8-12-2016

Depression and Empathy Predict Emotion-Modulated Startle Reactivity

Alyssa M. Ames
Georgia State University

DEPRESSION AND EMPATHY PREDICT EMOTION-MODULATED STARTLE REACTIVITY

by

ALYSSA AMES

Under the Direction of Erin C. Tully, PhD

ABSTRACT

Research supports varied patterns of emotion-modulated startle (EMS) reactivity among depressed individuals. The purpose of this study was to examine whether these varied patterns can be explained by depression, empathic tendencies, and emotional stimuli. The EMS paradigm is a well-validated measure of emotion-modulated reactivity in which the magnitude of startle reflexes in reaction to acoustic stimuli are recorded while participants view pleasant, neutral, and negative images (Lang, Bradley, & Cuthbert, 1990). Young adults (N = 120; M_{age} = 19.54, SD = 1.41; 75% female) completed self-report rating scales of depression symptoms and cognitive and affective empathic tendencies and the EMS paradigm. Individuals with low depression, regardless of their cognitive (η_p^2 = .44 and .47) and affective empathic tendencies (η_p^2 = .49 and .36), and individuals with high depression and high cognitive and affective empathic tendencies (η_p^2 = .23, .46, respectively) exhibited the typical linear EMS reactivity pattern of increasing startle reflex magnitude from pleasant to neutral to unpleasant images. In contrast, individuals with high depression along with low cognitive and affective empathic tendencies exhibited blunted EMS reactivity patterns (η_p^2 = .000, .04, respectively). These findings indicate blunted EMS reactivity patterns only in depressed individuals who have low cognitive and affective empathic tendencies and are likely disengaged from emotional stimuli, thus suggesting variability among depressed individuals in motivational states that prime or inhibit the startle reflex.

INDEX WORDS: Emotion reactivity, Electromyography, Psychophysiology, Perspective-taking, Depression

DEPRESSION AND EMPATHY PREDICT EMOTION-MODULATED STARTLE REACTIVITY

by

ALYSSA AMES

A Thesis Submitted in Partial Fulfillment of the Requirements for the Degree of

Master of Arts

in the College of Arts and Sciences

Georgia State University

2016

DEPRESSION AND EMPATHY PREDICT EMOTION-MODULATED STARTLE REACTIVITY

by

ALYSSA AMES

Committee Chair: Erin Tully

Committee: Erin Tone

Aki Masuda

Electronic Version Approved:

Office of Graduate Studies

College of Arts and Sciences

Georgia State University

August 2016

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

1 INTRODUCTION

Decades of research on affective functioning in depressed individuals has been complicated by differences in emotion reactivity tendencies in people with this disorder (Rottenberg, Gross, & Gotlib, 2005). While some depressed individuals react strongly to emotional stimuli, particularly the emotions of others (e.g., Joiner, Metalsky, Katz, & Beach, 1999), other depressed individuals have the opposite reaction and tend to withdraw and experience inhibited reactions to others' emotions (e.g., Derntl et al., 2011). To date, very little is known about the interpersonal characteristics that distinguish depressed individuals with these two distinct patterns of emotion reactivity tendencies. One potential individual difference variable is empathic tendencies as extreme high and low levels of empathy are associated with depression (Tully, Ames, Garcia, & Donohue, 2015) and higher levels of empathy are related to higher physiological arousal (Dimberg, Andréasson, & Thunberg, 2011).

The emotion-modulated startle (EMS) paradigm is a well-validated paradigm for studying emotional reactivity (Vrana, Spence, & Lang, 1988); specifically, it provides a measure for how much an individual's physiological startle reactivity is affected by the presentation of emotional stimuli (e.g., other's emotional expression). Some EMS studies have shown that startle reactivity is highly modulated by the valence of the emotional stimuli in depressed individuals (e.g., Dichter, Tomarken, Shelton, & Sutton, 2004), and other studies have shown that startle reactivity in depressed individuals is blunted and not modulated by emotional stimuli (e.g., Allen, Trinder, & Brennan, 1999). The present study examined whether individuals high in depression and high in empathy exhibit exaggerated EMS reactivity, and whether individuals high in depression along with very low levels of empathy exhibit blunted EMS reactivity.

1.1 Heterogeneity in Depression

Some studies support the idea that some depressed individuals tend to be hyper-reactive and overly engaged in the emotions of others (e.g., Joiner & Metalsky, 2001), while others tend to be under-reactive and withdrawn from the emotions of others (e.g., Seidel et al., 2010). Interpersonally, depressed individuals are found to present both overly-dependent interpersonal behaviors, such as excessive reassurance seeking (Joiner & Metalsky, 2001), and disengaged interpersonal behaviors, such as withdrawing from emotional conversation with others (Brown, Strauman, Barrantes-Vidal, Silvia, & Kwapil, 2011; Hokanson & Butler, 1992; Seidel et al., 2010). Relative to non-depressed individuals, some studies suggest that depressed individuals, exhibit lower behavioral responsivity to rewarding and pleasant stimuli (e.g., Henriques & Davidson, 2000; Kasch, Rottenberg, Arnow, & Gotlib, 2002), while other studies find depressed individuals exhibit larger increases in positive affect in response to pleasant daily life events (Bylsma, Taylor-Clift, & Rottenberg, 2011; Nezlek & Gable, 2001; Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003). Finally, relative to non-depressed individuals, depressed individuals are found to exhibit both reduced stress reactivity, such as blunted respiratory sinus arrhythmia levels in reaction to a social stressor (Bylsma, Salomon, Taylor-Clift, Morris, & Rottenberg, 2014) as well as heightened stress reactivity, such as increased cortisol stress reactivity (Burke, Davis, Otte, & Mohr, 2005). Taken together, these findings indicate that some depressed individuals are over-reactive to emotions while other depressed individuals are under-reactive.

1.2 Emotion Reactivity

Emotion reactivity has varied definitions in the psychological literature. In the present methodological paradigm, emotional reactivity was operationally defined as the extent to which an individual's physiological reactivity to acoustic stimuli is modulated by emotional cues (Lang, Bradley, & Cuthbert, 1997; Lazarus, 1991). According to Lang et al (1997), pleasant and unpleasant emotional cues activate appetitive and aversive motivational states, respectively, which are systems that govern the readiness for an individual to engage or withdraw from the environment. Lang et al (1990) also suggests that the extent to which these motivational systems are activated depends on the level of engagement with emotional cues. In general, flexible emotion-modulated reactivity optimizes adaptation to environmental demands by preparing an individual to respond to threat and reward (Ekman, 1992; Levenson, 1994), and flexible emotion reactions are associated with beneficial outcomes, such as trait positive emotionality (Oveis et al., 2009). Excessively high and low emotion-modulated reactivity, however, are found to be related to varied negative outcomes (Malhi et al., 2004; Rottenberg, Kasch, Gross, & Gotlib, 2002, respectively), including low well-being (Kogan, Gruber, Shallcross, Ford, & Mauss, 2013), emotional instability (Thompson et al., 2012), bipolar disorder (Malhi et al., 2004), and depression (Kogan et al., 2013; Rottenberg, 2007a; Rottenberg et al., 2002).

Research on emotion reactivity in depressed individuals has yielded contrasting conceptual models on how depression interacts with emotion-modulated reactivity. The negative potentiation hypothesis posits that negative moods facilitate potentiated responses to negative stimuli, such that depressed individuals, relative to nondepressed individuals, exhibit heightened reactivity to negative emotions (Lewinsohn, Hoberman, Teri, & Hautzinger, 1985; Scher, Ingram, & Segal, 2005). Some studies show support for heightened reactivity in depressed individuals relative to nondepressed individuals, such as greater electrodermal activity in response to negative social stimuli (Golin, Hartman, Klatt, Munz, & Wolfgang, 1977; Lewinsohn, Lobitz, & Wilson, 1973; Sigmon & Nelson-Gray, 1992). In contrast, the emotion context insensitivity hypothesis (ECI) proposes that depressed individuals, compared to nondepressed individuals, show less physiological and behavioral reactivity to positive and negative emotional stimuli (Rottenberg, 2007b; Rottenberg, Gross, & Gotlib, 2005). Indeed, a meta-analysis investigating emotion reactivity in individuals with Major Depressive Disorder (MDD) supports reduced physiological and behavioral emotion reactivity, relative to control groups that included individuals not meeting diagnostic criteria for MDD (Bylsma, Morris, & Rottenberg, 2008). Bylsma, Morris, and Rottenberg (2008) found reduced reactivity in facial movements and expressions, EMS reactions, approach and avoidance behaviors (e.g., decreased response to reward), and autonomic activity (i.e., skin conductance, heart rate and heart rate variability, blood pressure, and speed of respiration) to pleasant and unpleasant emotional stimuli.

Taken together, these emotion reactivity studies provide further evidence that while some depressed individuals tend to be over-reactive to emotions of others, other depressed individuals are under-reactive to others' emotions. The negative and positive emotional stimuli used in these studies were largely images and film clips depicting empathy-eliciting stimuli (i.e., people experiencing great pleasure or distress), suggesting that interpersonal characteristics that affect engagement with social material, such as empathic tendencies, may help explain these emotion reactivity differences found in depressed individuals.

1.2.1 Emotion reactivity and empathy

Broadly defined, empathy is the ability to recognize, understand, and experience emotions that another individual is or is expected to be experiencing (Batson, 1991; Davis, 1983; Eisenberg & Strayer, 1987; Hoffman, 1981; Leiberg & Anders, 2006; Ruby & Decety, 2004). Conceptually, empathy refers to the ability to experience emotions that are other-focused and shared with another individual and is distinct from empathic distress, which refers to the self-focused affective response to the negative emotions of others (Eisenberg, 1989). It is also different from sympathy, which refers to feelings of concern or sorrow for a person in distress, but not necessarily emotions that are similar to what the distressed person is or is expected to be experiencing (Eisenberg, 1989).

Empathy is often described as having two interrelated but distinct components, affective (empathic concern) and cognitive (perspective-taking) components (Davis, 1983). Affective empathy (i.e., empathic concern) refers to the experience of emotions that are caused by and similar to the emotions of another (Davis, 1983) and perspective-taking occurs when an individual adopts the mindset of the other (Davis, 1983). Affective and cognitive empathic tendencies affect the degree to which an individual attends to and engages with empathy-eliciting emotional cues in the environment (Decety, 2015). Models explaining the neurobiological and physiological underpinnings of empathy link affective and cognitive empathic tendencies and activation of motivational systems in reaction to empathy-eliciting cues in the environment (Decety, 2015; Decety, Norman, Berntson, & Cacioppo, 2012; Decety & Svetlova, 2012).

Empathy is typically theorized to be an adaptive characteristic associated with good psychological (Shiner & Masten, 2012) and interpersonal functioning (Chow, Ruhl, & Buhrmester, 2013). However, previous studies investigating a linear association between depression (defined as either heightened levels of depression symptoms or a diagnosis of MDD) and empathy have yielded mixed findings. Some studies support a positive association between empathy-related constructs (i.e., empathic accuracy, empathic helping behaviors, and empathic distress) and depression symptoms (Cramer & Jowett, 2010; Gawronski & Privette, 1997; Silton & Fogel, 2010) and clinical depression diagnoses (Wilbertz, Brakemeier, Zobel, Härter, &

Schramm, 2010). Other studies support a negative association between empathic perspective-taking, empathic concern, and MDD diagnoses (Cusi, MacQueen, Spreng, & McKinnon, 2011; Derntl, Seidel, Schneider, & Habel, 2012). Yet still, other studies find that empathic concern and empathic perspective-taking were not significantly associated with depression symptoms (Hughes, Gullone, & Watson, 2011; Lee, 2009) and clinical depression diagnoses (Thoma et al., 2011). Tully and her colleagues recently found that extremely high and low levels of empathic perspective-taking are associated with elevated depression symptoms, and that the association between empathic concern and elevated depression symptoms is moderated by emotion dysregulation, with moderate to high empathic concern only associated with elevated depression symptoms in the presence of emotion dysregulation (Tully et al., 2015). These findings indicate that the association between empathy and depression symptoms is complicated; it appears to be nonlinear, with both high and low empathy related to elevated depression symptoms, and the link to elevated depression symptoms and empathic concern present only in the context of emotion dysregulation.

Findings support a positive association between cognitive and affective empathy and emotion reactivity (Balconi & Bortolotti, 2012; Dimberg et al., 2011; Sonnby-Borgström, Jönsson, & Svensson, 2003). In studies conducted by Sonnby-Borgström, Jönsson, and Svensson (2003; 2002) and Dimberg, Andréasson, and Thunberg (2011), young adults with high affective empathic tendencies had greater facial muscle activity in reaction to images of positive and negative emotional facial expressions relative to individuals with low levels of affective empathy. In another study conducted by Balconi and Bortolotti (2012), high levels of cognitive and affective empathy in young adults were related to high levels of physiological arousal (i.e., skin conductance, heart rate, and the strength of zygomatic and corrugator muscle activity) in response to pleasant and unpleasant films depicting emotional and interpersonal scenarios. Taken together, it is possible to speculate that highly empathic individuals with elevated depression symptoms would likely exhibit heightened physiological emotion-modulated reactivity, while individuals with elevated levels of depression and low empathic tendencies would likely exhibit blunted emotion-modulated reactivity, relative to moderately empathic individuals who have been found to have low levels of depression (Tully et al., 2015).

1.3 Emotion-Modulated Startle Paradigm as a Measure of Emotion Reactivity

The EMS paradigm provides a method for measuring the degree to which an individual's physiological reactivity to a stressor changes as a function of emotional stimuli in their environment (Lang et al., 1990). Two components comprise this paradigm: (a) affective stimuli in the foreground that are typically presented visually and (b) a startle stimulus, which is often an auditory burst that occurs at random intervals during the presentation of emotional stimuli (Vrana et al., 1988). Participants are typically exposed to a short, loud burst of white noise that produces an obligatory startle reflex in both animal subjects (e.g., Brown, Kalish, & Farber, 1951) and human participants (e.g., Vrana et al., 1988).

There are many reasons why the eyeblink component of the startle reaction is targeted in these studies. First, the startle eyeblink is the result of a clearly defined stimulus that can be manipulated to occur at specific times (Lang et al., 1990). Second, the magnitude of the eyeblink reflex can be indexed by measuring the electrical activity of the muscle surrounding the eye (Lang et al., 1990). The startle eyeblink reflex results in contraction of the orbicularis oculi muscle and the reciprocal inhibition of the levator palpebrae, the muscles responsible for closing and raising the eyelid (Landis & Hunt, 1939).

Third, the eyeblink reflex is mediated by simple neural circuitry, which has been fairly well mapped in animal studies (Davis, 1980) and is highly modifiable by aspects of the environment, such as the presentation of emotional images (Lang et al., 1990). A startle stimulus elicits a defensive fear reaction (i.e., a startle reaction) that results from activation of the cochlear root neurons, which then activate the nucleus reticularis pontis caudalis (reticular formation within the brainstem), and ends with activation of motor neurons (Lee, López, Meloni, & Davis, 1996). Secondary neural inputs from the basolateral nucleus of the amygdala and the medial and central nuclei of the amygdala to the motor neurons also modulate startle magnitude to *negative* emotional stimuli (Campeau & Davis, 1995; Davis, 2006; Rosen, Hitchcock, Sananes, Miserendino, & Davis, 1991). An additional neural input from the nucleus accumbens to the motor neurons modulates the startle reactivity in the presence of *positive* emotional stimuli (Koch, Schmid, & Schnitzler, 1996). Thus, measuring the electrical activity of the muscles activated by the startle eyeblink reaction (EMG) when the participant views emotional stimuli quantifies the extent to which neurobiological mechanisms modulate an individual's physiological reactions to a stressor (auditory stimuli).

The emotional stimuli used in this paradigm are typically selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008). This set of emotional images includes approximately 600 color images that have been rated for arousal (intensity) and valence (emotion) by 100 college students. The unpleasant images selected for startle paradigms often depict very violent and/or grotesque images (e.g., disfigured body parts), the pleasant images depict nature scenes or erotica, and neutral (i.e., low arousal, low negative valence, low positive valence) images often depict mundane objects (e.g., hairdryer). Modulation of startle reactivity is typically greatest when the startle probe is presented while the participant views highly arousing and negatively valenced (i.e., unpleasant) images and highly arousing and positively (i.e., pleasant) valenced images (Davis & Whalen, 2001).

Studies assessing emotion modulation of eyeblink reactivity in typical samples have consistently found associations between increasing negativity of the images and magnitude of muscle contraction (e.g., Lang et al., 1990; Vrana et al., 1988). Highly aversive or negative motivational states induced by arousing unpleasant images amplify the defensive startle eyeblink reaction; whereas hedonic motivational states induced by viewing arousing pleasant images inhibit the defensive startle eyeblink reaction. Neutral stimuli do not engage either appetitive or aversive motivational states, so the resulting defensive reaction lies between the two extremes that result from pleasant and unpleasant images (Lang et al., 1990). The startle paradigm, then, can be used to quantify individual differences in the extent to which emotional contexts affect physiological stress reactivity. A *linear* increase in the magnitude of the startle reactivity from pleasant to neutral to unpleasant stimuli indicates modulation of stress reactivity, suggesting that unpleasant and pleasant images evoke aversive and appetitive motivational states, respectively. A *blunted* pattern of reaction (i.e., the absence of modulation) indicates that emotions did not affect the degree of stress reactivity.

1.3.1 Emotion-modulated startle paradigm and depression

Studies examining EMS reactivity in individuals with elevated depression symptoms and MDD diagnoses have yielded mixed findings, with some studies supporting exaggerated linear EMS reactivity (e.g., Kaviani et al., 2004), other studies supporting a linear pattern of EMS reactivity (e.g., Dichter & Tomarken, 2008), and still others supporting a blunted pattern of EMS reactivity (e.g., Mneimne, McDermut, & Powers, 2008) in individuals with elevated depression symptoms or MDD diagnoses. Many of the studies investigating EMS reactivity in depressed individuals do not report effect sizes. In order to synthesize and examine the magnitude of the effects across studies, I calculated effect sizes; they support moderate to large linear effects of image valence on startle magnitude (i.e., typical to exaggerated EMS reactivity) in depressed individuals that are nonsignificant due to the lack of statistical power.

