Cortical Reactivity and Attentional Bias during a Body Image Exposure

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Abstract

Photographs of one's own body can evoke different motivational tendencies, depending on one's own body satisfaction and narcissistic propensity. The present study had two main purposes: (1) to replicate and extend the findings from Chong (2014) in order to investigate whether the relationship between body satisfaction and frontal asymmetry is mediated by self-attentional bias, and (2) to determine whether the relationship between body satisfaction and self-attentional bias is moderated by narcissistic vulnerability. A total of 79 Lakehead University female undergraduates completed questionnaires pertaining to narcissism and body satisfaction followed by a laboratory visit to engage in a dot probe and picture-viewing task. The study failed to replicate the negative relationship between body satisfaction and frontal asymmetry, and to demonstrate the hypothesized mediating effect of attentional bias on this relationship. However, body satisfaction predicted attentional bias towards oneself among individuals high on narcissistic vulnerability. At 175 ms exposure duration during the dot probe task, greater narcissistic vulnerability predicted attentional bias towards oneself when participants had high body satisfaction relative to their low-satisfaction counterparts. An opposite pattern emerged at 500 ms exposure duration such that greater narcissistic vulnerability predicted attentional bias towards oneself when participants had low body satisfaction compared to their high-satisfaction counterparts. These observations suggest that in response to stimuli that pose a threat to self-representation, narcissistically vulnerable individuals may engage in attentional processing strategies to build and maintain their self-representation. The null findings are discussed in terms of replication concerns in psychological research, as well as limitations with the existing models of frontal asymmetry.

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In the past decade, researchers have become increasingly interested in the psychology of body image. Body image is a multifaceted construct that encompasses an individual's attitudes, perceptions, and behaviours pertaining to their body (Cash & Prunzinsky, 1990, 2002). According to Stice and Shaw (2002), body dissatisfaction refers to "negative subjective evaluations of one's physical body" (p. 985). Research indicates that body dissatisfaction is a common phenomenon among women and is typically revealed by a discrepancy between one's current body and their conceptualization of the ideal body (Cash & Szymanski, 1995; Fallon & Rozin, 1985; Fitzsimmons-Craft et al., 2015). Women express a desire for a thinner ideal figure and believe that men prefer thinner women (Bergstrom, Neighbors, & Lewis, 2004; Miller & Halberstadt, 2005). Consequently, body dissatisfaction and the desire to be thinner has become the norm, especially for adolescent girls in higher socioeconomic societies (Al Sabbah et al., 2009; Heatherton, Mahamedi, Striepe, Fields, & Keel, 1997; Tiggemann, 2005; Wiseman, Gray, Mosimann, & Ahrens, 1992). The prevalence of body dissatisfaction among adolescent girls ranges from 57% to 84% across many studies (Almeida, Severo, Araújo, Lopes, & Ramos, 2012; Lawler & Nixon, 2011). Given its high prevalence, body image dissatisfaction has become a growing area of research.

Women and adolescent girls are particularly evaluative of weight. A longitudinal study by Dion et al. (2015) found that body dissatisfaction in 18 year-old girls was associated with a desire to be thinner, weight control behaviours, and negative comments about weight. The researchers also found that body dissatisfaction is associated with body mass index (BMI), with higher BMI associated with a greater desire to be thinner. In a nonclinical sample of over 300 women attending university, 87% reported a desire to weigh less (Neighbors & Sobal, 2007).

Women in this sample also expressed greater body weight and shape dissatisfaction than males, even though the males in the sample were significantly more overweight. This suggests that women may be subject to different or more restrictive societal ideas of body weight and shape, and that women internalize these ideals to a greater extent than males regardless of actual body weight. Furthermore, 70% of women aged 30 to 74 report feeling dissatisfied with their weight, despite being within the average range (Allaz, Bernsteing, Rouget, Archinard, & Morabia, 1998). As well, young women prefer a body weight approximately 10% lower than their current weight (Laliberte, Newton, McCabe, & Mills, 2007). Laliberte et al. (2007) also found that body dissatisfaction and disordered eating is significantly related to the belief that one should control one's weight.

Another bodily aspect that women and adolescent girls are particularly evaluative of is body shape. For example, waist-to-hip ratio (WHR) has been shown to be indicative of health risk, with low WHR, or curvaceous body, being associated with better overall health and fertility (Singh, 1993; Streeter & McBurney, 2003). Accordingly, low WHR is viewed by women in Western cultures as more attractive than high WHR (Jasienska, Ziomkiewicz, Ellison, Lipson, & Thune, 2004). However, recent studies suggest that women are now beginning to favour a more androgynous, slender figure to reflect changing cultural ideals. Research has found that over the course of eight generations, women's size preference for waist, bust, underbust, forearm, bicep, calf, and thigh girth have become smaller, while size preference for arms and legs have become longer (Brooks, Shelly, Jordan, & Dixson, 2015; Crossley, Cornelissen, & Tovée, 2012).

Physical appearance is another bodily aspect that women and adolescent girls evaluate. The most significant predictor of appearance and body dissatisfaction is BMI, with women rating their body shape and appearance more poorly as BMI increases (Roefs et al., 2008). In terms of facial appearance, women rate symmetrical faces as more attractive (Fink, Neave, Manning, & Grammer, 2006). Research has also shown that women are highly evaluative of facial features (e.g., lips, eyes, nose, eyebrows, skin, hair) and believe their lives would change in important, positive ways if they attained facial features associated with the ideal beauty standard promoted by the media (Engeln-Maddox, 2006). However, ratings of attractiveness of facial features are idiosyncratic among women due to factors such as societal appearance norms, criticism from others regarding appearance, and conversations about appearance with peers (Jones, Vigfusdottir, & Lee, 2004).

Body dissatisfaction can have detrimental effects. High levels of body dissatisfaction have been associated with social anxiety (Cash & Fleming, 2002b), diminished quality of life (Cash & Fleming, 2002a), depression (Paxton, Neumark-Sztainer, Hannan, & Eisenberg, 2006), emotional distress (Johnson & Wardle, 2005), and low self-esteem (Stice & Bearman, 2001). Studies have also demonstrated body dissatisfaction to be a risk factor for the onset of eating disorder symptoms and maintenance of disordered eating (Johnson & Wardle, 2005; Laliberte et al., 2007; Stice & Agras, 1998). In a meta-analytic review of prospective studies pertaining to maintenance factors for disordered eating, body dissatisfaction surfaced as "one of the most consistent and robust maintenance factors for eating pathology" (Stice, 2002, p. 832-833).

Body Dissatisfaction and Personality

Personality may be one factor in the maintenance of body dissatisfaction. One of the strongest predictors of body dissatisfaction is neuroticism, the tendency to experience unpleasant emotions easily. Neuroticism has shown to be strongly linked with negative appearance evaluation (Kvalem , von Soest, Roald, & Skolieborg, 2006), dissatisfaction with facial appearance (Thomas & Goldberg, 1995), higher weight preoccupation (Davis, Shuster, Blackmore, & Fox, 2004), greater self-objectification (Miner-Rubino, Twenge & Frederickson, 2002), lower body appreciation (Swami, Hadji-Michael, & Furnham, 2008), and greater discrepancy between actual and ideal weight (Swami, Taylor, & Carvalho, 2011). Personality disorders have also been associated with body dissatisfaction, including borderline personality disorder (Sansone, Wiederman, & Monteith, 2001; Miller et al., 2010) and obsessive-compulsive disorder (Pollack & Forbush, 2013).

Body dissatisfaction and narcissism. Another personality construct that is associated with body dissatisfaction is narcissism. Narcissism refers to the capacity to maintain one's self-representation through a variety of cognitive-, affect-, and behaviour-regulatory processes (Pincus & Lukowitsky, 2010). There are two proposed phenotypic expressions of narcissism: narcissistic grandiosity and narcissistic vulnerability. Narcissism is most often associated with arrogant, domineering attitudes and behaviours that enhance one's self-representation, which is captured by narcissistic grandiosity. In contrast, narcissistic vulnerability is described as the experience of helplessness, low self-esteem, and shame in response to threats to self-representation (Pincus et al., 2009; Pincus & Lukowitsky, 2010). Although both phenotypic expressions of narcissism have been shown to be associated with excessive attention to appearance (Back, Schmulke, & Egloff, 2010; Swami, Cass, Waseem, Furham, 2015; Vazire, Naumann, Rentfrow, & Gosling, 2008), narcissistically vulnerable individuals are more likely to base their self-worth on appearance and are more sensitive to appearance evaluation and rejection. For example, studies have reported positive associations between narcissistic vulnerability and drive for thinness (Gordon & Dombeck, 2010), bulimic symptoms (Maples, Collins, Miller, Fischer & Seibert, 2011), and weight preoccupation (Davis, Claridge, & Cerullo, 1997). By comparison, no significant associations have been found between grandiose narcissism and symptoms of disordered eating (MacLaren & Best, 2013; Maples et al., 2011), which suggests that vulnerable, but not grandiose narcissism, is related to body dissatisfaction. Vulnerable narcissists are hypervigilant to interpersonal threats to body image (Besser & Zeigler-Hill, 2010). When such threats occur, these individuals experience severe emotional dysregulation including self-criticism, low self-esteem, and negative affect (Cain, Pincus, & Ansell, 2008; Miller et al., 2010). Consequently, this cognitive processing pattern places vulnerable narcissists at risk for body dissatisfaction. In contrast, grandiose narcissists endorse positive illusions about the self in order to minimize interpersonal threats to the self (Pincus et al., 2010). Such cognitive processing pattern may serve as a protective factor against emotional dysregulation and ensuing body dissatisfaction. In support of this assertion, research shows that grandiose narcissism is positively correlated with high self-esteem and negatively correlated with psychological distress (Miller et al., 2010).

Body Image Exposure

One way to elicit body dissatisfaction is to have participants engage in a body image exposure. In a study by Shafran, Lee, Payne, and Fairburn (2007), females engaged in a body checking manipulation whereby they attended to and analyzed disliked body parts while looking in a mirror. Immediately after engaging in body checking behaviour, females experienced body dissatisfaction and increased self-critical thought. Research has also found associations between exposure to media, affect, and body dissatisfaction in young girls. For example, a study by Tiggeman and McGill (2004) found that women high in body dissatisfaction who viewed magazine advertisements portraying the sociocultural ideal body types had greater negative affect and self-depreciating thoughts. Similarly, Tuschen-Caffier, Vögele, Bracht, and Hilbert (2003) found that self-reported negative emotions increased in response to body image exposures involving both video confrontation and imagery tasks. In an eating symptomatic sample, Ortega-Roldán, Rodríguez-Ruiz, Perakakis, Fernández-Santaella, and Vila (2014) showed that individuals with bulimia nervosa experienced less subjective pleasure and greater arousal, skin conductance, and cardiac acceleration while viewing a video of their own body, which suggests the uncomfortable nature of body image exposures for body-dissatisfied individuals.

Body satisfaction has an effect on an individual's emotional reactivity during a body image exposure. During mirror exposures, body-dissatisfied individuals experience greater elevation of negative emotions and more self-depreciating thoughts compared to their satisfied counterparts (Veale et al., 2016; Vocks, Legenbauer, Wächter, Wucherer, & Kosfelder, 2007). Conversely, women with high body satisfaction experience a pleasant emotional state while viewing photographs of themselves (Buck, Hillman, Evans, & Janelle, 2004). Taken together, these findings suggest that individual differences in body satisfaction influence the way people emotionally respond to a body image exposure.

A noteworthy study by Beato-Fernández et al. (2009) found implications for abnormal cortical activity in patients with eating disorders. Bulimia nervosa, anorexia nervosa, and nonclinical patients engaged in a filmed body image exposure while single photon emission computed tomography measured changes in regional cerebral blood flow. The results of the study revealed a hyperactivation of the right temporal and right occipital areas in patients with bulimia nervosa during exposure to their own body, and a hypoactivation in the mentioned areas during the exposure to a neutral stimulus. In contrast, patients with anorexia nervosa demonstrated hypoactivation of the left parietal and right superior frontal areas from rest to the neutral stimulus, followed by hyperactivation in the mentioned areas during exposure to their own bodies. Nonclinical patients demonstrated hypoactivaiton in the right temporal and right occipital areas during exposure to their own bodies and the neutral stimulus. These results suggest that patients with eating disorders may have functional differences in brain activity involved in processing their own body image (Beato-Fernández et al., 2009).

Frontal Asymmetry

A brain phenomena known of as frontal asymmetry may be particularly suited to studying individual differences in the way people react to seeing their bodies. Frontal asymmetry refers to the relative intensity of frontal lobe cortical activity in one hemisphere relative to the other, measured by electroencephalography (EEG). Differences in cortical activity between the left and right hemisphere is thought to have implications for what an individual is feeling or experiencing. The motivational direction model of frontal asymmetry (Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997) proposes that greater left than right frontal activity is associated with approach motivation, while the reverse is associated with withdrawal motivation. Another theory of frontal asymmetry is referred to as the affective-valence model (Ahern & Schwartz, 1985; Gotlib, Ranganath, & Rosenfeld, 1998; Silberman & Weingartner, 1986), which states that relatively greater left or right frontal activity is associated with increases in positive or negative affect, respectively.

The motivational direction model of frontal asymmetry describes the approach and withdrawal motivational tendencies of the left and right hemisphere (Harmon-Jones & Allen, 1997; Sutton & Davidson, 1997). Gray's (1972) Behaviour Inhibition System (BIS) has been correlated with greater right frontal lobe activity, while the Behavioural Activation System (BAS) has been correlated with greater left frontal lobe activity (Coan & Allen, 2003; Sutton & Davidson, 1997). These patterns of frontal asymmetry support the idea that lateral differences in frontal cortical activity are implicated in dispositions to approach and withdraw. Further evidence for the motivational direction model has come from studies supporting the association between greater left frontal activity and approach-related tendencies, such as optimism (De Pascalis, Cozzuto, Capara, & Alessandri, 2013), sensation-seeking (Gapin, Etier, & Tucker, 2009), and sensitivity to reward (Tomer et al., 2014).

The emotional tendencies of the left and right hemisphere can be explained by the affective-valence model of frontal asymmetry (Ahern & Schwartz, 1985; Gotlib et al., 1998; Silberman & Weingartner, 1986). A number of studies have associated greater left frontal activity with positive affect and greater right frontal activity with negative affect (Davidson, Schwartz, Saron, Bennett, & Goleman, 1979; Jacobs & Snyder, 1996; Tomarken, Davidson, Wheeler, & Doss, 1992). Individual differences in frontal asymmetry can also predict reactivity to emotionally evocative stimuli. For example, when individuals with greater resting left frontal activity are exposed to positive films, they experience more positive affect. Conversely, when individuals with greater resting right frontal activity are exposed to negative films, they experience more negative affect (Wheeler, Davidson, & Tomarken, 1993). Similarly, in a study of musically induced emotions, individuals exhibited greater left frontal activity during the presentation of positively valenced musical excerpts and greater right frontal activity during the presentation of negatively valenced musical excerpts (Schmidt & Trainor, 2001).

