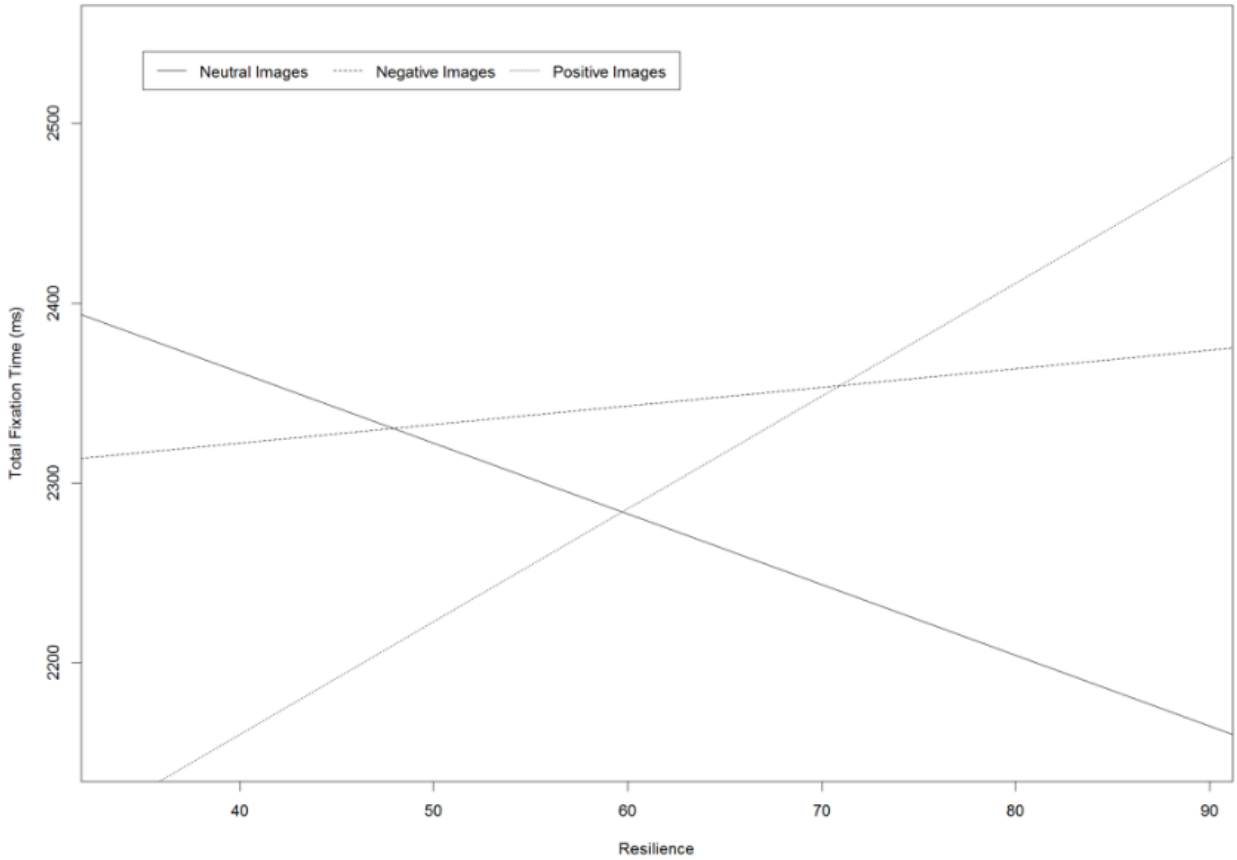

Figure 4. The y axis represents total fixation time in milliseconds. The x axis represents resilience as a continuous variable with lower scores beginning on the left increasing in value towards the right of x axis.

Resilience and Attentional Biases Following the Mood Induction

The second hypothesis predicted that the mood induction condition (neutral, negative, positive) would influence attentional biases for specific image types. Mood group was expected to increase attentional preferences towards congruent image types (e.g., positive mood and positive image; negative mood and negative image), whereas, decreased attentional preferences were expected for incongruent mood groups and image types (e.g., positive mood and negative image; negative mood and positive image). More specifically, negative mood induction was predicted to prime attentional biases towards negative images and away from positive images,

when compared to baseline measures of attention prior to the mood induction procedure. The positive mood group was expected to prime attentional biases towards positive images and away from negative images when compared to baseline measures of attention.

The third hypothesis predicted that there would be an interaction between resilience and image type following the mood induction procedure. Resilience was expected to predict attentional biases for specific image types, following the mood manipulation, regardless of the overall priming effect of mood. Therefore higher levels of resilience would continue to demonstrate an attentional preference for positive images and a reduced preference for negative images, despite the mood induction. In order to investigate different attentional patterns resulting from mood, attentional differences between pre-mood induction and post mood induction were calculated for all four dependent variables. Change scores were created for each participant by subtracting pre mood induction eye tracking means from post mood induction means on the percent of change, initial fixation time, total number of fixations, and total fixation time variables.

A linear mixed model was used to test for main effects of image type, mood induction condition (categorical repeated measures variables with levels neutral, negative, and positive), resilience (continuous), and the interaction between image type and resilience on post viewing tendencies (first fixation percentage, initial fixation time, total number of fixations, and total fixation time), following the mood induction procedure. See Table 5 for eye tracking change scores mean and standard errors.

Table 5

Eye Tracking Change Scores Following Mood Induction

Image Type		Mood Group		
		Neutral	Negative	Positive
Initial fixation percentage	Neutral	-2.18(1.56)	2.23(1.54)	.09(1.11)
	Negative	2.14(1.80)	1.86(2.04)	-3.28(1.89)
	Positive	.30(1.83)	-4.03(1.88)	3.23(1.5)
Initial fixation time	Neutral	109.14(61.57)	94.09(55.66)	-1.51(43.20)
	Negative	48.87(79.61)	-49.43(61.43)	-82.23(75.99)
	Positive	134.08(60.34)	103.23(68.88)	-42.25(43.07)
Total number of fixations	Neutral	-.15(.16)	-.20(.25)	-.33(.17)
	Negative	-.23(.18)	.01(.16)	.019(.21)
	Positive	.40(.16)	.08(.20)	.17(.17)
Total fixation time	Neutral	-24.75(62.74)	-101.50(75.14)	-141.66(61.05)
	Negative	-69.29(73.09)	16.73(75.15)	-5.44(57.63)
	Positive	173.13(51.79)	14.18(73.38)	97.37(76.55)

Note. Initial fixation percentage values were calculated for each image from the trial totals of all images. Values for *initial fixated time* and *total fixation time* represent trial mean in milliseconds, with standard error included in parenthesis, by image type. *Total number of fixations* represents the total number of fixations for each respective image.