Some studies indicate that individuals with mild depression and low levels of anhedonia have exaggerated linear EMS reactivity patterns (Kaviani et al., 2004), while other studies support a typical linear EMS reactivity pattern for individuals with mild to moderate depression (Dichter & Tomarken, 2008; Dichter et al., 2004). Dichter et al. (2004; 2008) published two studies that support large, significant (η_p^2 = .27; 51) linear EMS reactivity patterns in individuals with very low levels of current depression and significantly smaller and nonsignificant and yet moderate (η_p^2 = .06) and large (η_p^2 = .14) linear EMS reactivity patterns in individuals with current diagnoses of MDD.

Forbes et al. (2005) found that individuals with highly recurrent lifetime depression (i.e., episodes occurred too frequently for participants to quantify) had a nonsignificant, but large linear (η_p^2 = .17) EMS reactivity pattern. The same study also found significantly smaller than the significant as well as large linear EMS reactivity patterns (η_p^2 = .29; .42) in individuals who could quantify the number of past episodes of MDD (i.e., 1 to 2 depressive episodes; 3 or more episodes, respectively). One study with psychiatric inpatients used affective film clips, rather than IAPS images (Kaviani et al., 2004). The study found that psychiatric inpatients with a history of MDD, but with current depression and anhedonic symptom levels below the sample median demonstrated an exaggerated linear EMS reactivity pattern, whereas inpatients with a current MDD diagnosis and high levels of anhedonia had the typical linear EMS reactivity pattern. Overall, these studies yield findings that support exaggerated linear EMS reactivity patterns for individuals with very low to mild levels of depression (Dichter & Tomarken, 2008; Dichter et al., 2004; Kaviani et al., 2004) and typical linear EMS reactivity patterns for individuals with mild levels of depression, current MDD diagnoses, and recurrent lifetime diagnoses of MDD (Dichter et al., 2004; Forbes et al., 2005; Kaviani et al., 2004); however, not all studies support typical or exaggerated linear patterns in mild and moderately depressed individuals (e.g., Moran, Mehta, & Kring, 2012).

In fact, there is also support for blunted EMS reactivity patterns in individuals with elevated levels of depression symptoms and MDD diagnoses (e.g., Allen et al., 1999; Forbes et al., 2005; Kaviani et al., 2004; Mneimne et al., 2008; Moran et al., 2012). An outpatient sample of young adults with symptoms at or above the severe range on the Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) exhibited a blunted pattern of startle reactivity across emotional images (Moran et al., 2012). This blunted startle reactivity has been replicated in college students with symptoms at or above the mild range on the BDI, but not in college students with low levels of depression symptoms (i.e., symptom levels below 11 on the BDI) who had the typical linear pattern of startle reactivity across emotional images (Mneimne et al., 2008). Currently depressed psychiatric inpatients with symptom levels on the hospital depression and anxiety scale that were above the sample median had a blunted EMS reactivity pattern, and psychiatric inpatients with symptom levels below the sample median had the typical linear EMS reactivity pattern (Kaviani et al., 2004). In another study, blunted EMS reactivity patterns were observed only in psychiatric inpatients with scores in the severe range on the BDI and not in psychiatric inpatients with scores below the severe range (Allen et al., 1999). These studies continue to highlight the mixed EMS reactivity findings in individuals with depression symptoms and MDD diagnoses; specifically, the studies above indicate that individuals with severe (Allen et al., 1999; Moran et al., 2012) depression, but also mild (Mneimne et al., 2008) and moderate (Kaviani et al., 2004) depression sometimes have a blunted EMS reactivity pattern.

Combined, these studies support exaggerated linear, typical linear, and blunted EMS reactivity patterns for mildly depressed individuals (Kaviani et al., 2004; Mneimne et al., 2008), and typical linear or blunted EMS reactivity patterns for moderately depressed individuals (Dichter & Tomarken, 2008; Dichter et al., 2004) and typical linear or blunted EMS reactivity patterns for individuals with severe depression (Allen et al., 1999; Forbes et al., 2005; Kaviani et al., 2004). Characteristics associated with depression that affect physiological reactivity and engagement in the emotions of others, such as empathy, may help explain these differences. A blunted EMS reactivity pattern among individuals with elevated depression symptoms and low levels of empathy would indicate that individuals are not recognizing or experiencing similar emotions to individuals in viewed images; on the other hand, an exaggerated EMS reactivity pattern among individuals with elevated depression symptoms and high levels of empathic tendencies would indicate that they are highly engaged in the emotions of others and have physiological reactions that match the emotion the individual is or is expected to be experiencing.

Although no published study to date has directly investigated associations between depression and EMS reactivity as a function of empathy, or between empathy and EMS reactivity, studies have investigated the association between EMS reactivity and the lack of empathy. Individuals with psychopathic traits typically have very low levels of empathy (Hare, 1965), and studies investigating modulation of startle reactivity across emotional images for these individuals have consistently found a blunted EMS reactivity pattern (e.g., Patrick, Bradley, & Lang, 1993). These findings suggest that affective images do not activate the aversive or appetitive motivational states in individuals with low empathy, thus resulting in a blunted EMS reactivity pattern. We might expect, then, an opposite EMS reactivity pattern in individuals prone to experiencing high levels of empathy during images depicting the emotions of another. Findings indicating a blunted EMS reactivity pattern for individuals who typically have low levels of empathy (e.g., Patrick, Bradley, & Lang, 1993), together with findings supporting a link between high empathy and elevated physiological arousal (e.g., Sonnby-Borgstrom et al., 2003), and findings supporting a positive association between high and low empathy and elevated depression symptoms (Tully et al., 2015) suggest that differences in empathic tendencies will likely affect the degree to which empathy-eliciting cues modulate startle reactivity in individuals with elevated depression symptoms.

1.4 Overview of the Proposed Study and Hypothesis

Findings from several lines of research indicate that some depressed individuals tend to be overly-engaged and overly-reactive to emotional stimuli in their environment (e.g., Joiner et al., 1999), while other depressed individuals tend to be withdrawn and under-reactive to emotional stimuli (e.g., Derntl et al., 2011). Relatively little is known about differences in characteristics of depressed individuals with these two distinct patterns of emotion reactivity; these two groups may differ in degree to which they experience empathy, as greater empathic tendencies are related to higher emotion reactivity and lower empathic tendencies are related to blunted emotion reactivity, relative to moderate levels of empathy (Dimberg et al., 2011; Sonnby-Borgström et al., 2003), and because high and low levels of empathy are associated with high levels of depression (Tully et al., 2015). The purpose of this study was to test the hypothesis that depressed individuals who tend to be highly empathic display the exaggerated EMS reactivity pattern, depressed individuals with low levels of empathy display the blunted

EMS reactivity pattern, and nondepressed individuals with high and low levels of empathy will exhibit the typical linear EMS reactivity pattern.

2 Method

2.1 Participants

One hundred and twenty participants completed the EMS paradigm and had EMS eyeblink reflex responses that met criteria to be included in the analyses. Participants were between the ages of 18 and 24 (M_{age} = 19.54, *SD* = 1.41); 75% were female; and 35% self-identified as "White, not of Hispanic Descent," 34.2% as "Black/African American," 12% as "Hispanic," 8.5% as "Asian," 8.5% as "Multiracial," and 1.7% identified as another ethnicity. Participants were grouped into "White, not of Hispanic Descent," "African American," and "Other" categories for analyses. Participants were recruited through an online research participant pool at Georgia State University for partial fulfillment of research credits for undergraduate psychology courses. Written informed consent was obtained from all participants.

2.2 Materials and Design

2.2.1 Emotion-modulated startle paradigm

Participants completed an EMS paradigm. Procedures used in this study followed standard guidelines (Blumenthal et al., 2005) for image presentation, audio burst, physiological recording and reduction, cleaning, coding, and analyzing data. Participants viewed emotionally valenced (unpleasant and pleasant) and neutral images. An auditory startle stimulus probe was administered at random intervals between 3 and 5 seconds after the onset of a random subset of images. See Figure 1 for a schematic representation of the EMS paradigm.

2.2.2 Selection of images for the emotion-modulated startle paradigm

The purpose of the current study was to elicit modulation in response to images of people's distress (unpleasant valence condition) and to people's positive emotions and experiences (pleasant valence condition); thus, researchers carefully selected images that met these specifications. Researchers selected unpleasant images from the International Affective Picture System[1] (IAPS; Lang et al., 2008) using the following criteria: (a) the mean valence rating, as presented in the IAPS technical manual, was below a two on the Self-Assessment Manikin (SAM) pictorial rating scale, which ranges from 1 (*happy, smiling face*) to 9 (*unhappy, frowning face*) and mean arousal rating was above a six on the SAM, which ranges from 1 (*relaxed, sleepy figure*) to 9 (*an excited, wide-eyed figure*); (b) the image contained a least one person experiencing a distressing emotion (e.g., pain or fear) or a distressing event (e.g., a gun was pointed at an individual whose back was turned to the camera so no emotion could be discerned); and (c) no person in the image was experiencing a positive emotion. The pleasant images were selected based on the following criteria: (a) the mean valence and mean arousal ratings were above six, (b) the image contained at least one person experiencing a positive emotion or event, (c) no person in the image was experiencing a negative emotion. The neutral images were selected on the following criteria: (a) the mean valence rating was between four and six and mean arousal rating was below five. Researchers endeavored to find neutral images that

---

[1] *Selected Images*
Neutral Image IAPS Numbers: 2383*, 2570, 2396, 2397*, 2487, 2495*, 2305, 2579, 7010*, 7004, 7006*, 7000, 7217, 7185*, 7035, 7050, 5390, 5520, 7009
Unpleasant Image IAPS Numbers: 2683, 3053*, 3266*, 3530*, 6350*, 6520, 8485 9050, 9075, 9163, 9250, 9254, 9410*, 9413, 9414*, 9908, 2811, 2981, 9300
Pleasant I IAPS Numbers: 5621, 8030*, 8158, 8179, 8186*, 8190*, 8191, 8300, 8341, 8370, 8490, 8034, 8185*, 8080*, 8200, 8492*, 8206, 8193, 8180
Asterisks indicate images with a startle probe.

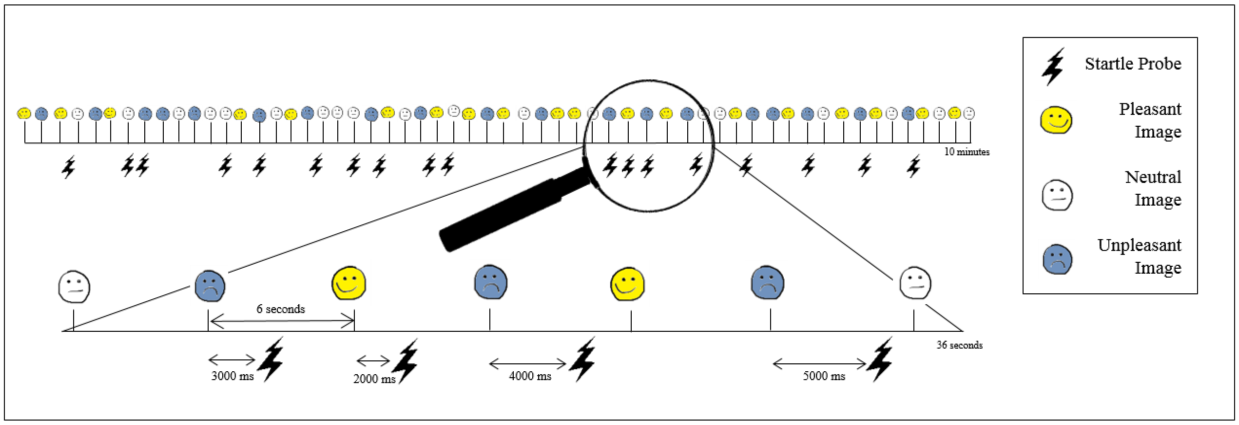


Figure 1. Schematic representation of the sequence of images and startle probes.
This figure is a representation of one participant's exposure to the EMS paradigm. Fifty-seven images were presented for 6 seconds each. They were arranged in randomly presented 7-image blocks that contained approximately equal numbers of pleasant, neutral, and unpleasant images. The audio bursts were presented during the same 18 images (six for each valence) across participants and occurred at random intervals of 2, 3, 4 or 5 seconds after image onset.

included at least one person, but only eight IAPS images met our criteria, so 11 of our 19 images contain inanimate objects rather than people.

Two research assistants independently identified images that met these criteria. When the researchers disagreed about whether or not the image met these criteria, a third researcher made the decision. Nineteen each of the pleasant and unpleasant images were then selected to maximize valence ratings and equate arousal ratings across the two conditions. This selection process resulted in a need to include one unpleasant image that did not contain a person; however, the startle probe was not administered while participants viewed this image.

Table 1 displays IAPS mean valence and arousal ratings by group for the final set of images selected for the study and the results of ANOVAs used to test for group differences in these ratings. As expected, the three valence conditions differ significantly in valence ratings, with pleasant images having significantly higher ratings than neutral images and neutral images having significantly higher ratings than unpleasant images. The pleasant and unpleasant

Table 1. Means and Standard Deviations for the Mean Valence and Arousal Ratings from the IAPS Technical Manual and ANOVA Tests for Group Differences in Valence

	Valence Ratings					
	Full Image Set			Startle Probe Image Set		
	N	*Mean*	*SD*	*N*	*Mean*	*SD*
Pleasant	19	7.09[a]	.56	6	7.49[a]	.39
Neutral	19	5.06[b]	.25	6	4.95[b]	.16
Unpleasant	19	2.08[c]	.42	6	1.69[c]	.28
F	650.58			590.40		
df	2, 54			2, 15		
p	<.001			<.001		

	Arousal Ratings					
	Full Image Set			Startle Probe Image Set		
	N	*Mean*	*SD*	*N*	*Mean*	*SD*
Pleasant	19	6.63[a]	.40	6	6.95[a]	.43
Neutral	19	2.89[b]	.60	6	2.68[b]	.60
Unpleasant	19	6.55[a]	.38	6	6.90[a]	.27
F	395.01			174.94		
df	2, 54			2, 15		
p	<.001			<.001		

Note. Superscripts indicate groups that differ significantly according the Tukey B HSD posthoc test.

conditions do not differ significantly in arousal ratings and have significantly higher arousal ratings than the neutral condition.

2.2.3 Image presentation

The 57 images (19 pleasant, 19 neutral, and 19 unpleasant) were presented in color on a 10x13 inch computer screen. Participants sat with their eyes approximately two feet away from the screen. The images were presented in eight blocks. Each block contained seven or eight pseudorandomly selected images with two or three images per valence. The same blocks of images were used across participants, and the blocks were presented in random order. Each image was displayed for six seconds.

2.2.4 Startle stimulus

Consistent with the published EMS guidelines (Blumenthal et al., 2005), the acoustic startle probe was a 100 dB and 50 ms burst of white noise with an instantaneous rise time. White noise is preferable because it does not contain periodic acoustic content that may convey meaningful signals. The startle audio burst was presented in one-third of the images from each valence and at random intervals after the image onset (2, 3, 4, and 5 seconds). The presentation of the images and acoustic stimuli was controlled by the DirectRT program (Empirisoft Corp., New York City, NY, USA).

2.2.5 Physiological recording and reduction

Electrical current associated with muscle movement of startle eyeblinks was measured with two 4-mm silver-silver chloride (Ag-AgCl) electrodes that were filled with BioPac Signa gel (Parker Laboratories, Inc., Fairfield, NJ, USA), a highly conductive electrode gel. The electrodes were placed 1 to 2 cm lateral to each other under the right lower eyelid on the orbicularis oculi muscle. Interelectrode impedance was measured to ensure proper contact between each electrode and the skin and equal electrical current across the two electrodes. Impedance had a mean of 6.91 Ω (ohms; *SD*= 5.77) in our sample; 89% of participants had an impedance at or below 10 Ω, which is the suggested impedance recommended for EMS studies (Blumenthal et al., 2005).

A BIOPAC MP150 data acquisition system was used to record and quantify the raw Electromyography (EMG) signals using AcqKnowledge software, version 4.1 for Windows (BIOPAC Systems, Inc., Camino Goleta, CA). Data were amplified online by a factor of 5000 and filtered online to minimize noise using high and low cutoffs of 500 Hz and 1 Hz, respectively. EMG signals were sampled and digitized online at a rate of 1000 Hz using a 16-bit analog to digital converter and then rectified and integrated offline with a 1 kHz sampling rate. Finally, the digitized startle eyeblink reflex magnitudes were scored and analyzed offline.

2.2.6 Eyeblink startle reflex calculation, coding, and reliability

Our procedure for calculating startle eyeblink amplitudes followed recommendations set forth in Blumenthal and colleagues' (2005) committee report. Response parameters were defined and identified using the AcqKnowledge software. See Figure 2 for a depiction of startle eyeblink response parameters. Startle eyeblinks can occur between 20 to 150 ms after the onset of an audio burst, which is considered the trial period. Baseline activity was defined as the average EMG activity during the 20 ms period following the presentation of the audio burst, i.e., before the trial period. The onset of a startle eyeblink was defined as the point during the trial period when the EMG activity exceeded a minimum threshold of two times the value of the mean of the EMG activity during the baseline period. Eyeblink amplitude was calculated by subtracting the average baseline EMG activity from the maximum peak value.