Despite support for both conceptual models, the motivational direction model appears to be more strongly associated with frontal asymmetry (Harmon-Jones, 2003). This assertion comes from several studies examining anger, a negatively valenced emotion that typically evokes greater left frontal activity (Harmon-Jones, 2003; Harmon-Jones & Allen, 1998; Harmon-Jones & Sigelman, 2001). Research on trait anger supports the motivational direction model, such that individuals with high levels of trait anger have greater left frontal activity and decreased right frontal activity (Harmon-Jones & Allen, 1998). Stewart, Levin-Silton, Sass, Heller, and Miller (2008) replicated this relationship and found that it occurred irrespective of the way in which anger was expressed (i.e., aggressive verbal or motor behaviour, suppression of angry feelings). Hewig, Hagermann, Seifert, Naumann, and Bartussek (2004) found that individuals who scored higher on measures of physical and verbal aggression and hostility had greater left frontal activity. Additionally, those who demonstrated greater left frontal activity scored higher on a measure of aggressive expression of angry feelings while those who demonstrated greater right frontal activity scored higher on a measure of active management of anger. Such findings demonstrate the relationship between approach and greater left frontal activity and between withdrawal and greater right frontal activity (Hewig et al., 2004).

Directly manipulating anger can also have an impact on frontal asymmetry. In a study of state-induced anger, Harmon-Jones and Sigelman (2001) found that individuals who were insulted demonstrated greater left frontal activity compared to individuals who were not insulted. Additional analysis revealed a positive relationship between reported anger and relative left frontal activity (Harmon-Jones, Vaughn-Scott, Mohr, Sigelman, & Harmon-Jones, 2004). Harmon-Jones, Peterson, and Harris (2009) replicated these results and extended them by demonstrating that social rejection, which is associated with anger and jealousy, causes an increase in left frontal activity. These findings show that state-induced anger influences frontal asymmetry.

Frontal asymmetry and psychopathology. The emotional and motivational propensities associated with frontal asymmetry have been implicated in the study of psychopathology. Depression, which is characterized by a general lack of approach motivation and decreased positive affect, has been associated with greater right frontal activity (Schaffer, Davidson, &

Saron, 1983). Nusslock et al. (2011) found greater cognitive vulnerability to depression was related to a decrease in resting state left frontal activity among individuals without a history of depression. Furthermore, cognitive vulnerability and frontal asymmetry were significant predictors of the onset of an episode of depression, suggesting that dispositional cortical activity is predictive of depression.

Frontal asymmetry also has implications for bipolar disorder, a mood disorder characterized by manic and depressive episodes. Greater resting state left frontal activity is associated with manic episodes (Kano, Nakamura, Mtsuoka, Ida, & Nakajima, 1992) while greater resting state right frontal activity is associated with depressive episodes (Allen, Iacono, Depue, & Arbisi, 1993). Nussock et al. (2012) found that elevated resting left frontal activity predicted vulnerability to manic episodes while decreased left frontal activity predicted vulnerability to depressive episodes. These findings suggest that this pattern of frontal asymmetry may serve as a neuropsychological marker to differentiate between unipolar depression and bipolar disorder.

Frontal asymmetry and manipulation. There are a variety of factors that influence frontal asymmetry. Seasonal variations influence mood such that the fall is associated with greater right frontal activity (Peterson & Harmon-Jones, 2009). Allen, Harmon-Jones, and Cavender (2001) demonstrated that the manipulation of EEG frontal asymmetry can be achieved through biofeedback training over a period of five days. Harmon-Jones et al. (2004) found that inducing sympathy before an angering event reduced left frontal activation caused by anger. Body posture also influences frontal asymmetry such that laying in a supine posture while angry does not result in typically observed greater left frontal activity (Harmon-Jones & Peterson, 2009). Moreover, Peterson, Shackman, and Harmon-Jones (2008) found that left and right hand contractions caused contralateral activation of the motor and prefrontal cortex. When participants received insulting feedback, those who made right hand contractions had greater left than right frontal activity and greater aggression compared to those who made left hand contractions. This finding suggests that motor movements, such as hand contractions, influence frontal asymmetry and emotional responding. Another study by Ponkanen, Peltola, and Hietanen (2011) found that shifts in frontal cortical activity were greater only when individuals viewed a living person as opposed to a photograph of a person on a computer screen. The researchers suggest that facing a live person is likely to play a greater role in influencing sensations of intimacy and experienced self-relevance.

Frontal asymmetry and self-reported affect. Research has suggested discrepancies between frontal asymmetry and self-reported affect. Research has found that receiving the direct or averted gaze of a living person, as opposed to a photograph of a person's face or an object, affects neural mechanisms regulating motivational and emotional responses (Hietanen, Leppänen, Peltola, Linna-aho, & Ruuhiala, 2008; Ponkanen et al., 2011). Direct gaze from a living person was associated with greater left frontal activity (i.e., approach motivation), while averted gaze was associated with greater right frontal activity (i.e., avoidance). Subjective ratings of arousal indicated that direct gaze produced greater arousal compared to averted gaze. Specifically, direct gaze was rated slightly positive but was not as pleasant or as positive as averted gaze. These subjective ratings of valence conflict with frontal asymmetry findings whereby averted gaze was related to withdrawal cortical activity and more positive affect, while direct gaze had the opposite effect (Hietanen et al., 2008; Ponkanen et al., 2011).

Further, Allen et al. (2001) found that self-reported affect was consistent with anticipated frontal cortical activity while viewing happy films, but not neutral or sad films. Similar discrepancies were found in a study examining exposure to 2D and 3D photographs of one's body and that of one's romantic partner (Storeshaw & Davis, 2010). Despite positive affective ratings of photographs of their partners, there was no observation of corresponding greater left frontal activity. Furthermore, participants responded to 3D photographs of themselves with more neutral affect but demonstrated greater right frontal activity, which is suggestive of withdrawal motivation. Allen et al. (2001) propose that the reason for the discrepancy between frontal asymmetry and self-reported affect may be due to methodological factors. For example, it is easier to shift cortical activity to the right hemisphere in individuals who are nondepressed (Allen et al., 2001). Therefore, factors such as psychopathology may influence the relationship between frontal asymmetry and self-reported affect.

Frontal asymmetry and viewing photographs. Studies that have examined frontal asymmetry using photographs have reported discrepant results. For the most part, affective photographs fail to produce predicted effects on frontal cortical activity. For example, Hagemann, Naumann, Becker, Maier, and Bartussek (1998) and Harmon-Jones (2007) found that exposure to positive and negative affective photographs did not elicit any significant changes in frontal asymmetry. Similarly, Elgavish, Halpern, Dikman, and Allen (2003) found that exposure to photographs obtained from the International Affective Picture System (IAPS) did not produce shifts in frontal activity. Another study investigated individual differences in terms of emotive tendencies and their effect on frontal activity in response to positive affective stimuli (Gable & Harmon-Jones, 2008). Possessing an emotive tendency of liking dessert and a longer period since having eaten led to greater left frontal activity while viewing photographs of desserts compared to neutral photographs. However, when measured over the course of the experiment, affective photographs themselves did not produce significant changes in frontal asymmetry.

In an EEG study by Uusberg et al. (2014), participants rated and viewed five types of affective photographs from the IAPS ranging from very pleasant to unpleasant while continuous EEG was recorded. It was hypothesized that affective perception of the stimuli would generate shifts in state asymmetry. Although the participants' subjective ratings of arousal and valence corresponded to the affective stimuli, expected asymmetry effects were not induced by the stimuli; instead, asymmetry was insensitive to affective stimuli on a sample and individual level. The researchers proposed that subjective ratings may reflect nothing more than correct cognitive categorization of stimuli. They also suggest that viewing affective photographs may lack the action-related component of motivation needed to induce asymmetry effects. In the study, participants were unable to overtly avoid or approach the presented stimuli, which might have diminished their motivation to do so and subsequently affected asymmetry. Another explanation offered by the researchers is that there may be stimulus-dependent individual differences in asymmetry responsiveness. In other words, there may have been individual differences in the participants' affective and motivational experience of each stimulus, which would explain the variance and inconsistency of asymmetry responses. Overall, the authors suggest that obtaining reactivity in frontal asymmetry is at least partially dependent on the availability of the action-related component of motivation, as well as the level of personal relevance of the stimuli.

An unpublished study by Chong (2014) tested these assumptions and examined the effects of intermittent periods of darkness on frontal asymmetry while female university students with varying levels of body satisfaction viewed photographs of themselves. EEG frontal cortical activity was recorded while participants engaged in one of two exposure conditions. Participants randomized to the no-darkness condition viewed each photograph for 10 s continuously, without transitions between photographs. In the darkness condition, participants viewed each photograph for 5 s each followed by 5 s of black screen, which effectively immersed the participant into complete darkness. The results of the study showed a positive relationship between body satisfaction and self-reported affect while viewing photographs of one's self. Furthermore, intermittent periods of darkness during a body image exposure had a moderating effect on the relationship between frontal asymmetry and body satisfaction. During the darkness exposure, individuals with low body satisfaction experienced greater right frontal activity, while individuals with high body satisfaction experienced greater left frontal activity. The researcher proposed that individuals with low body satisfaction may ruminate during the dark intervals, which would intensify negative affect and withdrawal motivation associated with greater relative right frontal activity. For individuals with high body satisfaction, darkness may facilitate positive affect and approach motivation associated with greater left frontal activity. Interestingly, the opposite pattern occurred with regard to the no-darkness exposure: Individuals with low body satisfaction experienced greater left frontal activity, while individuals with high body satisfaction experienced greater right frontal activity. The researcher explained this finding in terms of attentional bias. Individuals with low body satisfaction may appraise their own photographs as threatening and thus be motivated to attend to the continuous presentation of self-photographs, which would explain greater relative left frontal activity. Conversely, individuals with high body satisfaction may appraise their photographs as nonthreatening and be less motivated to allocate attentional resources to the continuous presentation of their own photographs, which would explain greater relative right frontal activity. However, this explanation is speculative, as the study did not utilize a measure of attentional bias. Thus, further investigation is needed in order to determine the role of attentional bias on the relationship between body satisfaction and frontal asymmetry.

Attentional Bias

Emotional stimuli that depict threat or fear are thought to receive preferential processing over nonemotional stimuli as they convey potentially important information about the environment. Attention is the process by which the perception and processing of stimuli is enhanced (Hillyard, Vogel, & Luck, 1998). Thus, attention has been proposed as one likely mechanism for prioritizing the processing of threatening information in the environment (MacNamara, Kappenman, Black, Bress, & Hajcak, 2013). Schupp, Junghöfer, Weike, and Alfons (2004) suggest that an individual's attention is initially captured by the emotional content of a stimulus in order to appraise it as either "threatening" or "nonthreatening." This initial capturing of attention serves as an adaptive function to initiate a defensive response. However, once an individual determines that a stimulus does not represent a real threat to them, there is less adaptive value in sustaining attention and consequently, the motivation to attend to the stimulus is allocated elsewhere or declines (Schupp et al. 2004).

Attentional bias towards threat among anxious individuals is a relatively robust phenomenon that has been found in a variety of anxiety disorders, including generalized anxiety disorder (Rinck, Becker, Kellermann, & Roth, 2003), social phobia (Amir, Elias, Klumpp, & Przeworski, 2003), posttraumatic stress disorder (Chan et al., 2013), specific phobia (Rinck, Reinecke, Ellwart, Heuer, & Becker, 2005), panic disorder (Buckley, Blanchard, & Hickling, 2002), and obsessive-compulsive disorder (Cisler & Olatunji, 2010). Researchers propose that attentional bias in anxious individuals can be explained by the vigilance-avoidance hypothesis of anxiety (Mogg, Bradley, Miles, & Dixon, 2004). This theory states that anxious individuals involuntarily and rapidly orient towards threat, and then subsequently shift attention away from threat in order to facilitate escape or avoidance of potential danger and to reduce anxiety.

Attentional bias has been examined with a variety of methodological paradigms, including Stroop (Hope, Rapee, Heimberg, & Dombeck, 1990), modified cueing (Amir et al., 2003), visual search (Eastwood et al., 2005) and movement tasks (Wieser, Pauli, Weyers, Alpers, & Muhlberger, 2009). However, the most commonly used paradigm to assess attentional bias toward threat is the dot probe (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van Ijzendoorn, 2007). In the dot probe paradigm (MacLeod, Mathews, & Tata, 1986), participants are situated in front of a computer or television and asked to stare at a fixation cross in the center of the screen. Upon termination of the fixation cross, two stimuli, one of which is neutral and one of which is threatening, simultaneously appear randomly on either side of the screen. The stimuli are presented for a predetermined length of time (e.g., 500 ms), before a dot, or target probe, is presented in the location of one of the former stimuli. Participants are instructed to indicate the location of the target probe as quickly as possible via keyboard response. Faster responses to targets that replace threat-related images are thought to reflect an increased attention towards threatening stimuli, typically termed as “attentional bias” to threat (MacLeod et al., 1986).

A number of studies have found evidence for attentional bias towards threatening information using the dot probe paradigm. For example, Leutgeb, Sarlo, Schongassner, and Schienle (2015) found that participants with a spider phobia, in comparison to participants without a spider phobia, had faster reaction times (RTs) for targets that replaced a photograph of a spider, suggesting that those with a spider phobia experience an attentional bias towards spider’s location on the screen. Another study by Jasper and Witthoft (2011) investigated threat-related attentional bias in participants with varying degrees of health anxiety using the dot probe paradigm. Health-threatening photographs (e.g., rashes, tumours) and neutral photographs were exposed at two durations (i.e., 175 and 500 ms). The results of the study demonstrated that participants with health anxiety had an attentional bias towards health-threatening photographs. This was indicated by faster RTs for targets that followed from health-threatening photographs rather than neutral photographs. Furthermore, participants with health anxiety had quicker RTs for targets following from health-threatening photographs presented for 175 ms, and slower RTs for targets that followed the same stimuli presented for 500 ms. These results from this study provide support for the vigilance-avoidance hypothesis of anxiety, such that individuals with health anxiety are initially vigilant towards, and then subsequently avoidant of, health-threatening stimuli.

Attentional bias and frontal asymmetry. Research has also investigated the association between EEG cortical activity and attentional bias as measured by the dot probe task. Miskovic and Schmidt (2010) investigated whether EEG asymmetry could predict attentional bias towards socially threatening stimuli in healthy, female university students. Participants' resting EEG frontal asymmetry was first recorded during a 6 min baseline (i.e., 3 min eyes closed, 3 min eyes open). Afterwards, participants engaged in a modified dot probe task, whereby each trial consisted of one stimulus presented for a duration of 250 ms. Participants viewed three types of valenced faces (i.e., angry, happy, neutral). The results of the study found that resting EEG asymmetry predicted attentional bias towards threatening social stimuli. Specifically, right resting frontal EEG asymmetry was associated with vigilance towards angry faces. The researchers proposed that greater attentional bias toward potentially threatening stimuli signals an imminent need to inhibit ongoing behaviour in order to further analyze the source of the threat.