First fixation percentage following mood induction. There was a significant interaction between image type and mood group, $F(4, 115) = 5.379$, $p = .001$, see Figure 5 for a visual representation displaying the mood condition by image type change scores for first fixation percentage. Pairwise comparisons indicated that there was a significant change in the proportion of initial orientations towards neutral images between the neutral ($M = -2.273\%$) and negative ($M = 2.432\%$) mood induction conditions, $p = .027$. Following the mood induction, the participants in the neutral mood induction condition oriented less towards neutral images when compared to participants in the negative group. Pairwise comparison indicated that there was not a significant change in proportion of initial orientations towards neutral images between the positive ($M =$

.160%) and neutral (*M* = -2.273%) mood conditions, *p* = .241 or the positive (*M* = .160%) and negative (*M* = 2.432%), mood conditions, *p* = .281.

Post mood induction changes were observed between several of the mood induction conditions for the negative images on the proportion of initial orientations measure. There was a significant change in proportion of initial orientations towards negative images between the neutral (*M* = 2.139%) and positive (*M* = -3.600%) mood induction conditions, *p* = .043. The proportion of change of initial orientations towards negative images between the negative (*M* = 2.328) and positive mood conditions (*M* = -3.600%) was also significant, *p* = .040. There was no significant difference between change of initial orientations towards negative images between the neutral (*M* -2.139%) and negative (*M* = 2.328) mood conditions, *p* = .946.

With respect to changes observed towards positive images following the mood induction procedure, the pairwise comparison on proportion of change in initial orientations between the positive (*M* = 3.663%) and negative (*M* = -4.640%) mood induction condition was significant, *p* = .002. Individuals in the positive mood induction condition initially oriented towards positive images more frequently following the mood induction, whereas individuals in the negative group had fewer initial orientations towards positive images following the mood induction. Although the pairwise comparison on proportion of change in initial orientations between negative (*M* = -4.640%) and neutral (*M* = .348%) mood conditions was trending towards significance, the contrast did not meet the threshold for statistical significance, *p* = .051. The pairwise comparison on proportion of change in initial orientations between neutral (*M* = .348%) and positive (*M* = 3.663%) mood conditions was not significant, *p* = .186.

Figure 5

Mood Condition by Image Type Change Scores for First Fixation Percentage

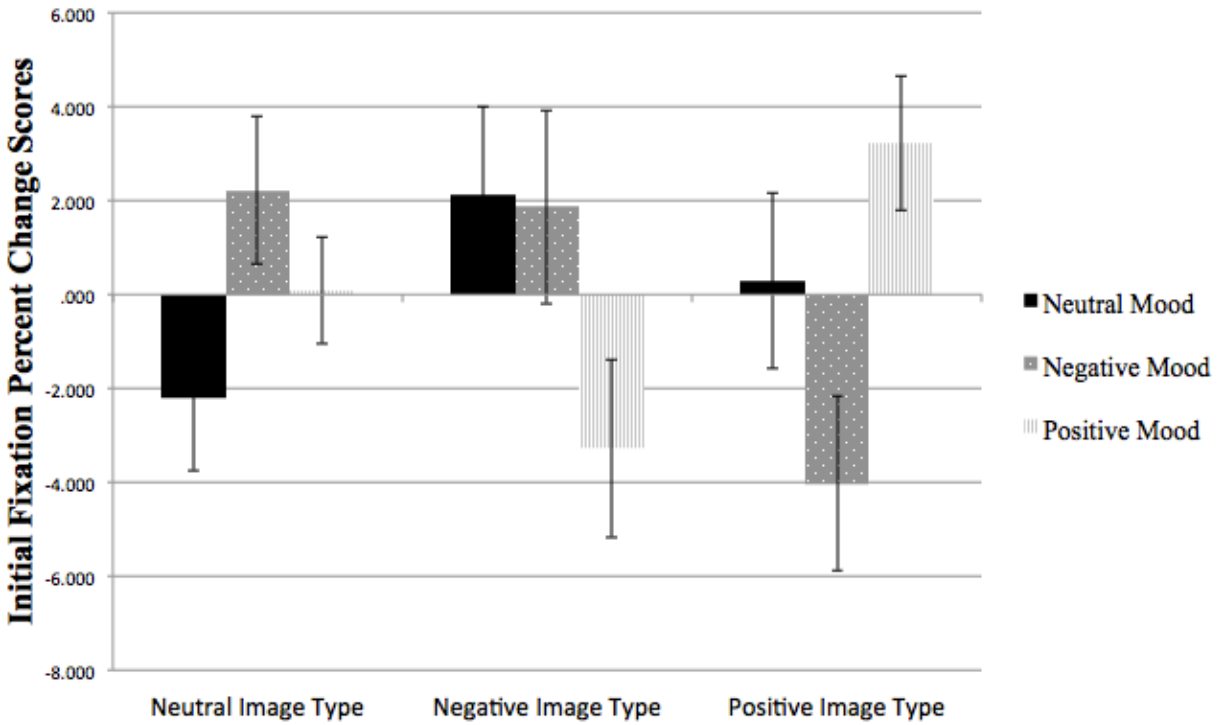

Figure 5. The y axis represents change scores on the initial fixation percentage outcome variable. Error bars included in the figure represent standard error values.

The hypothesized interactions between resilience and image type, $F(2,115) = 2.582$, $p = .080$, and between mood group and resilience, $F(2,156) = .189$, $p = .828$, were not significant on change scores for first fixation percentage. Contrary to what was hypothesized, resilience did not successfully predict change from baseline scores of initial orientation patterns (measured by percent change) towards neutral, negative or positive mood groups or images types. There was no significant effect of resilience following the mood induction, $F(1, 159) = .004$, $p=.947$, $b = 0.18$, indicating that varying levels of resilience did not influence mood induced changes of proportional (%) patterns of orientation.

Initial fixation time following mood induction. The image type by mood group $F(4, 119) =.348$, $p=.845$, image type by resilience $F(2, 119) =1.035$, $p=.358$, and mood group by

resilience interactions $F(2, 159) = 1.530$, $p = .220$, were not significant. No differences were observed in initial fixation time, following the mood induction, towards specific images (neutral, negative or positive) as a function of mood induction condition or varying levels of resilience. Furthermore, individuals demonstrated similar initial fixation times for all images regardless of the priming effect of mood on varying levels of resilience.

There was no significant effect of image type, $F(2, 119) = 1.525$, $p = .222$, indicating that without considering the effect of the other variables in the model, participant's fixation latencies towards image types did not change following the mood induction. Similarly, participants in all three mood groups, $F(1, 160) = 1.323$, $p = .269$, did not have significantly different initial orientation time change scores following mood induction. There was a significant main effect of resilience, $F(1, 159) = 5.873$, $p < .017$, $b = 1.38$, on initial orientation speed for all images following the mood induction procedure. Following the mood induction procedure, individuals with greater levels of resilience experience slower initial orientation when compared to individuals who are less resilient.