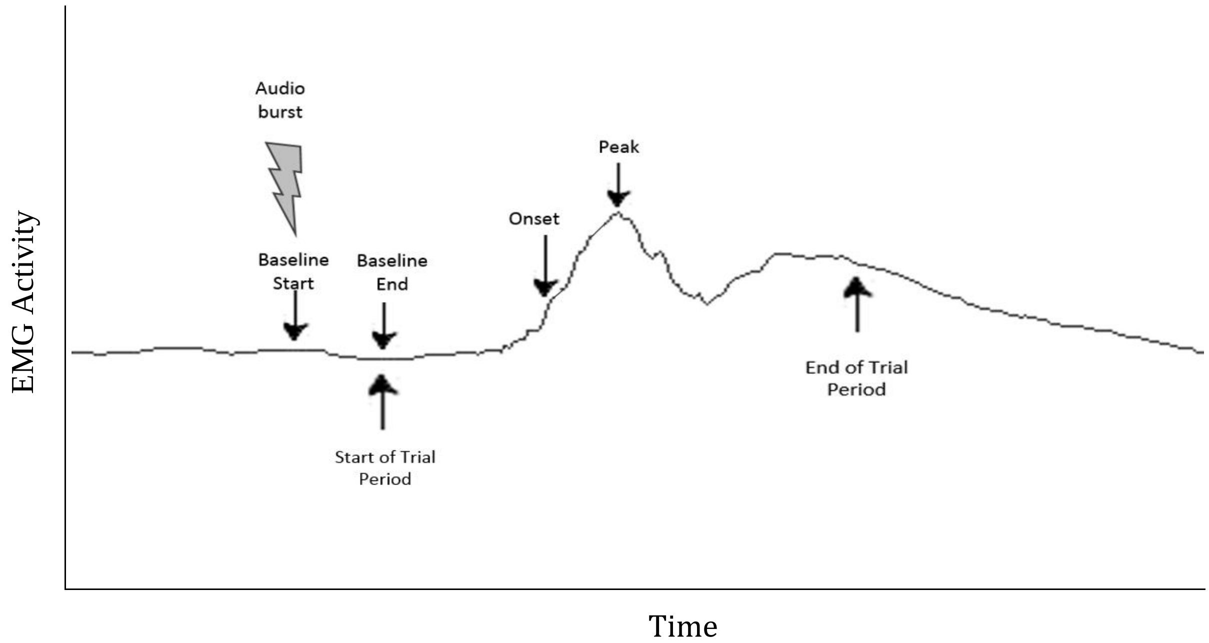


Figure 2. Startle eyeblink example with markings for response parameters.
This figure is an example of one trial for one participant with markings for the beginning and end of the baseline period, the beginning and end of the trial period and the onset for an eyeblink startle response.

The magnitude of the startle eyeblink reaction was then calculated from the peak amplitude of the startle eyeblink according to the formula put forth in the EMS paradigm guidelines (Blumenthal et al., 2005). EMS paradigm guidelines recommend the use of startle magnitude over startle amplitude, as this value accounts for nonresponse trials. First, the peak amplitude was z-transformed within participants. These values were then multiplied by the probability of eliciting a response for each valence condition, which is defined as the total number of detected responses divided by the total number of images presented from each valence (i.e., six) after removing trials contaminated with artifact (i.e., "rejected"); thus, the magnitude of the startle eyeblink includes a zero value for nonresponse trials.

Detection of the response parameters by the AcqKnowledge software was largely accurate; 3.3% of trials in the study's full sample were changed upon visual inspection, as some noise was misidentified as a startle eyeblink. Visual inspection of each trial was completed by trained, reliable coders, including one graduate student and three undergraduate students. For each participant, coders first observed electrical activity throughout the paradigm to get a sense for the electrical activity of the participant's startle eyeblink. Coders then determined whether the trial period contained a discernible startle eyeblink response. Startle eyeblinks were distinguished from spontaneous eyeblinks and random, inexplicable change in EMG activity, or noise (see Appendix 1 for an example of a rejected trial). Trials in which these artifacts interfered with the ability to detect a startle eyeblink response were "rejected." Appendix A displays the study's procedures for cleaning and coding these trials. Coders indicated whether a trial is rejected ("0" for not rejected and "1" for rejected) and completed these ratings separate from other coders and blind to valence condition.

Byrt's (1993) kappa was used to quantify the levels of agreement between coders' codings for "rejecting" trials; this statistic corrects for agreement that occurs by chance. The graduate student coder served as the master reliability coder for initial and drift reliability. Coders were trained on coding procedures (see Appendix A) until they achieved a minimum reliability with each other with a κ greater than or equal to .80, which indicates very strong agreement (Krippendorff, 2012). Participants were randomly assigned to coders, and one randomly selected participant of every five was coded by both the undergraduate and graduate student coders to calculate agreement.

Drift inter-rater reliability was calculated for every ten participants to ensure continued agreement between coders. All drift reliabilities for all coders were above .80 and no remediation plan was required. Reliabilities for all three undergraduate student coders were all above a κ of .90 and are listed in Table 2.

If a trial was “rejected” by a coder because artifacts interfered with the ability to detect a startle eyeblink response, the trial was excluded from analyses. A participant was dropped from analyses if factors interfered with collection of valid data, for example if their eyes were closed during the paradigm, or if the participant was a "nonresponder". A participant was considered a "nonresponder" if less than 50% of his or her startle trials (i.e., trials with an audio burst) in one or more of the valence conditions (i.e., three or more in unpleasant, pleasant, and/or neutral) had a startle eyeblink that met the criteria. Twenty-seven (*n*=45) percent of participants who completed the startle paradigm were nonresponders and thus filtered out of the main analyses.

Table 2. Reliabilities (Byrt’s kappa) for “Reject” Trials

	Coder 1		Coder 2		Coder 3	
Scored Variable	Training	Drift	Training	Drift	Training	Drift
Reject	.92	.91	.98	.91	.96	.93

Note. Drift reliability is based on the average of all reliabilities conducted after initial reliability criteria was met (i.e., κ greater than or equal to .80).

2.3 Questionnaires

2.3.1 Depression symptoms

Participants completed the *Inventory of Depression and Anxiety Symptoms* (IDAS; Watson et al., 2007), a self-report measure of current depression symptoms. The IDAS is composed of 64 items that assess feelings, sensations, problems, and experiences for the past two weeks on a Likert-type scale from 1 (“*not at all”*) to 5 (*“extremely*”). The general depression scale was used in this study; there are 20 items measuring dysphoric mood, appetite loss, insomnia, lack of energy, suicidality, and reversed scored well-being items. Items were summed and a prorated total score was used for nine participants who completed 95% of the measure. The general depression scale had strong internal consistency reliability (coefficient alpha, α = .88) and test-retest reliability (*r*=.83) in a sample of young adults (Watson et al., 2007). The internal consistency reliability in our sample was similarly strong (α=.91). This scale has good convergent and divergent validity in psychiatric and student samples, with stronger correlations with the Beck Depression Inventory-II (.83; BDI-II; Beck, Steer, & Brown, 1996) than the Beck Anxiety Inventory (.69; BAI; Beck & Steer, 1990).

2.3.2 Empathy

Participants also completed the *Interpersonal Reactivity Scale* (IRI; Davis, 1980; 1983), a self-report rating scale. Out of the three scales completed, two were used in this study. Cognitive empathy was measured with the perspective-taking scale, which assesses tendencies to adopt the mindset of another person. The empathic concern scale assesses feelings of warmth, compassion, and concern for other's distress, and was used as a measure of affective empathy. Each scale has seven items. An example of a perspective-taking item is, "When I'm upset at someone, I usually try to 'put myself in his shoes' for a while", and an example of an empathic concern item is, "I often have tender, concerned feelings for people less fortunate than me". Participants rated items on a Likert scale from 0 (*Does not describe me well*) to 4 (*Describes me very well*). Items were summed for each scale and a prorated total score was used for one participant who completed 86% of the measure. Two participants were not included in analyses because they completed less than 75% of the measure. The perspective-taking and empathic concern scales are correlated, but distinct, and have adequate test-retest reliability and internal consistency in the normative sample (Davis, 1980; Davis, 1983), and similar internal consistency reliability in our sample (α=.79; .76, respectively).

2.3.3 Self-assessment manikin

Participants rated the valence of the affective responses and the intensity of their arousal to the startle paradigm images using the Self-Assessment Manikin (SAM; Lang, 1980) pictorial rating scale. The images were presented once more after the completion of the EMS paradigm, with the valence and then the arousal SAM rating scales presented below one image at a time. The scale for valence ranged from 1 (*happy, smiling face*) to 9 (*unhappy, frowning face*) and for arousal ranged from 1 (*relaxed, sleepy figure*) to 9 (*an excited, wide-eyed figure*). The SAM has been used effectively to rate reactions to the IAPS images, including in EMS paradigms (Lang, Greenwald, Bradley, & Hamm, 1993).

2.4 Procedure

The study took place in the FEELINGS Lab at Georgia State University (GSU) and was approved and monitored by the Institutional Review Board (IRB) at GSU. Upon arrival to the laboratory, participants completed IRB-approved consent procedures. The participants then completed questionnaires and rating scales (i.e., demographic form, IDAS, and IRI) before completing the EMS paradigm. The participants completed additional rating scales that were unrelated in the current study. Following completion of the questionnaires, participants were prepped for Electromyogram (EMG) recording. Preparation involved cleansing the skin with an alcohol swab and an abrasive pad, carefully placing the conductive gel-filled electrodes, and checking impedance with an impedance meter to ensure proper connectivity between the skin and electrode. After obtaining impedance below threshold of 10 kΩ (ohms), the research assistant left the room to begin recording the EMG signal. Then, the participant completed the EMS paradigm. After completion of the paradigm, participants rated valence and arousal of the 57 EMS images using the SAM rating scale.

2.5 Data Analytic Plan

The data analytic plan included three steps. First, I present descriptive statistics and descriptive analyses to examine how the study variables are related to one another. I used chi-square tests and *t* tests to test for significant differences in the study's predictor grouping variables, top and bottom quartiles for depression, empathic concern, and empathic perspective-taking scores, by gender, age, race/ethnicity, and whether or not the participants were dropped from analyses because they were nonresponders in the EMS paradigm. Bivariate correlations were used to test associations between the continuous variables, startle magnitudes in the three conditions, depression, empathic concern, and empathic perspective-taking, in the full sample.

Second, manipulation checks were conducted using four repeated measures ANOVAs to check that the effect of valence category on arousal and valence ratings did not differ for depressed and non-depressed individuals as a function of high and low empathy. One repeated measures ANOVA was conducted to examine whether there was a significant linear effect of image valence on startle magnitude in the full sample. Third, the study's hypotheses were evaluated with tests of the effect of the 3-way interaction between depression, empathy, and image valence on startle magnitude. I planned to probe the nature of significant interaction by testing the linear effect of image valence on startle magnitude within each of the depression by empathy grouping variables. In this study, given our limited power, I also followed up nonsignificant interactions in the same way, focused on effect sizes to explore the nature of the effects, and cautiously interpret the findings.

Analyses were performed using SPSS version 21 for Windows (IBM Corp., Armonk, NY, USA). Five repeated measures analyses of variance (ANOVA) were calculated to test the study's manipulations, and two repeated measures ANOVA were calculated to test the study's hypothesis. The within-subjects factor for all ANOVAs was *image valence* with three levels (pleasant, neutral, and unpleasant). Each between-subjects grouping variable (i.e., depression, perspective-taking, and empathic concern) was separated into low and high groups; the high groups included individuals scoring at or above the upper quartile and the low groups included individuals with scores below the bottom quartile. Estimates of effect size were reported as partial eta squared (η_p^2) with $0.01 \leq \eta_p^2 < 0.06$ determined to be a small effect size, $0.06 \leq \eta_p^2 < 0.14$ a medium effect size, and $\eta_p^2 \geq 0.14$ a large effect size (Cohen, 1988).

Assumptions of ANOVA were checked and the following tests were conducted: Kolmogorov-Smirnov test (normality), Levene's test (homogeneity of variance), and Mauchly's test (sphericity). If the assumption of normal distribution of the dependent variable or of homogeneity of variance were violated, square root, inverse, and logarithmic transformations of the data were used to try to correct this violation. If the assumption of sphericity was violated, I applied the Greenhouse-Geisser correction ($\varepsilon = .79$), as recommended by Girden (1992).

3 RESULTS

3.1 Descriptive statistics

Tables 3, 4, and 5 present descriptive statistics for the study's categorical and continuous variables for the full sample and each of the experimental groups.

Table 3. *Descriptive Statistics for Demographic Variables: Frequencies, Means, and Standard Deviations*

		Full Sample	Depression		Perspective-Taking		Empathic Concern	
			Low	High	Low	High	Low	High
	N	120	29	30	36	37	35	36
		Mean (*SD*) or Frequency						
	Age	19.54 (1.41)	19.32 (1.31)	19.83 (1.66)	19.28 (1.19)	19.78 (1.68)	19.46 (1.31)	19.63 (1.50)
	Gender (% Female)	75%	75.9%	83.3%	77.8%	73%	60%	80.6%
Race/ ethnicity	Black	34.2%	42.9%	30%	41.7%	32.4%	38.2%	45.7%
	White	35%	28.6%	43.3%	30.6%	38.2%	44.1%	25.7%
	Other	30.8%	28.6%	26.7%	27.8%	29.4%	17.6%	28.6%

3.2 Group Differences

To determine whether covariates should be included in the main analyses, tests (i.e., independent samples *t*-tests and chi-square analyses) of differences in the study's primary variables by demographic variables were conducted. In the full sample of EMS responders (N = 120), there were no significant differences between men and women in race, $\chi^2(2) = 0.05$, p = .98, V = .02, or age, $t(117) = 1.48$, p = .14, d = .27, and there were no differences between racial groups in age, $\chi^2(12) = 10.67$, p = .56, V = .21. Tests of differences revealed no significant differences between individuals with high depression and individuals with low depression in gender, $\chi^2(1) = 0.51$, p = .48, V = .09, race, $\chi^2(2) = 1.55$, p = .46, V = .16, or age, $t(56) = -1.30$, p = .20, d = -.35. Individuals with high levels of perspective-taking and individuals with low perspective-taking tendencies did not differ in gender, $\chi^2(1) = 0.23$, p = .63, V = .06, race, $\chi^2(2)$ = 0.73, p = .70, V = .10, or age, $t(63.04) = -1.46$, p = .15, d = -.37. Individuals with high levels of empathic concern did not differ from individuals with low levels of empathic concern in gender,

$\chi^2(1) = 3.60$, $p = .06$, $V = .23$, race, $\chi^2(2) = 2.80$, $p = .25$, $V = .20$, or age, $t(68) = -0.51$, $p = .61$, $d = -.12$. In sum, the study's experimental groups did not differ significantly in the study's demographic variables, thus, covariates were not included in the main analyses.

Independent samples t-tests analyses were conducted to determine if the quartile groups differed significantly in levels of empathy and depression. Mean levels of empathic concern did not differ significantly between the low empathic concern and high and low depression groups, $t(16) = -0.66$, $p > .05$, $d = -.33$, or between the high empathic concern and high and low depression groups, $t(17) = -0.73$, $p = .47$, $d = -.36$. There were no significant differences in the mean level of depressive symptoms between the high depression and low and high empathic concern groups, $t(16) = -0.80$, $p = .44$, $d = -.40$, or between the low depression and low and high empathic concern groups, $t(17) = -1.28$, $p = .22$, $d = -.62$. Similarly, levels of empathic perspective-taking did not differ significantly between the low empathic perspective-taking and high and low depression groups, $t(17) = -.78$, $p = .45$, $d = -.38$, or between the high empathic perspective-taking and high and low depression groups, $t(19) = -2.05$, $p > .05$, $d = -.94$. There were no significant differences in the level of depressive symptoms between the high depression and low and high empathic perspective-taking groups, $t(18) = -1.05$, $p = .31$, $d = -.49$, or between the low depression and low and high perspective-taking groups, $t(18) = 1.14$, $p = .27$, $d = .54$.

Chi-square and independent samples *t*-tests analyses were used to test for differences in study's categorical and continuous variables, respectively, for the participants who were dropped from analyses because they were nonresponders (n=45) in the EMS paradigm and the remainder of the sample (n=120). Chi-square tests yielded no significant differences in gender, $\chi^2(1) = 1.00$, $p = .33$, $V = .08$. The responder and nonresponder groups differed in race, $\chi^2(2) = 7.45$, $p = .02$, $V = .22$. Participants who reported their race as Black or another racial/ethnic minority were more likely to be nonresponders than participants who reported their race as White. Independent samples *t*-tests yielded no significant differences in age, $t(161) = 1.12$, $p = .27$, $d = .18$, depression symptoms, $t(165) = 1.48$, $p = .14$, $d = .23$, perspective-taking tendencies, $t(161) = -0.37$, $p = .72$, $d = -.06$, or empathic concern tendencies, $t(161) = -1.61$, $p = .11$, $d = -.25$. As such, participants lost due to their nonresponder status only differed by race from those who were retained in the main analysis.

Table 4. *Descriptive Statistics of Primary Study Variables: Means, Standard Deviations, and Observed Ranges*

		Full Sample		Depression		Perspective-Taking		Empathic Concern	
				Low	High	Low	High	Low	High
	N	120		29	30	36	37	35	36
		Observed Range	Mean (*SD*)						
	Depression	22.00-88.42	42.26 (14.38)	27.24 (2.21)	62.75 (10.26)	42.21 (14.63)	43.96 (17.11)	38.73 (12.34)	45.25 (15.40)
	Perspective Taking	7.00-28.00	18.15 (4.70)	17.82 (4.76)	19.00 (5.52)	12.67 (2.41)	23.54 (2.16)	16.02 (4.98)	19.28 (5.19)
	Empathic Concern	7.00-28.00	20.55 (4.80)	19.52 (5.09)	21.57 (4.86)	18.33 (5.59)	22.24 (4.53)	14.63 (3.21)	25.81 (1.45)
Image Arousal Ratings	Pleasant	1.00-9.00	4.59 (2.30)	4.47 (2.47)	3.99 (2.35)	4.20 (2.20)	4.72 (2.34)	3.91 (2.17)	4.87 (2.15)
	Neutral	1.00-6.00	1.67 (1.02)	1.43 (0.50)	1.65 (0.86)	1.64 (1.11)	1.72 (1.02)	1.46 (0.78)	1.68 (0.91)
	Unpleasant	1.00-8.68	5.53 (2.08)	5.42 (2.54)	5.40 (2.07)	5.02 (2.10)	5.73 (2.27)	4.82 (2.20)	6.12 (1.79)
Image Valence Ratings	Pleasant	1.05-9.00	6.31 (1.32)	6.46 (1.52)	5.82 (1.32)	5.98 (1.37)	6.34 (1.27)	5.98 (1.30)	6.24 (1.38)
	Neutral	1.00-8.47	5.15 (0.95)	5.05 (0.91)	5.00 (1.04)	5.00 (1.01)	5.20 (1.09)	5.02 (0.83)	4.92 (1.06)
	Unpleasant	1.00-5.26	2.18 (0.89)	2.26 (1.02)	2.29 (0.87)	2.17 (0.85)	2.14 (0.99)	2.72 (1.14)	1.82 (0.64)
Startle Magnitude	Pleasant	-0.83-0.96	-0.09 (0.29)	-0.18 (0.29)	-0.06 (0.24)	-0.08 (0.35)	-0.11 (0.22)	-0.06 (0.36)	-0.11 (0.23)
	Neutral	-0.64-0.92	0.08 (0.28)	0.07 (0.23)	0.08 (0.25)	0.06 (0.27)	0.08 (0.30)	0.02 (0.24)	0.10 (0.27)
	Unpleasant	-0.57-0.83	0.07 (0.32)	0.20 (0.30)	0.02 (0.27)	0.10 (0.32)	0.10 (0.31)	0.09 (0.35)	0.08 (0.28)

Note. Participants who completed the EMS paradigm and are "responders" are included in the full sample. Startle magnitude for each valence condition is the z-transformation of the peak amplitude of the startle eyeblink multiplied by the probability of eliciting a response in each valence. The magnitude values are expressed in microvolts (μV).

