THE EFFECTS OF SELF-AFFIRMATION ON BASIC EMOTIONAL RESPONSES

A Dissertation

by

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ABSTRACT

Reflecting on what one values in life—a common means of self-affirmation—can change how a person thinks, feels, and behaves. The purpose of the current research was to extend self-affirmation theory beyond the realm of self-esteem defenses to simpler responses to emotional stimuli and investigate the extent to which individual differences in BIS moderate self-affirmation's effects on diverse measures of emotional responding. In Experiment 1, I tested the hypothesis that affirming one's values reduces the intensity of the startle eye-blink response, a psychophysiological measure of defensiveness, to threatening emotional stimuli, especially for those high in the behavioral inhibition system (BIS). For those high in BIS, self-affirmation reduced startle eye-blink magnitudes to threatening images. In Experiment 2, I tested the hypothesis that affirmed participants higher in BIS sensitivity would have larger late positive potentials, an upward going brainwave known to indicate processing of stimuli, to threatening images compared to those lower in BIS. For those high in BIS, self-affirmation sustained the LPP over time during negative picture viewing. In Experiment 3, I tested the hypothesis that nonaffirmed participants higher in BIS would self-report less emotional reactivity, more attentional disengagement, and more emotion regulation. These hypotheses were not supported. These findings suggest that self-affirmation can affect basic emotional responding, particularly at the psychophysiological level.

DEDICATION

TO MY PARENTS WITH LOVE

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1. INTRODUCTION

Taking stock of what one values in life is a form of self-affirmation that can reduce defensive responding to self-threats (Steele, 1988). Health warnings, for example, may trigger defensive cognitions aimed at denying the personal relevance of the threat, but persons who have recently affirmed a core personal value have been observed to acknowledge health risks and report strong intentions to behave more healthily in the future (e.g., Harris, Mayle, Mabbott, & Napper, 2007; Howell & Shepperd, 2012; Sherman, Nelson, & Steele, 2000). Similarly, people routinely attribute their failures to external causes and their successes to internal causes, but affirming core personal values has been found to reduce these self-serving attributional tendencies (Sherman, Zinias, Major, Kim, & Prenevost, 2007). The purpose of the current research is to extend self-affirmation theory beyond the realm of self-esteem defenses to simpler responses to emotional stimuli.

1.1 Self-Affirmation Theory and Research

Self-affirmation theory supposes that people are motivated to maintain the integrity of the self (Sherman & Cohen, 2006; Steele, 1988). Generally speaking, people prefer to see themselves as moral, competent, and kind rather than immoral, inept, and cruel. The motive to maintain self-integrity may be glimpsed when people encounter information that threatens their desired self-views. Such threats have been found to trigger psychological defenses aimed at dispelling self-doubt and preserving desired self-views (for a meta-analysis of relevant research, see vanDellen, Campbell, Hoyle, &

Bradfield, 2011). These defenses can be cancelled, however, by affirming some other aspect of the self, particularly an important aspect unrelated to the threat (e.g., one's core values in life).

Early research on self-affirmation theory focused on the role of the self in dissonance processes. Steele and Liu (1983), using a variant of the classic induced compliance paradigm (Brehm & Cohen, 1962; Cooper, Fazio, & Rhodewalt, 1978), found that students who freely generated arguments in favor of a tuition increase subsequently become more favorable toward the possibility of a tuition increase. However, affirming a core personal value unrelated to the tuition issue attenuated dissonance-related attitude change. This pattern and its conceptual replications led Steele (1988) to propose a self-based revision of dissonance theory that positions the integrity of the self, rather than psychological consistency, as the key to cognitive dissonance.

Subsequent experiments have moved away from cognitive dissonance to observe that affirming core values changes how individuals react to a diverse assortment of self-threats, including stereotype threat (Martens, Johns, Greenberg, & Schimel, 2006), mortality salience (Schmeichel & Martens, 2005), losing a sports competition (Sherman & Kim, 2005), hearing rival sociopolitical views (Cohen, Aronson, & Steele, 2000), relational insecurity (Stinson, Logel, Shepherd, & Zanna, 2011), uncertainty about a personal dilemma (McGregor, Zanna, Holmes, & Spencer, 2001), and unrealistically high performance expectations (Siegel, Scillitoe, & Parks-Yancy, 2005). The patterns observed in these studies are quite consistent, and the conclusion is clear: Self-affirmation "can sharply attenuate defensive biases, and encourage attitude and behavior

change in potentially threatening or contentious domains" (Sherman & Cohen, 2002, p. 122).

Rather than examining how self-affirmation changes responses to contentious or self-threatening information, as has been the norm in prior research, the current research examined the effect of self-affirmation on responses to emotional stimuli. My specific purpose was to test the hypothesis that affirming values influences the intensity of negative emotional responding. If this hypothesis is correct, then I should find evidence that self-affirmation influences the intensity of responding to emotional stimuli across diverse measures including facial electromyography (EMG), electroencephalography (EEG), and self-reported emotional reactions.

1.2 Defensive and Appetitive Motivational Systems

Self-affirmation reduces defensive responses to ego threats (for a review, see Sherman & Cohen, 2006), but does self-affirmation also reduce defensive responses to more basic threatening stimuli (e.g., images of snakes or guns)? Threatening stimuli and situations (e.g., animal or human attacks) activate the defensive motivational system, which is built upon the amygdala (Bradley, Codispoti, Cuthbert, & Lang, 2001). The defensive motivational system can be found in most organisms and is thought to have evolved from ancestrally early physiological systems of direct avoidance of or withdrawal from aversive stimuli (Lang, Bradley, & Cuthbert, 1998). However, humans have evolved a defensive system that is more complex than the simple avoidance of aversive stimuli, and thus the defensive motivational system in humans is implicated in situations that do not directly undermine survival (e.g., when viewing pictures of

spiders). Presumably, defensive responses to ego threats observed in previous self-affirmation studies reflect the activation of the basic defensive motivational system. If that is true, then it is likely that self-affirmation affects the defensive motivational system. Responses to emotional (i.e., threatening or negative) pictures may reflect the activation of the defensive motivational system (Bradley et al., 2001); therefore, in the current research I used emotional picture viewing paradigms to gauge self-affirmation's effects on the defensive motivational system.

The current research also gauged the effects of self-affirmation on rewarding stimuli. Rewarding or positive stimuli activate the appetitive motivational system, which is supported by the mesolimbic dopamine system (Lang et al., 1998). The appetitive motivational system can be found in most organisms and involves direct approach to appetitive stimuli that promote survival (e.g., obtaining mates or food; Bradley et al., 2001). As with the defensive motivational system, the appetitive motivational system in humans is complex and has been implicated in situations that are not directly relevant to survival (e.g., when viewing pictures of exciting sports activities). Prior research has rarely assessed self-affirmation's effects on responses to positive information or events. In trying to understand how self-affirmation may influence basic motivational systems, I deemed it important to explore responses to positive stimuli and activity in the appetitive motivational system as well as responses to negative stimuli and activity in the defensive motivational system.

1.3 Measures of Emotional Responding

Responses to emotional picture viewing can be assessed in a variety of ways, and there is no single, gold standard measure of motivational or emotional responses to pictures. Therefore, the current program of research included a diverse selection of measures to examine the effects of self-affirmation on emotional responses. Specifically, the current research measured the startle eye-blink response, an event-related brain potential known as the late positive potential (LPP), and self-reports of emotion to study emotional reactions to pictures.

Experiment 1 used the startle eye-blink response. The startle eye-blink response is a basic protective or defensive response to intense or abrupt stimuli that is measured using facial electromyography (EMG). The startle response is mediated by the amygdala and is amplified by fear in humans and non-human animals alike (Davis, 1992). In a typical emotion-modulated startle paradigm participants view pictures while being subjected to short blasts of white noise (i.e., startle probes). Numerous experiments have found that the force of an eye-blink elicited by a startle probe is modulated by the emotional valence of the picture being viewed during the probe. Specifically, startle responses tend to increase in magnitude while viewing negative or threatening (relative to neutral or positive) pictures, consistent with the notion that the startle eye-blink is a defensive response (Lang, Bradley, & Cuthbert, 1990).

Does affirming the self reduce the magnitude of the startle eye-blink response during threatening stimuli? Experiment 1 represents the first attempt to answer this question. Evidence that self-affirmation reduces the magnitude of the threat-potentiated

startle would be broadly consistent with prior research on the effects of self-affirmation on self-esteem defenses. However, startle eye-blink responses are not a self-esteem defense. Rather, startle responses reflect the operation of a defensive motivational system that is thought to promote physical protection and survival (Lang et al., 1990). Evidence that self-affirmation reduces threat-potentiated startle responses would thus suggest that self-affirmation's effects extend to basic mechanisms of motivation and emotion and are not limited to self-esteem defenses.

In addition to the defensive motivational system, self-affirmation may influence the appetitive motivational system. Viewing positive pictures may activate the appetitive motivational system and inhibit the defensive startle response. If self-affirmation also reduces activation of the appetitive system, then the startle responses to positive pictures will be larger (i.e., less inhibited) among affirmed participants than among non-affirmed participants.

Experiment 2 measured EEG activity during picture viewing. The LPP is an event-related potential (ERP) that is modulated by the emotional qualities of an eliciting stimulus. The LPP, like other ERPs, is a quantified electrical potential in the brain that corresponds to specific events. Similar to the startle eye-blink response, the LPP is modulated by viewing emotional pictures. Unlike the startle eye-blink response, however, the LPP is not a measure of the defensive motivational system; rather, it is thought to reflect the processing (or lack thereof) of an eliciting stimulus. Numerous studies have found that the LPP is larger when viewing positive and negative pictures as compared to neutral pictures (e.g., Cuthbert, Schupp, Bradley, Birbaumer, & Lang,

2000; Hajcak & Olvet, 2008; Schupp, Cuthbert, Bradley, Cacioppo, Ito, & Lang, 2000). These studies suggest that larger LPPs reflect the preferential processing of emotionally- or motivationally-relevant stimuli. Further, memory for emotional pictures is greater for pictures that elicit larger LPPs (Dolcos & Cabeza, 2002), further suggesting that larger LPPs reflect deeper or more elaborate processing (Hajcak, Macnamara, & Olvet, 2010).

Does affirming the self influence the amplitude of the LPP during threatening stimuli? Experiment 2 represents the first attempt to answer this question. I predicted that self-affirmation would increase the amplitude of the threat-potentiated LPP, consistent with evidence that self-affirmation increases processing of threatening information. For example, one study found that affirmed participants were more persuaded by evidence that challenged their prior beliefs about capital punishment, suggesting that self-affirmation not only reduced defensive bolstering of one's prior beliefs but also increased processing of the belief-threatening information (Cohen et al., 2000). Insofar as affirmation enables individuals to process and consider (rather than defend against or dismiss) threatening information, affirmation may increase LPP amplitudes during negative pictures. Experiment 2 also explored the effects of self-affirmation on LPPs during positive picture viewing, to further probe the influence of self-affirmation on the activation of the appetitive motivational system.

Experiment 3 measured emotional responding with self-reports. Although prior studies have not typically found effects of self-affirmation on self-reported mood (e.g., Cohen et al., 2000; Shrira & Martin, 2005), self-affirmation may nonetheless affect how individuals feel in response to emotional images. Stated differently, by itself self-

affirmation may have little effect on a person's emotional state, but affirmation may nonetheless affect responding to emotional events. Experiment 3's main focus was on the defensive motivational system and responding to negative pictures, but I also included positive pictures for exploratory purposes. Evidence that self-affirmation influences self-reported valence or arousal in response to emotional images would provide further evidence that self-affirmation affects basic emotional responding.

1.4 Individual Differences in Behavioral Inhibition System

The prediction that self-affirmation influences negative emotional responding is predicated on the assumption that all persons respond similarly to threatening pictures. Research suggests, however, that individual differences in anxiety-related traits moderate the magnitude of the threat-potentiated reactions. Gray (1976, 1982) hypothesized that trait anxiety and defensive responses to threats are mediated by a neurobiological behavioral inhibition system (BIS). According to Gray, greater BIS sensitivity leads to more intense responding to punishments, warnings of punishments, and potential threats compared to lesser BIS sensitivity, and ample evidence lends support to this view (Carver & White, 1994; Leen-Feldner, Zvolensky, & Feldner, 2004).

Most relevant for present purposes is evidence that anxiety-prone persons and persons higher in BIS sensitivity exhibit larger negative emotional responses to threatening stimuli. For example, individuals higher in BIS exhibit larger startle responses to negative versus neutral or positive images, whereas persons who are less anxiety-prone or lower in BIS exhibit little or no startle potentiation during negative

images (Caseras et al., 2006; Corr, 2002; Hawk & Kowmas, 2003; for an overview, see Vaidyanathan, Patrick, & Cuthbert, 2009). Additionally, negative pictures are rated as more aversive, more arousing, and elicit greater P3 responses (i.e., an earlier component of the LPP) among individuals higher rather than lower in BIS (Balconi, Falbo, & Brambilla, 2009; Balconi, Falbo, & Conte, 2012). Therefore, any effects of self-affirmation on responses to threatening information may be especially pronounced among individuals who are more prone to experience threat—those higher in BIS.

In addition to the behavioral inhibition system, Gray (1987) hypothesized that sensitivity to rewards is mediated by a neurobiological behavioral activation system (BAS). Persons higher in BAS sensitivity exhibit smaller (more inhibited) startle responses to positive versus neutral or threatening images, whereas persons lower in BAS sensitivity respond similarly across picture types (Hawk & Kowmas, 2003). BAS sensitivity has also been associated with increased positive feelings toward positive pictures and enhanced P3 and LPP responses to positive pictures (Balconi et al., 2009; Balconi et al., 2012). In the current experiments, individuals higher in BAS may respond with greater activation of the appetitive motivational system in response to positive stimuli (i.e., show smaller startle responses, larger LPPs, and more positive ratings), but no specific predictions were made as to the influence of self-affirmation on positive emotional responses.[1]

[1] A study by Crocker, Niiya, & Mischkowski (2008) found that self-affirmation increases other-oriented positive feelings (e.g., love, giving, and sympathy) as compared to no affirmation. I did not measure other-oriented positive emotions in the current studies but did measure reactions to positive stimuli related to food and exciting sports activities.