Number of fixations following mood induction. Interactions between image type and mood group, $F(4, 115) = .954$, $p = .435$, and image type and resilience, $F(2, 115) = 2.785$, $p = .066$ were not significant. Mood induction did not successfully prime attentional biases towards specific image types following the mood induction procedure. Also, varying levels of resilience had a comparable number of fixations towards neutral, negative and positive images following the mood induction. The interaction between mood group and resilience, $F(2, 165) = .339$, $p = .713$, was not significant indicating that individuals with varying levels of resilience had a comparable number of fixations across all three mood induction conditions.

Furthermore, there were no significant differences observed based on image type, $F(2, 115) = 2.409$, $p = .094$, mood group, $F(2, 165) = .330$, $p = .719$, or resilience, $F(1, 165) = .052$, $p = .821$, $b = 0.01$, in predicting change in number of fixations following the mood manipulations. Thus no differences were observed towards different image types across different mood induction conditions or on varying levels of resilience following the mood induction procedure.

Total fixation time following mood induction. There was a significant interaction between image type and resilience, $F(2,109) = 4.533$, $p=.013$, indicating that there were significant differences in time spent viewing specific image types as a function of resilience (see Figure 6 for graphed interaction). Secondary analysis found individuals with higher levels of resilience experienced a greater proportion of change away from negative images following the mood induction relative to the change observed in total viewing time of positive, $F(1,110) = 7.571$, $p = .007$, and neutral, $F(1,110) = 5.768$, $p = .018$, images. Individuals with higher resilience experienced an attentional bias away from negative stimuli when compared to positive and neutral images. There were no significant differences in total viewing time change scores as a function of resilience between positive and neutral images, $F(1,110) = .136$, $p = .713$, following the mood induction procedure.

Figure 6

Resilience by Image Type Interaction on Total Fixation Change Score

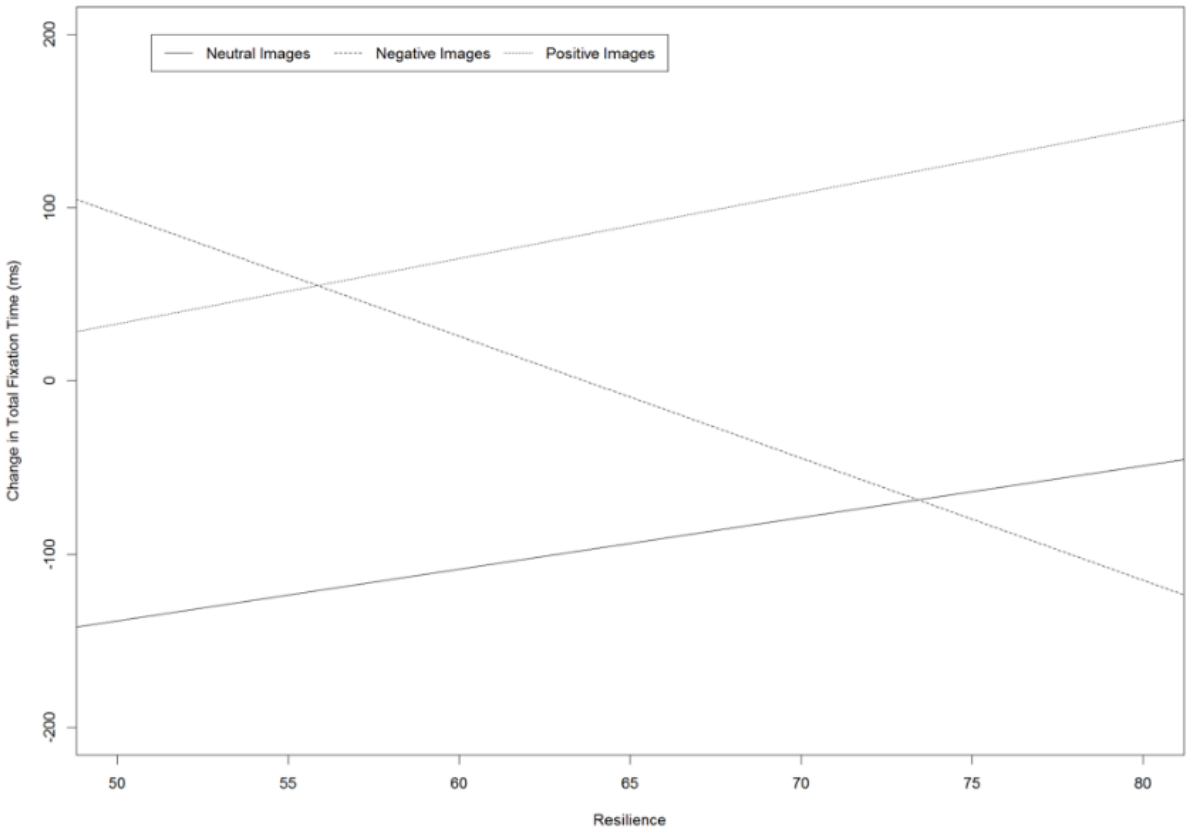

Figure 6. The y axis represents total fixation time in milliseconds. The x axis represents resilience as a continuous variable with lower scores beginning on the left and increasing in value towards the right of x axis.

The interaction between image type and mood group, $F(4, 109) = 1.386$, $p = .243$, was not significant. Individuals in different mood induction conditions viewed all images types similarly following the mood induction. The interaction between mood group and resilience, $F(2, 166) = .111$, $p = .895$, was also not significant, suggesting that changes in total fixation times from baseline were not different between specific mood induction condition and resilience. The main effect of mood condition, $F(2, 166) = .196$, $p = .822$ on total fixation time was not

significant, indicating that neutral, negative, positive mood conditions demonstrated comparable change scores for total fixation time.

Discussion

The purpose of the current was study was to investigate the effect of resilience on attentional biases, as well as to determine if these attentional biases persist despite the induction of different mood states. In order to address the research hypotheses, we measured eye movements for neutral, negative, and positive images before and after mood induction, and examined differences in attentional patterns as a function of an individual's level of resilience.

Based on the Broaden and Build model, which has been used to explain the positive emotional regulation style of resilient individuals (Tugade & Fredrickson, 2007, 2004), positive emotions are proposed to broaden an individual's attentional scope and cognitive resources (Fredrickson, 1998; Fredrickson & Branigan, 2005). Furthermore, the model postulates that positive emotions undo the effects of negative emotions over and above what would be expected from a simple emotion substitution process (Fredrickson, Mancuso, Branigan & Tugade, 2000). The results from the current study lend support to the idea that individuals who are more resilient demonstrate differences in attentional processes for neutral, negative, and positive material, whereby two distinct patterns emerged. More resilient individuals demonstrated a tendency to engage their attention towards positive content, as well as to disengage from negative content, as a function of mood induction. More specifically, an attentional bias towards positive images and away from neutral images was observed prior to the mood induction and an attentional bias was observed away from negative images following the mood induction as resilience scores increased. Additionally, mood also predicted attentional patterns to emotionally congruent material following the mood induction. The current findings suggest that mood congruent trait

(resilience) and state (mood) factors influence attentional biases towards and away from emotionally valenced images.