In a similar study, Pérez-Edgar, Kujawa, Nelson, Cole, and Zapp (2013) examined the role of stress on frontal asymmetry and attentional bias towards threatening stimuli. Participants first engaged in a dot probe task consisting of three types of valenced faces (i.e., angry, happy, neutral) presented for either 17 ms or 500 ms. EEG resting frontal asymmetry was then recorded for each participant during a 4-min baseline. Participants then engaged in a speech preparation task, whereby they were told they would have to give a short speech about their most embarrassing moment. Participants were shown a short 2-min video of a confederate giving her embarrassing speech and then given 2 min to prepare and rehearse his or her own speech. EEG signals were collected during this preparation time. The results of the study found that EEG frontal asymmetry at baseline did not predict attentional bias towards angry or happy faces. However, an increase in right frontal asymmetry from baseline to the stressful speech condition was associated with attentional bias towards angry and away from happy faces. These findings suggest that individuals experience withdrawal in response to stressful, threatening events.

Research by Grimshaw, Foster, and Corballis (2014) investigated whether resting frontal asymmetry could predict attention to threat. Participants' resting EEG frontal asymmetry was first recorded during a 4-min baseline. They then completed the dot probe task consisting of three types of valenced faces (i.e., angry, happy, neutral) presented for either 250 ms or 1000 ms. Before each block of dot probe trials, participants viewed a series of images taken from the International Affective Picture System (IAPS) in order to maximise the likelihood of instituting a negative attentional bias. Each series included six unpleasant and six neutral images, each presented for 6 s. The study found that those with greater resting left frontal asymmetry did not have an attentional bias towards threatening stimuli. However, among those with greater resting right frontal asymmetry, those with low right parietal activity showed vigilance for threat and those with high right parietal activity showed avoidance. This finding suggests that frontal and parietal asymmetries interact to predict attentional bias to threat. Taken together with the few other studies that have studied the relationship between frontal asymmetry and attention bias (Miskovic & Schmidt, 2010; Pérez-Edgar et al., 2013), these findings also suggest that a focus on attentional control processes may extend our understanding of how frontal and parietal asymmetries could give rise to a broad range of individual differences in personality and emotional processing.

Attentional bias and body dissatisfaction. Body dissatisfaction, which is characterized by an overvaluation of and preoccupation with body weight, shape, and appearance, has implications for attentional bias. Women who are dissatisfied with their bodies tend to have selective attention of shape- and weight-related information such that they maintain a focus on negative aspects of their own body or minimize awareness of nonbodily aspects (Aspen, Darcy, & Lock, 2013; Vitousek & Orimoto, 2012). For example, an eye-tracker study by Ju and Johnson (2010) showed that women who internalized the sociocultural norm of attractiveness oriented their attention towards a highly rated attractive model in a magazine longer and more often than other low- to moderate-rated magazine models. In addition, women's self-report of social comparison were positively related to gaze duration and eye fixations, further suggesting an attentional bias towards body-related information. In a study investigating visual attention, Jansen, Nederkoorn, and Mulkens (2005) found eating-symptomatic patients were more likely to avert their attention from "beautiful" body parts and focused on "ugly" body parts when viewing images of their own body. When shown images of others' bodies, they attended to "beautiful" parts. Conversely, healthy controls attended to "beautiful" parts when looking at their own bodies and attended to "ugly" parts when looking at images of another's body. Similarly, Tuschen-Caffier et al. (2015) found that patients with anorexia nervosa and bulimia nervosa display longer and more frequent gazes towards their self-defined dissatisfying body parts compared to their self-defined beautiful body parts. Taken together, these findings suggest that attentional bias toward dissatisfying body parts may maintain and exacerbate body dissatisfaction.

In a study using the dot probe paradigm, Smith and Rieger (2010) investigated the role of mood in triggering selective attention towards negative shape- and weight-related information in a sample of healthy, female undergraduate students. Participants were randomized to one of three induction conditions (i.e., body dissatisfaction, negative mood, or neutral), whereby participants were asked to imagine themselves in a described situation. Afterwards, participants engaged in a dot probe task consisting of negative weight- and shape-related words. The results of the study found that participants who engaged in a negative mood induction had an attentional bias towards negative shape- and weight-related words. The researchers suggest that the negative mood induction may have aroused social anxiety in the participants, which in turn caused them to selectively attend to aspects of their appearance that may be negatively evaluated by others.

Blechert, Ansorge, and Tuschen-Caffier (2010) investigated body-related attentional biases in eating disorders with anorexia nervosa and bulimia nervosa using the dot probe paradigm. The study found that participants with anorexia nervosa had faster RTs for targets following photographs of their own body than photographs of another participant's body. Participants with bulimia nervosa, on the other hand, did not show such a bias and instead revealed a nonsignificant tendency in the other direction. Healthy control participants did not show any attentional bias for photographs of their own or another participant's body. These findings suggest that those with an eating disorder attend to negative or threatening body-related stimuli. Furthermore, the study evidences a difference in attentional bias between healthy controls and those with an eating disorder, as well as between those with anorexia nervosa and bulimia nervosa.

The Present Study

Previous research by Chong (2014) demonstrates that body-dissatisfied individuals experience approach motivation towards photographs of themselves, as demonstrated by greater left frontal asymmetry. On the other hand, body-satisfied individuals experience withdrawal motivation, which is associated with greater right frontal activity. This finding may be explained in terms of attentional processing, as previous research shows that body-dissatisfied individuals have an attentional bias towards body-related information (Rieger et al., 2010; Smith & Rieger, 2010). However, there is no published research into frontal asymmetry as it might relate to body satisfaction and attentional bias. The purpose of this study is to replicate and extend previous findings from Chong (2014) in order to investigate whether the relationship between body satisfaction and frontal asymmetry is mediated by self-attentional bias during a continuous body image exposure to photographs of oneself. Guided by the current literature, the following hypotheses are offered:

(1) Frontal asymmetry will be negatively associated with body satisfaction, such that low body satisfaction will predict greater relative left frontal asymmetry, while high body satisfaction will predict greater relative right frontal asymmetry.

(2) Self-attentional bias will mediate the relationship between body satisfaction and frontal asymmetry (see Figure 1). Specifically, those with low body satisfaction will have an increase in attentional bias towards body-related information pertaining to one's self and greater relative left frontal asymmetry. Conversely, those with high body satisfaction will

have a decrease in attentional bias towards body-related information pertaining to one's self and greater relative right frontal asymmetry.

Previous research has also shown that body dissatisfaction is associated with narcissistic vulnerability (Swami et al., 2015) and that body-dissatisfied individuals interpret body-related information as threatening (Blechert et al., 2010; Smith & Rieger, 2010). However, there is no published research into body satisfaction as it might relate to narcissistic vulnerability in the context of an attentional bias research paradigm. As an exploratory examination of this issue, the present study sought to investigate whether the relationship between body satisfaction and attentional bias towards oneself is moderated by narcissistic vulnerability during a continuous body image exposure to photographs of oneself. As this is a more exploratory issue, no specific predictions were made as to the directionality of the possible moderating effect of narcissistic vulnerability.

[redacted]

Figure 1. Hypothetical model of the mediating effect of self-attentional bias on the relationship between body satisfaction and frontal asymmetry; M_i = mediator effect; X = predictor variable; Y = criterion variable.

Method

Participants

The present study recruited female participants since much of the body image exposure literature is predicated upon women. Females were recruited from psychology and nursing undergraduate courses at Lakehead University via classroom announcements and a mass e-mail. The e-mail provided a brief description of the study, an overview of the eligibility criteria, and a hyperlink to complete an online questionnaire via SurveyMonkey (see Appendix A). Prior to completion of the online questionnaire, participants were provided an online participant information letter and consent form (Appendix B). A total of 79 participants completed the online testing battery and subsequently scheduled lab appointments. The age of participants ranged from 17 to 47 (M = 20.27, SD = 5.73). Approximately 84.8% of participants self-identified as Caucasian, 6.3% as Aboriginal, 2.5% as South Asian, 2.5% as East Asian and the remaining as “Other”. The mean BMI was 24.67 (SD = 5.04). To be eligible, participants were required to be female, right-handed, nonsmoker, and enrolled in an introductory psychology and/or nursing course at Lakehead University offering bonus points. Participants received half of one bonus point upon completing the online questionnaire, half of one bonus point for completing the first schedule lab visit, and one and one-half bonus points for completing the second schedule lab visit. Bonus points were applied to participants’ final grade in a university course eligible for bonus points.

Materials

Demographics Questionnaire. (Appendix C). A demographic questionnaire was used to collect information regarding participants’ age, marital status, ethnicity, school enrolment status, program of study, and prescribed and/or over-the-counter medication(s).

Edinburgh Handedness Inventory – Short Form. (EDI – Short Form; Veale, 2014; Appendix D). This scale measures hand preference for four everyday tasks: writing, throwing, using a toothbrush, and using a spoon. Participants rated how often they use their left and right hand for each item on a scale of -100 (*always left*) to +100 (*always right*). As handedness has been shown to influence cortical activity in the frontal lobes (Papousek & Schulter, 1999), the present study used the EDI – Short Form as a screening tool to ensure participants were predominately right handed. Self-reported handedness by participants was predominately right (M = 90.03, SD = 17.26).

Self-Assessment Manikin. (SAM; Bradley & Lang, 1994; Appendix E). The purpose of this instrument is to assess the emotional valence and arousal a person experiences in response to a stimulus. Individuals are asked to indicate their current feelings based on a 9-point scale arrayed with a graphic character. In the current experiment, the SAM was used to determine the extent to which photographs influence state affective valence (1 = *unhappy, annoyed, unsatisfied, despaired, bored* and 9 = *happy, pleased, satisfied, content, hopeful*) and arousal (1 = *relaxed, calm, sluggish, sleepy, unaroused* and 9 = *stimulated, excited, jittery, wide awake, aroused*). According to Morris (1995), the correlations between scores obtained using the SAM and Mehrabian and Russell's three-factor theory of emotions were impressive for both valence (r = .94) and arousal (r = .94). The SAM has been used in several studies involving affective photographs as a reliable measure of arousal and affective reactivity (Bradley & Lang, 1994; Buck, Hillman, Evans, & Janelle, 2004; Pahlavan & Lubart, 2007).

Body Image States Scale. (BISS; Cash, Fleming, Alindogan, Steadman, & Whitehead, 2002; Appendix F). The purpose of this scale is to measure an individual's evaluative and affective body image states, assessing domains such as physical appearance, body size and shape, weight, attractiveness, and looks. The questionnaire is composed of six items rated on a 9-point scale in which high scores indicate positive state body image. Research by Vocks, Hechler, Rohrig, and Legenbauer (2009) show that internal consistency for women is between α = .77 – .85. In other studies, test-retest reliability for women has shown to be *r* = .69 over a two- to three-week period (Cash et al., 2002). The BISS demonstrates construct validity as assessed by an experiment on reactivity to information regarding appearance and body image investment, as well as convergent validity by correlating with a number of body image indicators such as the BMI (Cash et al., 2002).

Brief-Pathological Narcissism Inventory. (B-PNI; Schoenleber, Roche, Wetzel, Pincus, & Roberts, 2015; Appendix G). This is a 28-item self-report measure of pathological narcissism that produces two subscales; narcissistic Grandiosity and Vulnerability. Respondents rate how much they agree with each item on a 6-point scale ranging from 0 (*not at all like me*) to 5 (*very much like me*). Higher scores reflect greater pathological narcissism. Item response theory and confirmatory factor analyses established the best-performing 28 items from the original 52-item PNI developed by Pincus et al. (2009). In the validation study of the B-NPI, Cronbach's alpha index of internal consistency were reported to be α = .82 – .86 for Grandiosity and .93 for Vulnerability. The B-PNI demonstrates criterion validity by correlating with other narcissism measures (Schoenleber et al., 2015).

Apparatus

Electroencephalography. Electroencephalography (EEG) activity was used to measure participants' frontal asymmetry in alpha power (square microvolts = μV^2). The electrode placement complied with the International Electrode Placement System, using the following electrodes: left and right frontal (F3 and F4), left and right parietal (P3 and P4), and midline central (Cz). Parietal activity was examined as research typically investigates parietal asymmetry alongside frontal asymmetry in studies of attentional processing (Weissman and Woldorff, 2005). A ground electrode was placed 2.5 cm below the left clavicle and 5 cm from the armpit. The Cz electrode served as the reference electrode. Participants were fitted with a 24-channel Waveguard cap with electrodes fed through a 72-channel amplifier and into a computer with ASA 4.7 Experiment Manager (Version 9.2) software to record the signals (all EEG apparatus was supplied by Advanced Neuro Technology, Enschede, the Netherlands). Using ElectroGel, efforts were made to bring impedance values below 25 kΩ. Cortical activity was continuously sampled during each of the three recording blocks for 5 min at 1024Hz sampling frequency.

Procedure

Participants completed a battery of online questionnaires via SurveyMonkey, which included a demographic questionnaire, the EDI-Short Form, the BISS, the B-PNI, and questionnaires related to a separate study. Upon completion, participants were credited with half of one bonus point and invited to sign up for a laboratory appointment on Experiment Manager System (Sona Systems) to have their photographs taken. After signing up, participants were instructed to attend the first laboratory session wearing dark street clothing for purposes of standardization across the experimental procedure. Upon arrival at the laboratory for the 20-min appointment, participants read the participant information letter (Appendix H) and signed the participant consent form (Appendix I). Participants then had 30 photographs taken in 8 different angles (0°, 45°, 90°, 135°, 180°, 225°, 270°, and 315°) and 3 different poses (i.e., full portrait pose of the entire body, a seated portrait pose of the entire body, head and shoulder portrait pose). One photograph was taken at each angle for all poses, except at 0°, whereby three photographs were taken. Additionally, participants were asked to maintain a neutral facial expression while having their photographs taken. A tripod-mounted Canon EOS 7D camera with a Canon EF-S 17-85mm image stabilizer lens was used to take photographs of the participant. The photographs were then downloaded, cropped, and adjusted (lighting, colour saturation) using Adobe Photoshop Lightroom (Version 6.0) on an IBM® IntelliStation M Pro workstation computer. Photographs were also prepared in a slideshow format using Adobe Photoshop Lightroom (Version 6.0). Participants' weight was recorded using a Brecknell (LPS-400) digital scale. As well, height and head circumference were measured. At the end of the session, participants used the laboratory computer to sign up for a second laboratory session via Experiment Manager System. Afterwards participants were thanked and credited with half of one bonus point.