1.5 Goals and Overview of the Current Experiments

The majority of previous self-affirmation research has focused on responses to self-esteem threats, and relatively little research has considered the effects of self-affirmation on more basic emotional responses. Examining such responses may increase understanding of self-affirmation's effects by linking them explicitly to basic motivational systems. Thus, the main goal of the current experiments was to test the hypothesis that self-affirmation influences emotional responding using diverse measures of emotional responding. In each experiment participants affirmed an important value or not and then viewed emotionally-charged images. Additionally, these studies investigated the extent to which individual differences in BIS and BAS moderate self-affirmation's effects on the startle eye-blink response (Experiment 1), the LPP (Experiment 2), and self-reported valence and arousal (Experiment 3), respectively. Experiment 3 also tested the extent to which changes in emotion regulation or attention strategies explain any effects of self-affirmation on emotional responding.

2. EXPERIMENT 1[*]

Based on evidence that self-affirmation reduces defensiveness, in addition to evidence that trait BIS sensitivity is associated with more defensive responses to threat, I predicted that expressing one's core values in life attenuates the relationship between BIS and threat-potentiated responding. Given the nature of the threat-potentiated startle response, picture valence was expected to explain most of the variance in startle response magnitudes. However, I predicted that self-affirmation would have unique relevance to BIS and startle responses to negative pictures, such that BIS would amplify startle responses only among non-self-affirmed participants. In other words, I hypothesized that self-affirmation breaks the link between BIS sensitivity and the threat-potentiated startle response. To test this hypothesis I conducted an experiment in which I measured individual differences in BIS, manipulated the opportunity for self-affirmation, and assessed eye-blink responses to startle probes presented during negative, neutral, and positive picture viewing. I included positive pictures to explore the whether self-affirmation affects the appetitive motivational system as well as the defensive motivational system.

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[*] Part of the following material is used with permission from Crowell, Page-Gould, & Schmeichel (2015).

2.1 Method

2.1.1 Participants

One hundred forty-four undergraduate students (71 women; age $M = 18.80$, $SD = 3.37$) participated to fulfill a course requirement. They were randomly assigned between the self-affirmation and no affirmation conditions. Six participants were excluded from analyses due to computer problems (e.g., the computer did not save their data; $n = 5$) or because they did not write an essay as instructed ($n = 1$). Another thirty-eight participants were excluded for reasons described below (including problems with the physiological measurements). Following exclusions data from 100 participants (69% of the original sample) remained for analysis.

2.1.2 Procedure and materials

Participants reported individually to a study described as an investigation of the consequences of thinking and writing about important life values. After providing informed consent, participants completed a demographics questionnaire and the BIS/BAS scales (Carver & White, 1994). A sample item from the 7-item BIS scale is "Criticism or scolding hurts me quite a bit." Participants responded to each item using a scale from 1 (*strongly disagree*) to 4 (*strongly agree*). In the current study, the average total score on the BIS subscale was $M = 20.48$ ($SD = 3.59$, $\alpha = .79$).[2]

[2] Participants also completed the 13-item behavioral activation system (BAS) scale ($M = 40.88$, $SD = 4.53$, $\alpha = .81$). Results pertaining to BAS sensitivity are not relevant to the current investigation and are not reported here.

2.1.2.1 Self-affirmation manipulation

After completing the questionnaires and sitting for electrode placement, participants spent five minutes thinking and writing about personal values. Participants in the *no affirmation condition* reviewed a list of 12 values and personal characteristics and then wrote an essay on why artistic appreciation (i.e., one of the items on the list) may be important to other people.[3] Participants in the *self-affirmation condition* reviewed the same list of values, ranked them in order of personal importance, and then wrote an essay explaining why their highest ranked value is important to them (Cohen et al., 2000).

Immediately after the values task participants donned headphones and viewed a picture slideshow while facial EMG was recorded. Participants were instructed to view pictures the entire time they appeared on screen and to ignore any noises they might hear over the headphones.

2.1.2.2. Startle paradigm

Trials began with a 3 s fixation cross, followed by a picture for 6 s and an inter-trial interval (ITI) of 8-12 s. Picture stimuli consisted of 60 images from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 2008)[4]. Four practice trials

[3] I chose artistic appreciation as the value for participants to ponder in the no affirmation condition because my previous research indicated that participants rarely identify this as their #1 value. Indeed, in the self-affirmation condition the average rank of the artistic appreciation value was 9.53 (out of 12).

[4] Neutral pictures from IAPS: 2038, 2190, 2393, 2394, 2397, 2487, 2506, 2516, 2850, 5534, 7000, 7009, 7025, 7035, 7041, 7053, 7058, 7100, 7161, 7180, 7185, 7236. Negative pictures from IAPS: 1052, 1205, 1270, 1300, 2811, 3000, 3022, 3071, 3130, 3150, 3250, 3400, 3550, 6230, 6550, 6560, 7380, 9300, 9405. Positive pictures from IAPS: 4608, 4651, 4656, 4658, 4659, 4670, 4681, 4695, 5621, 7200, 7260, 7350, 7390, 7460, 7470, 8031, 8161, 8186, 8260.

included neutral pictures accompanied by startle probes. Experimental trials included 19 negative pictures, 19 positive pictures, and 18 neutral pictures. Positive pictures featured individuals involved in exciting or fun activities. Neutral pictures mainly featured individuals in mundane activities. Negative pictures mainly featured acts of violence and mutilations. Pictures appeared in random order except that no more than two of the same type (e.g., negative) appeared in succession.

Startle probes consisted of 50 ms, 102 dB bursts of white noise presented through headphones and occurred during 10 negative, 10 positive, and 10 neutral pictures either 3.5 or 4.5 seconds after picture onset. Eleven additional startle probes were presented during ITIs to prevent participants from learning when to expect the probes. We analyzed startle eye-blinks to probes presented during pictures. These procedures closely mirror previous studies of the emotion-modulated startle response (e.g., Corr, 2002; Peterson & Harmon-Jones, 2012)

2.1.2.3 Data collection and reduction

Startle eye-blink responses were recorded in accordance with the recommendations of Blumenthal et al. (2005) using two 9-mm tin electrodes (Electro-Cap International, Eaton, OH) placed over the left inferior orbicularis oculi below the inner and outer canthi. Impedance levels were targeted for 10 kΩ or below. Double blinks, blinks with excessive signal noise, and spontaneous blinks occurring immediately prior to stimulus onset or in the interval between stimulus onset and the minimal blink onset latency (20 ms) were excluded from analyses. Five participants who did not blink in response to startle probes were excluded from analyses, as were eight participants

whose electrodes did not stay attached, nine participants whose electrode impedances strayed above 10 kΩ, and 16 participants who had more than half of their startle responses to one picture type rejected for the reasons identified above (see Peterson & Harmon-Jones, 2012; Springer, Rosas, McGetrick, & Bowers, 2007).[5] To account for individual differences in startle amplitude and between-subject variance attributable to electrode placement, startle eye-blink magnitudes for the remaining 100 participants were standardized within participants by applying a t-score transformation to each value (Globisch, Hamm, Esteves, & Öhman, 1999).

2.2 Results

2.2.1 Startle responding as a function of affirmation condition and picture type

First, we conducted a 2 (Self-Affirmation Condition) × 3 (Picture Type) mixed-model analysis of variance (ANOVA) on startle eye-blink magnitudes. As expected, we observed a significant linear pattern for the within-subjects variable of picture type, F (2, 196) = 20.93, $p < .001$. Consistent with previous research, startle responses increased in magnitude from positive to neutral to negative pictures. We found no main effects or interactions involving self-affirmation condition, Fs < 1, ps > .70. Please refer to Figure 1.

[5] Due to hard drive failure the original raw data files were lost. The data files that survived on my failsafe drive had been cleaned to include only those participants whose startle responses surpassed the thresholds used by Springer et al. (2007) and Peterson and Harmon-Jones (2012) (i.e., we could not retrieve the raw data from participants who had had more than half of their startle responses to one picture type rejected). Therefore our data analyses include only those participants who met the thresholds used by Springer et al. and Peterson and Harmon-Jones.

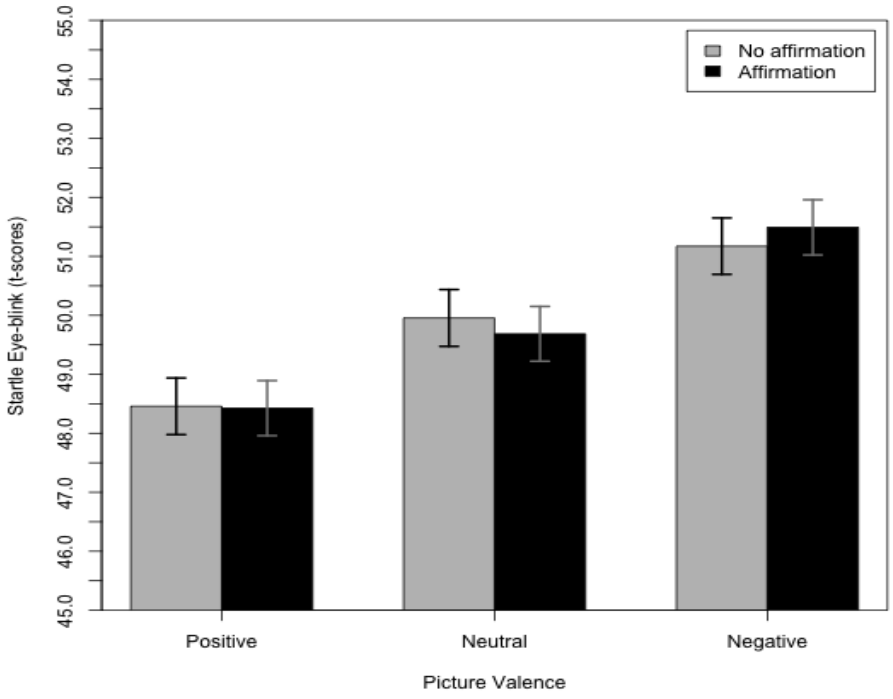


Figure 1. Startle eye-blink responses (t-scores) as a function of self-affirmation condition and picture type.

2.2.2 Startle responding during negative pictures as a function of affirmation condition and trait BIS

Our primary prediction was that self-affirmation (versus no affirmation) would reduce the relationship between BIS and startle responses during negative pictures. It did. Individual differences in startle responding were controlled by entering startle responding during neutral pictures as a predictor. The regression analysis predicted startle responding to negative pictures from startle responding to neutral pictures, trait

BIS (centered), self-affirmation condition (coded 0 = no affirmation and 1 = self-affirmation), and the condition × BIS interaction. Not surprisingly, startle responding during neutral pictures was a significant predictor of startle responding during negative pictures, t (98) = 9.01, $p < .001$. More importantly, the predicted two-way interaction between self-affirmation and BIS was significant, t (98) = 2.49, $p = .02$.

We examined the correlations between BIS and startle responses during negative pictures within each self-affirmation condition separately. BIS predicted startle response magnitudes during negative picture viewing in the no affirmation condition, r (47) = .36, $p = .01$, consistent with evidence that BIS sensitivity potentiates startle responding to negative stimuli (e.g., Caseras et al., 2006). As predicted, self-affirmation reduced the relationship between BIS and threat-potentiated startles to non-significance, r (49) = -.21, $p = .13$. Please see Figure 2.

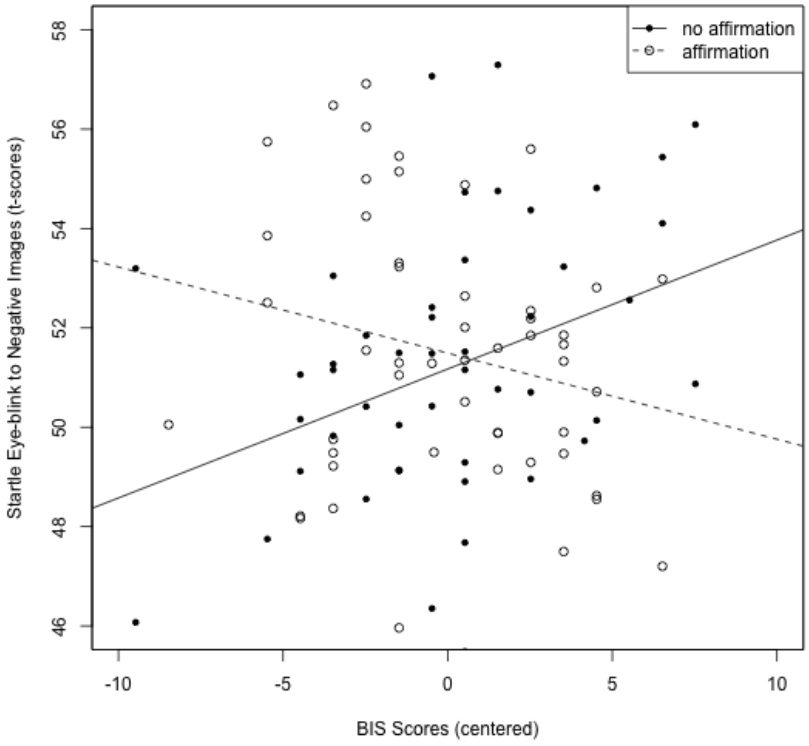


Figure 2. Scatterplot with simple slopes for the relationship between BIS and mean startle responses to negative pictures as a function of self-affirmation condition.

The t-tests on predicted values derived from the regression equation indicated that, among participants lower in BIS, self-affirmation caused more startle responding during the negative picture relative to the no affirmation condition, t (98) = 2.10, p = .038. Among participants higher in BIS, affirmation condition did not significantly influence startle responding, t (98) = -1.40, p = .166, though the trend was in line with

our prediction that self-affirmation would reduce the startle eye-blink response for individuals higher in trait BIS. See Figure 3.