Table 5. *Descriptive Statistics of Primary Study Variables*

		Low Depression, High Perspective Taking	Low Depression, Low Perspective Taking	High Depression, High Perspective Taking	High Depression, Low Perspective Taking
	N	10	10	11	10
		Mean (*SD*)			
	Depression	26.60 (2.88)	27.80 (1.69)	66.58 (9.77)	60.81 (11.92)
	Perspective Taking	23.20 (2.04)	12.70 (1.95)	25.09 (2.17)	13.10 (2.38)
Startle Magnitude	Pleasant	-0.24 (0.22)	-0.15 (0.20)	-0.13 (0.12)	-0.004 (0.36)
	Neutral	0.17 (0.23)	-0.03 (0.19)	0.08 (0.29)	0.09 (0.27)
	Unpleasant	0.15 (0.30)	0.26 (0.31)	0.05 (0.28)	-0.02 (0.31)

Note. Participants who completed the EMS paradigm and are "responders" are included in each group. Startle magnitude for each valence condition is the z-transformation of the peak amplitude of the startle eyeblink multiplied by the probability of eliciting a response in each valence. The magnitude values are expressed in microvolts (μV).

3.3 Correlations among study variables

Bivariate (Pearson's) correlations for continuous variables were calculated on data from the full sample and are presented in Table 6. Higher startle magnitudes during the presentation of unpleasant images were associated with lower startle magnitudes during the presentation of neutral and pleasant images. Higher startle magnitude during the presentation of neutral images was associated with higher startle magnitude during the presentation of pleasant images.

Table 6. *Correlations among Continuous Study Variables*

					Startle Magnitude		
		Depression	Perspective Taking	Empathic Concern	Pleasant	Neutral	Unpleasant
	Perspective Taking	.13					
	Empathic Concern	.17	.37*				
Startle Magnitude	Pleasant	.11	-.10	-.08			
	Neutral	.03	.05	.08	-.39*		
	Unpleasant	-.15	.02	-.001	-.55*	-.49*	

Note. *$p < .001$.

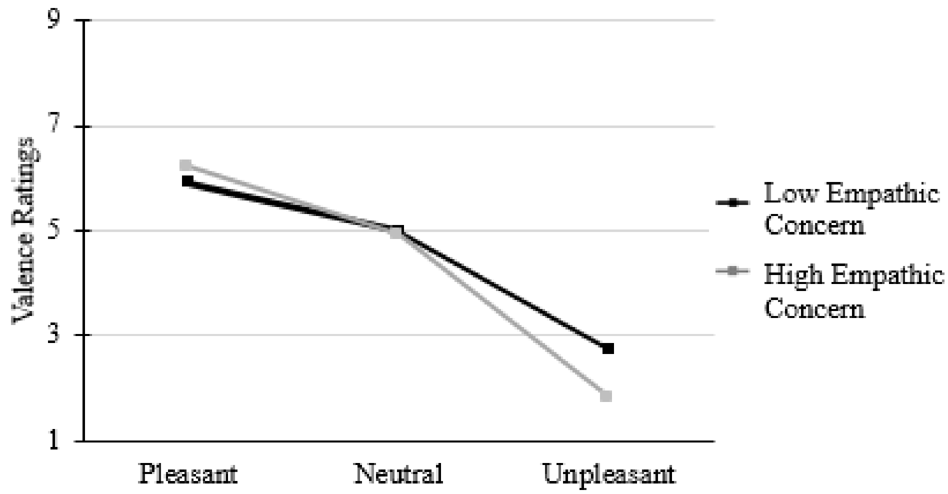
3.4 Manipulation checks

Figures 4 and 5 present ratings of the images' valence and arousal for depressed and non-depressed individuals as a function of high and low empathy, respectively. Figure 3 presents the linear effect of image valence category on valence ratings for individuals with high and low empathic concern. Figure 6 presents the effect of image valence on startle magnitude for the full sample.

3.4.1 Image ratings for valence

One outlier for valence ratings of unpleasant images was removed because the standardized residual was greater than ±3 standard deviations. Valence ratings for neutral images were not normally distributed for individuals with high depression, *D*(29) = .24, $p < .001$, individuals with low depression, *D*(26) = .28, $p < .001$, individuals with low perspective-taking tendencies, *D*(35) = .25, $p < .001$, individuals with high perspective-taking tendencies, *D*(35) = .21, $p < .001$, individuals with low levels of empathic concern, *D*(32) = .32, $p < .001$, or individuals with high levels of empathic concern, *D*(33) = .21, $p < .001$. Valence ratings were not normally distributed for unpleasant images for individuals with low depression, *D*(26) = .22, $p < .01$, individuals with high perspective-taking tendencies, *D*(35) = .19, $p < .01$, or for individuals with high levels of empathic concern, *D*(33) = .17, $p < .05$. Valence ratings were also not normally distributed for pleasant images for individuals with high perspective-taking tendencies, *D*(35) = .17, $p < .05$. Following square root, inverse, and logarithmic transformations, distributions still violated the assumption of normality and some of the previously normally-distributed variables became non-normally distributed. Since violations of normality have a relatively small effect on the F-statistic (Glass, Peckham, & Sanders, 1972) and data transformations were not successful, analyses were conducted with untransformed variables.

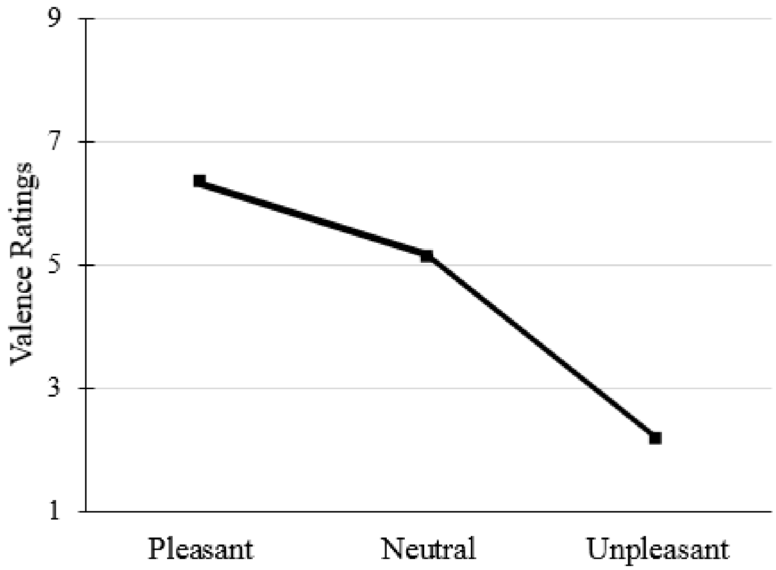
The 3-way interaction of depression, perspective-taking, and image valence category on valence ratings was not significant, *F*(1.48, 50.44) = 0.28, $p = .69$, $\eta_p^2 = .01$, observed power = .09. The 2-way interactions of depression and image valence category, *F*(1.48, 50.44) = 1.51, $p = .23$, $\eta_p^2 = .04$, observed power = .27, and perspective-taking and image valence category, *F*(1.48, 50.44) = 0.18, $p = .77$, $\eta_p^2 = .01$, observed power = .07, on valence ratings were also not significant. The 3-way interaction of depression, empathic concern, and image valence category on valence ratings was not significant, $F(2, 60) = 2.64$, $p = .08$, $\eta_p^2 = .08$, observed power = .51. The 2-way interaction of depression and image valence category on valence ratings was also not significant, $F(2, 60) = 2.59$, $p = .08$, $\eta_p^2 = .08$, observed power = .50. The 2-way interaction of empathic concern and image valence category on valence ratings was significant, $F(2, 60) = 6.09$, $p < .01$, $\eta_p^2 = .17$, observed power = .87. For individuals with low empathic concern and high empathic concern, planned contrast tests examining the polynomial trend for both groups revealed a significant linear effect of image valence category on valence ratings (i.e., pleasant valence ratings < neutral valence ratings < unpleasant valence ratings), $F(1, 30) = 102.40$, $p < .001$, $\eta_p^2 = .77$, observed power = 1.00; $F(1, 33) = 246.85$, $p < .001$, $\eta_p^2 = .88$, observed power = 1.00, respectively. Thus, the expected linear increase in valence ratings for the pleasant to the neutral to the unpleasant images was found in individuals with high and low empathy, but the linear effect was slightly but significantly stronger in participants with high empathic concern. These effects are depicted in Figure 3. In the full sample, there was a significant main effect of image valence category on valence ratings, $F(1.54, 177.35) = 531.15$, $p < .001$, $\eta_p^2 = .82$ (see Figure 4). Planned contrast tests examining the polynomial trend revealed a significant linear effect of image valence category on valence ratings as expected (i.e., pleasant valence ratings < neutral valence ratings < unpleasant valence ratings), $F(1, 115) = 650.68$, $p < .001$, $\eta_p^2 = .85$. The main effect of depression, $F(1, 34) = 0.33$, $p = .57$, $\eta_p^2 = .01$, observed power = .09, perspective-taking, $F(1, 34) = .68$, $p = .41$, $\eta_p^2 = .02$, observed power = .13, and empathic concern $F(1, 30) = 0.34$, $p = .57$, $\eta_p^2 = .01$, observed power = .09, on valence ratings were not significant.



	Mean (*SD*)		
	Pleasant	Neutral	Unpleasant
Low Empathic Concern	5.92 (1.33)	4.99 (1.33)	2.75 (1.15)
High Empathic Concern	6.21 (1.39)	4.92 (1.08)	1.81 (0.65)

Figure 3. Depiction of the effect of empathic concern and image valence on valence ratings.

In sum, the overall pattern of valence ratings across image valence categories did not differ between participants with high and low depression, participants with high and low empathic perspective-taking, or participants with high depression and low depression as a function of high and low empathic perspective-taking or empathic concern. The expected linear effect of image valence category on valence ratings was found for participants with high and low empathic concern, but the linear effect was slightly, but significantly stronger for individuals with high levels of empathic concern. For the full sample of EMS responders, pleasant images had higher ratings than neutral images and neutral images had higher ratings than unpleasant images. Together, these data indicate that as images increased in negativity (i.e., pleasant < neutral < unpleasant), valence ratings increased, as expected; thus, supporting the emotion manipulation.



Mean (*SD*)		
Pleasant	Neutral	Unpleasant
6.30 (1.32)	5.15 (0.96)	2.18 (0.89)

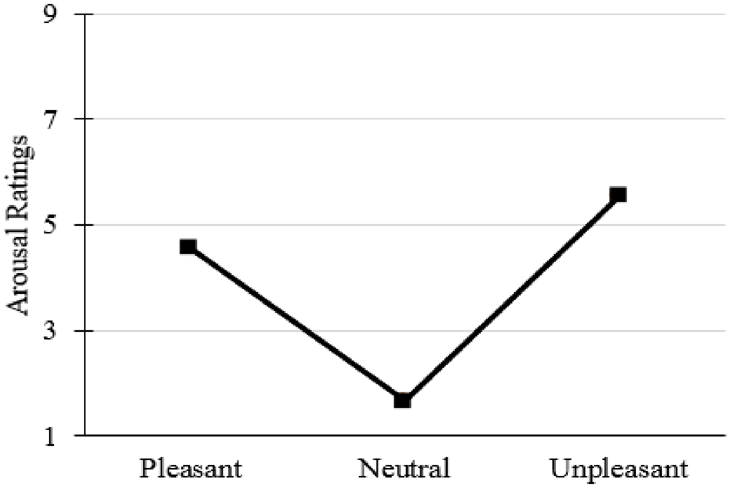
Figure 4. Depiction of the main effect of image valence on valence ratings for the full responding sample.

3.4.2 Image ratings for arousal

Two outliers for arousal ratings of neutral images removed as their standardized residuals were greater than ±3 standard deviations. Arousal ratings for neutral images were not normally distributed for the individuals with high depression, *D*(29) = .24, *p* < .001, individuals with low depression, *D*(26) = .20, *p* < .01, individuals with high perspective-taking tendencies, *D*(35) = .25, *p* < .001, individuals with low perspective-taking tendencies, *D*(35) = .25, *p* < .001, individuals with high of empathic concern, *D*(33) = .23, *p* < .001, or individuals with low levels of empathic concern, *D*(32) = .29, *p* < .001. Arousal ratings were also not normally distributed for unpleasant images for individuals with high perspective-taking tendencies, *D*(35) = .17, *p* < .01, and individuals with low perspective-taking tendencies, *D*(33) = .33, *p* < .001. Once again, I used untransformed variables since distributions violated normality even after square root, inverse, and logarithmic transformations and because the F-statistic is relatively unaffected by violations of normality (Glass et al., 1972).

The 3-way interaction of depression, perspective-taking, and image valence on arousal ratings was not significant, $F(2, 33) = 2.29$, $p = .12$, $\eta_p^2 =.12$, observed power = .43. The 2-way interactions of depression and image valence, $F(2, 33) = 0.82$, $p = .45$, $\eta_p^2 =.05$, observed power = .12, and perspective-taking and image valence, $F(2, 33) = 0.25$, $p = .78$, $\eta_p^2 =.02$, observed power = .09, on arousal ratings were also not significant. The 3-way interaction of depression, empathic concern, and image valence on arousal ratings was not significant, $F(2, 29) = 2.71$, $p = .08$, $\eta_p^2 = .16$, observed power = .49. The 2-way interactions of depression and image valence, $F(2, 29) = 0.65$, $p = .53$, $\eta_p^2 =.04$, observed power = .15, and empathic concern and image valence, $F(2, 29) = 2.28$, $p = .12$, $\eta_p^2 =.14$, observed power = .43, on arousal ratings were also not significant. In the full sample, there was a significant main effect of image valence on arousal ratings, $F(2, 228) = 200.69$, $p < .001$, $\eta_p^2 = .64$ (see Figure 5). Planned contrast tests examining the polynomial trend revealed a significant quadratic effect of valence on arousal ratings as expected (i.e., pleasant arousal ratings > neutral arousal ratings < unpleasant arousal ratings), $F(1, 114) = 391.91$, $p < .001$, $\eta_p^2 = .78$. The main effect of depression, $F(1, 34) = 0.01$, $p = .92$, $\eta_p^2 =.000$, observed power = .05, perspective-taking, $F(1, 34) = 1.32$, $p = .26$, $\eta_p^2 =.04$, observed power = .20, and empathic concern $F(1, 30) = 1.07$, $p = .31$, $\eta_p^2 =.03$, observed power = .17, on arousal ratings were not significant.

In sum, the overall pattern of arousal ratings across image valences did not differ between participants with high and low depression, participants with high and low empathic perspective-taking and empathic concern, or participants with high depression and low depression as a function of high and low empathic perspective-taking or empathic concern. For the full sample of EMS responders, the arousal ratings were higher for pleasant and unpleasant than neutral images. These data, then, indicate the images were equally arousing in each of the study groups, which supports the emotion manipulation.

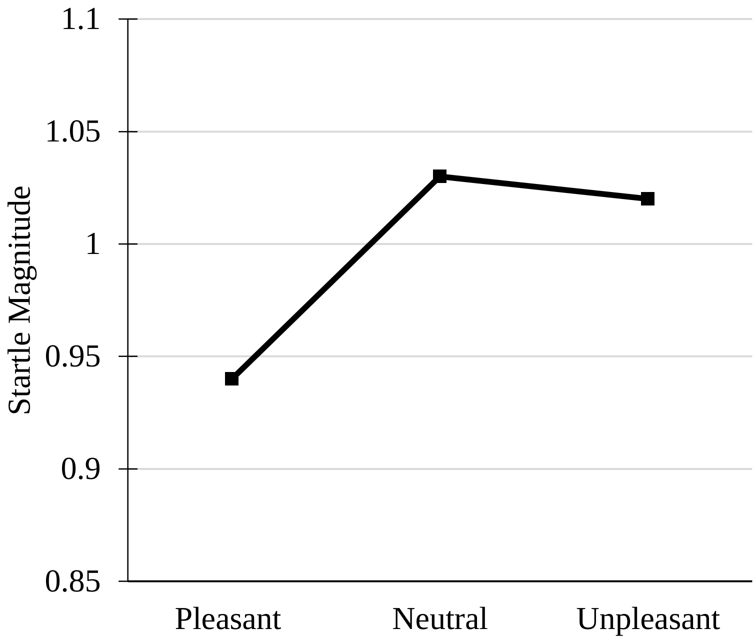


Mean (*SD*)		
Pleasant	Neutral	Unpleasant
4.55 (2.29)	1.67 (1.02)	5.54 (2.06)

Figure 5. Depiction of the main effect of image valence on arousal ratings for the full responding sample.