Twenty-four hours prior to the second scheduled laboratory session, participants received an email reminder for their upcoming laboratory visit. Participants were also instructed to refrain from consuming caffeine, nicotine, alcohol, or medication, and engaging in physical exercise two hours prior to the scheduled laboratory session to avoid noise effects on EEG data recording. Upon arrival for the second 1.5-hour laboratory visit, participants were fitted with an EEG cap and given verbal instructions regarding the experimental procedure (see Figure 2). Afterwards, the researcher retreated into a back room to attend to the computers controlling the EEG recording, dot probe task, and picture presentations. The dot probe task was programmed and presented using Inquisit Version 4.0 (Millisecond software). During the picture viewing task, photographs were presented in a slideshow format using VideoLan VLC media player (Version 2.1.0). All pictures in the dot probe and picture viewing task were projected onto a 72-inch diagonal wide Samsung DLP television located 2 m in front of the seated participant. It was the only source emitting light in the otherwise completely dark experimental room.

[redacted]

Figure 2. Timeline of activities during second lab visit.

Participants were exposed to three types of photographs during the final laboratory visit: photographs of themselves (self), photographs of an anonymous female participant (other), and blackened silhouettes of another anonymous female student (neutral). The latter served as neutral stimuli devoid of any recognizable details of the face or body. In generating neutral photographs, the average BMI was calculated for the first 25 participants who completed the first laboratory visit. The participant with the average BMI = 23.81 (SD = 4.34) had her photographs modified into silhouettes for neutral photographs using Adobe Photoshop Elements (Version 13.0).

Other photographs were determined by a pilot study. A separate sample of 5 models were recruited via Facebook posting (see Appendix J). Models arranged a 20-min laboratory session with a research assistant via e-mail and were instructed to attend wearing dark street clothing. Upon arrival, models read the information letter (see Appendix K) and consent form (see Appendix L). Models then had 30 photographs taken in the same manner as described in the procedure above. Four female graduate students in the Department of Psychology then volunteered to rate photographs of 30 individuals: the first 25 participants to complete the first laboratory visit and the 5 models. The purpose of rating 25 participant photographs among the 5 model photographs was to prevent a rating bias in favour of the models. Raters viewed a slideshow presentation consisting of one photograph of each participant in a full portrait pose of the entire body. Each photograph was displayed for 1.5 min, making the slideshow presentation a total length of 45 min. Photographs were initially randomized and presented to all raters in the same order; thus, raters could not identify which was a model photograph. While viewing the presentation, raters determined the extent to which each photograph was attractive in terms of body weight, size/shape, and physical appearance (1 = *Not at all attractive* and 9 = *Very Attractive*). Additionally, raters determined the extent to which each photograph influenced state affective valence (1 = *unhappy, annoyed, unsatisfied, despaired, bored* and 9 = *happy, pleased, satisfied, content, hopeful*) and arousal (1 = *relaxed, calm, sluggish, sleepy, unaroused* and 9 = *stimulated, excited, jittery, wide awake, aroused*) (see Appendix M). Each rater's three attractiveness scores were averaged for an overall attractiveness score, and then averaged among all raters. Valence and arousal ratings were also averaged among all raters. The model with the highest average attractiveness rating among the four raters (M = 7.17, SD = 0.43) had her set of 30 photographs used for other photographs in the dot probe task. Average valence and arousal rating for this model was M = 3.75, (SD = 0.96) and M = 5.25 (SD = 1.50) respectively.

In the first part of the second laboratory visit, participants engaged in a modified version of Miskovic and Schmidt's (2010) dot probe paradigm. Trials began with a fixation cross in the center of the screen (1000 ms), followed by the onset of a "threatening" photograph (i.e., self or other) and a neutral photograph presented simultaneously to the left and right side of the screen. Threatening and neutral photographs had an equal probability of appearing on either side of the screen. Three types of photograph pairs were randomized and presented with equal probability across the task: (1) self and neutral, (2) other and neutral, and (3) neutral and neutral. The dot probe literature suggests that patterns of vigilance and avoidance to threat may shift with increasing exposure to the stimulus of interest (e.g., Jasper & Witthoft, 2011). As an exploratory examination of this issue, each pair of photographs in the present dot probe task had an equal probability of being presented for either 175 ms or 500 ms before a target probe (i.e., dot) was presented in the location of one of the former photographs. Participants were instructed to indicate the target probe's location as quickly and accurately as possible using the "<" (left) and ">" (right) keyboard response. Faster RTs to targets that replaced a threat-related image reflected an attentional bias towards threat. Trials were initiated by the participant's response or after a specified interval (i.e., 3000 ms) if no response occurred. The inter-trial interval was 1000 ms. The experiment order began with one practice block of 24 trials, consisting of only neutral/neutral photograph pairs, followed by two testing blocks consisting of 120 trials each and the presentation threatening/neutral photograph pairs. Of the 240 test trials, 180 (75%) were valid (i.e., target probe appearing in the same location as the previously presented threatening photograph) and 60 (25%) were invalid (i.e., target probe appearing in the location opposite of the previously presented threatening photograph). Trials with incorrect responses and RTs less than 100 ms or more than 1000 ms were not recorded.

In the second part of the laboratory session, participants closed their eyes, relaxed, and remained as still as possible for a 5-min baseline EEG recording. At the end of the recording block, a bell rang to signal the participant to open their eyes. Participants then engaged in a picture viewing task. Participants were exposed to two different viewing blocks presented in the same order: neutral and self photographs. Each photograph block consisted of 30 photographs presented for a total of 5 min. Each photograph was presented for 10 s with 0 s transition between photographs. After each block, participants were instructed via written passages on the television to complete the SAM questionnaire. Upon completion of the picture viewing task, participants were assisted with removing the EEG cap, thanked, dismissed, and credited with 1.5 bonus points.

Results

Data Preparation

Regarding EEG data, artefacts resulting from eye blinks, movements, or muscle activity were visually inspected and removed using Advanced Source Analysis (ASA; Version 4.8.0) software from Advance Neuro Technology (Enschede, Netherlands). Analysis of EEG data used a high-pass filter and a low cut-off frequency of 1 Hz, and the interval between epochs was 0.5 s. To extract alpha-band activity, the fast Fourier transform filter was applied to derive power spectral densities with specific interest in the 8 – 13 Hz band. A Hanning Window was then used to extract epochs. The maximum number of epochs per 5-min recording block was 602, with the average number of utilizable epochs in the sample being 566 per participant. Ninety-five percent of epochs were artefact-free for the neutral block (M = 569.82, SD = 77.99), and 96% of epochs were artefact-free for the self block (M = 575.59, SD = 61.51).

Psychometric, SAM, dot probe, and EEG data were entered in SPSS v. 23. All continuous variables were assessed for normality using $Z_{skewness}$, calculated as skewness / *SE*. Any $Z_{skewness}$ score beyond ±1.96 was considered significantly skewed at $p < .05$ (Field, 2013). Positively skewed EEG alpha μV^2 values at all four recording sites were subjected to the natural log transformation as is customary in this field of research. SAM arousal rating for the eyes closed block was positively skewed ($Z_{skewness}$ = 4.4), indicating that participants experienced low arousal. A positive skew can be expected as participants were asked to relax (i.e., reduce arousal) during the eyes close block. As such, no data transformation was applied to SAM ratings. Curvilinear regression analysis was used to determine whether a nonlinear relationship existed between criterion and predictor variables; none were discovered. Among EEG data, two participants had missing frontal and parietal alpha μV^2 values for the self block due to technical error in recording. In addition, outliers were discovered in five parietal asymmetry scores from three separate individuals and eight frontal asymmetry scores from four separate individuals. Outliers were defined as *z* scores beyond $\pm$3.29 (Field, 2013). Missing and outlier EEG recordings were replaced by participants' average EEG μV^2 of the remaining blocks. A total of 183 incorrect responses and 85 outlier RTs (i.e., above 1000 ms or under 100 ms) were found among all recorded dot probe trials and removed from analysis. The average number of incorrect responses per participant was 2.32 (*SD* = 2.45) and the average number of outliers per participant was 1.08 (*SD* = 1.39).

Questionnaire data. Descriptive information regarding psychometric variables is reported in Table 1. All of the psychometric variables exhibited good internal consistency as evidenced by Cronbach's α. Examination of this table reveals BISS is negatively associated with B-PNI Vulnerability and B-PNI Vulnerability is positively associated with B-PNI Grandiosity.

EEG and SAM data. In accordance with Papousek and colleagues' (2013) procedure, EEG laterality coefficients (LC) were computed for each picture block expressed as a percent of differential alpha power in the right (R) minus left hemisphere (L) relative to total alpha power according to the following formula: LC = [(R - L)/(R + L)] X 100. In the interpretation of this

Table 1

Descriptive Statistics, Reliability Coefficients, and Intercorrelations of the Psychometric Variables

Variables	*M*	*SD*	α	$Z_{skewness}$	Range (Actual)	(1)	(2)
(1) BISS	5.40	1.32	.80	−0.26	2.5 – 8.0		
(2) B-PNI Vulnerability	1.77	0.88	.89	0.79	0.38 – 3.69	−.30*	
(3) B-PNI Grandiosity	2.52	0.84	.84	−0.34	0.33 – 4.67	−.17	.58**

Note. *N* = 79. BISS = Body Image States Scale; B-PNI = Brief-Pathological Narcissism. Inventory; α = Cronbach's alpha internal consistency.
**p* < .01; *p* < .001

metric, the assumption is made that alpha power is the inverse of cortical activity, thus decreases in power reflect increase in cortical activation (Allen, Coan, & Nazarian, 2004). Positive LC values therefore indicate greater alpha activity at the R than at the L hemisphere scalp, and thus greater L than R hemisphere cortical activity expressed as a percent of total alpha power. Conversely, negative values indicate greater alpha activity in the L than in the R hemisphere, which reflects greater right hemisphere cortical activity. In EEG studies, this asymmetry ratio is equivalent to the well-established practice of calculating cortical asymmetry, whereby the inverse log transformation of the raw EEG alpha output for the left and right frontal hemispheres are computed (InR – InL). Previous findings show virtually perfect correlations between the inverse log transformation method and LC method (Davidson, 1988; Papousek & Schulter, 2002). Furthermore, LC allows for easier comparison of data from different studies, different frequency bands, and different locations (Pivik et al., 1993). A reactivity index (self minus neutral picture block) was calculated for frontal (ΔFLC) and parietal (ΔPLC) laterality coefficients. Positive values represent migration towards greater left hemisphere cortical activity when photographs transition from neutral to self blocks; negative values signify shifts toward right hemisphere activity.

Table 2 presents the descriptive statistics for the untransformed EEG and SAM data across the three viewing blocks. Given the study's focus on the latter two blocks only, a dependent means *t* test was conducted for each of the eight variables using logarithmically transformed EEG alpha μV^2 values. While SAM Valence remained stable, SAM Arousal significantly increased as participants transitioned from neutral to self viewing blocks. A significant decline in alpha power from neutral to self viewing blocks was observed at all four EEG recording sites, signifying a diffuse increase in anterior (frontal) and posterior (parietal) cortical activity. Frontal LC remained stable while parietal LC declined, wherein the latter may be interpreted as a migration to the right hemisphere.

Dot probe data. Table 3 presents the descriptive statistics for the dot probe variables. A self- and other-attentional bias index (ABI) was calculated for each exposure duration of 175 ms and 500 ms as follows: [invalid threat trial RTs–valid threat trial RTs] – [invalid neutral trial RTs–valid neutral trial RTs] (Miskovic & Schmidt, 2010). In the interpretation of this metric, the assumption is made that attentional bias towards a stimulus results from an individual's attention being allocated to the location of the screen where the stimulus is presented. As such, greater attentional bias towards a stimulus is demonstrated by quicker RTs to target probes that appear in the same location as the stimulus (i.e., valid trial) and slower RTs to target probes that appear in the opposite location as the stimulus (i.e., invalid trial). Thus, larger differences between the RTs of valid and invalid trials for a stimulus indicate greater attentional bias towards the stimulus. In the case of little to no attentional bias, RTs for valid and invalid trials are similar, as attention is not allocated to any particular location on the screen. Thus, smaller differences between the RTs of valid and invalid trials for a stimulus indicate less attentional bias towards the stimulus. Conceptually, the ABI metric compares attentional bias of threatening photographs to neutral photographs. Larger ABI values represent greater attentional bias towards threatening

Table 2

Means and Standard Deviations of SAM and EEG Variables Across the Viewing Blocks of the Experimental Procedure

	Viewing blocks				
Variables	Eyes closed	Neutral pictures	Self pictures	$t(82)$	p
SAM					
Valence	6.99 (1.36)	5.20 (1.45)	5.22 (1.89)	−.07	.95
Arousal	3.27 (1.59)	3.10 (1.72)	4.01 (1.96)	−5.36	< .001
EEG recording sites					
F3	8.50[a] (7.04)	6.18 (5.01)	5.50 (4.72)	5.76[b]	< .001
F4	8.60 (7.40)	6.22 (5.31)	5.54 (5.04)	6.06	< .001
P3	25.36 (22.06)	9.17 (7.38)	7.68 (6.54)	5.22	< .001
P4	28.24 (25.25)	8.55 (6.94)	6.91 (5.48)	6.25	< .001
EEG laterality coefficient					
Frontal	−0.47 (7.44)	−0.44 (7.41)	−0.61 (7.28)	−0.03	.98
Parietal	3.77 (14.73)	−2.77 (10.73)	−3.68 (9.56)	1.99	.05

Note. $N = 79$. The table shows means and standard deviations of SAM ratings and EEG alpha power (μV^2) in the left and right frontal (F3, F4), the left and right parietal (P3, P4) electrode sites, and the frontal and parietal laterality coefficient scores during eyes closed, neutral, and self view blocks during the experimental procedure. Standard deviations are in parentheses. SAM = Self Assessment Manikin.

[a]Untransformed power spectral density in the 8-13 Hz alpha power band expressed in microvolts μV^2 . [b]The dependent means *t* test compared neutral to self blocks on logarithmically transformed EEG alpha μV^2 values.

Table 3

Means and Standard Deviations of Reaction Times (ms) Across Dot Probe Variables

Variables	175 ms	500 ms
Self		
Valid	431.73 (68.44)	439.70 (64.53)
Invalid	474.55 (69.57)	465.95 (69.82)
Other		
Valid	447.70 (65.04)	447.69 (62.29)
Invalid	466.58 (61.89)	449.47 (66.51)
Neutral		
Valid	449.26 (62.58)	447.61 (59.60)
Invalid	444.67 (63.15)	448.68 (63.21)
Attentional Bias Index (ABI)		
Self-ABI	47.41 (46.75)	25.18 (48.21)
Other ABI	23.47 (43.48)	0.71 (39.47)
Attentional Bias Score (ABS)		
Self-ABS	23.94 (37.15)	24.48 (42.67)

Note. $N = 79$. Standard deviations are in parentheses.

photographs compared to neutral photographs. A self-attentional bias score (self-ABS) was then calculated for each exposure duration as follows: self-ABI – other-ABI. Larger self-ABS values represent greater attentional bias towards photographs of oneself compared to another anonymous female.