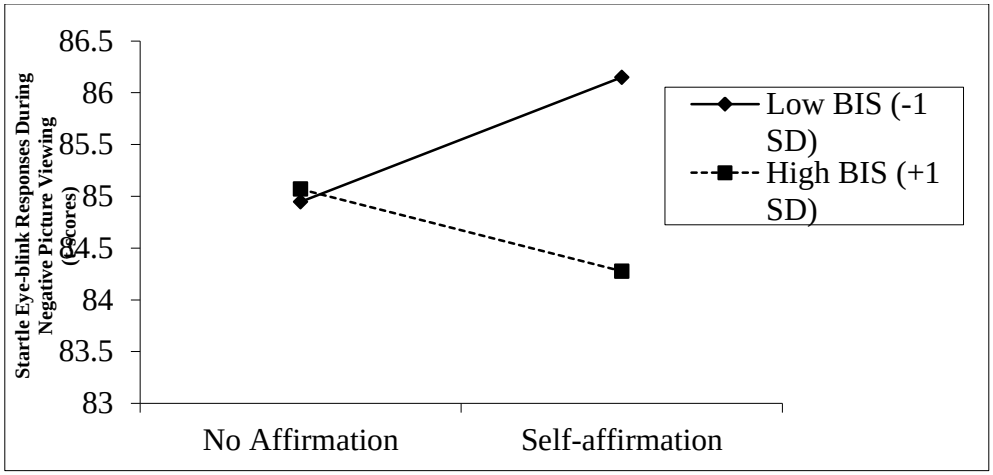


Figure 3. Startle eye-blink responses during negative pictures as a function of affirmation condition and individual differences in BIS.

2.2.3 Startle responding during positive pictures as a function of affirmation condition and trait BIS

We repeated the regression analysis, this time with startle responding to positive pictures as the criterion variable and the same predictors as above. Startle responding to neutral pictures was a significant predictor in this analysis, t (98) = 3.87, $p < .001$, as was the interaction between trait BIS and affirmation condition, t (98) = 1.99, $p = .05$. This

interaction effect was unexpected. Within-cell correlations indicated that BIS did not predict startle magnitudes during positive picture viewing in either the no affirmation condition, r (47) = -.15, p = .31, or the self-affirmation condition, r (49) = .11, p = .49. Additionally, the t-tests on predicted values derived from the regression equation indicated that, among participants lower and higher in BIS, affirmation condition did not significantly influence startle responding, ps > .09, though the trend was similar to the results for negative pictures.

2.2.4 Hierarchical linear model of the effect of BIS, affirmation condition, and picture type on startle responding

In addition to the regressions reported above, we analyzed the data using hierarchical linear modeling (HLM) in order to have more statistical power to model the effects of BIS, affirmation condition, picture type, and their interactions on startle eye-blink magnitudes. Startle responses were modeled as a 3 (picture type, within-subjects) × 2 (affirmation condition, between-subjects) × continuous (BIS, between-subjects) multilevel model with a random intercept and random slope for valence estimated for each participant, which allowed us to account for the dependence of startle responses within participants and allow for cross-level interactions, respectively. BIS scores were mean-centered, and the categorical variables were effect-coded.

Supporting the validity of the EMG measurement, we observed a strong main effect of picture type on startle responses, F (2, 2579) = 18.53, p < .001 (see Figure 1). There was no main effect of affirmation condition, F (1, 2579) = 0.0003, p = .987. Our primary prediction was that self-affirmation (versus no affirmation) would reduce the

relationship between BIS and startle responses during negative pictures. It did. The predicted 3-way interaction between picture type, affirmation condition, and BIS was significant, F (2, 2579) = 3.72, p = 0.02.

We probed the simple effects of the 3-way interaction within each stimulus type following the methods of Aiken and West (1991). In response to negative pictures, the predicted two-way interaction between self-affirmation and BIS was significant, b = -0.22, SE = 0.09, t (96) = -2.34, p = .02. BIS predicted startle eye-blink magnitudes during negative picture viewing in the no affirmation condition, b = 0.26, SE = 0.12, t (96) = 2.08, p = .04, consistent with evidence that BIS sensitivity potentiates responding to threat (e.g., Caseras et al., 2006). As predicted, the relationship between BIS sensitivity and threat-potentiated startles was eliminated in the self-affirmation condition, b = -0.17, SE = 0.14, t (96) = 1.27, p = .21 (see Figure 2). The interaction between self-affirmation and BIS did not predict startle responses when viewing either neutral pictures, b = -0.12, SE = 0.09, t (96) = 1.25, p = .22, or positive pictures, b = 0.09, SE = 0.09, t (96) = 0.95, p = .35.

2.3 Discussion

Self-affirmation has repeatedly been observed to reduce defensive responding to psychological threats to self-regard (e.g., health-risk information, cognitive dissonance;

for a review, see Cohen & Sherman, 2014). The current study found that self-affirmation also reduces defensive responses to threatening images (e.g., snakes, men with weapons, cockroaches on food), particularly among individuals prone to experiencing threat (i.e., those higher in BIS sensitivity). This finding suggests that the benefits of self-affirmation extend beyond soothing the self to assuaging even more primitive defensive motivational systems.

3. EXPERIMENT 2

In addition to reducing defensive responses to threats, self-affirmation can also increase openness to and processing of threatening stimuli (Cohen et al., 2000). The goal of Experiment 2 was to test the effects of self-affirmation on the processing of threatening pictures using a physiological measure of emotion, the late positive potential (LPP). The LPP is modulated by emotional content of stimuli and reflects motivational relevance and depth of information processing of stimuli, such that larger LPPs indicate more motivational relevance and deeper or more elaborate processing relative to smaller LPPs (Hajcak et al., 2010).

In this experiment participants self-affirmed or not and then viewed a series of emotionally-charged images while electrocortical activity was measured using EEG. I hypothesized that affirmed participants higher in BIS sensitivity would have larger LPPs to negative images compared to those lower in BIS. Evidence to support this hypothesis would suggest that self-affirmation increases processing of threatening information. As in Experiment 1, this experiment also included positive pictures to explore the possible effects of self-affirmation on responses to stimuli that activate the appetitive motivational system.

3.1 Method

3.1.1 Participants

One hundred and ten undergraduate students (54 women and 56 men; age M = 19.01, SD = 0.96) completed the experiment in exchange for credit toward a course

requirement. Six additional participants completed the study but were excluded from analyses for the following reasons: 2 had bad EEG recordings due to a malfunctioning grounding electrode, 2 had missing picture viewing task data due to computer errors, 1 had missing questionnaire data due to computer errors, and 1 completed the affirmation task in the incorrect order.

3.1.2 Materials and procedure

Participants first completed the BIS/BAS scales (Carver & White, 1994). In this study the average total score on the BIS subscale was $M = 20.24$ ($SD = 3.72$, $\alpha = .77$).[6] After participants provided informed consent, an experimenter attached sensors to participants' heads using 59 tin electrodes in a stretch-lycra electrode cap. Electrodes were also placed on participants' earlobes for offline re-referencing. EEG electrode impedances were below 5000 Kohms, and differences in impedance at homologous sites were below 1000 Kohms. After cap placement and a 4 min period for recording electrical activity in the brain at rest, participants completed the same self-affirmation manipulation as in Experiment 1.

3.1.2.1 Picture viewing paradigm

Following the self-affirmation manipulation participants viewed a series of images on a computer screen. Participants were instructed to view pictures the entire time they appeared on screen. Trials began with a 3 s fixation cross, followed by a picture for 3.5-6 s and an ITI of 6-12 s. Picture stimuli consisted of 60 images from the

[6] Participants also completed the BAS scale ($M = 40.77$, $SD = 3.97$, $\alpha = .67$). Results pertaining to BAS sensitivity are not relevant to the current investigation and are not reported here.

IAPS (Lang et al., 2008). The first four images were neutral practice trials and were not analyzed. Experimental trials included the same 18 positive, 19 neutral, and 19 negative pictures from the IAPS as in Experiment 1.

Following the image viewing task participants sat quietly for 4 min to permit another recording of resting brain activity. Participants then completed a modified flanker task adapted from Eriksen and Eriksen (1974). The flanker task measured individual differences in neural responses to errors and was included for exploratory purposes; results associated with this task will not be presented here.

3.1.3 Psychophysiological recording and quantification

EEG signals were amplified with Neuroscan SynAmps2 (El Paso, TX), bandpass filtered (0.05 – 100 Hz), notch filtered (60 Hz), and digitized at 500 Hz. Eye movements were recorded from the supraorbit of left eye. Artifacts (e.g., horizontal eye movements and muscle movements) were first removed by hand. Then, a regression-based eye movement correction was applied to correct vertical eye movements (Semlitsch, Anderer, Schuster, & Presslich, 1986), after which the data were again visually inspected to ensure proper correction.

Stimulus-locked ERPs were computed for the picture task. All data were epoched 100 ms prior to the stimulus to 3000 ms after the stimulus and were filtered with a lowpass of 16 Hz at 12 db. Waveforms were baseline corrected using prestimulus activity. Averages of centroparietal sites (i.e., CP1, CP2, CPz, Cz, and Pz) for each participant were calculated for each stimulus type (i.e., positive, negative, and neutral

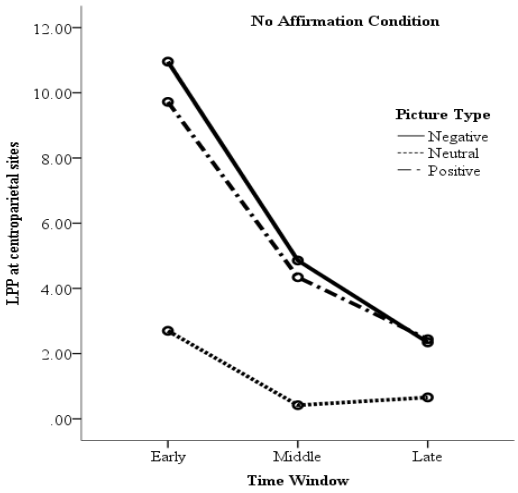
images), and the LPP was quantified by the area under the curve in early (500 ms to 1000 ms), middle (1000 ms to 2000 ms), and late (2000 ms to 3000 ms) time windows.

3.2 Results

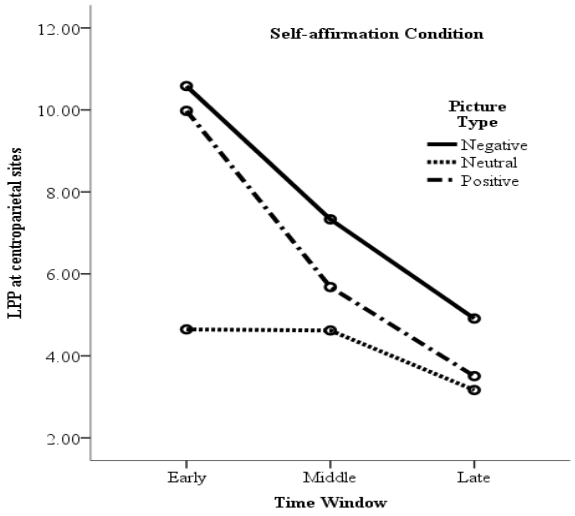
3.2.1 LPP amplitudes as a function of affirmation condition and time window

A 2 (Affirmation Condition) × 3 (Picture Type) × 3 (Time Window) mixed-model analysis of variance (ANOVA) on the LPP yielded a main effect of picture type, F (2, 216) = 19.04, $p < .001$, such that LPPs were larger for positive and negative pictures than for neutral pictures. LPP amplitudes did not differ between positive and negative picture types. The ANOVA also revealed a main effect of time window, F (2, 216) = 76.77, $p < .001$, such that LPPs were largest at the early time window and dissipated over time. The main effect of affirmation condition was non-significant, F (1, 108) = 2.61, $p = .109$.

The two-way interaction between picture type and time window was significant, F (4, 432) = 21.39, $p < .001$. As Figure 4 shows, LPPs decreased over time for positive and negative pictures but not for neutral pictures. The two-way interaction between affirmation condition and time window was marginally significant, F (2, 216) = 2.98, $p = .053$. As Figure 5 shows, LPPs during the early window were similar across affirmation conditions, but LPPs during the middle and late windows decreased more in the no affirmation condition versus the self-affirmation condition. All other interactions were non-significant, ps > .28.



A



B

Figure 4. LPP amplitudes as a function of time window and picture type, separately by affirmation condition.

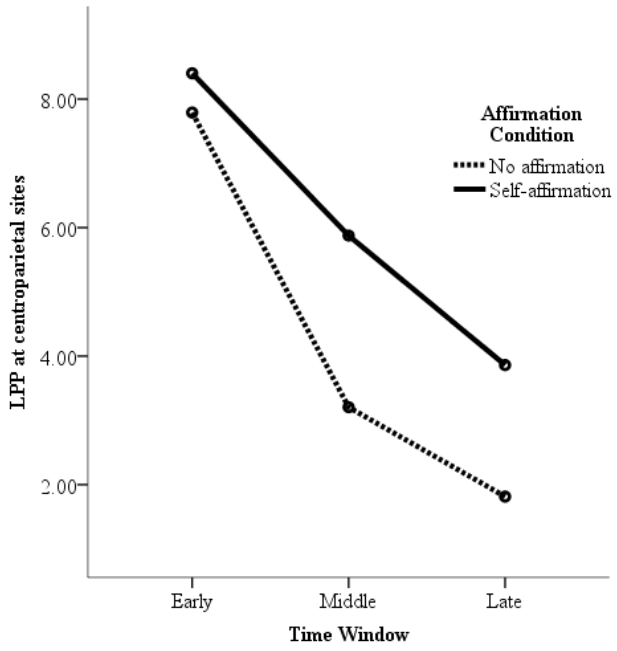


Figure 5. LPP amplitudes as a function of time window and affirmation condition.

3.2.2 LPP amplitudes in the early time window during negative picture viewing as a function of affirmation condition and trait BIS

In the next set of analyses I analyzed the effects of self-affirmation on LPPs to negative pictures across the early, middle, and late time windows, respectively. Refer to Table 1 for means, standard deviations, and correlations separately by affirmation condition. Controlling for neutral picture LPPs in the early time window, I regressed LPP amplitude during the early window of negative picture viewing on affirmation

condition (coded 0 = no affirmation; 1 = affirmation), trait BIS (centered), and their interaction. LPPs during neutral picture viewing predicted LPPs during negative picture viewing, $B = 0.37$, $p < .001$. The main effect of BIS was also significant, $B = 0.46$, $p = .006$, such that higher scores on BIS predicted larger LPPs to negative pictures. Neither the main effect of affirmation condition, $B = -1.05$, $p = .39$, nor the interaction between affirmation condition and BIS, $B = -0.07$, $p = .84$, were significant.