3.4.3 Effect of valence on startle magnitude in full sample

One outlier in startle magnitude during the presentation of pleasant slides was removed because the standardized residual was greater than ±3 standard deviations. The magnitude of startle responses during the presentation of pleasant slides was not normally distributed, $D(119) = .10$, $p < .01$; as such, square root transformations of outcome variables were used in analyses, as they corrected for skew. The main effect of valence on startle magnitude was significant, $F(2, 118) = 9.23$, $p < .001$, $\eta_p^2 = .14$. Planned contrast tests examining the polynomial trend revealed a significant linear effect of valence on startle magnitude (i.e., pleasant < neutral < unpleasant), $F(1, 119) = 10.34$, $p < .01$, $\eta_p^2 = .08$. Figure 6 presents this effect. Unpleasant images increased the magnitude of the startle eyeblink reaction and the pleasant images decreased the magnitude of the startle eyeblink reactions in the full sample. This is the typical linear pattern of EMS reactivity often found in individuals without psychopathology (Lang et al., 1990; Vrana et al., 1988).



Mean (*SD*)		
Pleasant	Neutral	Unpleasant
0.94 (0.16)	1.03 (0.14)	1.02 (0.16)

Figure 6. Depiction of the main effect of image valence on startle eyeblink magnitude for the full sample of EMS responders. Mean startle magnitude values are standardized within-person, square-root transformed, and expressed in microvolts (μV).

3.5 Test of study hypotheses

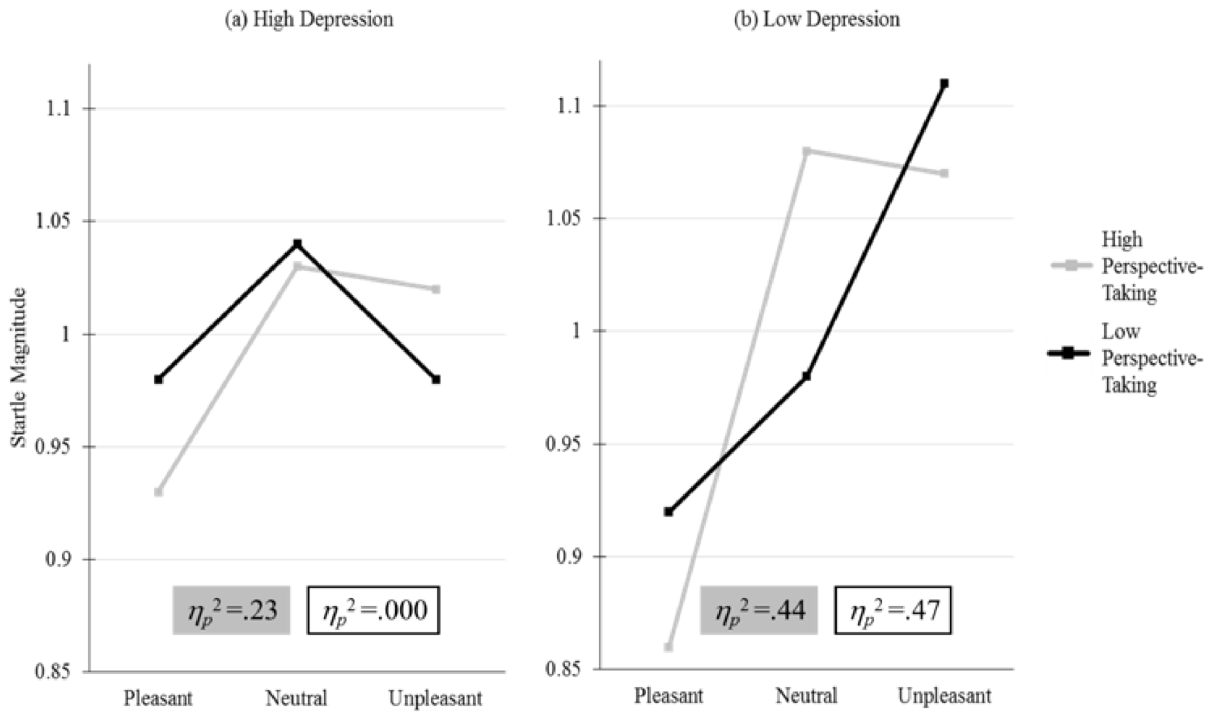
The assumption of normality was violated for the magnitude of startle responses during pleasant, $D(120) = .08$, $p < .05$; and unpleasant images, $D(120) = .10$, $p < .01$. Analyses were conducted with square root transformations of outcome variables, as these transformations successfully corrected non-normal distribution of these variables.

3.5.1 Depression x perspective-taking x image valence

No outliers in startle magnitude were detected. The 3-way interaction of depression, perspective-taking, and image valence category on startle magnitude was not significant, $F(2, 36) = 0.88$, $p = .43$, $\eta_p^2 = .05$, observed power = .19. The 2-way interactions of depression and image valence category, $F(2, 36) = 2.20$, $p = .13$, $\eta_p^2 = .11$, observed power = .42, and perspective-taking and image valence category, $F(2, 36) = 1.23$, $p = .31$, $\eta_p^2 = .06$, observed power = .25, on startle magnitude were also not significant. The main effect of image valence category on startle magnitude was significant and the effect size was large, $F(2, 74) = 7.10$, $p < .01$, $\eta_p^2 = .16$, observed power = .92. Planned contrast tests examining the polynomial trend revealed a significant linear effect of valence on startle magnitude (i.e., pleasant < neutral < unpleasant) and the effect size was large, $F(1, 37) = 10.17$, $p < .01$, $\eta_p^2 = .22$, observed power = .87. The main effects of depression, $F(1, 37) = 1.19$, $p = .28$, $\eta_p^2 = .03$, observed power = .19, and perspective-taking, $F(1, 37) = 0.88$, $p = .35$, $\eta_p^2 = .02$, observed power = .15, on startle magnitude were not significant.

As described in the data analysis plan, when the 3-way interactions were nonsignificant, I tested the EMS effects in each group to provide exploratory information about the size of the effects. For individuals with elevated levels of depression symptoms and low empathic perspective-taking tendencies, the linear effect of image valence on startle magnitude was not significant and the effect size was negligible, $F(1, 9) = 0.001$, $p = .97$, $\eta_p^2 = .000$, observed power = .05, indicating that these individuals exhibit a blunted startle reaction across emotional images. The linear effect of image valence on startle magnitude was not significant, but the effect size was large for depressed individuals with high perspective-taking tendencies, $F(1, 10) = 3.01$ $p = .11$, $\eta_p^2 = .23$, observed power = .35. For individuals with low depression and high and low perspective-taking tendencies, the linear effect of image valence on startle magnitude was significant and large, $F(1, 9) = 7.18$, $p < .05$, $\eta_p^2 = .44$, observed power = .67, and $F(1, 9) = 7.82$, $p < .05$, $\eta_p^2 = .47$, observed power = .70, respectively. In sum, investigation of the size of the linear effects revealed a medium-large- to large-sized linear effects for all groups ($\eta_p^2 = .23$,

.44, .47), except for depressed individuals with low perspective-taking tendencies (η_p^2 =.000). These effects are displayed in Figure 7.



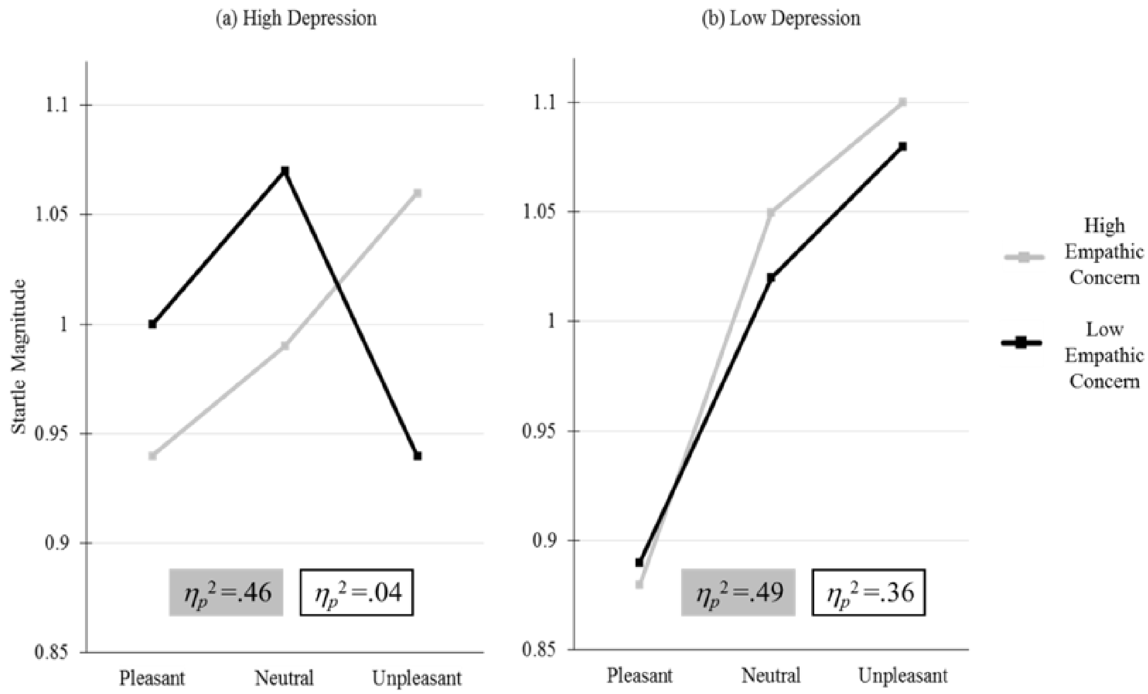
	Mean (*SD*)		
	Pleasant	Neutral	Unpleasant
High Depression and High Perspective Taking	0.93 (0.07)	1.03 (0.14)	1.02 (0.14)
High Depression and Low Perspective Taking	0.98 (0.18)	1.04 (0.14)	0.98 (0.16)
Low Depression and High Perspective Taking	0.86 (0.13)	1.08 (0.11)	1.07 (0.14)
Low Depression and Low Perspective Taking	0.92 (0.11)	0.98 (0.10)	1.11 (0.14)

Figure 7. Depiction of the 3-way interaction of depression, perspective taking, and valence on startle magnitude.
Mean startle magnitudes are standardized within-person, square-root transformed, expressed in microvolts (μV), and plotted separately for (a) high and (b) low depression by image valence condition. η_p^2 = the size of the effect of image valence on startle magnitude for each group.

3.5.2 Depression x empathic concern x image valence

Two outliers in startle magnitude during the presentation of pleasant slides were removed because the standardized residual was greater than ±3 standard deviations. The 3-way interaction of depression, empathic concern, and image valence on startle magnitude was not significant, $F(1.61, 53.10) = 1.15$, $p = .32$, η_p^2 =.34, observed power = .22. The 2-way interactions of depression and image valence, $F(1.61, 53.10) = 2.95$, $p = .07$, $\eta_p^2 = .08$, observed power = .50, and empathic concern and image valence, $F(1.61, 53.10) = 1.39$, $p = .26$, $\eta_p^2 = .04$, observed power = .26, on startle magnitude were also not significant. As before, the main effect of image valence category on startle magnitude was significant and large, $F(1.61, 53.10) = 6.32$, $p < .01$, $\eta_p^2 = .16$, observed power = .83. Planned contrast tests examining the polynomial trend revealed a significant linear effect of valence on startle magnitude (i.e., pleasant < neutral < unpleasant) and the effect size was large, $F(1, 33) = 8.36$, $p < .01$, $\eta_p^2 = .20$, observed power = .80. The main effects of depression, $F(1, 33) = 1.02$, $p = .32$, $\eta_p^2 = .03$, observed power = .17, and empathic concern, $F(1, 33) = 0.64$, $p = .43$, $\eta_p^2 = .02$, observed power = .12, on startle magnitude were not significant.

Given the nonsignificant interactions, again I followed up by testing the EMS effects in each group and provide information about the size of the effects. Similar to the findings for perspective-taking, for individuals with elevated depression symptoms and low empathic concern tendencies, the linear effect of image valence on startle magnitude was not significant and very small, $F(1, 5) = 0.21$, $p = .66$, $\eta_p^2 = .04$, observed power = .07, indicating that these individuals exhibit a blunted startle reaction across emotional images. The linear effect of image valence on startle magnitude was significant and very large for individuals with elevated depression symptoms and high empathic concern tendencies, $F(1, 11) = 9.31$ $p = .11$, $\eta_p^2 = .46$, observed power = .79. For individuals with low levels of depression symptoms and high and low empathic concern tendencies, the linear effect of image valence on startle magnitude was significant and very large, $F(1, 6) = 5.82$, $p < .05$, $\eta_p^2 = .49$, observed power = .53, and $F(1, 11) = 6.19$, $p < .05$, $\eta_p^2 = .36$, observed power = .62, respectively. Investigation of the effect sizes revealed a medium-large- to large-sized linear effects for all groups ($\eta_p^2 = .36$, .46, .49), except for depressed individuals with low empathic concern (η_p^2=.04), which had a very small effect size. These effects are displayed in Figure 8.



Between Subjects Group	Mean Startle Magnitude (*SD*) Pleasant	Neutral	Unpleasant
High Depression and High Empathic Concern	0.94 (0.06)	0.99 (0.09)	1.06 (0.11)
High Depression and Low Empathic Concern	1.00 (0.13)	1.07 (0.13)	0.94 (0.20)
Low Depression and High Empathic Concern	0.88 (0.09)	1.05 (0.08)	1.10 (0.16)
Low Depression and Low Empathic Concern	0.89 (0.14)	1.02 (0.11)	1.08 (0.14)

Figure 8. Depiction of the 3-way interaction of depression, empathic concern, and valence on startle magnitude.
Mean startle magnitude values are standardized within-person, square-root transformed, expressed in microvolts (μV), and plotted separately for (a) high and (b) low depression by image valence condition. η_p^2 = the size of the effect of image valence on startle magnitude for each group.

In lieu of non-significant 3-way interactions, the size of the linear effects of image valence on startle magnitude for our various grouping variables partially supported the study's hypotheses. As expected, the linear effect of image valence on startle magnitude was negligible, or very small, for depressed individuals with low levels of empathy and very large for nondepressed individuals, regardless of levels of empathy. Inconsistent with our hypothesis, the linear effect of image valence on startle magnitude was large, but not exaggerated, relative to nondepressed individuals, for depressed individuals with high levels of empathy.

4 CONCLUSIONS

The primary aim of the present investigation was to examine whether empathic engagement with other's emotions may help explain the mixed findings about the size of the associations between depression and EMS reactivity. More specifically, the study investigated the hypothesis that the association between depression and EMS reactivity was exaggerated for individuals with high empathic perspective-taking or empathic concern and that the association was blunted for individuals with low levels of empathic perspective-taking or empathic concern. The interactions between depression, cognitive and affective empathic tendencies, and emotional context (i.e., valence of image) were not significant; however, the size of the linear effects of emotional context on startle magnitude for each of these groups partially supported the study's hypotheses, so they were cautiously interpreted.

Findings from the current study suggest that individuals with elevated levels of depression have blunted EMS reactivity only when they had low empathic perspective-taking tendencies (i.e., when they tend not to recognize and take the perspective of another individual) or had low empathic concern tendencies (i.e., tend not to recognize and share the emotions of another individual). In contrast, individuals with elevated depression symptoms have the typical linear, but not exaggerated (as hypothesized), EMS reactivity pattern when they have heightened tendencies to experience empathic perspective-taking and empathic concern. These findings suggest one possible explanation for previous mixed findings of associations between EMS reactivity and depression symptoms and MDD diagnoses by indicating that EMS reactivity patterns in individuals with elevated depression symptoms differ as a function of empathy.

The present findings indicate that individuals with elevated levels of depression and low empathic tendencies exhibited blunted EMS reactions, meaning that the emotional context did not modulate startle reactivity for individuals with elevated depression symptoms and low empathic tendencies. This finding is in line with studies indicating that individuals with elevated depression symptoms have blunted EMS reactivity patterns (Mneimne et al., 2008; Moran et al., 2012). This finding is also in line with other findings indicating that individuals with low levels of empathy, specifically on measures of psychopathy, tend to have blunted EMS reactivity (e.g., Patrick, Bradley, & Lang, 1993). Moreover, blunted emotion-modulated reactivity is consistent with the ECI hypothesis that proposes that depressed individuals, relative to nondepressed individuals, show less physiological reactivity to emotional stimuli (Rottenberg, 2005) and further suggest that ECI may characterize individuals with low levels of empathy, in particular.

Individuals with elevated depression symptoms and low empathic tendencies may not be able to share in the emotional states of others because they are excessively focused on their own emotions and thoughts (Flory, Räikkönen, Matthews, & Owens, 2000) and thus may be unable to react sensitively to the perspective and emotions of another individual. Additionally, depressed individuals with low empathy are less likely to engage in approach-oriented behaviors, such as prosocial or reparative acts, since pleasant emotions do not activate the appetitive motivational system, as the current study's findings suggest. The idea that there is a lack of prosocial behavior in depressed individuals with low empathy is consistent with findings that depressed individuals engage in low levels of approach-oriented behaviors (Seidel et al., 2010), and findings that individuals tend not to engage in prosocial acts if they have low empathic tendencies (Eisenberg, Fabes, & Spinrad, 2006) or are high in negative emotionality (Eisenberg et al., 1996).

I hypothesized exaggerated pattern of EMS reactivity (i.e., not larger than the linear effects of emotional images on startle reactivity for highly empathic individuals with high levels of depression symptoms. However, inconsistent with our hypothesis, highly empathic individuals with elevated depression symptoms exhibited the typical linear EMS reactivity pattern, with medium to large linear effects of emotional images on startle reactivity (i.e., empathic perspective-taking; $\eta_p^2 = .23$; empathic concern; $\eta_p^2 = .46$). These findings are in line with models of empathy that explain that emotional cues activate a highly empathic individual's appetite and aversive motivational states (Decety, 2015; Decety et al., 2012; Decety & Svetlova, 2012) as well as studies that demonstrate a typical linear EMS reactivity pattern in individuals with depression symptoms and MDD diagnoses (Dichter & Tomarken, 2008; Dichter et al., 2004; Forbes et al., 2005; Kaviani et al., 2004).