Hypothesis 1

Regarding the first hypothesis, bivariate correlation using SPSS was used to examine the relationship between BISS and ΔFLC. Contrary to expectations, a negative relationship between BISS and ΔFLC was not discovered, $r(79) = .003$, $p = .98$. These results demonstrate no evidence of an association between body satisfaction and frontal asymmetry. However, it is possible that this relationship exists via the mediating effect of self-attentional bias, the analysis for which is described below.

Hypothesis 2

The second hypothesis was investigated through a series of mediated multiple regression models using the SPSS *PROCESS* macro for model 4 (Hayes, 2013). The goal of mediation analysis is to establish the intervening variable, or mediator (M), through which *X* exerts its effect on *Y* (Hayes, 2013). The first mediation model investigated whether the regression of ΔFLC (Y) on BISS (X) was mediated by self-ABS at 175 ms (M_i) (see Figure 3a). There was no significant indirect effect of BISS on ΔFLC through self-ABS at 175ms, $b = -.001$, CI [−.01, .004] (see Table 4). This represented a small effect, $K^2 = .004$, 95% CI [.00, .02]. Hence it was concluded that self-ABS at 175 ms does not mediate the relationship between BISS and ΔFLC. The second mediation model investigated whether the regression of ΔFLC (Y) on BISS (X) was mediated by self-ABS at 500 ms (M_i) (see Figure 3b). The results signified BISS as a predictor of self-ABS at 500 ms ($b = -6.84$, $p = .031$). Nonetheless self-ABS at 500 ms was nonsignificant in predicting ΔFLC ($b = -.0003$, $p = .45$). As the results have indicated, there was no significant indirect effect of BISS on ΔFLC through self-ABS at 500 ms, $b = -.002$, CI [−.003, .01] (see Table 5). This represented a small effect, $K^2 = .02$, 95% CI [.001, .06]. The results suggest that self attentional bias at 175 ms and 500 ms have no mediating effect on the relationship between body satisfaction and frontal asymmetry.

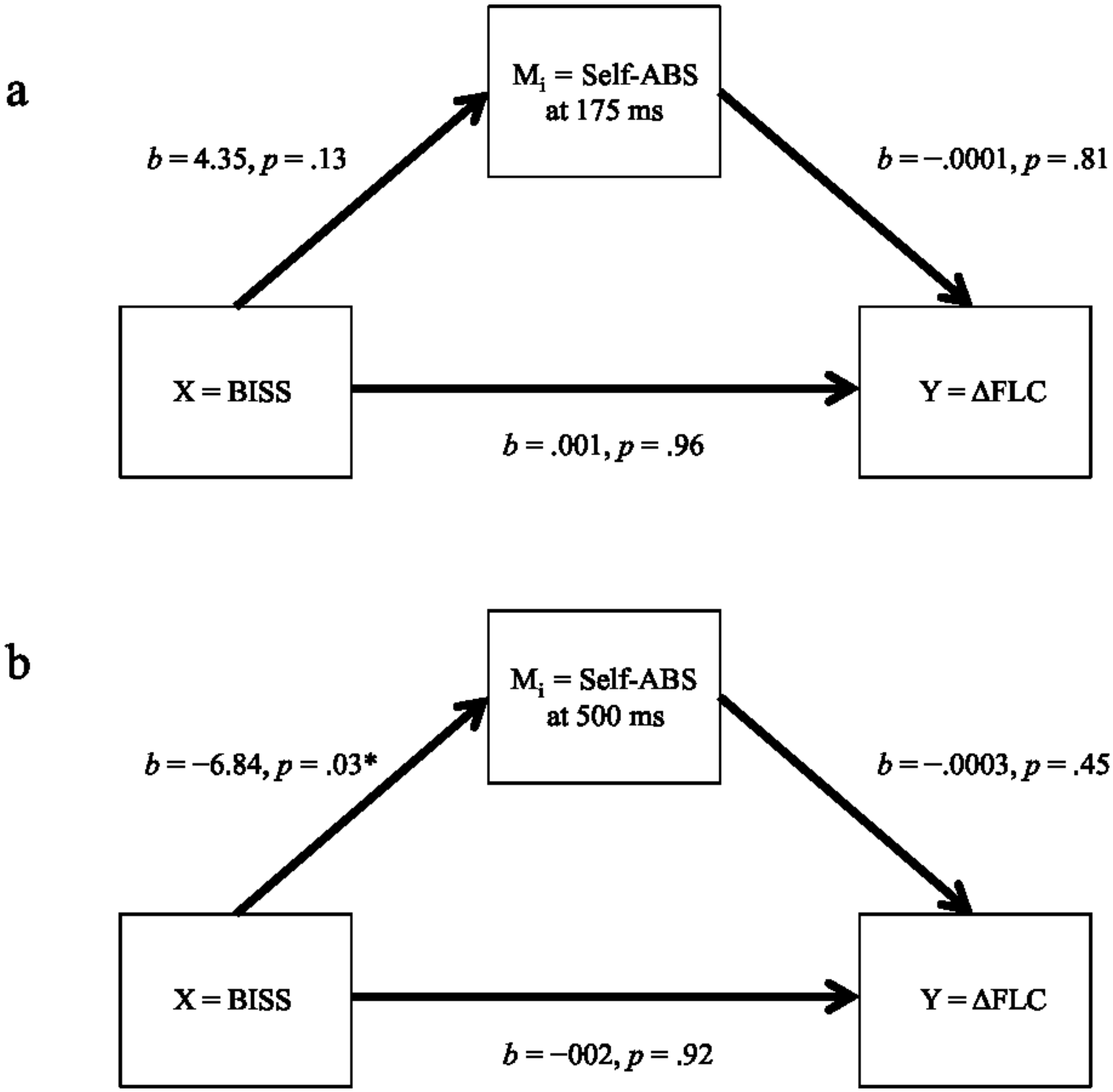

Figure 3. Mediation model of the effects of BISS upon ΔFLC as mediated by Self-ABS at 175 ms (a) and 500 ms (b). M_i = mediator variable; X = predictor variable; Y = criterion variable; BISS = Body Image States Scale; ΔFLC = change in frontal cortical asymmetry as photographs transition from neutral to self block; Self-ABS = self-attentional bias score.

Table 4.

Mediated Multiple Regression Analysis With Self-ABS at 175 ms as the Mediator

	Self-ABS at 175 ms			ΔFLC		
	b	*SE B*	*p*	*b*	*SE B*	*p*
BISS	4.35	2.81	.13	.001	.02	.96
Self-ABS at 175 ms	–––	–––	–––	−.0001	.001	.81
	R^2 = .02 $F(1,77) = 2.404$, $p = .13$			R^2 = .001 $F(1,76) = .028$, $p = .97$		

Note. N = 79. BISS = Body Image States Scale; ΔFLC = change in frontal cortical asymmetry as photographs transition from neutral to self block; Self-ABS = self-attentional bias score

Table 5.

Mediated Multiple Regression Analysis With Self-ABS at 500 ms as the Mediator

	Self-ABS at 500 ms			ΔFLC		
	b	*SE B*	*p*	*b*	*SE B*	*p*
BISS	−6.84	3.12	.03	−.002	.018	.92
Self-ABS at 500 ms	–––	–––	–––	−.0003	.0004	.45
	R^2 = .05 $F(1,77) = 4.81$, $p = .13$			R^2 = .01 $F(1,76) = .31$, $p = .74$		

Note. N = 79. BISS = Body Image States Scale; ΔFLC = change in frontal cortical asymmetry as photographs transition from neutral to self block; Self-ABS = self-attentional bias score

Exploratory Analysis

An exploratory analysis was conducted to investigate whether the relationship between body satisfaction and attentional bias towards oneself is moderated by narcissistic vulnerability. A series of moderated multiple regression models were tested using the SPSS *PROCESS* macro for model 1 (Hayes, 2013). The goal of moderation analysis is to determine when a moderator variable (M) influences the magnitude of the relationship between *X* and *Y*. The first model investigated whether the regression of self-ABS at 175 ms (Y) on BISS (X) was moderated by B-PNI Vulnerability (M). As revealed in Table 6, there was a significant BISS × Vulnerability interaction. In other words, the effect of BISS on self-ABS at 175 ms exposure duration is dependent upon whether one is high or low on Vulnerability. This interaction was further probed using a pick-a-point approach to simple slopes analysis of unstandardized regression coefficients for Y on X at $\pm$ 1 *SDs* on M. The resulting positive slope was statistically significant for participants high (+1 *SD*) on Vulnerability, $b = 10.96$ ($SE\ b = 2.69$), $t = 4.07$, $p = .006$. Above average BISS predicts greater attentional bias to oneself at 175 ms when participants are above average on B-PNI Vulnerability (see Figure 4a). The slope of Y on X for participants low on B-PNI Vulnerability was not statistically significant.

The second regression model revealed that the regression of self-ABS at 500 ms (Y) on BISS (X) was moderated by B-PNI Vulnerability (M) (see Table 6). Simple slopes analysis uncovered a significant negative prediction for participants high on B-PNI Vulnerability, $b = -11.18$ ($SE\ b = 4.00$), $t = -2.80$, $p = .007$. Below average BISS predicts greater attentional bias to oneself at 500 ms when participants are above average on B-PNI Vulnerability (see Figure 4b). The slope for participants low on B-PNI Vulnerability was not statistically significant.

The same two regression models were also tested with B-PNI Grandiosity serving as the moderator variable. As revealed in Table 7, no significant main or conditional interaction effects emerged in either analysis. Therefore, grandiose narcissism does not moderate the relationship between body satisfaction and self-attentional bias.

Table 6

Moderated Multiple Regression Results of the Regression Coefficients Predicting Self-ABS at 175 ms and 500 ms (Y) from BISS (X) with B-PNI Vulnerability (M)

	175 ms				500 ms			
	b [95% CI]	*SE b*	*t*(78)	*p*	*b* [95% CI]	*SE b*	*t*(78)	*p*
Constant	26.23 [18.16, 34.30]	4.05	6.48	.000	22.25 [12.28, 32.23]	5.01	4.44	.000
BISS	5.15 [0.04, 10.27]	2.57	2.01	.048	−5.56 [−11.91, 0.80]	3.19	−1.74	.086
B-PNI Vulnerability	8.33 [0.17, 16.49]	4.10	2.03	.046	2.16 [−7.22, 11.53]	4.71	0.46	.648
BISS x B-PNI Vulnerability	6.63 [1.96, 11.30]	2.35	2.83	.006	−6.42 [−11.77, −1.07]	2.69	−2.40	.019

Note. $N = 79$. $R^2 = .11$ for 175 ms; $R^2 = .08$. for 500 ms

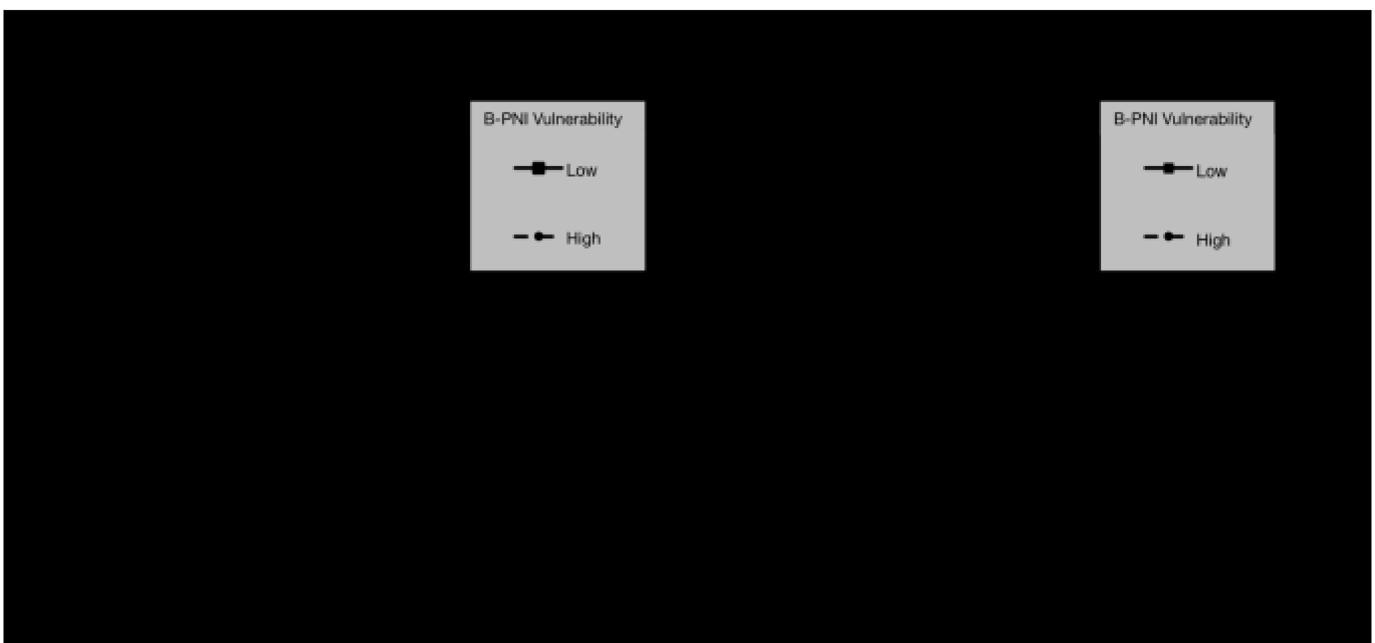

Figure 4. Self-attentional bias score (ABS) plotted as a function of the Body Image States Scale (BISS) by the Brief-Pathological Narcissism Inventory (B-PNI) Vulnerability subscale at 175 ms (a) and 500 ms (b) exposure duration. Scores for low and high BISS and B-PNI were ± 1 *SD* from the mean.

Table 7

Moderated Multiple Regression Results of the Regression Coefficients Predicting Self-ABS at 175 ms and 500 ms (Y) from BISS (X) with B-PNI Grandiosity (M)

	175 ms				500 ms			
	b [95% CI]	*SE b*	*t*(78)	*p*	*b* [95% CI]	*SE b*	*t*(78)	*p*
Constant	24.50 [16.17, 32.84]	4.19	5.85	< .001	24.35 [14.51, 34.18]	4.94	4.93	< .001
BISS	3.91 [−2.02, 9.85]	2.98	1.31	.19	-6.68 [−13.61, 0.25]	3.48	−1.92	.06
B-PNI Grandiosity	2.08 [−8.34, 12.50]	5.23	0.40	.69	0.16 [−11.86, 12.18]	6.03	0.03	.98
BISS x B-PNI Grandiosity	3.13 [−3.47, 9.74]	3.31	0.95	.35	-0.70 [−7.77, 6.36]	3.55	-0.20	.84

Note. $N = 79$. $R^2 = .04$ for 175 ms; $R^2 = .05$. for 500 ms

Discussion

The purpose of the present study was to replicate and extend previous findings from Chong (2014) to assess the effect of attentional bias on the relationship between frontal asymmetry and body satisfaction within the context of a body image exposure. It was hypothesized that frontal asymmetry would be negatively associated with body satisfaction, such that low body satisfaction would predict greater relative left frontal asymmetry, while high body satisfaction would predict greater relative right frontal asymmetry. Previous research shows that body-dissatisfied individuals have an attentional bias towards body-related information (Blechert et al., 2010; Smith & Rieger, 2010). Thus, it was hypothesized that self-attentional bias would mediate the relationship between body satisfaction and frontal asymmetry. Also of interest was to determine whether narcissistic vulnerability has a moderating effect on the relationship between body satisfaction and self-attentional bias. This exploratory question is based on previous research demonstrating an association between narcissistic vulnerability and body dissatisfaction (Swami et al., 2015).