Table 1

Means, SDs, and Correlations for the No Affirmation and Self-Affirmation Conditions

Variable	*M*	*SD*	1	2	3	4	5	6	7	8	9	10	11
No affirmation condition (n = 52)													
1. BIS	20.30	3.84	–	.26	.29*	.04	-.15	.05	-.08	-.04	.03	-.19	-.20
2. BAS	40.75	4.20		–	.12	.19	.14	.07	-.08	-.09	-.08	-.07	-.11
3. LPP neg early	10.96	7.19			–	.57***	.36**	.37**	-.03	.00	.59***	.23	.13
4. LPP neg middle	4.86	6.36				–	.82***	.25	.21	.26	.24	.24	.08
5. LPP neg late	2.34	5.59					–	.03	.14	.20	.07	.11	.05
6. LPP neut early	2.70	8.85						–	.68***	.56***	.55***	.58***	.48***
7. LPP neut middle	0.42	11.20							–	.89***	.27	.55***	.52***
8. LPP neut late	0.66	11.43								–	.21	.49***	.48***
9. LPP pos early	9.72	7.07									–	.79***	.71***
10. LPP pos middle	4.34	7.96										–	.91***
11. LPP pos late	2.44	7.23											–
Self-affirmation condition (n = 58)													
1. BIS	20.19	3.65	–	-.13	.28*	.36**	.26*	.18	.14	.02	.35**	.35**	.25
2. BAS	40.79	3.80		–	.05	.26*	.10	.06	.02	-.01	.15	.08	-.08
3. LPP neg early	10.58	7.22			–	.59***	.66***	.53***	.45***	.40**	.78***	.65***	.46***
4. LPP neg middle	7.33	7.55				–	.73***	.56***	.51***	.40**	.64***	.58***	.29*
5. LPP neg late	4.91	6.73					–	.53***	.58***	.58***	.53***	.66***	.54***
6. LPP neut early	4.65	7.33						–	.84***	.66***	.47***	.40**	.42**
7. LPP neut middle	4.62	8.06							–	.80***	.40**	.51***	.47***
8. LPP neut late	3.17	8.71								–	.36**	.49***	.44**
9. LPP pos early	9.98	7.09									–	.77***	.52***
10. LPP pos middle	5.68	7.97										–	.83***
11. LPP pos late	3.51	8.05											–

Note. * $p < .05$. ** $p < .01$. *** $p < .001$.

3.2.3 LPP amplitudes in the middle time window during negative picture viewing as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting LPPs to neutral and negative picture viewing during the middle time window. Again, LPP amplitude in the middle window for neutral pictures was a significant predictor of LPP amplitude during the middle window for negative pictures, $B = 0.25$, $p < .001$. The main effect of BIS was also significant, $B = 0.40$, $p = .018$, such that high scores on BIS predicted larger LPP amplitudes. As in the early window, the main effect of affirmation, $B = 1.48$, $p = .245$, and the interaction between affirmation condition and BIS, $B = 0.55$, $p = .102$, were non-significant.

3.2.4 LPP amplitudes in the late time window during negative picture viewing as a function of affirmation condition and trait BIS

In a third regression, LPPs during neutral picture viewing predicted LPPs during negative picture viewing in the late time window, $B = 0.24$, $p < .001$. The main effects of BIS, $B = .14$, $p = .352$, and affirmation condition, $B = 1.99$, $p = .076$, were non-significant, but this time the interaction between affirmation condition and BIS was significant, $B = 0.66$, $p = .025$.

The t-tests on predicted values derived from the regression equation indicated that among participants higher in BIS (1 *SD* above the mean), self-affirmation caused larger LPPs during the late window of negative picture viewing relative to the no affirmation condition, $t\ (106) = 4.46$, $p = .005$. Among participants lower in BIS (1 *SD* below the mean), affirmation condition did not influence LPP amplitudes, $t\ (106) = -$

0.48, p = .756. See Figure 6. This pattern of results supports the prediction that self-affirmation influences negative emotional picture processing particularly among persons higher in BIS.

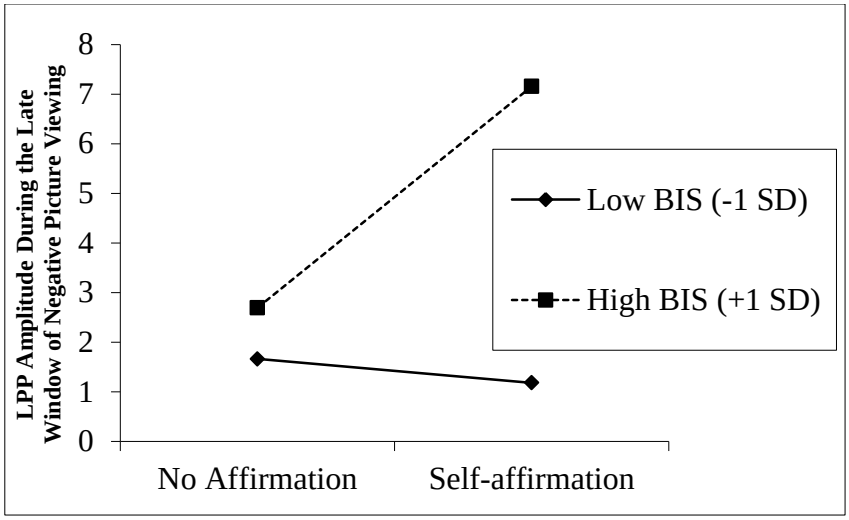


Figure 6. LPP amplitudes during the late time window of negative picture viewing as a function of affirmation condition and individual differences in BIS.

3.2.5 LPP amplitude in the early time window during positive picture viewing as a function of affirmation condition and trait BIS

The next set of analyses examined LPPs to positive pictures as a function of affirmation condition across the early, middle, and late time windows, respectively. Controlling for neutral picture LPPs during the early window, I regressed LPP amplitude during the early window of positive picture viewing on affirmation condition (coded 0 = no affirmation; 1 = affirmation), trait BIS (centered) and their interaction. LPPs during

neutral picture viewing predicted LPPs during positive picture viewing, $B = 0.43$, $p < .001$. No other effects were significant, ps > .09.

3.2.6 LPP amplitude in the middle time window during positive picture viewing as a function of affirmation condition and trait BIS

In a regression predicting LPPs during the middle window of positive picture viewing, LPPs during neutral viewing predicted LPPs during positive pictures, $B = 0.43$, $p < .001$. Neither the main effects of affirmation condition, $B = -0.45$, $p = .734$, nor BIS, $B = 0.16$, $p = .36$, were significant. The interaction between affirmation condition and BIS was significant, $B = 0.94$, $p = .007$.

The t-tests on predicted values derived from the regression equation indicated that, among participants lower in BIS, self-affirmation caused smaller LPPs during the middle window of positive picture viewing relative to the no affirmation condition, $t (106) = 3.95$, $p = .033$. Among participants higher in BIS, affirmation condition did not significantly influence LPP amplitude, $t (106) = 3.04$, $p = .106$, though the trend was similar to the negative pictures. See Figure 7.

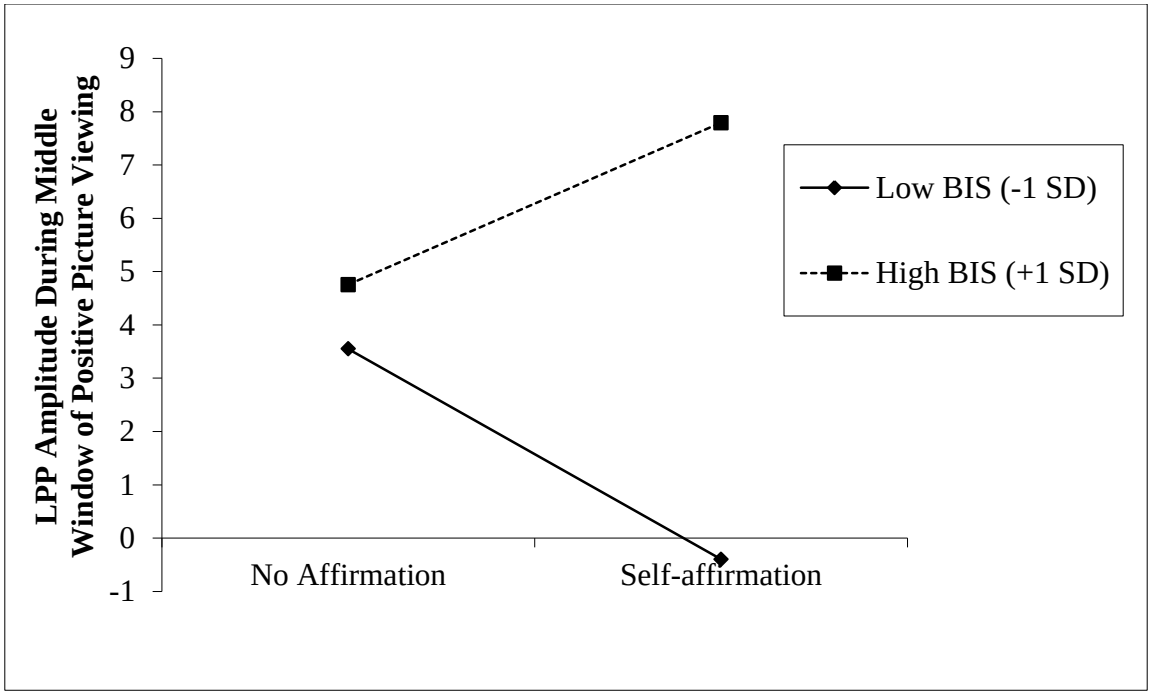


Figure 7. LPP amplitudes during the middle time window of positive picture viewing as a function of affirmation condition and individual differences in BIS.

3.2.7 LPP amplitude in the late time window during positive picture viewing as a function of affirmation condition and trait BIS

In a regression predicting LPPs during the late window of positive picture viewing, LPPs during neutral viewing predicted LPPs during negative pictures, $B = 0.35$, $p < .001$. Neither the main effects of affirmation condition, $B = 0.21$, $p = .876$, nor BIS, $B = 0.09$, $p = .611$, were significant. The interaction between affirmation condition and BIS was significant, $B = 0.87$, $p = .014$.

The t-tests on predicted values derived from the regression equation indicated that among participants lower in BIS, the affirmation condition did not significantly influence LPP amplitude, t (106) = 3.02, p = .105, though the trend was similar to the middle window of positive picture viewing. Among participants higher in BIS, affirmation condition did not significantly influence LPP amplitude, t (106) = 3.44, p = .066, though the trend was similar to the negative pictures. See Figure 8.

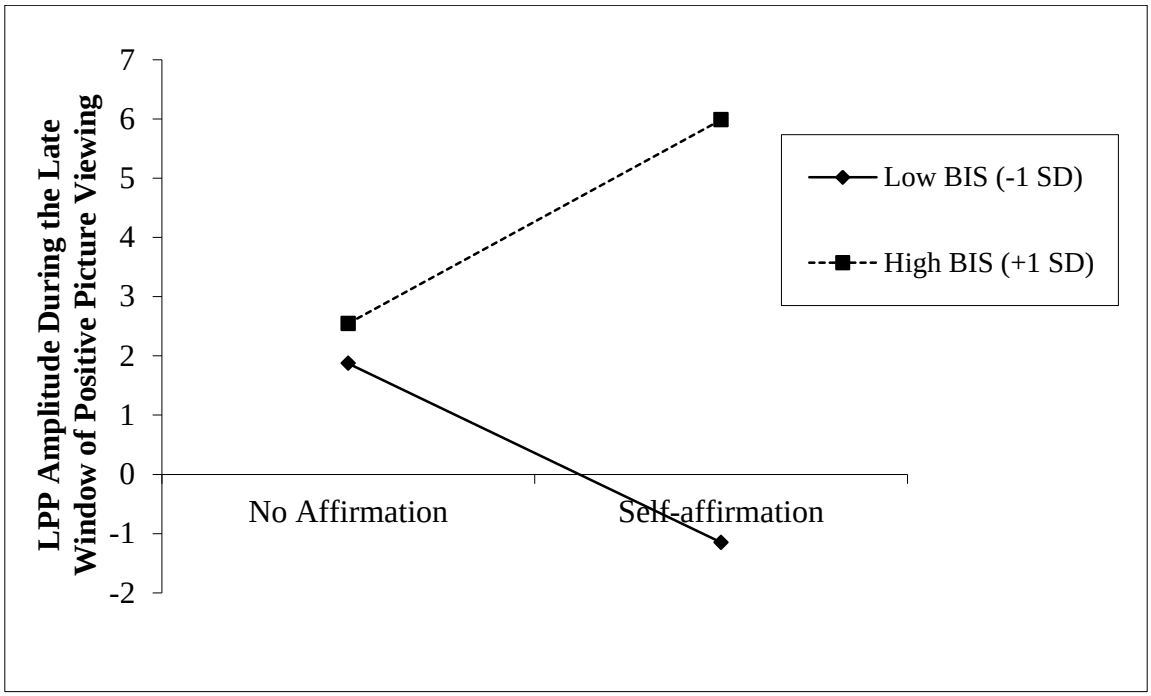


Figure 8. LPP amplitudes during the late time window of positive picture viewing as a function of affirmation condition and individual differences in BIS.

3.3 Discussion

Experiment 2 tested the hypothesis that self-affirmation influences electrocortical responses to emotional images. Specifically, I was interested to know whether self-affirmation (versus no affirmation) increases LPP amplitudes to negative pictures particularly among participants higher in BIS. As in previous research, individual differences in BIS predicted LPPs to negative images, such that those higher in BIS had larger LPPs than those lower in BIS (Balconi et al., 2009; Balconi et al., 2012). Crucially, the self-affirmation manipulation moderated the relationship between BIS and LPP amplitudes to negative images (i.e., high BIS individuals had larger LPPs following self-affirmation), particularly for LPP amplitudes later in picture viewing (i.e., 2000-3000 ms after picture onset). Thus, in the no affirmation condition, high BIS participants appeared to process threatening stimuli thoroughly at first but this processing dropped off dramatically over time. In the self-affirmation condition, however, high BIS participants processed the negative images more thoroughly over time. This pattern of results suggests that self-affirmation enabled high BIS individuals to sustain processing of negative emotional images.

Individual differences in BIS did not predict LPPs to positive images. I did not have specific hypotheses about a possible interaction between self-affirmation and BIS on positive LPPs. However, the results suggested that affirmed (compared to non-affirmed) participants who were lower in BIS had significantly smaller LPPs to positive images in the 1000-2000 ms window. Overall, the results of Experiment 2 suggest that self-affirmation leads to sustained processing of negative stimuli among individuals higher in BIS.