However, these findings are discrepant from studies that support an exaggerated EMS reactivity pattern in individuals with elevated depression symptoms (Dichter & Tomarken, 2008; Dichter et al., 2004; Kaviani et al., 2004), or other findings suggesting that highly empathic individuals exhibit very strong physiological reactions in response to empathy-eliciting cues (e.g., Balconi & Bortolotti, 2012). These current study's findings may help clarify why some findings support exaggerated EMS reactivity in depressed individuals (e.g., Kaviani et al., 2004), as individuals with a more severe clinical presentation and/or tend to focus on one's own distress in response to the emotions of others may have heightened EMS reactivity.

Startle reactivity in the EMS paradigm is a function of "bottom-up" reactivity and "top down" control (Lang et al., 1997); that is, the EMS paradigm taps arousal processes related to the readiness of perceptual and motivational systems to attend to and encode emotional information ("bottom-up" reactivity) and modulation of these perceptual and motivational systems by attention and executive functioning systems ("top-down" control; Lang et al., 1997; Dominguez Borras & Vuilleumier, 2013; Vuilleumier & Huang, 2009). Typical EMS reactivity would indicate that emotional cues were attended to, "top-down" processes promoted activation of specific neural circuits involved in processing emotional information, and motivational systems were engaged (Lang et al., 1997). Blunted EMS reactivity would indicate that emotional cues were either not attended to or that the activation of neural circuits involved in processing emotional information was minimized or thwarted by other "top-down" processes (e.g., differences in executive attention), which would then fail to engage motivational systems (Lang et al., 1997; Vuilleumier, 2005; Vuilleumier & Huang, 2009). Individuals with blunted EMS reactivity may have looked away from the emotional material or looked at the information without recognizing the emotional significance (Bohlin, Graham, Silverstein, & Hackley, 1981), which is consistent with findings that indicate that depressed individuals withdraw from emotional stimuli (Brown et al., 2011). Thus, the current study's findings indicate that depressed individuals with elevated empathy demonstrate more emotional attention (Vuilleumier, 2005), and activation of neural circuitry involved in processing emotional information, than depressed individuals with low levels of empathy, as evidenced by the typical EMS reactivity pattern in depressed individuals with elevated empathy.

Empathy may affect EMS reactivity in depressed individuals due to the influence of several "bottom-up" reactivity (i.e., affective resonance; Preston & de Waal, 2002) and "top-down" control processes (i.e., executive attention; Posner & Rothbart, 2007, and mental flexibility; Decety & Jackson, 2004) that interact to make up the core of empathy and influence the processing of emotional information. "Bottom-up" reactivity processes that underlie empathy, such as affective resonance, affect arousal to others' emotions through shared representations between the self and other, which is related to the readiness of perceptual and motivational systems to attend to and encode emotional information (Decety & Meyer, 2008). Self-regulatory processes that voluntarily control the allocation of attention to emotional information and integrate emotional information are associated with empathy (Eisenberg & Eggum, 2009) and are "top-down" processes that promote the activation of neural circuits involved in processing emotional information (Posner & Rothbart, 2007). Our findings indicate that depressed individuals with low levels of empathy may have blunted EMS reactivity due to low levels and/or poor integration of "bottom-up" and "top-down" processes, while these same processes promote emotion modulation of startle reactivity in depressed individuals with high levels of empathy.

Our findings suggest that when individuals with elevated depression symptoms tend to empathically engage and experience similar emotions of another individual, they are able to react swiftly and adapt efficiently, not excessively, to changing environmental demands. As such, one profile of depressed individuals appears to be an "emotion flexible" profile characterized by high levels of perspective-taking and sharing in others' emotions and physiological reactivity that is modulated by observing others' pleasant or unpleasant experiences and emotions. Alternatively, some individuals with elevated depression symptoms often get "stuck" and are inflexible in various ways, such as with negative thoughts (i.e., cognitive inflexibility, rumination; e.g., Nolen-Hoeksema, 1991, Masuda & Tully, 2012), self-focused emotions (i.e., empathic distress; e.g., Schreiter et al., 2013), and even in self-focused behaviors (i.e., excessive reassurance-seeking; e.g., Joiner et al., 1999). Thus, one profile of depressed individuals appears to be an "emotion inflexible" profile characterized by low levels of perspective-taking and sharing in others' emotions and physiological reactivity that is not modulated by observing others' pleasant or unpleasant experiences and emotions.

Overall, these findings indicate that differences in empathic tendencies might help explain why some depressed individuals display blunted EMS reactivity and other depressed individuals display more typical EMS reactivity, though not exaggerated EMS reactivity, to others' emotions. Additionally, according to our findings, the ECI hypothesis (Rottenberg et al., 2005) does not accurately predict emotion reactivity for every individual with elevated levels of depression, as such, the ECI hypothesis may benefit from integrating the associations between depression, empathic tendencies, and EMS reactivity. Broadly, these findings indicate that individuals with elevated levels of depression differ in the degree to which motivational states are induced by emotional images as a function of their empathic tendencies, suggesting that depression may have heterogeneous etiologies that are linked to heterogeneity in empathic tendencies and physiological reactivity to emotional contexts.

Limitations

The current study has a few limitations that merit discussion. First, grouping variables were created using quartile splits, which categorized constructs that are naturally continuous, and reduced the sample size, which resulted in being under-powered to detect significant effects. Second, consistent with other EMS studies (Blumenthal et al., 2005), a considerable number of participants had to be dropped because they were considered "nonresponders" because the EMS paradigm did not elicit enough detectable startle eyeblinks to include them in the analysis. Third, self-reported image valence ratings of image valence category were different between individuals with high and low empathic concern. While the linear effect of image valence category on ratings of image negativity (i.e., pleasant valence ratings < neutral valence ratings < unpleasant valence ratings) was significant and large for both groups, individuals with high levels of empathic concern reported a linear increase in negativity that was slightly, but significantly, larger than individuals with low levels of empathic concern. Fourth, although the sample was diverse in terms of racial and ethnic composition, the sample was composed of predominantly female undergraduates and was not a clinical sample, and there were no significant gender differences in levels of depression. As such, our findings may have limited applicability to clinically depressed samples and future studies will benefit from examining the study's hypotheses within these groups. Finally, this study relied on self-report measures, which are subject to both reporter bias and subjectivity.

4.1 **Future Directions**

Future studies should use statistical models that can handle continuous measures of depression and empathy, such as mixed growth models, and examine the study's hypotheses in a clinically depressed sample. There may be other mechanisms that further elucidate the mixed EMS reactivity findings in depression. Future research should examine other cognitive-related variables, such as mindfulness tendencies, as our pattern of findings suggests that cognitive flexibility may allow for more varied reactions to stress across emotional contexts. As such, it is expected that depressed individuals with cognitive inflexibility (i.e., low levels of mindfulness) would exhibit blunted EMS reactivity patterns, indicating that emotional cues would not activate their motivational states and they would not react flexibly to a changing emotional environment. Additionally, future research should examine whether depressed individuals do in fact fall into different groupings based on emotion-processing-related tendencies, such as empathy.

A particularly important avenue for future research is to use ecologically valid stimuli that depict the emotions of people who are close to each participant (e.g., family member, close friend), as depressed individuals with high empathic tendencies may be more likely to exhibit exaggerated EMS reactivity than when emotional stimuli depict strangers. Individuals experience greater empathy for people with whom they are close (Cialdini, Brown, Lewis, Luce, & Neuberg, 1997). Further, they are more likely to mimic the emotions that close others' are perceived to be experiencing relative to perceived emotions of strangers (Meyer et al., 2012).

This discrepancy between empathic responses for familiar versus unfamiliar people is consistent with findings that indicate differences in neural substrate activation while processing unpleasant emotions of strangers versus friends. The same regions show activation during the experience of one's own distress and when one is observing a friend's distress. In addition, regions associated with thinking about what the other, and not oneself, is experiencing show activation when participants observe strangers' distress (Meyer et al., 2012). Furthermore, conceptual models have suggested that highly empathic individuals may be at risk for depression through self-attributed and misplaced blame for perceived transgressions against familiar persons (Zahn-Waxler & van Hulle, 2012). Individuals experience heightened physiological reactivity when they self-attribute blame for unpleasant emotions of close others (Ioannou et al., 2013; Mills, Imm, Walling, & Weiler, 2008) and have high levels of arousal when they are prone to experience misplaced blame (Freed & D'Andrea, 2015). It will be important for future research to examine whether depressed individuals with elevated empathy have exaggerated EMS reactivity due to tendencies to blame themselves or take responsibility for the emotions of others through the use of ecologically valid emotional stimuli. Such work might also test self-blame as a mediator of the association between empathy and EMS reactivity in depressed individuals.

4.2 Clinical Implications

The findings of the present investigation have implications for interventions for depressed individuals. Previous studies have indicated that individuals with MDD diagnoses who have blunted emotion-modulated reactions exhibit more severe and chronic course of depression and have slower treatment recoveries than individuals with MDD diagnoses and higher emotion-modulated reactions (Canli et al., 2005; Kasch et al., 2002; Keltner & Gross, 1999; Peeters, Berkhof, Rottenberg, & Nicolson, 2010). These individuals do not appear to get the benefit of a positive emotional environment and positive reinforcements; thus, predicting a longer-lasting depression (Lewinsohn, 1975; Lewinsohn et al., 1973).

The present findings suggest that one potentially novel treatment approach for these individuals is supporting their development of tendencies to respond more empathically to the emotions of others. This may involve teaching skills for managing their own emotions in the face of others' emotions so that they can engage with, rather than withdraw from, others' emotions. Therapies that target clients' typical emotional response, such as Mindfulness-Based Cognitive Therapy (Segal, Williams, & Teasdale, 2002) and Acceptance and Commitment Therapy (Hayes, Strosahl, & Wilson, 1999), may be the most effective course of treatment for depressed individuals with low levels of empathic tendencies as they may counteract the blunted emotion-modulated reactions by helping the client recognize, identify, understand, and accept their emotional responses. Therapies that optimize interpersonal involvement in order to increase the frequency in which an individual's positive emotions and appetitive motivational states are activated, such as Interpersonal Psychotherapy (Gunlicks-Stoessel & Mufson, 2016) and Behavioral Activation Therapy (Hopko, Ryba, McLndoo, & File, 2016), may be the most effective course of treatment for depressed individuals with high levels of empathic tendencies.

4.3 Conclusion

In summary, the findings from the current study suggest that differences in empathic tendencies can help explain the heterogeneity in emotion-modulated reactivity among individuals with elevated depression symptoms. Specifically, emotional contexts do not appear to modulate physiological reactivity for individuals with high levels of depression symptoms and low cognitive and affective empathic tendencies, but emotional contexts appear to modulate reactivity for individuals with elevated depression symptoms and high levels of cognitive and affective empathic tendencies and in nondepressed individuals, regardless of empathic tendencies. These findings suggest that some depressed individuals have blunted emotion-modulated reactivity and other depressed individuals have typical emotion-modulated reactivity and that these two patterns of reactivity can be predicted by the individual's empathic tendencies; as such, depression may have heterogeneous etiologies, especially after accounting for the contributions of empathy.

REFERENCES

Allen, N. B., Trinder, J., & Brennan, C. (1999). Affective startle modulation in clinical depression: Preliminary findings. *Biological Psychiatry, 46*(4), 542-550. doi: 10.1016/s0006-3223(99)00025-6

Ax, A. F. (1964). Goals and methods of psychophysiology. *Psychophysiology, 1*(1), 8-25. doi: 10.1111/j.1469-8986.1964.tb02616.x

Balconi, M., & Bortolotti, A. (2012). Empathy in cooperative versus non-cooperative situations: The contribution of self-report measures and autonomic responses. *Applied Psychophysiology and Biofeedback, 37*(3), 161-169. doi: 10.1007/s10484-012-9188-z

Batson, C. D. (1991). *The altruism question: Toward a social-psychological answer*. Hillsdale, NJ England: Lawrence Erlbaum Associates, Inc.

Batson, C. D., Fultz, J., & Schoenrade, P. A. (1994). Distress and empathy: Two qualitatively distinct vicarious emotions with different motivational consequences. In B. Puka & B. Puka (Eds.), *Reaching out: Caring, altruism, and prosocial behavior.* (pp. 57-75). New York, NY, US: Garland Publishing.

Beck, A. T., Ward, C. H., Mendelson, M., Mock, J., & Erbaugh, J. K. (1961). An inventory for measuring depression. *Archives of General Psychiatry, 4*(6), 561-571. doi: 10.1001/archpsyc.1961.01710120031004

Blumenthal, T. D., Cuthbert, B. N., Filion, D. L., Hackley, S., Lipp, O. V., & Van Boxtel, A. (2005). Committee report: Guidelines for human startle eyeblink electromyographic studies. *Psychophysiology, 42*(1), 1-15. doi: 10.1111/j.1469-8986.2005.00271.x

Bohlin, G., Graham, F. K., Silverstein, L. D., & Hackley, S. A. (1981). Cardiac orienting and startle blink modification in novel and signal situations. *Psychophysiology, 18*, 603-611. doi: 10.1111/j.1469-8986.1981.tb01832.x

Brief, A. P., & Motowidlo, S. J. (1986). Prosocial organizational behaviors. *Academy of Management Review*, *11*(4), 710-725. doi: 10.5465/amr.1986.4283909

Brown, J. S., Kalish, H. I., & Farber, I. (1951). Conditioned fear as revealed by magnitude of startle response to an auditory stimulus. *Journal of Experimental Psychology, 41*(5), 317-328. doi: 10.1037/h0060166

Brown, E. D., Strauman, T., Barrantes-Vidal, N., Silvia, P. J., & Kwapil, T. R. (2011). An experience-sampling study of depressive symptoms and their social context. *The Journal of Nervous and Mental Disease, 199*(6), 403-409. doi: 10.1097/nmd.0b013e31821cd24b

Burke, H. M., Davis, M. C., Otte, C., & Mohr, D. C. (2005). Depression and cortisol responses to psychological stress: a meta-analysis. *Psychoneuroendocrinology, 30*(9), 846-856. doi: 10.1016/j.psyneuen.2005.02.010

Bylsma, L. M., Salomon, K., Taylor-Clift, A., Morris, B. H., & Rottenberg, J. (2014). Respiratory sinus arrhythmia reactivity in current and remitted major depressive disorder. *Psychosomatic Medicine, 76*(1), 66-73. doi: 10.1097/psy.0000000000000019

Bylsma, L. M., Taylor-Clift, A., & Rottenberg, J. (2011). Emotional reactivity to daily events in major and minor depression. *Journal of Abnormal Psychology, 120*(1), 155-167. doi: 10.1037/a0021662

Campeau, S., & Davis, M. (1995). Involvement of the central nucleus and basolateral complex of the amygdala in fear conditioning measured with fear-potentiated startle in rats trained concurrently with auditory and visual conditioned stimuli. *The Journal of Neuroscience, 15*(3), 2301-2311.

Canli, T., Cooney, R. E., Goldin, P., Shah, M., Sivers, H., Thomason, M. E., . . . Gotlib, I. H. (2005). Amygdala reactivity to emotional faces predicts improvement in major depression. *NeuroReport: For Rapid Communication of Neuroscience Research, 16*(12), 1267-1270. doi: 10.1097/01.wnr.0000174407.09515.cc

Chow, C. M., Ruhl, H., & Buhrmester, D. (2013). The mediating role of interpersonal competence between adolescents' empathy and friendship quality: A dyadic approach. *Journal of Adolescence, 36*(1), 191-200. doi: 10.1016/j.adolescence.2012.10.004

Cialdini, R. B., Brown, S. L., Lewis, B. P., Luce, C., & Neuberg, S. L. (1997). Reinterpreting the empathy-altruism relationship: When one into one equals oneness. *Journal of Personality and Social Psychology, 73,* 481-494. doi: 10.1037/0022-3514.73.3.481

Cohen, J. E. (1988). *Statistical power analysis for the behavioral sciences*. Hillsdale, NJ: Erlbaum.

Cramer, D., & Jowett, S. (2010). Perceived empathy, accurate empathy and relationship satisfaction in heterosexual couples. *Journal of Social and Personal Relationships, 27*(3), 327-349. doi: 10.1177/0265407509348384

Cusi, A. M., MacQueen, G. M., Spreng, R. N., & McKinnon, M. C. (2011). Altered empathic responding in major depressive disorder: Relation to symptom severity, illness burden, and psychosocial outcome. *Psychiatry Research, 188*(2), 231-236. doi: 10.1016/j.psychres.2011.04.013

Davis, M. (1980). Neurochemical modulation of sensory-motor reactivity: acoustic and tactile startle reflexes. *Neuroscience & Biobehavioral Reviews, 4*(2), 241-263. doi: 10.1016/0149-7634(80)90016-0

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*(1), 113-126. doi: 10.1037/0022-3514.44.1.113

Davis, M. H. (2004). Empathy: Negotiating the border between self and other. In L. Z. Tiedens, C. W. Leach, L. Z. Tiedens, & C. W. Leach (Eds.), *The social life of emotions.* (pp. 19-42). New York, NY, US: Cambridge University Press.

Davis, M. (2006). Neural systems involved in fear and anxiety measured with fear-potentiated startle. *American Psychologist, 61*(8), 741-756. doi: 10.1037/0003-066x.61.8.741

Davis, M., & Whalen, P. J. (2001). The amygdala: vigilance and emotion. *Molecular Psychiatry, 6*(1), 13-34. doi: 10.1038/sj.mp.4000812

Davis, M. H. (1980). A multidimensional approach to individual differences in empathy. *JSAS Catalog of Selected Documents in Psychology, 75*, 989–1015.