The current study provided support for the first hypothesis, which proposed that resilient individuals would demonstrate baseline differences in attention for specific image types. When comparing viewing tendencies between positive and neutral images, less resilient individuals were more inclined to view neutral images, whereas individuals who were more resilient spent more time viewing positive images. The interaction between resilience and image type prior to mood induction supports that resilient individuals have an attentional bias towards positive images and away from neutral images, which was inversely true for less resilient individual.

In the current study, more resilient individuals spent more time viewing positive images prior to mood induction procedure and less time viewing negative images following the mood induction procedure regardless of the effect of the mood induction condition. Although attentional preferences were found, theses differences were not consistently present across all image types and eye tracking measures. Specifically, attentional biases were noted on three of the four eye tracking variables measured, including initial fixation time, total fixation time and first fixation percentage, but attentional biases were not observed on the total number of fixations eye tracking measure.

As previously noted, measures such as proportions of initial orientations, and speed of initial orientations measure “automatic” processing, whereas total number of fixations and total fixation time measure “controlled” processing (Ceballos, Komogortsev, & Turner, 2009). In addition to being a measure of “controlled” processing, the total fixation time variable captures an individual’s engagement or disengagement towards specific image types. Gotlib and Joormann (2010) conducted a review suggesting attentional biases in depression do not appear to

be due to an automatic orientation bias, characterized by more frequent and faster orientations towards the negative stimuli. Moreover, the researcher proposed that depressed individuals demonstrate attentional difficulties disengaging from negative stimuli once it has captured their attention. Given that attentional biases in depression have been linked to difficulties disengaging from negative content, perhaps an engagement/disengagement paradigm may help explain the findings of the current study. The finding that attentional biases were only observed on the total fixation time measure prior to mood induction may suggest the process of developing resilience is better explained by being able to disengage ones attention away from neutral stimuli and engage ones attention on positive stimuli.

Although this study is the first to demonstrate that individuals higher in resilience have attentional biases towards positive stimuli, these preferences may be partial explained within the Broaden and Build model. Other studies have shown that individual with higher levels of resilience report more frequent positive affect than less resilient individuals (Tugade & Fredrickson, 2004; Tugade, Fredrickson, & Barrett, 2004). Thus, having chronic access to positive affect has been proposed as a characteristic that is inherent to trait resilience. Resilience scores of the participants in the current study were positively correlated with self-reported scores of positive affect during the initial phase of the study. That is, more resilient individuals experienced higher levels of positive affect prior to the administration of any experimental procedure or manipulation. Given the findings from the current study, and previous research indicating that resilient individuals experience more positive affect than individuals with lower levels of resilience, attentional preferences of resilient individuals may have resulted from mood congruent affective states. These findings provide preliminary support that resilient individuals may maintain and regulate their emotions by engaging their attention on material congruent with

a positive mood state. Research in the field of emotion regulation has found that individuals use strategies, including attentional deployment and appraisal, to achieve and maintain desired mood states (Gross, 1998). Thus, resilient individuals may be more adept in deploying their attention toward material they appraise as pleasant in an effort to achieve or maintain positive mood states.

The second hypothesis, which predicted mood congruent attentional preferences following a mood induction procedure, was supported. Changes in overall patterns of initial orientation were found between several mood groups for multiple image types. Our findings indicate that, following the mood induction procedure, the positive mood condition oriented less towards negative images whereas participants in both the control group and the negative mood induction group demonstrated a higher proportion of initial orientations towards negative images. The pattern of results suggests that when in a happy mood state, negative stimuli are less likely to attract our attention, whereas if one is in a negative or neutral mood state, negative stimuli are more likely to attract our attention. These findings are consistent with previous research that has suggested that mood states can produce mood congruent attentional biases towards emotion content (Becker & Leinenger, 2011; Tamir & Robinson, 2007). Additionally, the state induced attentional biases were observed on a measure of "automatic" processing, suggesting that the bias was employed effortlessly and unintentionally by participants. Given that these differences only emerged following the mood induction procedure, a case could be made that attentional deployment strategies used to regulate emotions could be trained through manipulations of situational affect.

Contrary to what was expected, attentional preferences were also observed for neutral stimuli relative to mood states. The neutral mood group demonstrated attentional biases away from neutral stimuli, whereas the individuals in negative mood states demonstrated attentional

biases towards neutral stimuli following the mood induction procedure. Unlike individuals induced into positive mood states, who demonstrated minimal differences in their tendency to orient on neutral stimuli following mood induction, neutral stimuli appeared to be more captivating for participants induced into a negative mood and less captivating individuals induced into the neutral mood condition, relative to viewing tendencies prior to the mood manipulation. Although this finding was not expected, it is not entirely surprising when speculating on emotional regulatory goals of individuals assigned to the negative and neutral mood induction conditions. As such, individuals induced in the negative mood condition may attend to neutral information as a strategy to down regulate negative affect by attending to emotion neutral content. Whereas, individuals induced into a neutral mood group, may be attempting to deploy their attention towards material that can be appraised as emotionally meaningful.

Attentional biases towards positive images were only found to be significant between the positive and negative mood groups. Individuals who received the positive mood induction experienced more changes from their baseline scores for initial orientation towards positive images, when compared to individuals in the negative mood group, who experienced a reduction in proportions of initial orientations towards positive images relative to baseline scores. This suggests that when experiencing a positive mood, positive stimuli are more likely to catch our attention, whereas when we are in a negative mood, positive stimuli are in fact less likely to capture our attention when compared to baseline attentional tendencies. Extant research has found that a temporary induction into a positive mood state (Tamir & Robinson, 2007) can produced mood congruent attentional biases towards positive material. The control group

(neutral mood induction) demonstrated nearly identical tendencies to orient towards positive images when compared to pre-mood induction attentional patterns.

While there were several differences in experimental design, the findings from the current study are consistent with research that found mood congruent attentional biases towards positive material following induction into a positive mood (Tamir & Robinson, 2007) and mood congruent attentional biases towards negative material when induced into a negative mood (Becker & Leinenger, 2011). Previous research has used different methods to induce mood, alternative affective stimuli, and has employed different procedures to measure attentional preferences. More specifically, previous studies that have found mood congruent attentional biases have used mood induction procedures such as emotionally provoking writing tasks (Becker & Leinenger, 2011), autobiographical recall, guided imagery, and music (Tamir & Robinson, 2007), whereas film clips were used to induce mood in the current study.

Although there are major design differences, findings from the current study are consistent with previous findings, lending support to the idea that temporary emotional states can influence how we selectively attend to information. Furthermore, affect may have a priming effect on attention, thus sensitizing preferences for content that is congruent with an individual's mood state. Although the current findings provide a framework to describe and predict the direction of attentional biases towards emotional content in different mood states, it does not entirely explain the process underlying this phenomenon. However, it does not seem unreasonable to postulate that in addition to decreasing the cognitive resources required to process emotion congruent material, priming may also increase the salience of specific emotional content. In other words, we may be more inclined to pay attention to emotions that we consider relevant, familiar, and easy to understand.