4. EXPERIMENT 3

Experiments 1 and 2 found that self-affirmation influences emotion-related physiological responses, particularly in response to negative emotional images and particularly for individuals high in BIS. The first aim of Experiment 3 was to investigate the extent to which self-affirmation affects more explicit emotion-related responses via self-reports of valence and arousal. I was most interested in responses to negative pictures for three reasons. First, self-affirmation reduced the startle eye-blink response among high BIS individuals in Experiment 1 only during negative picture viewing. Second, although affirmation interacted with individual differences in BIS sensitivity to influence LPP amplitude during both positive and negative picture viewing in Experiment 2, BIS had a clearer relationship with responding to negative stimuli. Third, research on the effects of self-affirmation has typically involved responses to negative or threatening stimuli (e.g., threatening health information; Harris et al., 2007). Therefore, participants in Experiment 3 viewed a greater number of negative than positive or neutral pictures.

A second aim of the Experiment 3 was to test the extent to which participants engaged in emotion regulation or attentional disengagement during negative picture viewing. In Experiment 2 high BIS participants showed a steep reduction in the LPP over time unless they had self-affirmed. One reason for the steeper reduction in the LPP among non-affirmed high BIS participants may be that those participants attempted to down-regulate their responses or disengage from the negative emotional images. Koole

and Rothermund (2011) claimed that "if the intensity (or direction) of an emotion changes over time, although the emotion eliciting stimulus remains the same, and no instruction regarding emotion regulation is given, then it is likely that spontaneous or implicit emotion regulation processes are responsible for the change" (p. 393). The results of Experiment 2 suggested that individuals high in BIS may have spontaneously engaged in emotion regulation or attentional disengagement to down-regulate their responses, unless they had previously self-affirmed. The fact that high BIS participants who had self-affirmed showed less of a reduction in the LPP over time is consistent with the idea that self-affirmation helped high BIS individuals to engage with and process threatening images instead of avoiding or down-regulating their response to them.

Emotion regulation is often studied in the laboratory by explicitly instructing participants to use emotion regulation strategies while viewing emotional stimuli (e.g., Gross & Levenson, 1993; Ochsner, Bunge, Gross, & Gabrieli, 2002). However, most forms of emotion regulation probably do not require instruction. Spontaneous emotion regulation refers to the implementation of emotion regulation strategies without explicit instruction from experimenters (e.g., Schmeichel & Demaree, 2010). This type of emotion regulation can occur with conscious awareness (i.e., the participants can report having employed emotion regulation strategies) or without conscious awareness (i.e., the participants may not be aware that they have employed emotion regulation strategies). Experiment 3 aimed to ascertain whether participants spontaneously engage in and are consciously aware of efforts at emotion regulation during picture viewing, and whether the tendency to do so differs as a function of self-affirmation condition and BIS

sensitivity, respectively. To assess the extent to which participants engaged in emotion regulation and attentional disengagement, after some pictures participants reported whether they had attempted reduce their emotional response to the picture and whether they had focused their attention on the picture while it was on the screen.

Efforts to regulate emotions have been found to deplete inner regulatory resources. For example, dieters who suppressed their emotional reactions to a sad video clip subsequently ate more ice cream than those who did not suppress their emotional reactions (Vohs & Heatherton, 2000; see also Muraven, Tice, & Baumeister, 1998; Schmeichel, 2007). Building on this previous research I reasoned that if participants regulate their emotional responses, then they should perform worse on a subsequent self-control task. I chose to use the cognitive estimation test (CET; Bullard et al., 2004) as the dependent measure of self-control. The CET requires participants to estimate the duration, quantity, weight, or distance of items for which there is no clear or obvious answer. When answering items on the CET individuals must elaborate and reason from existing knowledge to generate estimates of unknown quantities. Previous studies have found that prior exercises of self-control reduce performance on the CET (Schmeichel, Vohs, & Baumeister, 2003; Vohs, Baumeister, & Schmeichel, 2012). In the current study, evidence that non-affirmed high BIS participants perform worse than affirmed high BIS participants on the CET would suggest that high BIS participants spontaneously engaged in emotion regulation during the image viewing task.

Based on the results of the previous experiments I reasoned that self-affirmation and BIS would interact to influence responding particularly later (versus earlier) in the

processing of emotional pictures. In Experiment 1 the startle probes occurred 3.5-4.5 s into picture viewing. And the results of Experiment 2 revealed an interaction between affirmation condition and BIS sensitivity in the 2000-3000 ms time window but not in the earlier time windows. Therefore, in Experiment 3 I varied the duration of the pictures, such that some pictures were shown for a short amount of time (i.e., 2 s) before participants rated their emotional reactions—before any emotion regulation attempts were likely to occur—whereas other pictures appeared onscreen for a longer amount of time (i.e., 6 s) before participants rated their emotional reactions—by which time emotion regulation attempts were likely to have begun.

Based on the results of Experiments 1 and 2 and previous research (e.g., Balconi et al., 2009), I expected participants higher in BIS to report more negative emotional valence and arousal in response to the short duration pictures as compared to participants lower in BIS, whereas I expected high BIS participants would downregulate their response and thus report less emotional negative emotional reactions in response to the longer (versus shorter) duration pictures. In line with Experiment 2's results, affirmed participants high in BIS, on the other hand, should have stronger responses to negative images regardless of the duration of the pictures. This pattern of results would suggest that high BIS participants typically down-regulate or try not to attend to negative emotional pictures after a few seconds of picture viewing, unless they have self-affirmed.

4.1 Method

4.1.1 Participants

I conducted an a priori power analysis using GPower (Faul, Erdfelder, Lang, & Buchner, 2007) with power (1-*B*) set at 0.80 and alpha = .05 (two-tailed). To test the effect of self-affirmation condition on the dependent variables, the power analysis suggested 64 participants per group in order to detect a medium-sized main effect (Cohen's $d = 0.50$). Given my interest in the potential moderating effect of individual differences in BIS, I aimed for a sample of 120 participants per affirmation condition (i.e., 240 participants in total) to ensure a highly-powered test.

Two hundred and fifty undergraduate students (186 women and 64 men; age $M = 18.52$, $SD = 0.95$) completed the experiment in exchange for credit toward a course requirement. Eleven additional participants completed the study but were excluded from analyses for the following reasons: 4 were more than 3 *SD*s from the mean on BIS, 3 were missing more than 50% of responses to picture trials, 3 were more than 3 *SD*s away from mean on valence ratings, and 1 did not follow instructions on the affirmation task.

4.1.2 Materials and procedure

All questionnaires and stimuli were presented using MediaLab software on Windows computers. Participants reported to the laboratory in groups of up to four. After providing consent participants filled out the measure of trait BIS, completed the self-affirmation manipulation, viewed and rated their emotional responses to a series of negative, positive, and neutral pictures, completed a self-control task, and answered additional personality questionnaires.

4.1.2.1 Individual difference questionnaires

Participants completed the following questionnaires: BIS/BAS (Carver & White, 1994), the brief self-control scale (Tangney, Baumeister, & Boone, 2004), the approach/avoidance temperament questionnaire (AATQ; Elliot & Thrash, 2002), the mindful attention awareness scale (MAAS; Brown & Ryan, 2003), an emotion regulation questionnaire (Gross & John, 2003), a modified version of the cognitive interference questionnaire (Sarason, Sarason, Keefe, Hayes, & Shearin, 1986) and a general demographic questionnaire. The BIS scale is the key predictor of interest and participants completed it before the affirmation manipulation; other individual difference measures were included for exploratory purposes, were completed at the end of the experiment, and did not relate to results reported below. In this study the average total score on the BIS subscale was $M = 21.16$ ($SD = 3.08$, $\alpha = .61$).[7]

4.1.2.2 Affirmation manipulation

Participants were assigned at random to complete the same affirmation manipulation (self-affirmation versus no affirmation) as in Experiments 1 and 2.

4.1.2.3 Picture viewing paradigm

Participants viewed 30 negative, 20 positive, and 20 neutral images from the IAPS (Lang et al., 2008).[8] Pictures appeared in a pseudo-random order provided that no

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[7] Participants also completed the BAS scale ($M = 39.74$, $SD = 4.65$, $\alpha = .81$). Results pertaining to BAS sensitivity are not relevant to the current investigation and are not reported here.

[8] Neutral pictures from IAPS: 2102, 2200, 2393, 2394, 2506, 2513, 2516, 2850, 5534, 6150, 7000, 7002, 7004, 7006, 7009, 7025, 7031, 7100, 7185, 7236. Negative pictures from IAPS: 1052, 1205, 1270, 1274, 1300, 2095, 2703, 2811, 3000, 3010, 3063, 3071, 3150, 3500, 3530, 3550, 6212, 6250, 6313, 6510, 6550, 7380, 9300, 9405, 9419, 9433, 9620, 9622, 9810, 9902. Positive pictures from IAPS: 4608, 4651, 4658,

more than three pictures of the same type (e.g., negative) appeared successively. A fixation cross appeared at the center of the screen. After 1.5 s the fixation cross disappeared and was replaced by a picture. Half of each picture type appeared for 2 s (i.e., short duration condition) and half of each picture type will appear for 6 s (i.e., long duration condition).

4.1.2.3.1 Valence and arousal ratings. After each picture, a fixation cross appeared on screen for 1 s, followed by valence and arousal rating screens for 2 s each. Valence rating screens depicted a self-assessment manikin (SAM; Bradley & Lang, 1994) of unhappy to increasingly happy faces labeled 1 (*unhappy*) through 7 (*very happy*). Arousal rating screens depicted a SAM of increasing states of arousal labeled 1 (*very calm*) through 7 (*very excited*). (See the Appendix for examples.) Participants responded by pressing the number on the keyboard that best reflected their response to the preceding picture.

4.1.2.3.2 Emotion regulation and attention questions. After seven of the short and long duration negative picture trials and five of the short and long duration positive and neutral picture trials, and immediately after responding to the SAMs, participants were prompted to indicate how much they tried to decrease their emotional reactions to the preceding image on a scale from 1 (*none*) to 7 (*quite a bit*) and how much their mind was focused on the image on a scale from 1 (*my mind was completely on the picture*) to 7 (*my mind was completely on unrelated concerns*). Additionally, at the end of the study

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4670, 4681, 5260, 5470, 5621, 7200, 7260, 7270, 7390, 7460, 7470, 8031, 8161, 8186, 8260, 8490, 8501.

(i.e., after the CET) participants were prompted to describe what they did, if anything, to change their emotional responses to the images.

In summary, a trial of the picture paradigm included: a fixation cross for 1 s, a picture for 2 s or 6 s, a fixation cross for 1 s, a valence SAM, an arousal SAM, and sometimes an emotion regulation question and attention question. Upon completing the picture viewing task, participants completed a measure of self-control ability, the CET.

4.1.2.4 CET

The CET consisted of 20 open-ended questions with unclear answers that required participants to estimate time/duration, quantity, weight and distance of various items (e.g., "How much do a dozen, medium-sized apples weigh?" and "How long is a giraffe's neck?"). Participants were allowed as much time as they needed to answer each question. The CET was scored in relation to normative performance of a large adult sample (Bullard et al., 2004), such that appropriate estimates (i.e., those within 25-75% of the normative sample) received a score of 0, mildly inappropriate estimates (i.e., those within 5-25% or 75-95% of the normative sample) received a score of 1, and wildly inappropriate (i.e., those below 5% or above 95% of the normative sample) received a score of 2. Responses for which a score could not be given (e.g., "depends on the age of the giraffe") were excluded from analyses. Therefore, a sum of usable answers divided by total number of answers (out of 20) was computed for each participant and higher scores on the CET thus indicated poorer cognitive estimation (which I took to reflect poorer self-control).

4.2 Results

4.2.1 Valence as a function of affirmation condition, picture type, and picture duration

First, I conducted a 2 (Self-Affirmation Condition) × 2 (Picture Duration) × 3 (Picture Type) mixed-model analysis of variance (ANOVA) on self-reported valence. As expected, I observed a significant main effect for picture type, F (2, 496) = 1663.12, p < .001. Pairwise comparisons (Bonferroni corrected) revealed that positive pictures (M = 4.80, SE = 0.04) were rated most positively, negative pictures (M = 2.05, SE = 0.04) were rated most negatively, and neutral pictures (M = 4.01, SE = .02) were rated in between the other two picture types (ps < .001).

I also observed an unexpected significant main effect for picture duration, F (1, 248) = 64.34, p < .001. Pairwise comparisons (Bonferroni corrected) revealed that pictures that appeared onscreen for the longer (6 s) duration (M = 3.68, SE = 0.02) were rated higher in valence (p < .001) relative to pictures that appeared onscreen for the shorter (2 s) duration (M = 3.56, SE = 0.02). Although not predicted, I also observed an interaction between picture type and picture duration, F (2, 496) = 7.57, p = .001. Paired samples t-tests revealed that valence ratings were higher for long duration neutral, positive, and negative pictures than for short duration pictures, t (249) = 4.98, p < .001, t (249) = 6.31, p < .001, and t (249) = 2.71, p = .007, respectively. Please refer to Table 2 for means and standard deviations and Figure 9 for a visual depiction of the interaction. I found no main effect of or interactions involving self-affirmation condition, Fs < 2.70, ps > .10.

Table 2. Means and standard deviations for self-reported valence, arousal, emotion regulation, and attention by picture type, picture duration, and affirmation condition.

	Valence	Arousal	Emotion regulation	Attention
No affirmation condition (n = 125)				
Neutral short duration	3.93 (0.39)	2.28 (0.97)	1.61 (0.91)	2.43 (1.38)
Neutral long duration	4.05 (0.39)	2.30 (1.00)	1.76 (1.01)	2.45 (1.36)
Positive short duration	4.74 (0.70)	3.75 (1.23)	2.11 (1.17)	2.17 (1.08)
Positive long duration	4.86 (0.73)	3.64 (1.24)	1.94 (0.95)	2.15 (1.01)
Negative short duration	2.03 (0.63)	3.82 (1.30)	2.57 (1.26)	2.06 (1.03)
Negative long duration	2.06 (0.68)	3.86 (1.34)	2.53 (1.21)	2.08 (0.85)
Self-affirmation condition (n = 125)				
Neutral short duration	3.95 (0.42)	2.13 (0.88)	1.56 (0.81)	2.27 (1.18)
Neutral long duration	4.10 (0.45)	2.20 (0.95)	1.61 (0.83)	2.35 (1.25)
Positive short duration	4.70 (0.59)	3.74 (1.21)	2.12 (1.10)	2.10 (0.96)
Positive long duration	4.90 (0.65)	3.63 (1.27)	1.85 (0.95)	2.06 (0.97)
Negative short duration	2.03 (0.63)	3.75 (1.23)	2.65 (1.31)	1.98 (1.02)
Negative long duration	2.10 (0.68)	3.72 (1.28)	2.65 (1.29)	2.11 (0.93)

Note. Standard deviations are in parentheses.