Replication Concerns in Psychological Research

Contrary to previous findings from Chong (2014), no significant negative association was found between body satisfaction and frontal asymmetry. This finding may be explained in terms of replication concerns in psychological research. In one of the first and largest projects of its kind, a team of researchers at the Center for Open Science replicated studies reported in 100 original papers in an effort to obtain an initial estimate of the reproducibility of psychological science (Open Science Collaboration, 2015). Studies were sampled from three high-status psychology journals: *Psychological Science, Journal of Personality and Social Psychology,* and *Journal of Experimental Psychology: Learning, Memory, and Cognition.* The replication protocol included: (1) randomly selecting articles and their key finding from each journal, (2) contacting the original authors for study materials, and (3) preparing and reviewing the study and analysis plan by the original authors and authors assigned to replicate the study. The results of the study show that 97% of the original studies had significant results (p <.05), while only 36% of the replication studies had a significant result. Furthermore, combining original and replication results left 68% of studies with statistically significant effects. Taken together, these findings demonstrate a small replication effect in psychological science.

The authors propose two reasons for the small replication effect, which may help explain the null finding of the present study. First, replications can fail if the methodology differs from the original in ways that can potentially interfere with the observed effect. Despite using original materials and study protocols, the present study had some notable differences from Chong

(2014). These differences include the characteristics and number of the experimenters running the study, the addition of the dot probe protocol, the inclusion of more nursing students, the standardized aspect ratio of the photographs, and laboratory setup. Such factors in the procedure, sample, or setting could have impacted the magnitude of the observed effect in unanticipated ways. Second, null results are published less frequently than statistically significant results (Franco, Malhotra, & Simonovits, 2014), which in turn may produce a literature with an upwardly biased effect size. In examining all research results, the replication studies that were conducted by the Centre for Open Science significantly reduced this bias, perhaps towards a more realistic effect. As such, the null finding of the present study may suggest an alternative theoretical explanation, the implications of which are discussed below.

Limitations of Existing Models of Frontal Asymmetry

The present study hypothesized that self-attentional bias would mediate the relationship between body satisfaction and frontal asymmetry. However, findings from the study do not support this hypothesis; thus, attentional bias does not explain the negative relationship between body satisfaction and frontal asymmetry reported by Chong (2014). The null frontal asymmetry findings in the study may be explained by the limitations of the existing models of frontal asymmetry. According to Grimshaw and Carmel (2014), there are two major limitations to the existing models. First, the models are premised on the assumption that there is one fundamental model, based on emotion and motivation, which should explain all the findings in the literature. However, this assumption is unlikely to hold as there is support for each existing model. Second, none of the existing models specifies the mechanisms that are lateralized or explains how they give rise to either emotion or motivation. In other words, they do not explain what drives frontal asymmetry.

Research suggests that there are no reliable hemispheric asymmetries related to the *generation* of emotional and motivational experiences. This is reflected in the discrepancies found in the literature regarding the relationship between frontal asymmetry and self-report affect (Allen et al., 2001; Hietanen et al., 2008; Ponkanen et al., 2008; Storeshaw & Davis, 2010) and viewing affective photographs (Elgavish et al., 2003; Gabel & Harmon-Jones, 2008; Hagemann et al., 1998; Harmon-Jones, 2007; Uusberg et al., 2014). Instead, research demonstrates broad and bilaterally distributed activity across the prefrontal cortex in response to highly arousing stimuli (for reviews, see Kaiser, Andrews-Hanna, Wager, & Pizzagalli, 2015; Lindquist, Satpute, Wager, Weber, & Barrett, 2016; Wager et al., 2003). In support of this assertion, participants in the present study had greater self-report arousal in response to self photographs compared to neutral photographs. Correspondingly, participants experienced an increase in cortical activity across all EEG recording sites, as well as bilaterally distributed cortical activity in the frontal lobes, as photographs transitions from neutral to self viewing blocks.

Lateralization effects emerge in a more complex pattern than previous theories have suggested when considering specific brain structures within hemispheres. In particular, neuroimaging studies have identified an association between cognitive control of emotion and asymmetries within areas of the dorsolateral prefrontal cortex (dlPFC). The dlPFC is a brain area associated with executive functioning (i.e., updating, shifting, inhibition) and directing attention in goal-relevant ways in response to emotional stimuli (Miyake & Friedman, 2012). Studies on emotion regulation demonstrate the role of the left dlPFC in supressing negative emotional stimuli (Compton et al., 2003) and the role of the right dlPFC in supressing positive emotional stimuli (Beauregard, Lévesque, & Bourgouin, 2001). Taking into account these findings and the limitations of the existing models, Grimshaw and Carmel (2014) proposed an alternative explanation of frontal asymmetry called the asymmetric inhibition model. This model explains frontal asymmetry in terms of executive control mechanisms that inhibit interference from irrelevant emotional distractors. Specifically, the model proposes that activation in the left dlPFC is associated with inhibition of negative emotional distractors, while activation in the right dlPFC is associated with inhibition of positive emotional distractors. The authors propose that the asymmetric inhibition model has a number of advantages. First, it focuses on asymmetry in a single brain area rather than an entire hemisphere, thus allowing for specific and testable predictions. Second, unlike the previous models, the asymmetric inhibition model is based on supporting evidence regarding how emotion and motivation is generated. Previous research on frontal asymmetry may also be explained in terms of this new model, such that left dlPFC activity is associated with the inhibition of withdrawal instead of the support of approach motivation and right dlPFC activity is associated with the inhibition of approach instead of the support of withdrawal motivation.

In light of the literature, the present study may have failed to replicate and extend the findings reported by Chong (2014) as a result of examining motivation in the prefrontal lobes, which have been proven to be unreliable predictors of motivation. These null findings may reflect an alternative theoretical explanation to frontal asymmetry, such as the asymmetric inhibition model. However, it is difficult to determine how higher order functions such as attentional processing are amenable to threatening stimuli, as the study did not directly examine asymmetry in the dlPFC. In the investigation of motivation towards photographs of one’s self, the study observed broadly distributed cortical activity across the prefrontal cortex instead of examining the specialized function of the dlPFC with respect to cognitive control of emotion.

Nonetheless, the null findings make advances towards the theoretical innovation of frontal asymmetry and understanding of neurocognitive processes involved in attentional processing.

Parietal Asymmetry

In contrast to the frontal lobes, the study evidenced a trend towards greater right parietal asymmetry as photographs transitioned from the neutral to self viewing blocks. Previous research shows that activity in the right parietal hemisphere is associated with enhanced spatial processing of sensory stimuli in the environment (Culham, Cavina-Pratesi, & Singhal, 2006) and greater attentional control (Balle et al., 2013). Schmidt and Trainor (2001) also suggest that parietal asymmetry might occur only when maintaining a focus of attention on external stimuli as opposed to an internal focus. Furthermore, previous research shows that cortical activity in the left parietal lobe is associated with processing stimuli of low salience, while right parietal lobe activity is associated with processing stimuli of high salience (Bardi, Kanai, Mapelli, & Walsh, 2013; Bardi, Kanai, & Walsh, 2010). Given these findings, a trend towards greater right parietal asymmetry in the present study may be expected as partcipants viewed externally presented photographs and had higher self-reported arousal in response to self photographs compared to neutral photographs. Although at a trend level, these findings suggest a negative relationship between parietal asymmetry and salience of emotional stimuli, whereby greater right parietal asymmetry is associated with processing stimuli of high salience.

Valence and Arousal Interaction

Results from the study also evidenced stable SAM valence ratings as photographs transitions from neutral to self viewing blocks. However, SAM arousal ratings increased in response to self photographs compared to neutral photographs. These results are comparable to those found by Chong (2014), whereby participants experienced greater arousal, but not valence, in response to self-photographs. Instead of being linearly associated, research suggests valence and arousal are unique dimensions that interact with one another in response to emotional stimuli. Bradley and Lang (1994) propose that SAM ratings of positive valence reflect one's tendency to approach a stimulus, whereas negative valence reflects a tendency to escape or withdraw from a stimulus. SAM arousal ratings, on the other hand, reflect the amount of vigour associated with a given motivational tendency (i.e. approach or withdrawal). In the present study, participants reported both positive and negative valence in response to self-photographs. However, neutral valence ratings would have resulted from averaging all participants' valence responses. As such, an increase in arousal in response to self-photographs may reflect an increase in vigour to either approach or withdraw from self-photographs, depending on one's experience of valence. Overall, these findings support the interaction between valence and arousal in response to emotional stimuli.

Self-Attentional Bias Among Vulnerable Narcissists

An exploratory question was proposed concerning whether the relationship between body satisfaction and attentional bias towards one's self is moderated by narcissistic vulnerability. Body satisfaction predicted attentional bias towards oneself *only* among individuals high on narcissistic vulnerability. Further, and of greater interest, is the differential direction in prediction as a function of exposure duration. At 175 ms, individuals high on narcissistic vulnerability evidenced greater attentional bias towards oneself when they had high body satisfaction relative to their low-satisfaction counterparts. An opposite pattern emerged at 500 ms such that those high on narcissistic vulnerability experienced greater attentional bias towards oneself when they reported low body satisfaction compared to their high-satisfaction counterparts. In neither case with respect to exposure duration did body satisfaction predict attentional bias among those participants low in narcissistic vulnerability.

Observations regarding vulnerable narcissism can be explained in terms of the vigilance-avoidance hypothesis (Mogg et al., 2004). According to this theory, individuals rapidly orient their attention towards threat and then subsequently shift attention away from threat in order to facilitate escape or avoidance of potential danger. Thus, in order to determine whether an individual appraises a stimulus as threatening, one would have to examine the pattern of attentional bias towards the stimulus over varying exposure durations. For example, Vassilopoulos (2005) examined the time course of attentional bias for emotional words in high and low socially anxious individuals during a dot probe task. Participants were presented three types of emotional stimuli (i.e., social-threat words, positive social words, and physical-threat words) at 200 ms and 500 ms exposure durations. The study found that individuals high in social anxiety had an increase in attentional bias towards all emotional words at 200 ms, and then a decrease in attentional bias towards the same words presented at 500 ms. Similarly, Koster, Verschuere, Crombez, and Damme (2005) examined attentional bias towards neutral, high-threatening, and mild-threatening stimuli among socially anxious individuals at three exposure durations: 100 ms, 500 ms, and 1250 ms. One of the main findings from the study was that individuals high in social anxiety demonstrated greater attentional bias towards mild and high threatening stimuli at 100 ms and 500 ms, and then a decrease in attentional bias towards the same stimuli presented at 1250 ms. In both studies, the authors suggest that socially anxious individuals might rapidly become vigilant of threatening stimuli at short exposure durations, but then direct their attention away from such stimuli at longer durations in order to reduce their subjective discomfort or anxiety. Taken together, these studies suggest the importance of examining attentional bias at various exposure durations to identify a pattern of vigilance-avoidance.

In the present study, attentional bias towards photographs of one's self was examined at 175 ms and 500 ms, thus allowing for the examination of vigilance and avoidance. In accordance with previous research, one can assert that vulnerable narcissists with high body satisfaction appraised photographs of themselves as threatening. These individuals had an increase in attentional bias towards photographs of themselves at 175 ms and then a decrease in attentional bias towards the same photographs presented at 500 ms, thus demonstrating a pattern of vigilance-avoidance. Conversely, vulnerable narcissists with low body satisfaction appraised photographs of themselves as nonthreatening. These individuals demonstrated little attentional bias towards photographs of themselves at 175 ms and subsequently greater attentional bias towards the same photographs at 500 ms, thus suggesting a pattern of gradual attention.

In response to stimuli that pose a threat to self-representation, vulnerable narcissists may engage in attentional processing strategies to enhance and protect their self-representation. Classical theories contend that narcissistic vulnerability results from either parental devaluation or overvaluation early in life, which in turn leads to positively and negatively distorted self-representations (Zeigler-Hill, Green, Arnau, Sisemore, & Myers, 2011). In order to confirm their current conceptions of themselves, vulnerable narcissists may develop a strong motivational tendency to maintain and defend such distorted self-concepts (Horvath & Morf, 2009). For vulnerable narcissists who evaluate themselves in an overly *positive* manner, avoidance strategies are used to cope with threat when the ideal self-representation is not possible or admiration is not forthcoming (Dickinson & Pincus, 2003; Horvath & Morf, 2009). Thomaes and Sedikides (2015) refer to this avoidance strategy as "self-protective disengagement" (p. 10). In the present study, individuals with high body satisfaction may appraise their own photographs as threatening because the photographs do not measure up to their inflated self-representation. Thus, these individuals may rapidly detect photographs of themselves as threatening and then subsequently avoid their photographs in order to mitigate potential damage to their self-representation. Conversely, previous research shows that individuals who evaluate themselves in an overly *negative* manner perpetuate their self-representation by seeking information that confirms their currently held negative self-views (see Kwang & Swann, 2010). In the present study, vulnerable narcissists with low body satisfaction may demonstrate a pattern of gradual attention towards their own photographs in order to confirm and maintain their self-representation of low body satisfaction.

A more speculative explanation for self-attentional bias in vulnerable narcissists with low body satisfaction is the mere ownership effect. According to this theory, individuals ascribe more liking to entities merely because they belong to them (Beggan, 1992). For example, Kim and Johnson (2012) found that objects that are assigned to one's self are more desirable than objects assigned to another person. This effect may extend to entities such as aspects of one's self-representation. Participants in this study may have become increasing vigilant towards photographs of themselves in order to further integrate low body satisfaction into their self-representation to increase feelings of liking and maintain their self-representation.

This study also evidenced a positive association between grandiose and vulnerable narcissism (r = .58). This finding is comparable to the association observed in a study by Schoenleber et al (2015) which found the correlation between B-PNI Grandiosity and Vulnerability to be r = .55 - .64. Although the two phenotypes of narcissism were associated with one another, only narcissistic vulnerability correlated with body satisfaction. Furthermore, grandiose narcissism did not moderate the relationship between body satisfaction and self-attentional bias, unlike narcissistic vulnerability. These findings support previous research suggesting that vulnerable, but not grandiose narcissism, is related to body satisfaction (MacLaren & Best, 2013; Maples et al., 2011).