The final hypothesis predicted that resilient individuals would demonstrate post-mood induction differences in attention for specific image types regardless of the mood induction condition. This hypothesis was supported given that individuals with higher levels of resilience viewed negative stimuli differently when compared to individuals with lower levels of resilience, following the mood induction procedure. More specifically, individuals with higher resilience experienced a significant amount of change when measuring total viewing time for negative images, when compared to individuals who were less resilient. As resilience increased, viewing time on negative images decreased, thus suggesting the presence of a bias away from negative stimuli. Of primary importance was that the finding that attentional biases were prominent following a temporary change in affective state, regardless of the specific mood induction condition. Given that patterns in viewing tendencies changed following the mood manipulation, resilient individuals may employ selective attentional processes differently when compared to individuals who are less resilient. These differences appeared in response to temporary changes in emotional states, suggesting that emotional activation may be a key component in how more resilient individuals attend to emotional content.

There is a growing body of literature supporting the presence of attentional biases for emotional content as a function of trait characteristics such as depression (Gotlib, Krasnoperova, Yue, & Joormann, 2004), dysphoria (Bradley, Mogg, & Lee, 1997), anxiety (Mogg, Bradley, & Williams, 1995) and optimism (Isaacowitz, 2005). The current findings contribute to the extant research by providing additional support for trait differences in selective attention. Of interest in the current study is that resilience was found to be related to an attentional bias towards positive stimuli prior to mood induction, however following the mood induction, the attentional bias was away from negative stimuli rather than towards positive stimuli. The presence of attentional

biases away from negative stimuli is consistent with research conducted with optimists (Isaacowitz, 2005) that found that optimists viewed skin cancer images less than people who were less optimistic. Although attentional biases, resulting from varying levels of resilience, were away from negative stimuli, the findings provide preliminary evidence that attentional processes may play a role in a the development or maintenance of resilience.

There is an abundance of literature linking attention and emotion regulation strategies (for a complete review see Wadlinger & Isaacowitz, 2011). Previous research supports that resilience is associated with emotion regulation processes (Karreman & Vingerhoets, 2012), where resilient individuals have been found to use positive emotions to mediate cardiovascular recovery from stress situations, as well as to use positive appraisal strategies to derive meaning from aversive experiences (Tugade & Fredrickson, 2004). The presence of attentional preferences following emotional arousal could result from a resilient individual's efforts to regulate their emotions. Goal congruence models of attention have been provided to explain the propensity for optimists to demonstrate an inattentive bias away from negative stimuli (Isaacowitz, 2005), as well as explain observed attentional preferences for positive stimuli by older adults (Reed & Carstensen, 2012). Given it has been argued that resilient individuals use positive emotion regulation strategies to regulate affect (Tugade & Fredrickson, 2007), and have greater access to positive emotions (Tugade & Fredrickson, 2004), mood and trait congruent attentional biases may help explain how these processes develop. Moreover, more resilient individuals may selectively disengage from content that is incongruent with pleasant affective states as an emotion regulation strategy. In other words, resilient individuals may look away from negative content in an effort to decrease negative affect.

Although the current study contributes to existing literature in the area of resilience, mood and attentional biases, the findings must be understood within the context of certain limitations. The first limitation to be discussed is the validity of the neutral mood induction. Pre and post manipulation check scores, using the PANAS, indicated that scores for participants in the neutral mood condition changed following the mood induction procedure. Ideally, the neutral mood induction group would have demonstrated no change in affect scores on both the positive and negative affect subscales following the mood induction. Although the participants in the neutral mood group reported experiencing minimal change in negative affect following the film clip, this was not the case for reported affect scores on the positive dimension of the PANAS. The neutral mood group reported the greatest decrease in positive affect following the mood induction procedure, over and above the negative and the positive mood groups. The findings from the manipulation check (pre and post PANAS scores) suggest that the film clip used for the neutral mood condition was likely negative affect neutral, but was not positive affect neutral. Empirical evidence investigating the factor structure of the PANAS provides support for the need to independently interpret the positive and negative affect subscales rather than view them as opposite ends of the same continuum (Terracciano, McCrae, & Costa, 2003; Tuccitto, Giacobbi, & Leite, 2010). With this in mind, selection efforts entertained in the current study failed to consider the neutrality of the film within the context of both positive and negative affect, therefore limiting the scope of interpretability of the neutral mood group within the broader realm of affect.

Despite the efforts that were made to control variability on the arousal dimension of the IAPS images which were selected in the study, by choosing pictures rated as arousal neutral, this potential confound was overlooked when selecting the film clips. The positive and negative

affect clips were selected from research conducted by Gross and Levenson (1993), which included statistics on the mean ratings for the target emotion, as well as hit rate of the target emotion. The influence of arousal was not considered as a part of film selection. Previous research suggests that variations in arousal can influence an individual's affective experience in a similar fashion as content valence (Feldman, 1995). With these considerations in mind, formal pilot testing of each of the films clips should have been undertaken to validate the valence ratings of the neutral, negative and positive images, as well as to control for potential differences in evoked arousal across all film clips.

Building from the findings of the current study, future research can assist with better understanding the relationship of attentional biases within the context of resilience. Given the paucity of research documenting attentional biases in resilient individuals, studies aimed at replicating the current results will help establish the relationship between resilience and attentional processes. Additionally, the generalizability of the results can be tested by altering and/or adding to the materials, procedures or tasks used in the current study. There are a variety of mood induction procedures, such as velten MIPs, music MIPs, and receipt of a gift MIPs that could be used to test similar research questions. Furthermore, the current study investigated attentional biases while participants were engaged in a passive task (viewing screen naturally as if they were watching television). Future efforts could focus on investigating the active or passive quality of the task by adding a distracter or secondary task to help inform if attentional processes in resilience differ based on varying levels of tasks engagement. Although the study does provide evidence that resilient individuals do demonstrate attentional biases, these findings should be tested under varying conditions. Once the relationship between resilience and

attentional biases is better established, we may be able to draw broader conclusions on the processes of developing resilience and how resilient individuals cope with stress and adversity.

As attentional biases were observed for all image types, future research directed at understanding the role of neutral stimuli within the broader theme of emotionally valenced stimuli, rather than as a simple control condition, may provide insight into the selective process of attention and emotion rather than merely describing it. To date, studies investigating attentional biases have largely included the neutral image type condition as a relative comparison for emotionally valenced images types (Fox, Ridgewell, & Ashwin, 2009; Sears, Newman, Ference, & Thomas, 2011; Wadlinger, & Isaacowitz, 2006), which was also the case for the current study. Given the unexpected findings that individuals with lower levels of resilience selectively attend to neutral stimuli, future research aimed at understanding the role of neutral stimuli may provide increasing clarity on the dynamic between attention and neutral visual content within the scope of resilience. It is possible that the attentional bias towards either neutral or emotional content is an artefact of different emotional regulation strategies employed by resilient and non-resilient individuals. Whereby individuals with higher resilience may be attending to emotional content to either up-regulate or down-regulate their affective experience. Individuals who are less resilient may be more likely to attend to information that will neutralize their emotional experience. In any event, investigations aimed at understanding differences in how individuals with lower and higher levels of resilience attend to neutral visual stimuli vs. emotional visual stimuli may warrant future consideration.