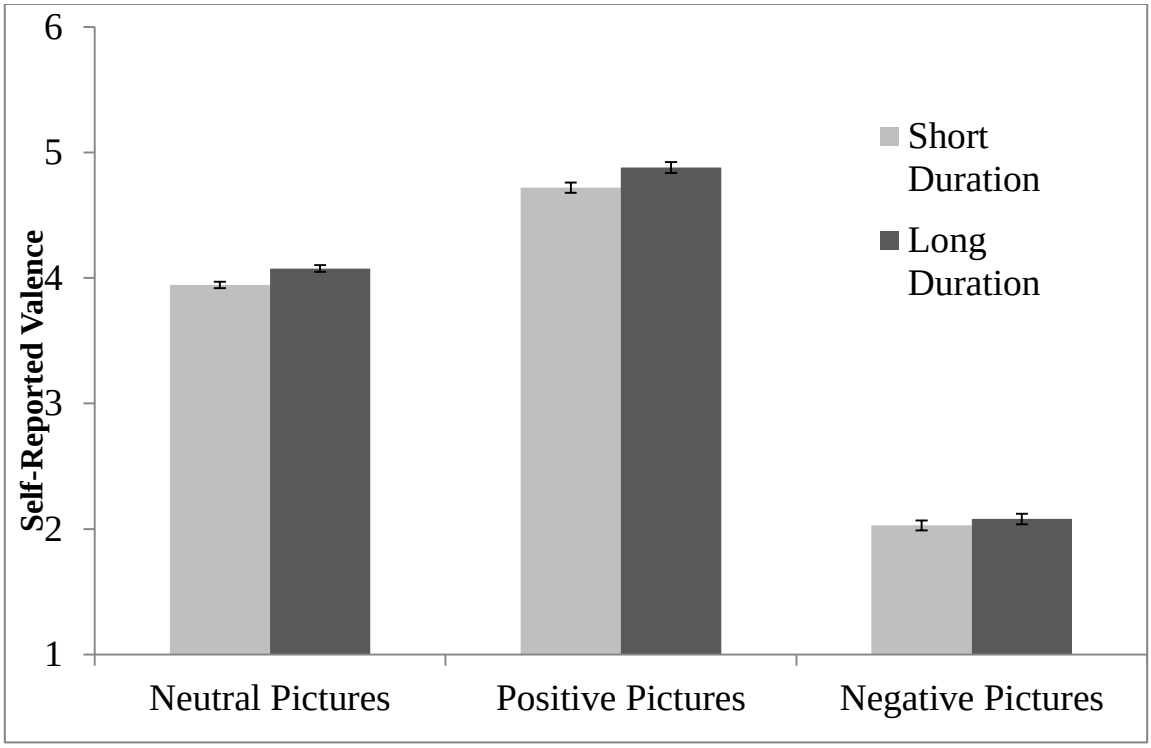

Figure 9. Self-reported valence as a function of picture type and picture duration.

4.2.2 Arousal as a function of affirmation condition, picture type, and picture duration

Next, I conducted a 2 (Self-Affirmation Condition) × 2 (Picture Duration) × 3 (Picture Type) mixed-model ANOVA on self-reported arousal. As expected, I observed a significant main effect for picture type, F (2, 496) = 279.45, p < .001. Pairwise comparisons (Bonferroni corrected) revealed that positive (M = 3.69, SE = 0.08) and negative pictures (M = 3.79, SE = 0.80) versus neutral pictures (M = 2.23, SE = 0.06) elicited more arousal (ps < .001), but positive and negative pictures did not differ from each other (p = .218). Although not predicted, I also observed an interaction between picture type and picture duration, F (2, 496) = 7.57, p = .001. Paired samples t-tests

revealed that arousal ratings were higher for short duration positive pictures than for long duration positive pictures, t (249) = 3.37, p = .001, but there were no difference in arousal ratings between the short and long duration neutral or negative pictures (ps > .10). Please refer to Table 2 for means and standard deviations and Figure 10 for a visual depiction of the Picture Type × Picture Duration interaction. I found no main effect of picture duration and no main effect or interactions involving self-affirmation condition, Fs < 1.23, ps > .27.

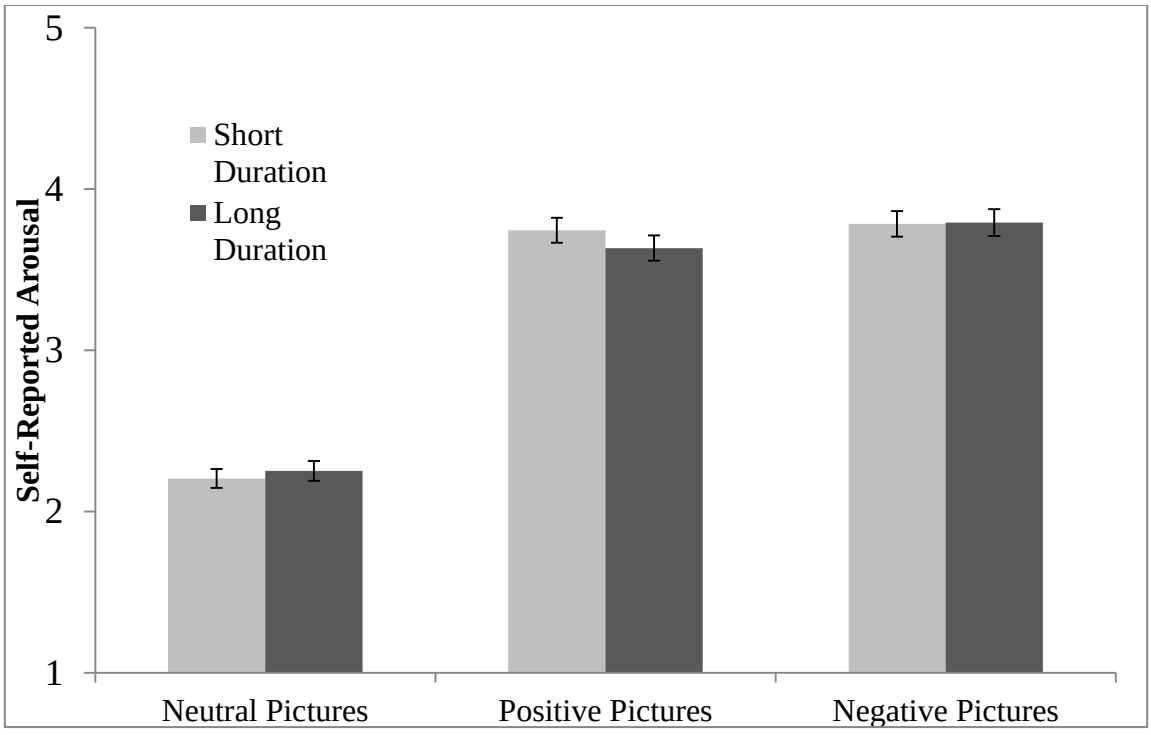

Figure 10. Self-reported arousal as a function of picture type and picture duration.

4.2.3 Self-reported emotion regulation as a function of affirmation condition, picture type, and picture duration

I conducted a 2 (Self-Affirmation Condition) × 2 (Picture Duration) × 3 (Picture Type) mixed-model ANOVA on self-reported attempts to down-regulate emotional responses. I observed significant main effects for picture type, F (2, 496) = 155.38, p < .001, and for picture duration, F (1, 248) = 6.28, p = .013. Pairwise comparisons (Bonferroni corrected) on picture type revealed that negative pictures (M = 2.60, SE = 0.08) versus positive pictures (M = 2.00, SE = 0.06) and neutral pictures (M = 1.63, SE = 0.05) elicited more down regulation, ps < .001, and positive pictures elicited more down regulation than neutral pictures (p < .001). Pairwise comparisons (Bonferroni corrected) on picture duration revealed that pictures that appeared onscreen for the shorter duration (M = 2.10, SE = 0.06) versus the longer duration (M = 2.06, SE = 0.06) elicited more down regulation (p = .013). I also observed an interaction between picture type and picture duration, F (2, 496) = 23.22, p < .001. Paired samples t-tests revealed that emotion regulation ratings were lower for short duration neutral pictures than for long duration neutral pictures, t (249) = 3.02, p = .003, and emotion regulation ratings were lower for long duration positive pictures than for short duration positive pictures, t (249) = 5.18, p < .001. Please refer to Table 2 for means and standard deviations and Figure 11 for a visual depiction of the Picture Type × Picture Duration interaction. I found no main effect of or interactions involving self-affirmation condition, Fs < 1.60, ps > .18.

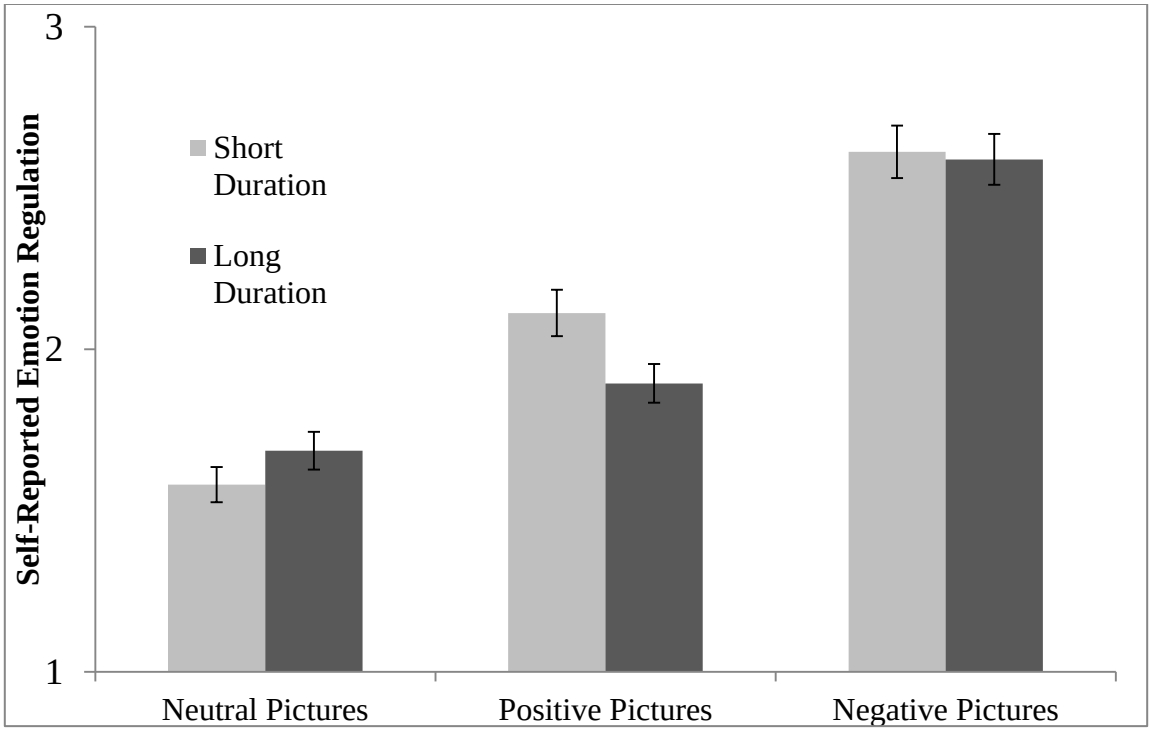

Figure 11. Self-reported emotion regulation as a function of picture type and picture duration.

4.2.4 Self-reported attentional engagement as a function of affirmation condition, picture type, and picture duration

Next, I conducted a 2 (Self-Affirmation Condition) × 2 (Picture Duration) × 3 (Picture Type) mixed-model ANOVA on self-reported attentional engagement. I observed a significant main effect for picture type, F (2, 496) = 20.16, $p < .001$. Pairwise comparisons (Bonferroni corrected) revealed that positive (M = 2.12, SE = 0.06) and negative pictures (M = 2.06, SE = 0.06) relative to the neutral pictures (M = 2.37, SE = 0.08) elicited more attentional engagement (ps < .001), but positive and negative pictures

did not differ from each other (p = .317). No other main effects of interactions were significant, Fs < 1.67, ps > .18.

4.2.5 Contributions of BIS to valence, arousal, emotion regulation, and attention to negative pictures

In the next set of analyses I analyzed valence, arousal, emotion regulation, and attention to negative pictures across the short and long pictures, respectively, taking individual differences in BIS into account. In each regression analysis I controlled for neutral picture ratings and regressed the dependent variable of interest on affirmation condition (coded 0 = no affirmation, 1 = affirmation), trait BIS (centered), and their interactions. To summarize all of these analyses, none yielded the predicted interactions between self-affirmation condition and BIS.

4.2.5.1 Valence for the short duration negative pictures as a function of affirmation condition and trait BIS

Valence ratings for short duration neutral pictures predicted valence ratings for negative pictures, B = 0.16, p = .012. The main effect of BIS was also significant, B = -0.24, p < .001, such that higher scores on BIS predicted more negative valence ratings. Neither the main effect of affirmation condition, B = 0.00, p = .994, nor the interaction between affirmation condition and BIS, B = -0.07, p = .371, were significant.

4.2.5.2 Valence for the long duration negative pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported valence to long duration neutral and negative picture viewing. Again, the main effect of BIS was

significant, B = -0.29, p < .001, such that higher scores on BIS predicted more negative valence ratings. Unlike the short duration negative pictures, the main effect of valence ratings for neutral pictures was not a significant predictor of valence ratings to the negative pictures, B = -0.03, p = .595. As for short duration negative pictures, the main effect of affirmation condition, B = 0.04, p = .572, and the interaction between affirmation condition and BIS, B = -0.11, p = .169, were non-significant.

4.2.5.3 Arousal for the short duration negative pictures as a function of affirmation condition and trait BIS

Arousal ratings for short duration neutral pictures predicted arousal ratings for negative pictures, B = 0.31, p < .001. The main effect of BIS was also significant, B = 0.20, p = .001, such that higher scores on BIS predicted higher arousal ratings. Neither the main effect of affirmation condition, B = -0.01, p = .925, nor the interaction between affirmation condition and BIS, B = 0.01, p = .939, were significant.