Davis, M. H. (1983). Measuring individual differences in empathy: Evidence for a multidimensional approach. *Journal of Personality and Social Psychology, 44*(1), 113-126. doi: 10.1037/0022-3514.44.1.113

Decety, J. (2015). The neural pathways, development and functions of empathy. *Current Opinion in Behavioral Sciences, 3*, 1-6. doi: 10.1016/j.cobeha.2014.12.001

Decety, J., & Jackson, P. L. (2004). The functional architecture of human empathy. *Behavioral and Cognitive Neuroscience Reviews*, *3*, 71–100. doi: 10.1177/1534582304267187

Decety, J., & Meyer, M. (2008). From emotion resonance to empathic understanding: A social developmental neuroscience account. *Development and Psychopathology, 20*, 1053–1080. doi: 10.1017/S0954579408000503

Decety, J., Norman, G. J., Berntson, G. G., Cacioppo, J. T. (2012). A neurobehavioral evolutionary perspective on the mechanisms underlying empathy. *Progress in Neurobiology,* 98, 38-48. doi: 10.1016/j.pneurobio.2012.05.001

Decety, J., & Svetlova, M. (2012). Putting together phylogenetic and ontogenetic perspectives on empathy. *Developmental Cognitive Neuroscience, 2*(1), 1-24. doi: 10.1016/j.pneurobio.2012.05.001

Derntl, B., Seidel, E.-M., Eickhoff, S. B., Kellermann, T., Gur, R. C., Schneider, F., & Habel, U. (2011). Neural correlates of social approach and withdrawal in patients with major depression. *Social Neuroscience, 6*(5-6), 482-501. doi: 10.1080/17470919.2011.579800

Derntl, B., Seidel, E.-M., Schneider, F., & Habel, U. (2012). How specific are emotional deficits? A comparison of empathic abilities in schizophrenia, bipolar and depressed patients. *Schizophrenia Research, 142*(1–3), 58-64. doi: http://dx.doi.org/10.1016/j.schres.2012.09.020

Dichter, G. S., & Tomarken, A. J. (2008). The chronometry of affective startle modulation in unipolar depression. *Journal of Abnormal Psychology, 117*(1), 1-15. doi: 10.1037/0021-843x.117.1.1

Dichter, G. S., Tomarken, A. J., Shelton, R. C., & Sutton, S. K. (2004). Early- and late-onset startle modulation in unipolar depression. *Psychophysiology, 41*(3), 433-440. doi: 10.1111/j.1469-8986.00162.x

Dimberg, U., Andréasson, P., & Thunberg, M. (2011). Emotional empathy and facial reactions to facial expressions. *Journal of Psychophysiology, 25*(1), 26-31. doi: 10.1027/0269-8803/a000029

Dominguez Borras, J., & Vuilleumier, P. (2013). Affective biases in attention and perception. In J. &. V. P. Armony (Ed.),*Cambridge handbook of human affective neuroscience* (pp. 331-356). New York, 2013: Cambridge University Press.

Eisenberg, N. (1989). Empathy and sympathy. In W. Damon (Ed.), *Child development today and tomorrow* (pp. 137-154). San Francisco, CA: Josey-Bass.

Eisenberg, N., & Eggum, N. D. (2009). Empathic responding: Sympathy and personal distress. In J. Decety & W. Ickes (Eds.), The social neuroscience of empathy (pp. 71-84). Cambridge, MA: The MIT Press.

Eisenberg, C., Fabes, R. A., Karbon, M., Murphy, B. C., Wosinski M., Polazzi, L., Carlo, G., & Juhnke, C. (1996). The relations of children's dispositional prosocial behavior to emotionality, regulation, and social functioning. *Child Development, 67*(3), 974-992 doi: 10.2307/1131874

Eisenberg, N., Fabes, R. A., & Spinrad, T. L. (2006). Prosocial development. In N. Eisenberg (Vol. Ed.) and W. Damon & R. M. Lerner (Series Eds.), *Handbook of child psychology: Vol. 3. Social, emotional, personality development* (6th ed., pp. 646–718). Hoboken, NJ: Wiley.

Eisenberg, N., & Strayer, J. (1987). Critical issues in the study of empathy. In N. Eisenberg & J. Strayer (Eds.), *Empathy and its development.* (pp. 3-13). New York, NY US: Cambridge University Press.

Ekman, P. (1992). Facial expressions of emotion: New findings, new questions. *Psychological Science, 3*(1), 34-38. doi: 10.1111/j.1467-9280.1992.tb00253.x

Flory, J. D., Räikkönen, K., Matthews, K. A., & Owens, J. F. (2000). Self-focused attention and mood during everyday social interactions. *Personality and Social Psychology Bulletin, 26*, 875-883. doi: 10.1177/0146167200269012

Forbes, E. E., Miller, A., Cohn, J. F., Fox, N. A., & Kovacs, M. (2005). Affect-modulated startle in adults with childhood-onset depression: Relations to bipolar course and number of lifetime depressive episodes. *Psychiatry Research, 134*(1), 11-25. doi: 10.1016/j.psychres.2005.01.001

Freed, S., & D'Andrea, W. (2015). Autonomic arousal and emotion in victims of interpersonal violence: shame proneness but not anxiety predicts vagal tone. *Journal of Trauma & Dissociation*, *16*(4), 367-383. doi: 10.1080/15299732.2015.1004771

Gawronski, I., & Privette, G. (1997). Empathy and reactive depression. *Psychological Reports, 80*(3, Pt 1), 1043-1049. doi: 10.2466/pr0.1997.80.3.1043

Glass, G. V., Peckham, P. D., & Sanders, J. R. (1972). Consequences of failure to meet assumptions underlying the fixed effects analyses of variance and covariance. *Review of Educational Research*, *42*(3) 237-288. doi: 10.3102/00346543042003237

Golin, S., Hartman, S. A., Klatt, E. N., Munz, K., & Wolfgang, G. L. (1977). Effects of self-esteem manipulation on arousal and reactions to sad models in depressed and nondepressed college students. *Journal of Abnormal Psychology, 86*(4), 435-439. doi: 10.1037/0021-843x.86.4.435

Gunlicks-Stoessel, M. L., & Mufson, L. (2016). Interpersonal psychotherapy for depressed adolescents. In M. K. Dulcan & M. K. Dulcan (Eds.), *Dulcan's textbook of child and* *adolescent psychiatry (2nd ed.).* (pp. 959-971). Arlington, VA, US: American Psychiatric Publishing, Inc.

Hare, R. D. (1965). Temporal gradient of fear arousal in psychopaths. *Journal of Abnormal Psychology, 70*(6), 442-445. doi: 10.1037/h0022775

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York, NY, US: Guilford Press.

Henriques, J. B., & Davidson, R. J. (2000). Decreased responsiveness to reward in depression. *Cognition & Emotion, 14*(5), 711-724. doi: 10.1080/026999300050117684

Hoffman, M. L. (1981). Is altruism part of human nature? *Journal of Personality and Social Psychology, 40*(1), 121-137. doi:10.1037/0022-3514.40.1.121

Hokanson, J. E., & Butler, A. C. (1992). Cluster analysis of depressed college students' social behaviors. *Journal of Personality and Social Psychology, 62*(2), 273-280. doi: 10.1037/0022-3514.62.2.273

Hopko, D. R., Ryba, M. M., McLndoo, C., & File, A. (2016). Behavioral activation. In C. M. Nezu, A. M. Nezu, C. M. Nezu, & A. M. Nezu (Eds.), *The Oxford handbook of cognitive and behavioral therapies.* (pp. 229-263). New York, NY, US: Oxford University Press.

Hughes, E. K., Gullone, E., & Watson, S. D. (2011). Emotional functioning in children and adolescents with elevated depressive symptoms. *Journal of Psychopathology and Behavioral Assessment, 33*(3), 335-345. doi: 10.1007/s10862-011-9220-2

Ioannou, S., Ebisch, S., Aureli, T., Bafunno, D., Ioannides, H. A., Cardone, D., Manini, B., Romani, G. L., Gallese, V., & Merla, A. (2013). The autonomic signature of guilt in children: A thermal infrared imaging study, *PloS one*, *8*(11), e79440. doi: 10.1371/journal.pone.0079440

Joiner, T. E., & Metalsky, G. I. (2001). Excessive reassurance seeking: Delineating a risk factor involved in the development of depressive symptoms. *Psychological Science, 12*(5), 371-378. doi:10.1111/1467-9280.00369

Joiner, T. E., Metalsky, G. I., Katz, J., & Beach, S. R. (1999). Depression and excessive reassurance-seeking. *Psychological Inquiry, 10*(3), 269-278. doi:10.1207/s15327965pli1004_1

Kasch, K. L., Rottenberg, J., Arnow, B. A., & Gotlib, I. H. (2002). Behavioral activation and inhibition systems and the severity and course of depression. *Journal of Abnormal Psychology, 111*(4), 589-597. doi:10.1037/0021-843x.111.4.589

Kaviani, H., Gray, J. A., Checkley, S. A., Raven, P. W., Wilson, G. D., & Kumari, V. (2004). Affective modulation of the startle response in depression: Influence of the severity of depression, anhedonia, and anxiety. *Journal of Affective Disorders, 83*(1), 21-31. doi: 10.1016/j.jad.2004.04.007

Keltner, D., & Gross, J. J. (1999). Functional accounts of emotions. *Cognition & Emotion, 13*(5), 467-480. doi:10.1080/026999399379140

Koch, M., Schmid, A., & Schnitzler, H.-U. (1996). Pleasure-attenuation of startle is disrupted by lesions of the nucleus accumbens. *Neuroreport, 7*(8), 1442-1446. doi: 10.1097/00001756-199605310-00024

Kogan, A., Gruber, J., Shallcross, A. J., Ford, B. Q., & Mauss, I. B. (2013). Too much of a good thing? Cardiac vagal tone's nonlinear relationship with well-being. *Emotion, 13*(4), 599-605. doi: 10.1037/a0032725

Krippendorff, K. (1989). Content analysis. In E. Barnouw, G. Gerbner, W. Schramm, T. L. Worth, & L. Gross (Eds.), *International encyclopedia of communication* (Vol. 1, pp. 403-407). New York, NY: Oxford University Press.

Landis, C., & Hunt, W. A. (1939). *The startle pattern*. New York: Farrar, Straus, & Giroux.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1990). Emotion, attention, and the startle reflex. *Psychological Review, 97*(3), 377-395. doi: 10.1037//0033-295x.97.3.377

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1997). Motivated attention: Affect, activation, and action. In P. J. Lang, R. Simons, & M. Balaban (Eds.), *Attention and orienting: Sensory and motivational processes* (pp. 97-135). Hillsdale, NJ: Erlbaum.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (2008). International affective picture system (IAPS): Affective ratings of pictures and instruction manual. *Technical Report A-8*.

Lazarus, R. S. (1991). Progress on a cognitive-motivational-relational theory of emotion. *American Psychologist, 46*(8), 819-834. doi: 10.1037/0003-066x.46.8.819

Lee, S.A. (2009). Does empathy mediate the relationship between neuroticism and depressive symptomatology among college students? *Personality and Individual Differences, 47*(5), 429-433. doi: 10.1016/j.paid.2009.04.020

Lee, Y., López, D. E., Meloni, E. G., & Davis, M. (1996). A primary acoustic startle pathway: obligatory role of cochlear root neurons and the nucleus reticularis pontis caudalis. *The Journal of Neuroscience, 16*(11), 3775-3789.

Leiberg, S., & Anders, S. (2006). The multiple facets of empathy: a survey of theory and evidence. *Progress in Brain Research, 156*, 419-440. doi:10.1016/s0079-6123(06)56023

Levenson, R. W. (1994). Human emotion: A functional view. In P. Ekman & R. J. Davidson (Eds.), *The nature of emotion: Fundamental questions* (pp. 123-126). New York: Oxford University Press.

Lewinsohn, P. M. (1975). The behavioral study and treatment of depression. *Progress in Behavior Modification, 1*, 19-64. doi:10.1016/b978-0-12-535601-5.50009-3

Lewinsohn, P. M., Hoberman, H. M., Teri, L., & Hautzinger, M. (1985). An integrative theory of depression. In S. Reiss & R. R. Bootzin (Eds.), *Theoretical issues in behavior therapy* (pp. 331-359). Orlando, FL: Academic.

Lewinsohn, P. M., Lobitz, W. C., & Wilson, S. (1973). " Sensitivity" of depressed individuals to aversive stimuli. *Journal of Abnormal Psychology, 81*(3), 259-263. doi:10.1037/h0034529

Malhi, G. S., Lagopoulos, J., Ward, P. B., Kumari, V., Mitchell, P. B., Parker, G. B., . . . Sachdev, P. (2004). Cognitive generation of affect in bipolar depression: An fMRI study. *European Journal of Neuroscience, 19*(3), 741-754. doi: 10.1111/j.0953-816X.2003.03159.x

Masuda, A., Tully, E.C. (2012). The role of mindfulness and psychological flexibility in somatiztion, depression, anxiety, and general psychological distress of a non-clinical college sample. *Journal of Evidence-Based Complementary & Alternative Medicine, 17*(1), 66-71. doi: 10.1177/2156587211423400

Mneimne, M., McDermut, W., & Powers, A. S. (2008). Affective ratings and startle modulation in people with nonclinical depression. *Emotion, 8*(4), 552-559. doi: 10.1037/a0012827

Meyer, M. L., Masten, C. L., Ma, Y., Wange, C., Shi, Z., Eisenberger, N. I., & Han, S. (2012). Empathy for the social suffering of friends and strangers recruits distinct patterns of brain activation. *Social Cognitive and Affective Neuroscience, 8*(4), 446-454. doi*:* 10.1093/scan/nss019

Mills, R. S. L., Imm, G. P., Walling, B. R., & Weiler, H. A. (2008). Cortisol reactivity and regulation associated with shame responding in early childhood, *Developmental Psychology, 44*(5), 1369-1380. doi: 10.1037/a0013150

Moran, E. K., Mehta, N., & Kring, A. M. (2012). Emotional responding in depression: Distinctions in the time course of emotion. *Cognition and Emotion, 26*(7), 1153-1175. doi: 10.1080/02699931.2011.638909

Nezlek, J. B., & Gable, S. L. (2001). Depression as a moderator of relationships between positive daily events and day-to-day psychological adjustment. *Personality and Social Psychology Bulletin, 27*(12), 1692-1704. doi:10.1177/01461672012712012

Oveis, C., Cohen, A. B., Gruber, J., Shiota, M. N., Haidt, J., & Keltner, D. (2009). Resting respiratory sinus arrhythmia is associated with tonic positive emotionality. *Emotion, 9*(2), 265-270. doi:10.1037/a0015383

Patrick, C. J., Bradley, M. M., & Lang, P. J. (1993). Emotion in the criminal psychopath: Startle reflex modulation. *Journal of Abnormal Psychology, 102*(1), 82-92. doi: 10.1037/0021-843X.102.1.82

Peeters, F., Berkhof, J., Rottenberg, J., & Nicolson, N. A. (2010). Ambulatory emotional reactivity to negative daily life events predicts remission from major depressive disorder. *Behaviour Research and Therapy, 48*(8), 754-760. doi: 10.1016/j.brat.2010.04.008

Peeters, F., Nicolson, N. A., Berkhof, J., Delespaul, P., & deVries, M. (2003). Effects of daily events on mood states in major depressive disorder. *Journal of Abnormal Psychology, 112*(2), 203-211. doi:10.1037/0021-843x.112.2.203

Posner, M. I., & Rothbart, M. K. (2007). *Educating the human brain.* Washington, DC: American Psychological Association.

Preston, S. D., & de Waal, F. B. M. (2002). The communication of emotions and the possibility of empathy in animals. In S. G. Post, L. G. Underwood, J. P. Schloss, & W. B. Hurlbut (Eds.), *Altruism and altruistic love: Science, philosophy, and religion in dialogue* (pp. 284–308). New York: Oxford University Press.

Rosen, J. B., Hitchcock, J. M., Sananes, C. B., Miserendino, M. J., & Davis, M. (1991). A direct projection from the central nucleus of the amygdala to the acoustic startle pathway: anterograde and retrograde tracing studies. *Behavioral Neuroscience, 105*(6), 817-825. doi: 10.1037/0735-7044.105.6.817

Rottenberg, J., Gross, J. J., & Gotlib, I. H. (2005). Emotion context insensitivity in major depressive disorder. *Journal of Abnormal Psychology, 114*(4), 627-639. doi:10.1037/0021-843x.114.4.627

Rottenberg, J. (2005). Mood and emotion in major depression. *Current Directions in Psychological Science, 14*(3), 167-170. doi:10.1111/j.0963-7214.2005.00354.x

Rottenberg, J. (2007a). Cardiac vagal control in depression: A critical analysis. *Biological Psychology, 74*(2), 200-211. doi: 10.1016/j.biopsycho.2005.08.010

Rottenberg, J. (2007b). Major depressive disorder: Emerging evidence for emotion context insensitivity. In J. Rottenberg & S. L. Johnson (Eds.), *Emotion and psychopathology: Bridging affective and clinical science* (pp. 151-165). Washington, DC, US: American Psychological Association.

Rottenberg, J., Gross, J. J., & Gotlib, I. H. (2005). Emotion context insensitivity in major depressive disorder. *Journal of Abnormal Psychology, 114*(4), 627-639. doi: 10.1037/0021-843x.114.4.627

Rottenberg, J., Kasch, K. L., Gross, J. J., & Gotlib, I. H. (2002). Sadness and amusement reactivity differentially predict concurrent and prospective functioning in major depressive disorder. *Emotion, 2*(2), 135-146. doi:10.1037/1528-3542.2.2.135

Ruby, P., & Decety, J. (2004). How would you feel versus how do you think she would feel? A neuroimaging study of perspective-taking with social emotions. *Journal of Cognitive Neuroscience, 16*(6), 988-999. doi: 10.1162/0898929041502661

Scher, C. D., Ingram, R. E., & Segal, Z. V. (2005). Cognitive reactivity and vulnerability: Empirical evaluation of construct activation and cognitive diatheses in unipolar depression. *Clinical Psychology Review, 25*(4), 487-510. doi:10.1016/j.cpr.2005.01.005

Schreiter, S., Pijnenborg, G. H. M., & aan het Rot, M. (2013). Empathy in adults with clinical or subclinical depressive symptoms. *Journal of Affective Disorders, 150*(1), 1-16. doi: 10.1016/j.jad.2013.03.009

Segal, Z. V., Williams, J. M. G., & Teasdale, J. D. (2002). *Mindfulness-based cognitive therapy for depression: A new approach to preventing relapse*. New York, NY, US: Guilford Press.