Lastly, future research may want to examine the relationship between orientation time and resilience. Neither hypothesized nor expected, individuals with higher levels of resilience were found to have faster orientations times towards all images, regardless of image type prior to

mood induction and slower orientation times towards all images following mood induction. Future work dedicated to exploring the process underlying this attentional pattern in resilient individuals will likely contribute to a better understanding of the relationship between orientation latency and attention.

While the results of the current study contributes to the existing resilience and eye tracking literature, there may be merit in exploring how these findings can be translated into clinical practice. There is a growing body of research that suggests that attentional training can be beneficial for individuals with social anxiety (Heeren, Reese, McNally, & Philippot, 2012), depression (Sanchez, Vazquez, Marker, LeMoult, & Joormann, 2013), and chronic pain (Schoth, Georgallis, & Liossi, 2013). Furthermore there is empirical support suggesting that attention training techniques can be used to improve emotion regulation abilities (see Wadlinger & Isaacowitz, 2011 for a full review). That is, individuals have demonstrated improved emotional functioning through training their attention away from negative (Amir, Beard, Burns, & Bomyea, 2009; Najmi, & Amir, 2010; Schmidt, Richey, Buckner, & Timpano, 2009) or towards positive stimuli (Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007; Johnson, 2009). In light of these findings, and given that it has been proposed that resilience is a common rather than an exceptional phenomenon (Bonanno, 2004; Masten, 2001), attentional training techniques to promote resilience may be a promising area that warrants further investigation.

In conclusion, the current findings provided support that both resilience and mood produce attentional biases towards emotional content. The attentional biases in the current study were congruent with the participants induced mood and level of resilience, demonstrating both state and trait congruent attentional biases. As predicted, mood congruent attentional biases were observed in that participants induced into a positive mood had biases towards positive images

and away from negative images, and individuals in the negative mood induction group has biases towards negative images and away from positive images. Similarly, the study provided evidence for the present of trait congruent attentional biases, which appeared to be driven, at least in part, by varying levels of resilience. Resilient individuals demonstrated a bias towards positive stimuli and once emotion was aroused, the bias was away from negative stimuli. Interestingly, trait congruent attentional biases in resilience before and after mood induction were observed on a measure of attentional engagement, whereas state congruent attentional biases were observed on a measure of initial orientation. This finding suggest that being in a particular mood state will prime our attention towards mood congruent material but does not necessarily produce persistent engagement of one's attention towards mood congruent content. Inversely, trait congruent attentional biases produced as a function of resilience appeared to be related to how an individual engages and disengages their attention towards and away from emotional content rather than merely attracting ones attention. Thus, attentional biases in resilience may be best explained by an individual's tendency to demonstrate continued attentional engagement towards positive images and natural attentional disengagement away from neutral and negative images. As such, the current study contributes to existing literature not only by demonstrating attentional biases in resilience and mood; but by providing preliminary support that how we attend to emotional content in our environment can play a crucial role in our experience of day to day affect and our ability to thrive despite adversity.

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Appendix A

APPROVAL FOR CONDUCTING RESEARCH INVOLVING HUMAN SUBJECTS
Research Ethics Board – Laurentian University

This letter confirms that the research project identified below has successfully passed the ethics review by the Laurentian University Research Ethics Board (REB). Your ethics approval date, other milestone dates, and any special conditions for your project are indicated below.

TYPE OF APPROVAL	New	X	Modifications to project		Time extension	

Name of Principal Investigator and school/department	Danielle Valcheff (Dr. Chantal Arpin3Cribbie; supervisor) — Psychology (Laurentian University)
Title of Project	*Attentional Biases in Resilience*
REB file number	2011-07-11
Date of original approval of project	September 19th 2011
Date of approval of project modifications or extension *(if applicable)*	
Final/Interim report due on	August 30 2012
Conditions placed on project	Final or Interim report on August 30 2012

During the course of your research, no deviations or changes to the protocol, recruitment or consent forms may be initiated without prior written approval from the REB. If you wish to modify your research project, please complete the appropriate REB form.

All projects must submit a report to REB at least once per year. If involvement with human participants continues for longer than one year (e.g. you have not completed the objectives of the study and have not yet terminated contact with the participants, except for feedback of final results to participants), you must request an extension using the appropriate REB FORM.

In all cases, please ensure that your research complies with the Tri-Council Policy Statement (TCPS). Also please quote your REB file number on all future correspondence with the REB office.

Congratulations, and best of luck in conducting your research.

Susan James Ph.D.
Acting Chair of the *Laurentian University Research Ethics Board*
Laurentian University

Appendix B

Appendix B. Sample slide of images presented in the study. All slides used in the study were presented to the participants in colour.

Appendix C

A. I. M. QUESTIONNAIRE

DIRECTIONS: The following questions refer to emotional reactions to typical life-events. Please indicate how YOU react to these events by placing a number from the following scale in the blank space preceding each item. Please base your answers on how YOU react, not on how you think others react or how you think a person should react.

Almost Never	Never	Occasionally	Usually	Usually Always	Always
1	2	3	4	5	6

1. When I accomplish something difficult I feel delighted or elated.
2. When I feel happy it is a strong type of exuberance.
3. I enjoy being with other people very much.
4. I feel pretty bad when I tell a lie.
5. When I solve a small personal problem, I feel euphoric.
6. My emotions tend to be more intense than those of most people.
7. My happy moods are so strong that I feel like I'm in heaven.
8. I get overly enthusiastic.
9. If I complete a task I thought was impossible, I am ecstatic.
10. My heart races at the anticipation of some exciting event.
11. Sad movies deeply touch me.
12. When I'm happy it's a feeling of being untroubled and content rather than being zestful and aroused.
13. When I talk in front of a group for the first time my voice gets shaky and my heart races.
14. When something good happens, I'm usually much more jubilant than others.
15. My friends might say I'm emotional.
16. The memories I like the most are of those times when I felt content and peaceful rather than zestful and enthusiastic.
17. The sight of someone who is hurt badly affects me strongly.
18. When I'm feeling well it's easy for me to go from being in a good mood to being really joyful.
19. "Calm and cool" could easily describe me.
20. When I'm happy I feel like I'm bursting with joy.
21. Seeing a picture of some violent car accident in a newspaper makes me feel sick to my stomach.
22. When I'm happy I feel very energetic.
23. When I receive a reward I become overjoyed.
24. When I succeed at something, my reaction is calm and contentment.
25. When I do something wrong I have strong feelings of shame and guilt.
26. I can remain calm even on the most trying days.
27. When things are going good I feel 'on top of the world'.
28. When I get angry it's easy for me to still be rational and not overreact.
29. When I know I have done something very well, I feel relaxed and content rather than excited and elated.
30. When I do feel anxiety it is normally very strong.
31. My negative moods are mild in intensity.
32. When I am excited over something I want to share my feelings with everyone.
33. When I feel happiness, it is a quiet type of contentment.
34. My friends would probably say I'm a tense or 'high-strung' person.
35. When I'm happy I bubble over with energy.
36. When I feel guilty, this emotion is quite strong.
37. I would characterize my happy moods as closer to contentment than joy.
38. When someone compliments me, I get so happy I could 'burst'.
39. When I am nervous I get shaky all over.
40. When I am happy the feeling is more like contentment and inner calm than one of exhilaration and excitement.