Together these results show that body satisfaction predicts attentional bias towards oneself *only* in vulnerable narcissists. Those with high body satisfaction appraised photographs of themselves as threatening while those with low body satisfaction appraised photographs of themselves as nonthreatening. These findings suggest that vulnerable narcissists adopt attentional processing strategies in order to build and maintain their self-representation, regardless of whether aspects of self-representation are inherently positive or negative. To our knowledge, this is the first study to examine body-related threat detection in vulnerable narcissists. Future research is needed in order to replicate and extend the findings from the present study to determine what drives this attentional processing strategy.

Such attentional processing strategies have clinical implications for maintaining body satisfaction or dissatisfaction, depending on one's own narcissistic propensity. Understanding attentional bias in vulnerable narcissists may help professionals better understand the complex influence of narcissistic vulnerability on the maintenance of body dissatisfaction, especially among those with an eating disorder. These findings may also elucidate the relationship between specific body-related threats and their effect on the maintenance eating disorder-related behaviours.

Limitations and Future Directions

There are some notable limitations to this study. Participants were asked to refrain from eating, participating in physical activity, or consuming hypertensive medication prior to taking part in the lab sessions. However, 20 (25%) participants reported that they disregarded these criteria, which may have altered cortical responses. Moreover, the emotional state of participants prior to taking part in the study could not be controlled. Consequently, frontal asymmetry also may have been affected and had an impact on the findings. Future studies may want to incorporate a self-report measure of mood for participants to complete prior to engaging in a body image exposure. EEG methods also have their advantages and disadvantages. For example, EEG has the advantage of being a noninvasive method of measuring the brain's response to various stimuli in real time. However, the disadvantage of EEG is that it is difficult to directly measure subcortical activity of specific brain regions. Future research should examine cortical reactivity during a body image exposure using a more advanced technique that allows structural and functional imaging. Related to this, studies should examine frontal asymmetry in the dlPFC to investigate the validity of the asymmetric inhibition model. Such studies can help researchers gain more insight into the relationship between executive functioning and reactivity to emotional stimuli.

While the dot probe paradigm yielded significant findings in terms of attentional processing, it is not without its limitations. The dot probe paradigm is one of the most commonly used measures of attentional processing. However, the paradigm, as well as the metric to measure attentional bias, has been modified considerably across many studies, making it difficult to compare results from the present study to other studies. Attentional bias can also be defined in one of two ways. Attentional engagement refers to the selection and preferential processing of a specific stimulus due it's ability to *capture* attention, while attentional disengagement refers to the selection and preferential processing of a specific stimulus due to its ability to *hold* attention (Posner, 1980). Traditional dot probe tasks, such as the one used in the present study, measure how quickly participants respond to a target probe appearing in the same or opposite location of a previously presented stimulus. As such, the present study is limited to measuring attentional engagement. Future studies should replicate the present study using a modified version of the dot probe task that measures attentional engagement and disengagement concurrently (i.e., Grafton & MacLeod, 2014). Such a paradigm would be helpful in developing a richer understanding of attentional processing in vulnerable narcissists with varying body dispositions.

The characteristics of the population are yet another potential limitation to the study. It is possible that there may have been a difference in body satisfaction between those who volunteered in the study and those who did not. In the current study, none of the participants refused to take part upon learning that they would have their photographs taken, which may be an indication that the study self-selected those with high body satisfaction. Moreover, the small sample used in the study was primarily made up of a young cohort and consisted of only female university students. Consequently, the results of the study cannot be generalized to the entire population. Further studies should examine attentional processing and cortical reactivity during a body image exposure using a larger, more diverse sample of individuals.

Strengths and Conclusions

The present study had a number of noteworthy strengths. Many studies use normative affective or arousing stimuli in the investigation of attentional bias. The most common type of stimuli used are angry and happy faces. Angry faces represent universal signals of threat that may facilitate withdrawal-related motivational tendencies needed to escape potential harm or danger. By contrast, happy faces are universal signals of approval and facilitate approach-related tendencies required to engage opportunities to enhance one’s wellbeing (see Miskovic & Schmidt, 2010). Normative stimuli such as these are generated based on the average ratings of a sample of individuals. Thus, the drawback to using normative stimuli is that they do not take into account individual differences in affective and arousal responses. Variation in the salience of a stimulus may exist based on the unique experiences of the individual. In other words, what is highly salient to one person may not be to another. To account for this variation, the present study used self-photographs to enhance the motivational salience of the stimuli for all participants.

The type of stimuli used in the study are another strength. Studies examining self-attentional bias among body-dissatisfied individuals typically do not use neutral stimuli (e.g., Jansen et al., 2005; Ju & Johnson, 2010). Without a baseline for comparison, it is difficult to examine the magnitude of the observed effect within these studies. Other studies have used nonbody-related stimuli as neutral stimuli (e.g., Blechert et al., 2010, Smith & Rieger, 2010). However, comparing body and nonbody stimuli does not allow researchers to determine whether attentional bias is influenced by the relevance of body information. In the present study, three type of stimuli were examined for attentional bias: self, other, and neutral. Unlike previous studies, all stimuli comprised of body information and differed only in respect to self-relevance of the information. The use of such stimuli allowed for the examination of the influence of self-relevant stimuli on attentional bias, which no published research has investigated to the author's knowledge.

Another strength of the study was the use of the B-PNI. Previous studies have used self-report measures of narcissism with poor psychometric properties, the most common being the Narcissistic Personality Inventory (see Pincus et al., 2009). Such measures are afflicted with issues involving the ambiguity of normal versus pathological narcissism, as well as the limited scope of pathological narcissistic characteristics. In light of these issues, Pincus et al. (2009)

developed the PNI, which is a multidimensional self-report measure of pathological narcissism that assesses the constructs full range of clinical characteristics. Compared to other studies, the B-PNI in the present study provided a clinically relevant, efficient, reliable, and valid multidimensional measure of pathological narcissism. Inclusion of such a measure also helped to expose the complex relationship between narcissism and body satisfaction.

In summary, the present study failed to replicate and extend the findings from Chong (2014). These null findings reflect replication concerns in psychological research and perhaps suggest an alternative theoretical explanation to frontal asymmetry, such as the asymmetric inhibition model. By contrast, the study found that body satisfaction predicts attentional bias towards oneself in vulnerable narcissists. These findings suggest that vulnerable narcissists adopt attentional processing styles to build and maintain their self-representation. As a whole, results of this study make advances towards a more comprehensive understanding of attentional processing of threat in relation to body dissatisfaction. Further research is necessary, especially replication studies, to help determine the validity of the asymmetric inhibition model and what drives attentional processing strategies in vulnerable narcissists.

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Appendix A
Participant Recruitment Mass Email

Dear Potential Participant,

My name is Samantha Chong, a graduate student and research assistant working with Dr. Ron Davis in the Department of Psychology at Lakehead University. We are conducting a research project called the Picture Study. The purpose of this study is to examine the changes in brain and heart activity that may occur when a person views photographs of oneself and others.

To be eligible to participate, you must be:

- Female;
- A non-smoker;
- Not currently taking any cold, antidepressant, or hypertension medications

If you are eligible to participate in this study, you would first complete some questionnaires online that ask you about certain attitudes, behaviours, and emotions. These questionnaires will take about 30 minutes to complete.

To complete the online questionnaire, click on this:
https://www.surveymonkey.com/r/picture_study_part_1

Then you would sign up to attend two separate laboratory visits in the Department of Psychology with one of the research assistants. During the first laboratory visit you would have 30 photographs taken while you stand and sit in solid black pants and t-shirt with neutral facial expression and posture. Your head circumference, height, and weight would also be measured. This first visit will take about 30 minutes of your time. During the second laboratory visit days later, you will be fitted with ECG chest electrodes and an EEG cap in order to record your heart and brain activity while you view the photographs of yourself and other people. This second laboratory visit will take approximately 90 minutes of your time.

Your participation in this study is completely voluntary and you may withdraw from it at any time without penalty.

If you are registered in a Psychology undergraduate course eligible for bonus points, your participation by way of questionnaire completion and attending both laboratory meetings would lead to 2.5 bonus points credited to your final grade in that course. Please feel free to contact me and/or Dr. Ron Davis with any questions that you might have. This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca.

Sincerely,

Samantha Chong smchong@lakeheadu.ca (807) 630-9411
Dr. Ron Davis ron.davis@lakeheadu.ca (807) 343-8646

Appendix B
Online Participant Information Letter and Consent Form

Dear Potential Participant:

If you are a nonsmoking, right-handed female at Thunder Bay campus then this study might be of interest to you.

Our names are Samantha Chong and Daseul Shin, students and research assistants working with Dr. Ron Davis in the Department of Psychology at Lakehead University. We are conducting a research project called the Picture Study. The purpose of this study is to examine the changes in brain and heart activity that may occur when a person views photographs of oneself and others. Your participation involves sequential completion of three different parts to this study.

Today you will first complete this Part 1 consisting of questionnaires that ask you about certain attitudes, behaviours, perceptions, and emotions. This online questionnaire will take you about 20-30 minutes to complete. Then you would sign up to attend two separate laboratory visits in the Department of Psychology with one of the research assistants as follows:

Part 2 is your first lab visit where you would have 30 photographs taken while you stand and sit in dark clothing with neutral facial expression and posture. Your head circumference, height, and weight would also be measured. This first lab visit will take about 20 minutes of your time. Following that, at your Part 3 second lab visit days or weeks later, you will be fitted with ECG chest electrodes and an EEG cap in order to record your heart and brain activity while you complete a reaction time task and view the photographs of yourself and other people. This second lab visit will take approximately 90 minutes of your time.

Your participation in this study is completely voluntary and you may withdraw from it at any time without penalty. All information that you provide will be kept completely confidential. Only ourselves, Dr. Ron Davis, and research assistants Healey Gardiner and Heather Madussi, will be permitted to view your information. Dr. Davis is never aware of the identities of those who volunteer to participate in this study. All of the information that you provide will be assigned a code unattached to your name and securely stored at Lakehead University for 5 years as per University regulations. In addition, your identifying information will be kept completely confidential in reports of results and publications. A risk associated with your participation in this study is the possibility that thinking about personal issues while completing the questionnaires (e.g., self-esteem, body image) and/or viewing photographs may arouse a degree of distress as might normally occur when you think about such issues in your daily life. You may choose not to answer any question asked in the questionnaires without penalty or consequence. If at any point during or after this study you would like to speak to a mental health professional, feel free to contact the LU Student Health and Counseling Centre at 343-8361 or drop round at Prettie Residence.

If you are registered in a Psychology undergraduate course eligible for bonus points, your participation by way of completing this Part 1 questionnaire and attending both Parts 2 and 3 lab visits would lead to a total 3 bonus points credited to your final grade in that course(s).

Please feel free to contact us and/or Dr. Ron Davis with any questions that you might have. This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca

Sincerely,
Samantha Chong
Daseul Shin

- By checking this button you acknowledge that (1) you have read and understood the information above, (2) you are a nonsmoking, right-handed female at Thunder Bay campus, and (3) you wish to continue to the consent form to give your voluntary consent to now participate in this Part 1 questionnaire portion of the Picture Study. At the end of this questionnaire, you will be redirected to the online Sona Experiment Manager where you will schedule your first future lab visit as the Part 2 of your participation in this Picture Study.

Appendix C
Demographics Questionnaire

1. How old are you? _______________

2. Marital Status:

    - Married/Common law
    - Divorced/Separated
    - Single
    - Widowed

3. What is your ethnicity?

    - Caucasian/white
    - Aboriginal/First Nation
    - South Asian
    - Hispanic
    - African-Canadian/Black
    - East Asian
    - Middle Eastern
    - If none of these adequately describes your ethnicity, how would you identify yourself? __________________________

4. School Enrolment:

    - Full-time
    - Part-time
    - Non-enrolled

5. What subject are you majoring in? ___________________________

6. List the name(s) of prescribed medication(s) that you are currently taking:

    ____

7. List the name(s) of over-the-counter medication(s) that you are currently taking:

    ____

Appendix D
Edinburgh Handedness Inventory – Short Form (EDI – Short Form)

Please Indicate your preference in the use of hands in the following activities or objects:

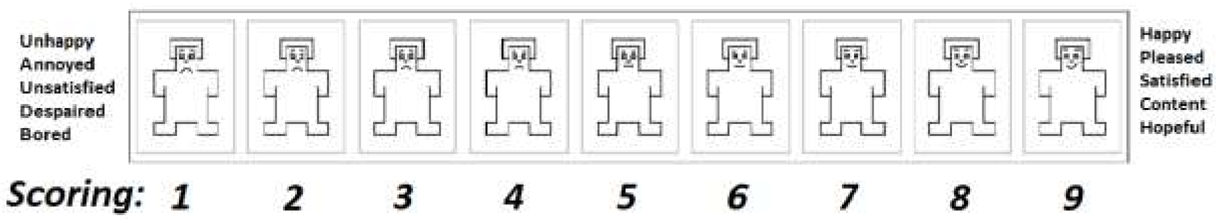
0 = Always Right; 1 = Usually Right; 3 = Both Equally; 4 = Usually Left; 5 = Always Left

1. Writing	0	1	2	3	4	5
2. Throwing	0	1	2	3	4	5
3. Toothbrush	0	1	2	3	4	5
4. Spoon	0	1	2	3	4	5

Appendix E
Self-Assessment Manikin (SAM)

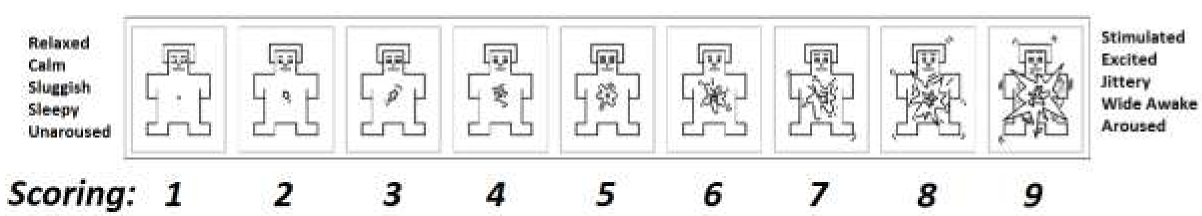
Please rate how you just felt while [you completed the reaction time task/ your eyes were closed/ you viewed the presentation] on the following valence scale:

This is the valence scale, in which the drawings range from a frowning figure to a smiling figure. If you felt completely happy while your eyes were closed, you can indicate this by selecting the appropriate rating under the figure on the right (9). You can indicate having felt completely unhappy by selecting the appropriate rating under the figure on the left (1). You can represent intermediate levels by selecting the rating which corresponds to the appropriate figure.



Please rate how you just while [you completed the reaction time task/ your eyes were closed/ you viewed the presentation] on the following arousal scale:

This is the arousal scale. If you felt completely stimulated, select the appropriate rating under the figure on the right (9). You can indicate that you felt completely relaxed by selecting the appropriate rating under the figure on the left (1). You can represent intermediate levels by selecting the rating which corresponds to the appropriate figure.