4.2.5.4 Arousal for the long duration negative pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported arousal to long duration neutral and negative picture viewing. Again, the main effect of neutral pictures was significant, B = 0.37, p < .001, and the main effect of BIS was significant, B = 0.20, p < .001, such that higher scores on BIS predicted higher arousal ratings. As it was for short duration negative pictures, the main effect of affirmation, B = -0.04, p = .486, and the interaction between affirmation condition and BIS, B = -0.00, p = .959, were non-significant.

4.2.5.5 Emotion regulation for the short duration negative pictures as a function of affirmation condition and trait BIS

Emotion regulation ratings for short duration neutral pictures predicted emotion regulation ratings for negative pictures, $B = 0.54$, $p < .001$. The main effect of BIS was also significant, $B = 0.15$, $p = .005$, such that higher scores on BIS predicted more reported efforts to down regulate emotional responses. Neither the main effect of affirmation condition, $B = 0.04$, $p = .423$, nor the interaction between affirmation condition and BIS, $B = 0.04$, $p = .588$, were significant.

4.2.5.6 Emotion regulation for the long duration negative pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported emotion regulation to long duration neutral and negative picture viewing. Again, the main effect of neutral pictures was significant, $B = 0.49$, $p < .001$, and the main effect of BIS was significant, $B = 0.14$, $p = .012$, such that higher scores on BIS predicted more efforts to down regulate emotional responses. As for short duration negative pictures, the main effect of affirmation, $B = 0.08$, $p = .124$, and the interaction between affirmation condition and BIS, $B = 0.06$, $p = .411$, were non-significant.

4.2.5.7 Attention for the short duration negative pictures as a function of affirmation condition and trait BIS

Attention ratings for short duration neutral pictures predicted attention ratings for negative pictures, $B = 0.54$, $p < .001$. The main effect of affirmation condition, $B = -$

0.01, p = .847, the main effect of BIS, B = 0.07, p = .205, and the interaction between affirmation condition and BIS, B = -0.03, p = .633, were all non-significant.

4.2.5.8 Attention for the long duration negative pictures as a function of affirmation condition and trait BIS.

I ran the same regression as above, this time substituting self-reported attention to long duration neutral and negative picture viewing. Again, the main effect of neutral pictures was significant, B = 0.65, p < .001. As for short duration negative pictures, the main effect of affirmation, B = 0.04, p = .387, the main effect of BIS, B = 0.05, p = .294, and the interaction between affirmation condition and BIS, B = -0.02, p = .741, were all non-significant.

4.2.6 Contributions of BIS to valence, arousal, emotion regulation, and attention results for positive pictures

In the next set of analyses, I analyzed the effects of self-reported valence, arousal, emotion regulation, and attention to positive pictures across the short and long pictures, respectively. In each regression analysis, I controlled for neutral picture ratings and regressed the dependent variable of interest on affirmation condition (coded 0 = no affirmation, 1 = affirmation), trait BIS (centered), and their interactions. Here again, none of these analyses yielded significant interactions between self-affirmation condition and BIS.

4.2.6.1 Valence for the short duration positive pictures as a function of affirmation condition and trait BIS

Valence ratings for short duration neutral pictures predicted valence ratings for positive pictures, $B = 0.38$, $p < .001$. The main effect of affirmation condition, $B = -0.04$, $p = .572$, the main effect of BIS, $B = -0.03$, $p = .628$, and the interaction between affirmation condition and BIS, $B = -0.02$, $p = .856$, were non-significant.

4.2.6.2 Valence for the long duration positive pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported valence to long duration neutral and positive picture viewing. Again, the main effect of valence ratings for neutral pictures was a significant predictor of valence ratings to the positive pictures, $B = 0.36$, $p < .001$. As for short duration positive pictures, the main effect of affirmation, $B = 0.00$, $p = .965$, the main effect of BIS, $B = -0.11$, $p = .064$, and the interaction between affirmation condition and BIS, $B = -0.04$, $p = .618$, were non-significant.

4.2.6.3 Arousal for the short duration positive pictures as a function of affirmation condition and trait BIS

Arousal ratings for short duration neutral pictures predicted arousal ratings for positive pictures, $B = 0.58$, $p < .001$. The main effect of affirmation condition, $B = 0.05$, $p = .367$, the main effect of BIS, $B = 0.04$, $p = .394$, and the interaction between affirmation condition and BIS, $B = -0.09$, $p = .179$, were non-significant.

4.2.6.4 Arousal for the long duration positive pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported arousal to long duration neutral and positive picture viewing. Again, the main effect of neutral pictures was significant, $B = 0.67$, $p < .001$. As it was for short duration positive pictures, the main effect of affirmation, $B = 0.04$, $p = .465$, the main effect of BIS, $B = -0.05$, $p = .341$, and the interaction between affirmation condition and BIS, $B = -0.03$, $p = .696$, were non-significant.

4.2.6.5 Emotion regulation for the short duration positive pictures as a function of affirmation condition and trait BIS

Emotion regulation ratings for short duration neutral pictures predicted emotion regulation ratings for positive pictures, $B = 0.68$, $p < .001$. The main effect of BIS was also significant, $B = 0.16$, $p < .001$, such that higher scores on BIS predicted more reported efforts to down regulate emotional responses. Neither the main effect of affirmation condition, $B = 0.02$, $p = .65$, nor the interaction between affirmation condition and BIS, $B = -0.06$, $p = .341$, were significant.

4.2.6.6 Emotion regulation for the long duration negative pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported emotion regulation to long duration neutral and positive picture viewing. Again, the main effect of neutral pictures was significant, $B = 0.62$, $p < .001$, and the main effect of BIS was significant, $B = 0.12$, $p = .016$, such that higher scores on BIS predicted more reported

efforts to down regulate emotional responses. As for short duration positive pictures, the main effect of affirmation, B = -0.01, p = .925, and the interaction between affirmation condition and BIS, B = -0.09, p = .166, were non-significant.

4.2.6.7 Attention for the short duration positive pictures as a function of affirmation condition and trait BIS

Attention ratings for short duration neutral pictures predicted attention ratings for positive pictures, B = 0.60, p < .001. The main effect of BIS was also significant, B = 0.18, p < .001, such that higher scores on BIS predicted more attentional disengagement. Neither the main effect of affirmation condition, B = -0.00, p = .985 nor the interaction between affirmation condition and BIS, B = -0.08, p = .251, were significant.

4.2.6.8 Attention for the long duration positive pictures as a function of affirmation condition and trait BIS

I ran the same regression as above, this time substituting self-reported attention to long duration neutral and positive picture viewing. Again, the main effect of neutral pictures was significant, B = 0.61, p < .001. The main effect of BIS was also significant, B = 0.15, p = .002, such that higher scores on BIS predicted more attentional disengagement. As for short duration positive pictures, neither the main effect of affirmation, B = -0.03, p = .571 nor the interaction between affirmation condition and BIS, B = -0.03, p = .643, were non-significant.

4.2.7 Performance on CET

Nine additional participants were excluded from the following analyses because they provided fewer usable answers (less than 3 *SD*s from the mean; n = 8) or scored

more than 3 *SD*s above the mean on total CET score (n = 1). The mean score was 0.52 (SD = 0.16). An independent samples t-test revealed no differences between the no affirmation condition (M = 0.51, SD = 0.14) and affirmation condition (M = 0.53, SD = 0.17) on CET performance, t (239) = 1.04, p = .298. In a regression analysis, I predicted performance on the CET from affirmation condition (coded 0 = no affirmation, 1 = affirmation), trait BIS (centered) and their interaction. None of the predictors were significant, ps > .31.

Because I was interested in how regulating emotions during the picture task may affect performance on the CET, I created a composite self-reported emotion regulation variable by averaging reported emotion regulation efforts across picture types and picture durations (M = 2. 08, SD = 0.92, α = .93). The emotion regulation composite correlated with CET performance, r (240) = .13, p = .048. Participants who reported regulating their emotions more scored higher (worse) on the CET. Separated by affirmation condition, greater efforts at emotion regulation predicted higher CET scores (i.e., poorer self-control) in the self-affirmation condition, r (118) = .22, p = .015, but not in the no affirmation condition, r (121) = .03, p = .739.

4.3 Discussion

Experiment 3 tested the hypothesis that self-affirmation influences self-reported responses to emotional images. I examined valence and arousal ratings to negative pictures displayed onscreen for shorter versus longer durations to track possible changes in emotional responding over time. I also tested whether self-affirmation reduces self-reported efforts to downregulate emotional responses and to disengage from negative

pictures; these measures were included to help elucidate the results observed in Experiment 2. Additionally, I predicted that participants would perform worse on a measure of self-control insofar as they had previously engaged in emotion regulation during the picture viewing task. Based on the results from Experiments 1 and 2, I hypothesized that trait BIS would moderate the effects of self-affirmation on emotional responding and self-control.

As in previous research, individual differences in BIS predicted valence and arousal ratings to negative images, such that those higher in BIS reported more negative valence and more arousal (e.g., Balconi et al., 2009). Additionally, those higher in BIS reported greater efforts to decrease their emotional responses to short and long duration pictures; BIS did not relate to self-reported attentional disengagement. Contrary to predictions, however, the relationships between BIS and the emotion ratings and BIS and performance on a subsequent self-control task were not moderated by self-affirmation.

Individual differences in BIS did not predict valence or arousal to positive images. However, higher BIS scores related to greater efforts to downregulate emotional responses and less attentional engagement with short and long duration positive pictures. Overall, the results of Experiment 3 suggest that BIS influences emotional responding to images, consistent with previous research, and engaging in emotion regulation undermines performance on a subsequent cognitive estimation task, but the self-affirmation manipulation did not combine with BIS to influence any of the dependent measures in Experiment 3.

5. GENERAL DISCUSSION AND CONCLUSIONS

Self-affirmation has been found to affect responding to self-threats (Sherman & Cohen, 2006). The main goal of the current research was to extend research and theory on self-affirmation by testing the hypothesis that self-affirmation influences basic emotional responding. Three studies tested the hypothesis that affirming core values influences emotional responding to pictures as revealed by psychophysiological measures (Experiments 1 and 2) and self-reports (Experiment 3), and as a function of different levels of BIS sensitivity. The experiments using psychophysiological measures of emotional responding supported predictions regarding negative emotional reactivity but the experiment using self-reports of emotional responding did not.

Experiments 1 and 2 found that self-affirmation affects two known emotional-modulated physiological responses: the startle eye-blink response and the late positive potential. In Experiment 1, among participants high in BIS, those who were self-affirmed exhibited smaller eye-blink magnitudes to startling noises while viewing negative pictures compared to those were not self-affirmed. This finding represents a novel form of support for the idea, based on self-affirmation theory, that affirming core personal values reduces defensiveness.

In Experiment 2, affirmed participants high in BIS exhibited larger, more sustained LPPs during negative picture viewing relative to non-affirmed participants high in BIS. This finding suggests that self-affirmation sustains processing of threatening information among individuals who are otherwise prone to defensive

responding to threat. This find is consistent with evidence that self-affirmation increases processing of threatening information. For example self-affirmation has been found to increase processing of the belief-threatening information (Correll, Spencer, & Zanna, 2004).

Experiment 3 was designed to test two related hypotheses. The first hypothesis was that self-affirmation influences self-reported valence and arousal to negative images. The second hypothesis was that non-affirmed participants spontaneously down-regulate their responses to or disengage their attention to negative emotional stimuli. Contrary to predictions, self-affirmation did not influence self-reported emotional reactions, emotion regulation, or attentional engagement to negative pictures shown for short or long amounts of time, nor did individual differences in BIS sensitivity moderate self-affirmation's effects as it had in the previous studies. Additionally, self-affirmation did not interact with BIS to influence performance on a subsequent self-control task (i.e., the CET). Thus, the findings from Experiment 3 suggest that self-affirmation does not influence self-reported responses to threatening images.

I included positive pictures in each study to assess the impact of self-affirmation on responses to more rewarding stimuli. Experiment 1 found that affirmation and BIS interacted to predict startle eye-blink responses to positive pictures, but follow-up tests were nonsignificant. In Experiment 2, affirmed (compared to non-affirmed) participants who were lower in BIS had significantly smaller LPPs to positive images in the middle time window. No significant results regarding positive pictures were found in Experiment 3. The results from these studies did not yield clear or consistent evidence

pertaining to the effects of self-affirmation on responses to positive emotional images, and therefore, I do not draw any substantive conclusions regarding self-affirmation's effects on positive emotional responses.

5.1 Implications for Self-Affirmation Theory

Self-affirmation reduces defensive responses to ego threats (Sherman & Cohen, 2006), and the results of the current studies, particularly Experiments 1 and 2, provide evidence that self-affirmations also affect responses to more basic threatening stimuli. The main implication of the current research for self-affirmation theory is that self-affirmation's effects may be due in part to the effects it has on the defensive motivational system. Presumably, the ego threats typically studied in the context of self-affirmation rely upon the activation of the defensive motivational system—the system I tried to tap by showing participants negative emotional images—and self-affirmation helps to soothe the activation of this system, at least for high BIS individuals.

Further, current results suggest that self-affirmation does not reduce activation of basic motivational systems across the board. An affirmed person is not necessarily unmotivated. In Experiments 1 and 2, the effects of self-affirmation were stronger and more consistent in reducing activity in the defensive motivational system relative to the appetitive motivational system, and in Experiment 3 affirmation did not affect self-report responses to stimuli intended to activate both the defensive and appetitive motivational systems.

5.2 Limitations and Future Directions

Experiment 1 did not directly address how self-affirmation breaks the link between BIS and the threat-potentiated startle response. One possibility is that self-affirmation reduces attention to threatening stimuli. However, in Experiment 2 I found that self-affirmation enhanced the LPP for some individuals viewing negative images, which suggests increased attention to threatening stimuli. Additionally, Experiment 3 did not find evidence that participants paid less attention to the negative pictures after affirmation. More research is needed to understand how affirmation can inhibit defensive responding to threatening stimuli as evidenced by the blunted threat-potentiated startle response in Experiment 1 and increase processing of threatening stimuli as evidenced by the sustained threat-related LPP in Experiment 2.