Appendix D

INTERNATIONAL PERSONALITY ITEM POOL
DEVELOPED BY GOLDBERG (1999)

Please answer this survey as honestly as possible. Any questions you may object to can be left blank. After completing this survey, determine your absolute and relative scores on this survey and store those scores in a safe place.

Please describe yourself as you generally are now, not as you wish to be in the future. Describe yourself as you honestly see yourself, in relation to other people you know of the same sex as you are, and roughly your same age

Below are phrases describing people's behaviors. Please read each statement carefully, and then indicate how accurately each statement describes you by marking the appropriate number on the scale beside each question.

1	***2***	***3***	***4***	***5***
Very Inaccurate	Moderately Inaccurate	Neither Inaccurate nor Accurate	Moderately Accurate	Very Accurate

1.	… I am the life of the party.	1	2	3	4	5
2.	… I feel little concern for others.	1	2	3	4	5
3.	… I am always prepared.	1	2	3	4	5
4.	… I get stressed out easily.	1	2	3	4	5
5.	… I have a rich vocabulary.	1	2	3	4	5
6.	… I don't talk a lot.	1	2	3	4	5
7.	… I am interested in people.	1	2	3	4	5
8.	... I leave my belongings around.	1	2	3	4	5
9.	… I am relaxed most of the time.	1	2	3	4	5
10.	… I have difficulty understanding abstract ideas.	1	2	3	4	5
11.	… I feel comfortable around people.	1	2	3	4	5
12.	… I insult people.	1	2	3	4	5
13.	… I pay attention to details.	1	2	3	4	5
14.	… I worry about things.	1	2	3	4	5
15.	… I have a vivid imagination.	1	2	3	4	5
16.	… I keep in the background.	1	2	3	4	5
17.	… I sympathize with others' feelings.	1	2	3	4	5
18.	… I make a mess of things.	1	2	3	4	5
19.	… I seldom feel blue.	1	2	3	4	5
20.	… I am not interested in abstract ideas.	1	2	3	4	5
21.	… I start conversations.	1	2	3	4	5
22.	… I am not interested in other people's problems.	1	2	3	4	5
23.	… I get chores done right away.	1	2	3	4	5
24.	… I am easily disturbed.	1	2	3	4	5

25. … I have excellent ideas.	1	2	3	4	5
26. … I have little to say.	1	2	3	4	5
27. … I have a soft heart.	1	2	3	4	5
28. … I often forget to put things back in their proper place.	1	2	3	4	5
29. … I get upset easily.	1	2	3	4	5
30. … I do not have a good imagination.	1	2	3	4	5
31. … I talk to a lot of different people at parties.	1	2	3	4	5
32. … I am not really interested in others.	1	2	3	4	5
33. … I like order.	1	2	3	4	5
34. … I change my mood a lot.	1	2	3	4	5
35. … I am quick to understand things.	1	2	3	4	5
36. … I don't like to draw attention to myself.	1	2	3	4	5
37. … I take time out for others.	1	2	3	4	5
38. … I shirk my duties.	1	2	3	4	5
39. … I have frequent mood swings.	1	2	3	4	5
40. … I use difficult words.	1	2	3	4	5
41. … I don't mind being the center of attention.	1	2	3	4	5
42. … I feel other’s emotions.	1	2	3	4	5
43. … I follow a schedule.	1	2	3	4	5
44. … I get irritated easily.	1	2	3	4	5
45. … I spend time reflecting on things.	1	2	3	4	5
46. … I am quiet around strangers.	1	2	3	4	5
47. … I make people feel at ease.	1	2	3	4	5
48. … I am exacting in my work.	1	2	3	4	5
49. … I often feel blue.	1	2	3	4	5
50. … I am full of ideas.	1	2	3	4	5

Appendix E

Connor-Davidson Resilience Scale (CD-RISC)

*For each item, please mark an "**x**" in the box below that best indicates how much you agree with the following statements as they apply to you over the last **month**. If a particular situation has not occurred recently, answer according to how you think you would have felt.*

Not true at all	Rarely true	Sometimes true	Often true	True nearly all the time
0	*1*	*2*	*3*	*4*

1. I am able to adapt when changes occur.
2. I have at least one close and secure relationship that helps me when I am stressed.
3. When there are no clear solutions to my proble ms, sometimes fate or God can help.
4. I can deal with whatever comes my way.
5. Past successes give me confidence in dealing with new challenges and difficulties.
6. I try to see the humorous side of things when I am faced with problems.
7. Having to cope with stress can make me stronger.
8. I tend to bounce back after illness, injury, or other hardships.
9. Good or bad, I believe that most things happen for a reason.
10. I give my best effort no matter what the outcome may be.
11. I believe I can achieve my goals, even if there are obstacles.
12. Even when things look hopeless, I don't give up.
13. During times of stress/crisis, I know where to turn for help.
14. Under pressure, I stay focused and think clearly.
15. I prefer to take the lead in solving problems rather than letting others make all the decisions.
16. I am not easily discouraged by failure.
17. I think of myself as a strong person when dealing with life's challenges and difficulties.
18. I can make unpopular or difficult decisions that affect other people, if it is necessary.
19. I am able to handle unpleasant or painful feelings like sadness, fear, and anger.
20. In dealing with life's problems, sometimes you have to act on a hunch without knowing why.
21. I have a strong sense of purpose in life.
22. I feel in control of my life.
23. I like challenges.
24. I work to attain my goals no matter what roadblocks I encounter along the way.
25. I take pride in my achievements.