Seidel, E.-M., Habel, U., Finkelmeyer, A., Schneider, F., Gur, R. C., & Derntl, B. (2010). Implicit and explicit behavioral tendencies in male and female depression. *Psychiatry Research, 177*(1), 124-130. doi:10.1016/j.psychres.2010.02.001

Shiner, R. L., & Masten, A. S. (2012). Childhood personality as a harbinger of competence and resilience in adulthood. *Development and Psychopathology, 24*(2), 507-528. doi: 10.1017/S0954579412000120

Sigmon, S. T., & Nelson-Gray, R. O. (1992). Sensitivity to aversive events in depression: Antecedent, concomitant, or consequent? *Journal of Psychopathology and Behavioral Assessment, 14*(3), 225-246. doi:10.1007/bf00962630

Silton, N. R., & Fogel, J. (2010). Religiosity, empathy, and psychopathology among young adult children of rabbis. *Archive for the Psychology of Religion, 32*(3), 277-291. doi:10.1163/157361210x532040

Sonnby-Borgström, M., Jönsson, P., & Svensson, O. (2003). Emotional empathy as related to mimicry reactions at different levels of information processing. *Journal of Nonverbal Behavior, 27*(1), 3-23. doi: 10.1023/A:1023608506243

Sonnby–Borgström, M. (2002). Automatic mimicry reactions as related to differences in emotional empathy. *Scandinavian Journal of Psychology, 43*(5), 433-443. doi:10.1111/1467-9450.00312

Thoma, P., Zalewski, I., von Reventlow, H. G., Norra, C., Juckel, G., & Daum, I. (2011). Cognitive and affective empathy in depression linked to executive control. *Psychiatry Research, 189*(3), 373-378. doi: http://dx.doi.org/10.1016/j.psychres.2011.07.030

Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Gotlib, I. H. (2012). The everyday emotional experience of adults with major depressive disorder: Examining emotional instability, inertia, and reactivity. *Journal of Abnormal Psychology, 121*(4), 819-829. doi: 10.1037/a0027978

Tully, E. C., Ames, A. M., Garcia, S. E., & Donohue, M. R. (2016). Quadratic associations between empathy and depression as moderated by emotion dysregulation. *The Journal of Psychology: Interdisciplinary and Applied, 150*(1), 15-35. doi: 10.1080/00223980.2014.992382

Vrana, S. R., Spence, E. L., & Lang, P. J. (1988). The startle probe response: A new measure of emotion? *Journal of Abnormal Psychology, 97*(4), 487-491. doi: 10.1037/0021-843x.97.4.487

Vuilleumier, P. (2005). How brains beware: neural mechanisms of emotional attention. *Trends in Cognitive Sciences*, *9*(12), 585-594. doi: 10.1016/j.tics.2005.10.011

Vuilleumier, P., & Huang, Y. M. (2009). Emotional attention uncovering the mechanisms of affective biases in perception. *Current Directions in Psychological Science*, *18*(3), 148-152. doi: 10.1111/j.1467-8721.2009.01626.x

Wilbertz, G., Brakemeier, E.-L., Zobel, I., Härter, M., & Schramm, E. (2010). Exploring preoperational features in chronic depression. *Journal of Affective Disorders, 124*(3), 262-269. doi: 10.1016/j.jad.2009.11.021

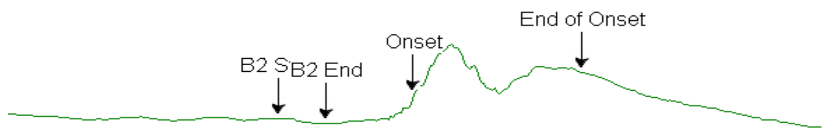
Zahn-Waxler, C., & van Hulle, C. (2012). Empathy, guilt, and depression: When caring for others becomes costly to children. In B. Oakley, A. Knafo, G. Madhavan & D. S. Wilson (Eds.), Pathological altruism. (pp. 321-344). New York, NY US: Oxford University Press.

APPENDICES

Appendix A Scoring/Cleaning Coding Manual

Scoring/Cleaning Coding Manual

The objective: During the scoring process, we must distinguish startle eyeblink responses from background EMG activity (spontaneous eyeblinks and noise).



The "B2 Start" marker denotes the beginning of the audio burst (0ms) and the "B2 End" denotes the 20ms after the onset of the audio burst. The "End of Onset" marker is 120 ms after the onset of the audio burst.

- It's expected that the startle response ***onset*** should only happen after 20ms (B2 End) and before 120ms (End of Onset) after the start of the audio burst.

Definitions:

Startle Eyeblink – A startle eyeblink is part of the brainstem's protective response to startling stimuli. In our study, we measure this through muscle activity of the Orbicularis oculi muscle.

Trial period – A trial period is the time after the baseline in which the startle eyeblink is expected to occur (20ms to 150ms after the onset of the audio burst).

Onset of Startle Eyeblink – the onset of the startle eyeblink is the point in time in which the EMG activity exceeds a minimum threshold and marks the beginning of the startle eyeblink. For our study, an onset of a startle eyeblink can occur once the electrical activity has reached two times the value of the mean of the baseline period.

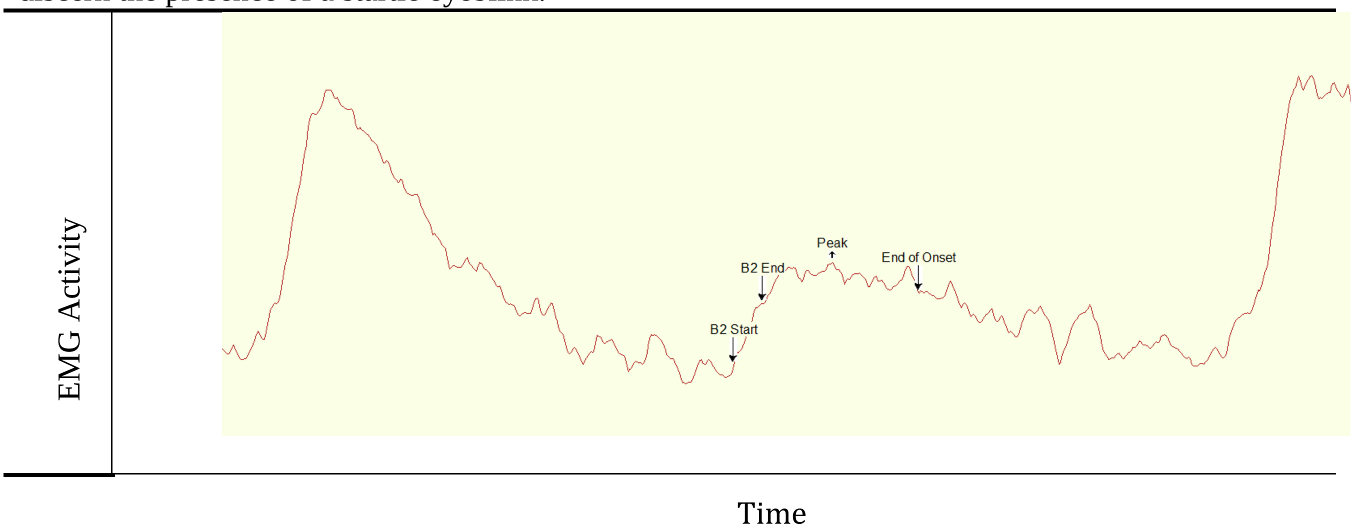
Noise – noise is random, inexplicable change in EMG activity (i.e., is presumed not to be the result of the startling stimulus). Generally, noise does not appear to display a pattern, the lines of the EMG activity appear squiggly and haphazard, and it looks different from an individual participant's eyeblink EMG signal. Noise can happen throughout the file: before the trial period (baseline) or during the trial period and impede our ability to distinguish a startle eyeblink.

Spontaneous Eyeblinks – A spontaneous eyeblink is an eyeblink that is not in response to startle stimuli. One example of a spontaneous eyeblink is an eyeblink that occurs before the "B2 End" (the time before a true startle eyeblink could possibly occur). If the eyeblink started before the 20ms mark, then it was not elicited by the audio burst.

Rejected Trials – We reject a trial if noise in the baseline period or the trial period makes it impossible to discern if a startle eyeblink is present. We also reject a trial if there is a spontaneous eyeblink that occurs in the baseline period (which is a rare occurrence and can be hard to distinguish from noise).

Non-response Trials – Nonresponse trials are trials in which the audio burst did not elicit a startle eyeblink from the participant. You will not have to code this, but you will need to know that this happens with some trials.

Figure: Example of a trial period that would be “rejected” due to noise obscuring the ability to discern the presence of a startle eyeblink.



Appendix A.1 Coding Manual

Coding Manual

General Rules:

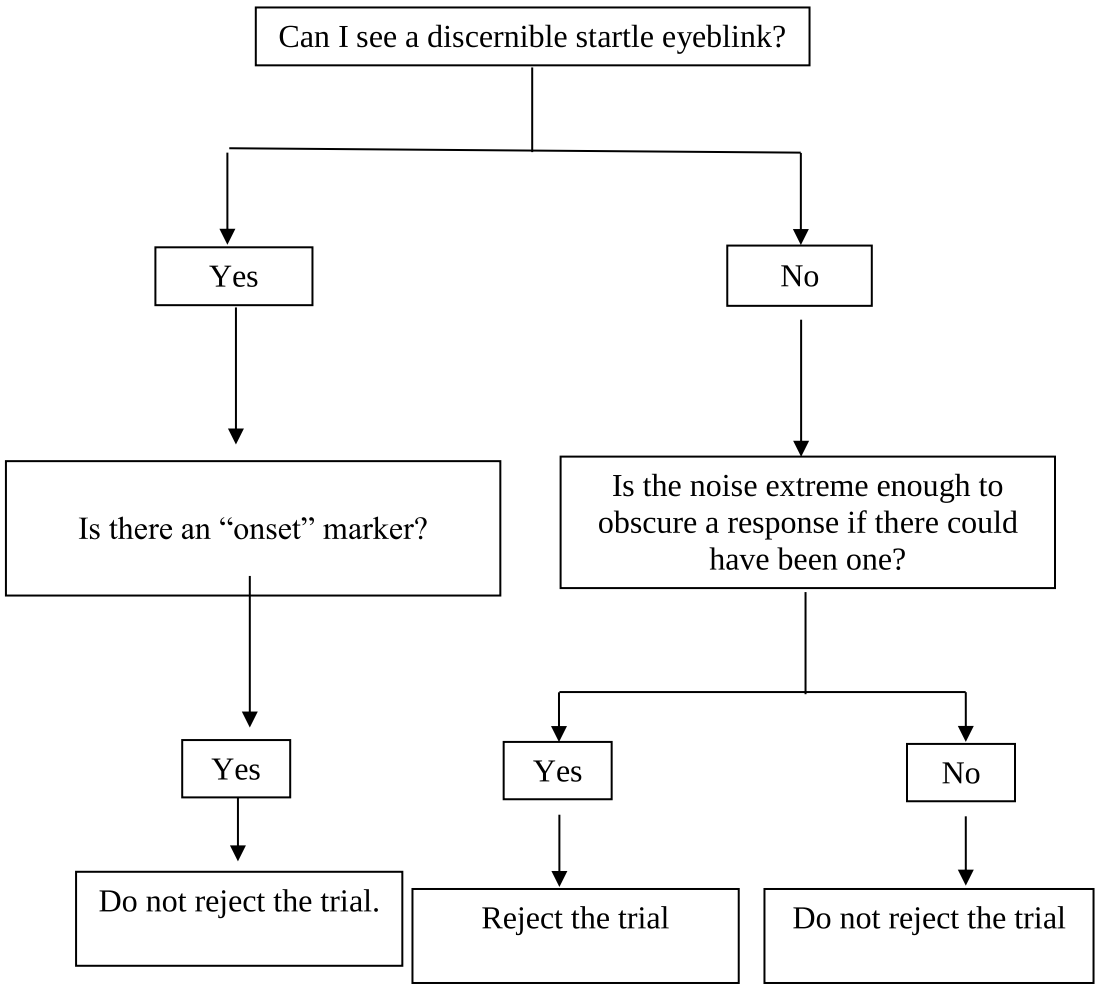
- Go one trial at a time, and *take your time.*
- We are going to err on the side of inclusion.

For the REJECT column:

- 0 = not rejected (i.e., keep the trial) - You will not reject a trial when noise does not interfere with the detection of a startle eyeblink (i.e., it is either a startle eyeblink or a nonresponse). When you are uncertain whether the trial should be rejected (i.e., you are on the fence and can't make a determination), err on the side of including the trial.
  (1) When uncertain, err on the side of inclusion (NOT rejected) if you can see a discernible startle eyeblink.
  (2) When uncertain, err on the side of inclusion (NOT rejected) if the noise is not extreme enough to obscure a response if there would have been one.
- 1 = rejected – Reject a trial if noise makes it impossible to discern a startle eyeblink or if there was a spontaneous eyeblink that started before the baseline period was over.

Appendix A.2 Startle Eyeblink Decision Tree

Startle Eyeblink Decision Tree



Appendix B Inventory of Depression and Anxiety Symptoms (IDAS)

Inventory of Depression and Anxiety Symptoms (IDAS)

Below is a list of feelings, sensations, problems, and experiences that people sometimes have. Read each item to determine how well it describes your recent feelings and experiences. Then select the option that best describes **how much** you have felt or experienced things this way **during the past two weeks, including today**. Use this scale when answering:

1	2	3	4	5
Not at all	**A little bit**	**Moderately**	**Quite a bit**	**Extremely**

_____ 1. I was proud of myself
_____ 2. I felt exhausted
_____ 3. I felt depressed
_____ 4. I felt inadequate
_____ 5. I slept less than usual
_____ 6. I felt fidgety, restless
_____ 7. I had thoughts of suicide
_____ 8. I slept more than usual
_____ 9. I hurt myself purposely
_____ 10. I slept very poorly
_____ 11. I blamed myself for things
_____ 12. I had trouble falling asleep
_____ 13. I felt discouraged about things
_____ 14. I thought about my own death
_____ 15. I thought about hurting myself
_____ 16. I did not have much of an appetite
_____ 17. I felt like eating less than usual
_____ 18. I thought a lot about food
_____ 19. I did not feel much like eating
_____ 20. I ate when I wasn't hungry
_____ 21. I felt optimistic
_____ 22. I ate more than usual
_____ 23. I felt that I had accomplished a lot
_____ 24. I looked forward to things with enjoyment
_____ 25. I was furious
_____ 26. I felt hopeful about the future
_____ 27. I felt that I had a lot to look forward to
_____ 28. I felt like breaking things
_____ 29. I had disturbing thoughts of something bad that happened to me
_____ 30. Little things made me mad
_____ 31. I felt enraged
_____ 32. I had nightmares that reminded me of something bad that happened

______ 33. I lost my temper and yelled at people
______ 34. I felt like I had a lot of interesting things to do
______ 35. I felt like I had a lot of energy
______ 36. I had memories of something scary that happened
______ 37. I felt self-conscious knowing that others were watching me
______ 38. I felt a pain in my chest
______ 39. I was worried about embarrassing myself socially
______ 40. I felt dizzy or light headed
______ 41. I cut or burned myself on purpose
______ 42. I had little interest in my usual hobbies or activities
______ 43. I thought that the world would be better off without me
______ 44. I felt much worse in the morning than later in the day
______ 45. I felt drowsy, sleepy
______ 46. I woke up early and could not get back to sleep
______ 47. I had trouble concentrating
______ 48. I had trouble making up my mind
______ 49. I talked more slowly than usual
______ 50. I had trouble waking up in the morning
______ 51. I found myself worrying all the time
______ 52. I woke up frequently during the night
______ 53. It took a lot of effort for me to get going
______ 54. I woke up much earlier than usual
______ 55. I was trembling or shaking
______ 56. I became anxious in a crowded public setting
______ 57. I felt faint
______ 58. I found it difficult to make eye contact with people
______ 59. My heart was racing or pounding
______ 60. I got upset thinking about something bad that happened
______ 61. I found it difficult to talk with people I did not know well
______ 62. I had a very dry mouth
______ 63. I was short of breath
______ 64. I felt like I was choking

Appendix C Interpersonal Reactivity Index (Iri)

INTERPERSONAL REACTIVITY INDEX (IRI)

The following statements ask about your thoughts and feelings in a variety of situations. Decide how well each item describes you. Choose the appropriate number on the scale at the top of the page (1, 2, 3, 4, or 5) and write the number in the blank next to the item. Read each item carefully and answer as honestly and as accurately as you can.

ANSWER SCALE:	**1**	**2**	**3**	**4**	**5**
	Does not describe me well				**Describes me very well**

______ **1.** I often have tender, concerned feelings for people less fortunate than me.
______ **2.** I sometimes find it difficult to see things from the "other guy's" point of view.
______ **3.** Sometimes I don't feel very sorry for other people when they are having problems.
______ **4.** In emergency situations, I feel apprehensive and ill-at-ease.
______ **5.** I try to look at everybody's side of a disagreement before I make a decision.
______ **6.** When I see someone being taken advantage of, I feel kind of protective towards them.
______ **7.** I sometimes feel helpless when I am in the middle of a very emotional situation.
______ **8.** I sometimes try to understand my friends better by imagining how things look from their perspective.
______ **9.** When I see someone get hurt, I tend to remain calm.
______ **10.** Other people's misfortunes do not usually disturb me a great deal.
______ **11.** If I'm sure I'm right about something, I don't waste much time listening to other people's arguments.
______ **12.** Being in a tense emotional situation scares me.
______ **13.** When I see someone being treated unfairly, I sometimes don't feel very much pity for them.
______ **14.** I am usually pretty effective in dealing with emergencies.
______ **15.** I am often quite touched by things I see happen.
16. I believe that there are two sides to every question and try to look at them both.
______ **17.** I would describe myself as a pretty soft-hearted person.
______ **18.** I tend to lose control during emergencies.
______ **19.** When I'm upset at someone, I usually try to "put myself in his shoes" for a while.
______ **20.** When I see someone who badly needs help in an emergency, I go to pieces.
______ **21.** Before criticizing somebody, I try to imagine how I would feel if I were in their place.