In Experiment 2, I used the LPP as an index of processing depth but did not assess a non-physiological measure of cognitive processing. Previous research has shown that the magnitude of the LPP to an eliciting stimulus predicts later memory for that stimulus (Dolcos & Cabeza, 2002). A future study that includes a memory test for the pictures could help to solidify the conclusion that affirmed threat-prone individuals process threatening stimuli more deeply than nonaffirmed threat-prone individuals.

Given that my hypotheses for Experiment 3 pertaining to the effects of self-affirmation on self-reported emotional responses and subsequent self-control were not supported, it is worth considering possible explanations for the obtained pattern of results. First, Experiments 1 and 2 used physiological measurements, whereas Experiment 3 relied on self-reports. Perhaps the effects of self-affirmation are limited to

less conscious elements of emotional responding such as eye-blinks and brain waves, and do not influence conscious self-reports of emotional responding. Future research on the effects of self-affirmation on emotional responding should include both psychophysiological measures and self-reports together instead of relying on only one type of measurement. Including both types of measures in one study would help to test for a potential dissociation in self-affirmation's effects on more implicit versus more explicit channels of emotional responding.

Additionally, participants in Experiment 3 may not have been aware of their efforts to down regulate emotions or disengage attention, and therefore would not have been able to report their attempts. In order to ascertain whether participants had engaged in emotion regulation without conscious awareness, I included a self-control task at the end of the picture task. Previous research had suggested that regulating emotions reduces the capacity to exercise self-control on subsequent tasks (e.g., Vohs & Heatherton, 2000). I found some evidence that self-control performance was reduced in Experiment 3 among individuals who reported expending more effort to regulate their emotions, but neither self-affirmation nor BIS influenced subsequent self-control as I had predicted. There is some evidence that positive affect can improve self-control capacity (e.g., Tice, Baumeister, Shmueli, & Muraven, 2007). It is therefore possible that the inclusion of positive pictures along with the negative pictures in Experiment 3 masked any aftereffects of having regulated emotional responding to the negative images. A future study including only negative images may provide a cleaner test of the emotion regulation hypothesis I tried to test in Experiment 3.

Crocker et al. (2008) found that self-affirmation may increase feelings of other-oriented positive emotions such as love and sympathy. It is not clear how these more elaborate emotions relate to the appetitive motivational system, and the current studies did not address these types of positive emotions. Picture viewing paradigms, such as those used in the current studies, may not be the best method for evoking other-oriented feelings of love and sympathy.

5.3 Conclusions

Self-affirmation reduced the magnitude of the threat-related startle eye blinks among threat-prone individuals (Experiment 1) and appeared to sustain processing of threat-related stimuli among threat-prone individuals (Experiment 2). These findings represent novel support for the idea, based on self-affirmation theory, that affirming core personal values reduces defensiveness and increases processing of threatening information. However, self-affirmation did not appear to affect self-reported emotional responses (Experiment 3). The results of Experiments 1 and 2 in particular suggest that self-affirmation's effects extend beyond ego defenses to influence more basic mechanisms of motivation and emotion. More research is needed to understand boundary conditions of this effect. For example, do the benefits of self-affirmation apply

to more profoundly anxious or clinical populations? Acceptance and commitment therapy, a form of cognitive behavior therapy, involves having clients discuss their core personal values in a manner not unlike the self-affirmation manipulations used in the current experiments (for an introduction, see Twohig, 2012). More research on the motivational and emotional consequences of self-affirmation in the context of therapy may prove beneficial for threat-prone individuals.

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APPENDIX A

SELF-AFFIRMATION MANIPULATIONS

A-1. **No Affirmation Condition**

Ranking of Personality Characteristics and Values
Instructions: Below is a list of characteristics and values, some of which may be important to you and some of which may be unimportant. Please rank these values and qualities in order of their importance to you, from 1 to 12.
1 = most important item, 12 = least important item. Use each number only once.
My values and qualities:
_____ Artistic skills/Aesthetic appreciation
_____ Sense of humor
_____ Relations with friends/family
_____ Spontaneity/living life in the moment
_____ Social skills
_____ Athletics
_____ Music ability/appreciation
_____ Neatness/tidiness
_____ Physical attractiveness
_____ Creativity
_____ Business/managerial skills
_____ Romantic values
On this page, please indicate what value you ranked # 1 in the previous exercise. Then, write a brief account (1-3 paragraphs) of why this value is important to you and a time when your 1st-ranked value played an important role in your life.

A-2. **Self-Affirmation Condition**

Ranking of Personality Characteristics and Values
Instructions: Below is a list of characteristics and values, some of which may be important to you and some of which may be unimportant. Please briefly read and review these values and qualities.
_____ Artistic skills/Aesthetic appreciation
_____ Sense of humor
_____ Relations with friends/family
_____ Spontaneity/living life in the moment
_____ Social skills
_____ Athletics
_____ Music ability/appreciation
_____ Neatness/tidiness
_____ Physical attractiveness
_____ Creativity

_____ Business/managerial skills
_____ Romantic values
On this page, please write a brief account (1-3 paragraphs) of why "Artistic skills/Aesthetic appreciation" might be important to other people.

APPENDIX B

QUESTIONNAIRES

B-1. **BIS/BAS Questionnaire**

Instructions: Below is a series of statements that people might use to describe how they generally feel. Read each statement and decide whether it reflects your thoughts. The accompanying 4-point scale was 1 (strongly disagree), 2 (disagree), 3 (agree), and 4 (strongly agree).

1. If I think something unpleasant is going to happen I usually get pretty "worked up."
2. When I get something I want, I feel excited and energized.
3. When I want something, I usually go all-out to get it.
4. I will often do things for no other reason than they might be fun.
5. I worry about making mistakes.
6. When I'm doing well at something, I love to keep at it.
7. I go out of my way to get things I want.
8. I crave excitement and new sensations.
9. Criticism or scolding hurts me quite a bit.
10. I'm always willing to try something new if I think it will be fun.
11. If I see a chance to get something I want, I move on it right away.
12. Even if something bad is about to happen to me, I rarely experience fear or nervousness.
13. When good things happen to me, it affects me strongly.
14. I feel pretty worried or upset when I think or know somebody is angry at me.
15. It would excite me to win a contest.
16. I feel worried when I think I have done poorly at something.
17. When I go after something I use a "no holds barred" approach.
18. I often act on the spur of the moment.
19. I have very few fears compared to my friends.
20. When I see an opportunity for something I like, I get excited right away.

B-2. **Trait Self-Control**

Instructions: Please answer the following items as they apply to you. There are no right or wrong answers. Please choose a number, 1 through 5, that best represents what you believe to be true about yourself for each question. The accompanying 5-point scale was 1 (not at all like me), 2, 3 (sometimes like me), 4 , and 5 (very much like me).

1. I have a hard time breaking bad habits.
2. I am lazy.
3. I say inappropriate things.
4. I do certain things that are bad for me, if they are fun.
5. I refuse things that are bad for me.
6. I wish I had more self-discipline.

7. I am good at resisting temptation.
8. People would say that I have iron self-discipline.
9. I have trouble concentrating.
10. I am able to work effectively toward long-term goals.
11. Sometimes I can't stop myself from doing something, even if I know it's wrong.
12. I often act without thinking through all the alternatives.
13. Pleasure and fun sometimes keep me from getting work done.

B-3. **Mindful Attention Awareness Scale**

Instructions: The following questionnaire is a collection of statements about your everyday experience. Using the 1–6 scale, please indicate how frequently or infrequently you currently have each experience. Please answer according to what really reflects your experience rather than what you think your experience should be. The accompanying 6-point scale was 1 (almost always), 2 (very frequently), 3 (somewhat frequently), 4 (somewhat infrequently), 5 (very infrequently), and 6 (almost never).
1. I could be experiencing some emotion and not be conscious of it until sometime later.
2. I break or spill things because of carelessness, not paying attention, or thinking of something else
3. I find it difficult to stay focused on what's happening in the present.
4. I tend to walk quickly to get where I'm going without paying attention to what I experience along the way.
5. I tend not to notice feelings of physical tension or discomfort until they really grab my attention.
6. I forget a person's name almost as soon as I've been told it for the first time.
7. It seems I am "running on automatic" without much awareness of what I'm doing.
8. I rush through activities without being really attentive to them.
9. I get so focused on the goal I want to achieve that I lose touch with what I am doing right now to get there.
10. I do jobs or tasks automatically, without being aware of what I'm doing.
11. I find myself listening to someone with one ear, doing something else at the same time.
12. I drive places on "automatic pilot" and then wonder why I went there.
13. I find myself preoccupied with the future or the past.
14. I find myself doing things without paying attention.
15. I snack without being aware that I'm eating

B-4. **Cognitive Interference Questionnaire Items**

Instructions: This questionnaire concerns the kinds of thoughts that go through people's heads at particular times, for example, while they are working on a task. The following is a list of thoughts, some of which you might have had during the picture slideshow. Please indicate approximately how often each thought occurred to you while working on

it using the scale below each question. The accompanying 5-point scale was 1 (never), 2 (once), 3 (a few times), 4 (often), and 5 (very often).
1. I thought about how much time I had left.
2. I thought about how others have done on this task
3. I thought about the purpose of the experiment.
4. I thought about other activities (for example, assignments, work).
5. I thought about members of my family.
6. I thought about friends.
7. I thought about personal worries.
8. I thought about something that made me feel tense.
9. I thought about something that made me feel angry
10. I thought about something that happened earlier today.
11. I thought about something that happened in the recent past (last few days, but not today).
12. I thought about something that happened in the distant past.
13. I thought about something that might happen in the future.

B-5. **Emotion Regulation Questionnaire**

Instructions: Please answer the following questions. The accompanying 7-point scale was 1(strongly disagree) to 7 (strongly agree).
1. When I want to feel more positive emotion (such as joy or amusement), I change what I'm thinking about.
2. I keep my emotions to myself.
3. When I want to feel less negative emotion (such as sadness or anger), I change what I'm thinking about.
4. When I am feeling positive emotions, I am careful not to express them.
5. When I'm faced with a stressful situation, I make myself think about it in a way that helps me stay calm.
6. I control my emotions by not expressing them.
7. When I want to feel more positive emotion, I change the way I'm thinking about the situation.
8. I control my emotions by changing the way I think about the situation I'm in.
9. When I am feeling negative emotions, I make sure not to express them.
10. When I want to feel less negative emotion, I change the way I'm thinking about the situation.

B-6. **Cognitive Estimation Task**

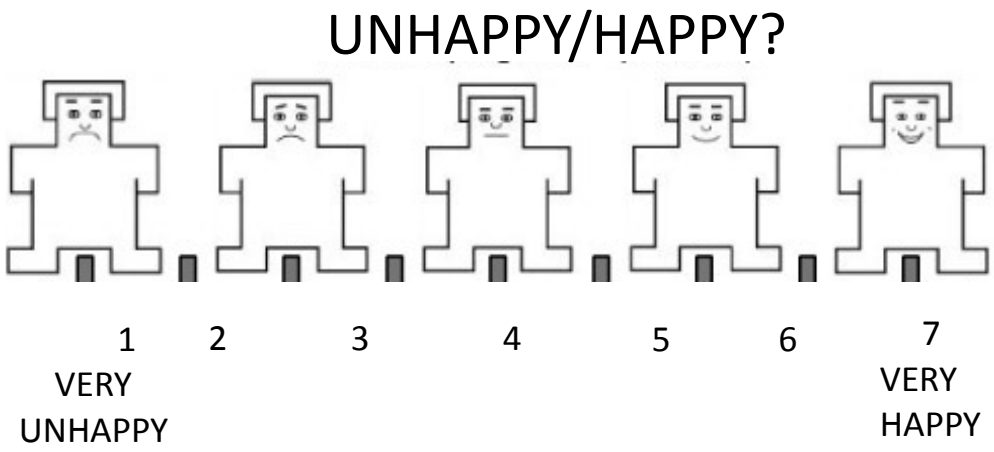
Please answer the following questions as best you can.
For most items, there is no perfectly correct answer – simply give your best estimate.
1. How many seeds are there in a watermelon?
2. How much does a telephone weigh?
3. How many sticks of spaghetti are there in a one pound package?

4. What is the distance an adult can walk in an afternoon?
5. How high off a trampoline can a person jump?
6. How long does it take a builder to construct an average-sized house?
7. How much do a dozen, medium-sized apples weigh?
8. How far could a horse pull a farm cart in one hour?
9. How many brushings can someone get from a large tube of toothpaste?
10. How many potato chips are there in a 40-cent, one-ounce bag?
11. How long would it take an adult to handwrite a one-page letter?
12. What is the age of the oldest living person in the United States today?
13. How long is a tablespoon?
14. How much does a folding chair weigh?
15. How long does it take to iron a shirt?
16. How long is a giraffe's neck?
17. How many slices of bread are there in a one-pound loaf?
18. How much does a pair of men's shoes weigh?
19. How much does the fattest man in the United States weigh?
20. How long does it take for fresh milk to go sour in the refrigerator?

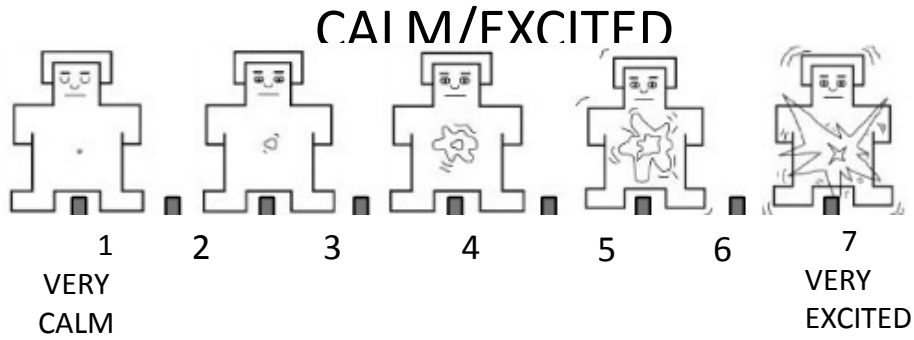
APPENDIX C

QUESTIONS DURING PICTURE TASK IN EXPERIMENT 3

C-1. **SAM Assessing Valence**



C-2. **SAM Assessing Arousal**



C-3. **Emotion Regulation Question**

How much did you try to decrease your emotional reaction to the previous picture?

1	2	3	4	5	6	7
None						quite a bit

C-4. **Attention Question**

To what degree was your mind focused on the previous picture?

1	2	3	4	5	6	7
My mind was completely on the picture						my mind was completely on unrelated concerns