Appendix F

The Ego Resiliency Scale (ER89)

		Does not apply at all 1	**Applies slightly, if at all 2**	**Applies somewhat 3**	**Applies very strongly 4**
1	I am generous with my friends	1	2	3	4
2	I quickly get over and recover from being startled	1	2	3	4
3	I enjoy dealing with new and unusual situations	1	2	3	4
4	I usually succeed in making a favorable impression on people	1	2	3	4
5	I enjoy trying new foods I have never tasted before	1	2	3	4
6	I am regarded as a very energetic person	1	2	3	4
7	I like different paths to familiar places	1	2	3	4
8	I am more curious than most people	1	2	3	4
9	Most of the people I meet are likeable	1	2	3	4
10	I usually think carefully about something before acting	1	2	3	4
11	I like to do new and different things	1	2	3	4
12	My daily life is full of things that keep me interested	1	2	3	4
13	I would be willing to describe myself as a “pretty strong personality”	1	2	3	4
14	I get over my anger at someone reasonably quick	1	2	3	4

Appendix G

The Positive and Negative Affect Schedule (PANAS)

This scale consists of a number of words that describe different feelings and emotions. Read each item and then list the number from the scale below next to each word. Indicate to what extent you feel this way right now, that is, at the present moment

Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1	2	3	4	5

_____ 1. Interested _____
_____ 2. Distressed _____
_____ 3. Excited _____
_____ 4. Upset _____
_____ 5. Strong _____
_____ 6. Guilty _____
_____ 7. Scared _____
_____ 8. Hostile _____
_____ 9. Enthusiastic _____
_____ 10. Proud _____
11. Irritable
12. Alert
13. Ashamed
14. Inspired
15. Nervous
16. Determined
17. Attentive
18. Jittery
19. Active
20. Afraid

Appendix H

Principal Investigator: **Danielle Valcheff**
Graduate Student (Applied Psychology)
Laurentian University
Dx_valcheff@laurentian.ca

This research project is intended to study eye movements while individuals are looking at pictures in order to better understand attentional mechanisms involved in this task. Participants will be invited to complete a series of questionnaires and then be asked to view a series of images on the computer screen while eye movements will be recorded. Participant will then view a short movie clip followed by another session where participants eye movements will be recorded while viewing images on the computer screen. The participation to this study is a single session of about 60 minutes. Further details about the project will be given after the participation in order to prevent bias in the information collected.

Name	Email	I want further information about the study (check)	I want to participate in the study (check)

Appendix I

Consent Form

I, _____, am interested in participating in this study on participants' attentional responses to a variety of images presented on a computer screen. This study is being conducted by Danielle Valcheff, an Applied Psychology Master's student supervised by Dr. Arpin Cribbie, faculty member in the department of psychology for Laurentian University (Barrie).

If I agree to participate, my participation will consist of attending one 60 minute session during which I will be asked to complete a series of questionnaires, view a series of images on a computer screen while wearing the eye tracker and watch a film clip. I give my consent for the use of my results obtained from the psychological, demographic and personality questionnaires and the eye tracker task. These results will be kept confidential, and only the researcher and her supervisor will have access to them. No personal information will be disclosed.

The benefit of the study is that I will gain firsthand experience of eye tracker technology. Additionally the scientific benefit is that the study data will provide key information necessary to better understand attentional biases.
My participation is strictly voluntary and I am free to withdraw from the study at any moment or refuse to participate without any penalty. Although it would be preferable that I answer all questions, if I am uncomfortable with any particular question, I am able to refuse to answer.

In the event that the results of my participation in the current study be used for used for secondary data analysis (where the data obtained from my participation in the study is different from the purpose which is outlined in the current consent) will contain no identifying information that can be linked to my participation.

I have also received assurance from the researcher that the information I will share will remain strictly confidential. There are two copies of this consent form, one which the researcher keeps and one which I keep. All data will be stored in a locked filling cabinet located in Dr. Annie Roy-Charland Cognitive Health Research Laboratory in room E-228 in the Alphone-Raymond building and will be destroyed after 7 years.
Whereas there are no inherent risks related to participation in the study, some participants may experience slight uneasiness when completing psychological questionnaires, viewing images or watching film clips. Should I desire additional support, I was provided with the contact information for Student Services on the Laurentian University. They are located in room L-210 and can be reached by phone at (705) 675-1151, ext. 3211.

If I have any questions about the study, I can contact the researchers at carpincribbie@laurentian.ca (705.728.1968 ext. 5356). This study has been approved by the Research Ethics Board of Laurentian University. If I have any ethical concerns about my participation in the study, I can contact the Research Officer, Dr. Jean Dragon at 705.675.1151 ext. 3213 (jdragon@laurentian.ca) at Laurentian University.
Participant's Signature:_____Date: _____

Researcher's Signature:_____Date: _____

I wish to receive a summary of the results of this study which will be available in August 2012, at the following address: _____

THANK YOU FOR YOUR PARTICIPATION.

Appendix J

DEBRIEFING FORM

Study Title: Attentional Biases in Resilience
Investigator: Danielle Valcheff

The questionnaires that you completed at the start of the study assessed various personality characteristics such as resilience, affect intensity, positive and negative affect, optimism, agreeableness, openness, stability and conscientiousness.

The dependent variables in this study were measures of attentional biases and was measured using the eye tracker technology by recording eye movements and fixations on images that were rated based on pleasantness. Following the initial viewing of the images, participants were asked to view a movie clip with the goal of inducing a target emotion. Participants were randomly assigned to one of three target emotions: amusement, sadness and neutral affect. Following the mood induction task participants were asked to view another series of images while attentional biases were being measured using the eye tracker.

I expect that participant's attentional biases would be influenced by their own personal level of resilience. More precisely, I am making several hypotheses that outline the specific directions of the attentional bias. The first is that individuals that are less resilient will have greater attentional biases towards negative stimuli and that individuals that are more resilient will have greater attentional biases towards positive stimuli. Additional hypotheses state that when placed in the negative affect condition individuals with greater levels of resilience will demonstrate more resistance towards a negative attentional bias when compared to individuals with lower levels of resilience. The study further hypothesized that when placed in the positive affect condition individuals with greater levels of resilience will demonstrate a stronger attentional bias towards positive stimuli when compared to individuals with lower levels of resilience.

These hypotheses are based on research that suggests that positive emotional regulation facilitates adaptive coping. A model proposed to explain resilience is the 'broaden and build' theory. This model suggests that negative emotions narrow cognitive resources, whereas positive emotions broaden cognitive resources. Research suggests that, when faced with stress, resilient individuals use positive emotion regulation which produces an increased ability to generate novel and creative problem solving strategies. Additionally, positive emotional regulation, to regulate emotions during stress, requires less conscious effort for resilient individuals than for those with lower levels of resilience. The combined influence of automatic activation and the use of positive emotions when faced with adversity create a cycle in which resilient individuals remain resilient due to the broadening of cognitive resources and the practice effects of their coping style. Differences could be expected in selective attentional biases towards emotional stimuli given that resilient individuals experience greater levels of positive affect.

If you have any questions about the study, you can contact the researcher at dx_valcheff@laurentian.ca or my supervisor Dr. Arpin-Cribbie at carpincribbie@laurentian.ca (705–728-1968 ext. 5356).

This study has been approved by the Research Ethics Board of both Laurentian University. If you have any concerns about your participation in the study, you can contact the Research Officer, Dr. Jean Dragon at 705-675-1151 ext. 3213 (jdragon@laurentian.ca) at the Laurentian Main Campus.

Many thanks once again for your participation in my study.

Danielle Valcheff