Appendix F
Body Image States Scale

For each of the items below, check the box beside the one statement that best describes how you feel **RIGHT NOW, AT THIS VERY MOMENT**. Read the items carefully to be sure the statement you choose accurately and honestly describes how you feel right now.

1. Right now I feel…

☐ ***Extremely dissatisfied*** with my physical appearance

☐ ***Mostly dissatisfied*** with my physical appearance

☐ ***Moderately dissatisfied*** with my physical appearance

☐ ***Slightly dissatisfied*** with my physical appearance

☐ ***Neither dissatisfied nor satisfied*** with my physical appearance

☐ ***Slightly satisfied*** with my physical appearance

☐ ***Moderately satisfied*** with my physical appearance

☐ ***Mostly satisfied*** with my physical appearance

☐ ***Extremely satisfied*** with my physical appearance

2. Right now I feel…

☐ ***Extremely satisfied*** with my body size and shape

☐ ***Mostly satisfied*** with my body size and shape

☐ ***Moderately satisfied*** with my body size and shape

☐ ***Slightly satisfied*** with my body size and shape

☐ ***Neither dissatisfied nor satisfied*** with my body size and shape

☐ ***Slightly dissatisfied*** with my body size and shape

☐ ***Moderately dissatisfied*** with my body size and shape

☐ ***Mostly dissatisfied*** with my body size and shape

☐ ***Extremely dissatisfied*** with my body size and shape

3. Right now I feel…

☐ ***Extremely dissatisfied*** with my weight

☐ ***Mostly dissatisfied*** with my weight

☐ ***Moderately dissatisfied*** with my weight

☐ ***Slightly dissatisfied*** with my weight

☐ ***Neither dissatisfied nor satisfied*** with my weight

☐ ***Slightly satisfied*** with my weight

☐ ***Moderately satisfied*** with my weight

☐ ***Mostly satisfied*** with my weight

☐ ***Extremely satisfied*** with my weight

4. Right now I feel…

☐ ***Extremely*** physically attractive

☐ ***Very*** physically attractive

☐ ***Moderately*** physically attractive

☐ ***Slightly*** physically attractive

☐ ***Neither*** attractive nor unattractive

☐ ***Slightly*** physically unattractive

☐ ***Moderately*** physically unattractive

☐ ***Very*** physically unattractive

☐ ***Extremely*** physically unattractive

5. Right now I feel…

☐ ***A great deal worse*** about my looks than I usually feel

☐ ***Much worse*** about my looks than I usually feel

☐ ***Somewhat worse*** about my looks than I usually feel

☐ ***Just slightly worse*** about my looks than I usually feel

☐ ***About the same*** about my looks as usual

☐ ***Just slightly better*** about my looks than I usually feel

☐ ***Somewhat better*** about my looks than I usually feel

☐ ***Much better*** about my looks than I usually feel

☐ ***A great deal better*** about my looks than I usually feel

6. Right now I feel that I look…

☐ ***A great deal better*** than the average person looks

☐ ***Much better*** than the average person looks

☐ ***Somewhat better*** than the average person looks

☐ ***Just slightly better*** than the average person looks

☐ ***About the same*** as the average person looks

☐ ***Just slightly worse*** than the average person looks

☐ ***Somewhat worse*** than the average person looks

☐ ***Much worse*** than the average person looks

☐ ***A great deal worse*** than the average person looks

Appendix G
Brief-Pathological Narcissism Inventory (B-PNI)

Below is a collection of statements about your everyday experience. Please read each statement. Using the scale below, indicate the extent to which you agree with each statement. In other words, how well does the statement describe you?

0 = Not at all like me
1 =Not much like me
2 = Very little like me
3 = Moderately like me
4 = Mostly like me
5 = Very Much like me

1. I can usually talk my way out of anything.	0	1	2	3	4	5
2. When people don't notice me, I start to feel bad about myself.	0	1	2	3	4	5
3. I often hide my needs for fear that others will see me as needy and desperate.	0	1	2	3	4	5
4. I can make anyone believe anything I want them to.	0	1	2	3	4	5
5. I get annoyed by people who are not interested in what I say or do.	0	1	2	3	4	5
6. I find it easy to manipulate people.	0	1	2	3	4	5
7. Sometimes I avoid people because I'm concerned that they'll disappoint me.	0	1	2	3	4	5
8. I typically get very angry when I'm unable to get what I want from others.	0	1	2	3	4	5
9. When others don't meet my expectations, I often feel ashamed about what I wanted.	0	1	2	3	4	5
10. I feel important when others rely on me.	0	1	2	3	4	5
11. I can read people like a book.	0	1	2	3	4	5
12. Sacrificing for others makes me the better person.	0	1	2	3	4	5
13. I often fantasize about accomplishing things that are probably beyond my means.	0	1	2	3	4	5
14. Sometimes I avoid people because I'm afraid they won't do what I want them to do.	0	1	2	3	4	5
15. It's hard to show others the weaknesses I feel inside.	0	1	2	3	4	5
16. It's hard to feel good about myself unless I know other people admire me.	0	1	2	3	4	5
17. I often fantasize about being rewarded for my efforts.	0	1	2	3	4	5
18. I am preoccupied with thoughts and concerns that most people are not interested in me.						

19. I like to have friends who rely on me because it makes me feel important.	0	1	2	3	4	5
20. Sometimes I avoid people because I'm concerned they won't acknowledge what I do for them.	0	1	2	3	4	5
21. It's hard for me to feel good about myself unless I know other people like me.	0	1	2	3	4	5
22. It irritates me when people don't notice how good a person I am.	0	1	2	3	4	5
23. I will never be satisfied until I get all that I deserve.	0	1	2	3	4	5
24. I try to show what a good person I am through my sacrifices.	0	1	2	3	4	5
25. I often fantasize about performing heroic deeds.	0	1	2	3	4	5
26. I often fantasize about being recognized for my accomplishments.	0	1	2	3	4	5
27. I can't stand relying on other people because it makes me feel weak.	0	1	2	3	4	5
28. When others get a glimpse of my needs, I feel anxious and ashamed.	0	1	2	3	4	5

Appendix H
Participant Information Letter

Dear Potential Participant:

My name is Daseul Shin, a student and research assistant working with Dr. Ron Davis in the Department of Psychology at Lakehead University. We are conducting a research project called the ***Picture Study***. The purpose of this project is to examine the changes in brain and heart activity that may occur when a person views photographs of oneself and others. We plan to show university volunteers pictures of other people. Here is where you may be able to help us out. We are looking for people age 18-25 with background training in modelling who would serve as models for our project. This is what's involved should you choose to participate:

1. Attend a 30-minute photographic session in our lab in the Department of Psychology,
2. during which photographs of you would be taken in three poses: full body, sitting, head and upper body,
3. while you are dressed in solid black pants, t-shirt, and socks with neutral facial and bodily expression.
4. We would also measure your weight and height, and make note of your age.

Your voluntary participation in this project means that you would be consenting to allow us to show any and all of these photographs to university students at Lakehead University.

Your participation in this project is completely voluntary and you may withdraw from it at any time without penalty. All personal information that you provide in item #4 above will be kept completely confidential by assigning a code to it without your name. That information will be securely stored at Lakehead University for 5 years, as per University regulations. In addition, your identifying information will be kept completely confidential in reports of results and publications.

There are no known physical or psychological risks associated with participating in this project.

Please feel free to contact us and/or Dr. Ron Davis with any questions that you might have. This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca

Thank you for considering participation in this project.

Sincerely,
Daseul Shin dshin@lakeheadu.ca (807) 346-0394
Dr. Ron Davis ron.davis@lakeheadu.ca (807) 343-8646.

Appendix I
Participant Consent Form

By providing my name and signature below, I indicate that I have read the “Participant Information Letter” and that I have had the opportunity to receive satisfactory answers from the researchers concerning any questions that I might have about my participation in the **Picture Study**. I understand and agree to the following:

1. I understand the information contained in the “Participant Information Letter”;
2. I agree to participate in the photographic session AND to allow the researchers to show any and all of my photographs to Lakehead University research volunteers;
3. I am a volunteer and can withdraw at any time from this project without penalty or consequence;
4. My personal information consisting of my weight, height, and age will remain confidential and will be securely stored in the Department of Psychology at Lakehead University for 5 years as per University regulations;
5. My personal information will remain anonymous should any publications or public presentations come out of this project; and
6. I may receive a copy of my photographs should I so request.
7. I understand and agree to this “Consent to Participate”

____________________________ ____________________________
Full Name (*please print*) Date

____
Signature *(please sign)*

Appendix J
Model Recruitment Posting

Models Needed!

Seeking individuals aged 18-25 who love stepping in front of the camera to have their pictures taken! Participants must be willing to have any and all of the pictures viewed by students at Lakehead University as part of a research study in the Department of Psychology that has been approved by the Research Ethics Board.

As compensation, we will provide you with high quality, digital copies of your pictures and amazing 3D pictures of yourself!

For more information, feel free to contact student researcher Samantha Chong at (807) 630 9411 or smchong@lakeheadu.ca

Appendix K
Participant Information Letter to Volunteer for Other photos

Dear Potential Participant:

Our names are Samantha Chong and Daseul Shin, students and research assistants working with Dr. Ron Davis in the Department of Psychology at Lakehead University. We are conducting a research project called the ***Picture Study***. The purpose of this project is to examine the changes in brain and heart activity that may occur when a person views photographs of oneself and others. We plan to show university volunteers pictures of other people. Here is where you may be able to help us out. We are looking for people age 18-25 with background training in modelling who would serve as models for our project. This is what's involved should you choose to participate:

1. Attend a 30-minute photographic session in our lab in the Department of Psychology,
2. during which photographs of you would be taken in three poses: full body, sitting, head and upper body,
3. while you are dressed in dark clothing with neutral facial and bodily expression.
4. We would also measure your weight and height, and make note of your age.

Your voluntary participation in this project means that you would be consenting to allow us to show any and all of these photographs to university students at Lakehead University.

Your participation in this project is completely voluntary and you may withdraw from it at any time without penalty. All personal information that you provide in item #4 above will be kept completely confidential by assigning a code to it without your name. That information will be securely stored at Lakehead University for 5 years, as per University regulations. In addition, your identifying information will be kept completely confidential in reports of results and publications.

There are no known physical or psychological risks associated with participating in this project. Please feel free to contact us and/or Dr. Ron Davis with any questions that you might have. This study has been approved by the Lakehead University Research Ethics Board. If you have any questions related to the ethics of the research and would like to speak to someone outside of the research team please contact Sue Wright at the Research Ethics Board at 807-343-8283 or research@lakeheadu.ca

Thank you for considering participation in this project.

Sincerely,

Samantha Chong smchong@lakeheadu.ca (807) 630-9411
Daseul Shin dshin@lakeheadu.ca (807) 356 0394
Dr. Ron Davis ron.davis@lakeheadu.ca (807) 343-8646.

Appendix L
Participant Consent Form to Volunteer for Other photos

By providing my name and signature below, I indicate that I have read the "Participant Information Letter" and that I have had the opportunity to receive satisfactory answers from the researchers concerning any questions that I might have about my participation in the **Picture Study**. I understand and agree to the following:

5. I understand the information contained in the "Participant Information Letter";
6. I agree to participate in the photographic session AND to allow the researchers to show any and all of my photographs to Lakehead University research volunteers;
7. I am a volunteer and can withdraw at any time from this project without penalty or consequence;
8. My personal information consisting of my weight, height, and age will remain confidential and will be securely stored in the Department of Psychology at Lakehead University for 5 years as per University regulations;
8. My personal information will remain anonymous should any publications or public presentations come out of this project; and
9. I may receive a copy of my photographs should I so request.
10. I understand and agree to this "Consent to Participate"

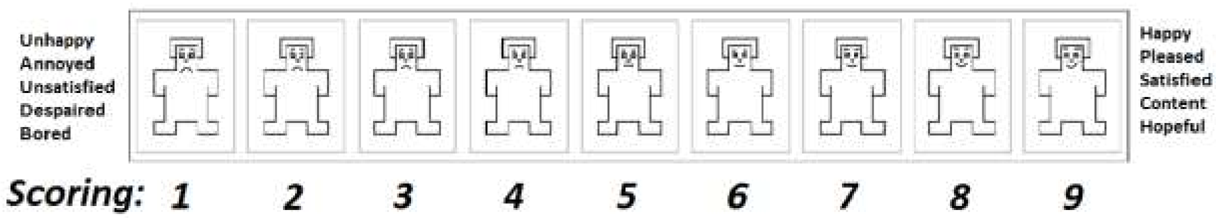
___________________________ ___________________________
Full Name (*please print*) Date

____
Signature *(please sign)*

Appendix M
Pilot Study Questionnaire for Other photos

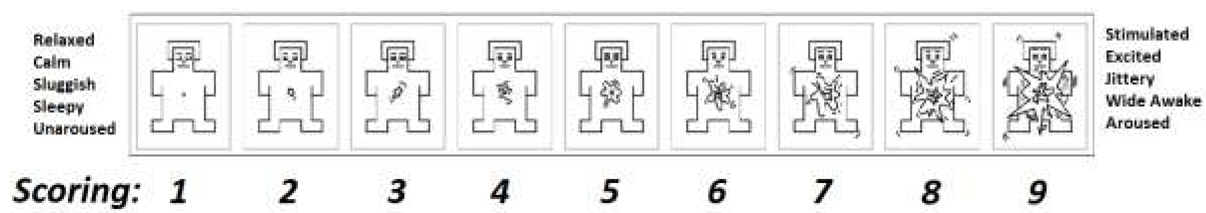
Please rate how you just felt while you viewed pictures of the model on the following valence scale:

This is the valence scale, in which the drawings range from a frowning figure to a smiling figure. If you felt completely happy while you viewed the model's photos, you can indicate this by circling the appropriate rating under the figure on the right (9). You can indicate having felt completely unhappy by selecting the appropriate rating under the figure on the left (1). You can represent intermediate levels by circling the rating which corresponds to the appropriate figure.



Please rate how you just while you viewed pictures of the model on the following arousal scale:

This is the arousal scale. If you felt completely stimulated, circle the appropriate rating under the figure on the right (9). You can indicate that you felt completely relaxed by circling the appropriate rating under the figure on the left (1). You can represent intermediate levels by circling the rating which corresponds to the appropriate figure.



In general, how attractive is the model's photographs in terms of *body weight*?

Not at all attractive				Moderately attractive				Very attractive
1	2	3	4	5	6	7	8	9

In general, how attractive is the model's photographs in terms of *body size and shape*?

Not at all attractive				Moderately attractive				Very attractive
1	2	3	4	5	6	7	8	9

In general, how attractive is the model's photographs in terms of *physical appearance*?

Not at all attractive				Moderately attractive				Very attractive
1	2	3	4	5	6	7	8	9