UNINTENTIONAL COGNITIONS OF VALENCED IMAGES: AFFECTIVE BIASES AND EEG CORRELATES

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by

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CERTIFICATION OF APPROVAL

I certify that I have read Unintentional Cognitions of Valenced Images: Affective Biases and EEG Correlates by Sheila L.R. Pugh, and that in my opinion this work meets the criteria for approving a thesis submitted in partial fulfillment of the requirement for the degree Master of Arts in Psychology: Mind, Brain, and Behavior at San Francisco State University.

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Using a valence variation of the Reflexive Imagery Task (RIT; Allen, Wilkins, Gazzaley, & Morsella, 2013), we observed behavioral and EEG effects of positive and negative images on unintentional cognitions in individuals (n = 16; M_{age} = 23.75; SD = 5.57; 12 female) with a risk of negativity bias (RNB; n_{RNB} = 7) and those without risk (Control; $n_{Control}$ = 9). A significant Group X Block interaction, $F(1,14) = 8.88$, $p = .010$, $\eta^2_p = .39$, revealed that individuals in the Control group were more successful at suppressing unintentional cognitions of negative images ($M = .71$, $SE = .09$) compared to positive images ($M = .94$, $SE = .15$), $t(14) = 3.60$, $p = .003$. Examination of alpha power (at electrode sensor sites F3 and F4) for positive trials in which participants experienced an involuntary cognition revealed that cortical activity was higher (lower alpha power) in the left frontal cortex ($M = 1.86$, $SE = .10$) compared to the right ($M = 1.96$, $SE = .09$), $F(1,14) = 6.41$, $p = .024$, $\eta^2_p = .31$. These results are in line with previous research on thought suppression and ironic processes (Wegner, 1994), cognitive theories of depression and anxiety (Clark & Beck, 2010), and the localization of emotional processing (Davidson & Henriques, 2000).

I certify that the Abstract is a correct representation of the content of this thesis.

Chair, Thesis Committee

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The ability to control one's behaviors and thoughts is essential for survival and has broad implications for one's overall well-being. Behaviorally, failures of self-control have been linked with criminal behavior, poor health, and poor school performance (Muraven, Tice, & Baumeister, 1998). Regarding thoughts, breakdowns in cognitive control have been associated with increased vulnerability to depression and other psychological disorders (American Psychiatric Association, 2000; Joormann & Vanderlind, 2014). Clearly, the ability to control one's behaviors and thoughts has wide ranging consequences for both the individual and society as a whole.

In comparison to behavior, however, the contents of one's conscious mind are difficult to control (Morsella, 2005). For example, when on a diet, one may be inclined to eat a forbidden food, such as a dessert. Although one can refrain from eating the dessert, and thus prevent the expression of the behavior, the inclination remains, encapsulated from voluntary control (Morsella, 2005). Thus, "inclinations can be behaviorally suppressed but not mentally suppressed" (Bargh & Morsella, 2008, p. 7). Similarly, individuals often report the experience of an unexpected thought suddenly "popping" into their mind. These unpredictable and unintentional thoughts can be relatively harmless, such as when one is trying to concentrate on work and instead finds oneself spontaneously thinking about an upcoming social event (Allen, Wilkens, Gazzaley, & Morsella, 2013). In other circumstances, however, unintentional thoughts can be intrusive or disruptive, particularly if the thoughts are negative. Worries about future

responsibilities, concerns about past shortcomings, and uncertainties about self-worth can be upsetting and, at times, disabling. In many forms of psychopathology, for example, persistent unintentional thoughts are not only a basic component of the clinical disorder (American Psychiatric Association, 2000; Hersen & Turner, 2003) but also a significant source of distress and dysfunction (Clark, 2005). Understandably, mental control attempts to suppress, replace, or avoid unintentional thoughts are common and, accordingly, have spurred a growing body of research.

Unintentional Cognitions, Thought Suppression, and Ironic Processes

Research on the attempt to keep unwanted thoughts out of mind, a process termed 'thought suppression', has been considerably influenced by a study by Wegner, Schneider, Carter, and White (1987). In their seminal "white bear" study, Wegner and colleagues (1987) observed that when participants were instructed to try to *not* think about a white bear, they often failed, experiencing on average more than six white bear thoughts during five minutes of stream-of-consciousness reporting. These individuals were then instructed to *think* about the white bear in a subsequent five minute period and showed significantly more white bear thoughts, compared to participants who were asked to *think* about the white bear in the initial stream-of-consciousness period. These findings not only exhibit that people have difficulty in suppressing a thought, but also that the attempt of thought suppression increases the likelihood of experiencing the intrusive thought (Wegner, Schneider, Carter, & White, 1987). This post-suppression rebound effect, in which initial suppression increases the frequency of the thought later, has been

replicated in many studies under various conditions (Abramowitz et al., 2001; Wenzlaff & Wegner, 2000).

The irony that thought suppression can backfire can be explained with the theory of ironic processes of mental control (Wegner, 1994). This theory proposes that attempting mental control initiates two simultaneous processes: "(a) an operating process that promotes the intended changed by searching for mental contents consistent with the intended state and (b) a monitoring process that tests whether the operating process is needed by searching for mental contents inconsistent with the intended state" (Wegner, 1994, p. 34). If we put this in the context of the white bear study for example, an individual instructed to suppress the thought of a white bear would have the operating process searching for thoughts that are not a white bear. This strengthens pathways that lead away from the unwanted thought. In contrast, the monitoring process strengthens pathways that lead toward the unwanted thought as it monitors for occurrences of the thought of a white bear. Although successful mental control is achieved when the two processes are working together, an imbalance can cause the ironic opposite of the intention. This is because the operating process is considered an effortful, conscious process that requires greater cognitive capacity than the less effortful, unconscious monitoring process. Thus under conditions that reduce cognitive capacity, such as stress, distraction, and mental load, the operating process will be limited and the monitoring process will be more likely to guide our conscious thoughts back toward the unwanted thought intensified by the monitoring process (Wegner, 1994). Obviously, there are

numerous examples in everyday life of both successful mental control (e.g., holding back on impulses, concentrating on difficult tasks, distracting oneself from an unwanted thought) and ironic effects (e.g., saying the exact opposite of what one meant to say, worrying about sleep to the point that it keeps one from sleeping, dieting results in one eating more of the specifically forbidden food). Under this theory, the deciding factor determining whether mental control or ironic effects will win out in any given circumstance is the availability of adequate mental capacity (Wegner, Erber, & Zanakos, 1993; Wegner, 1994).

Depression and Mental Control

Although up to 80% of the general population experiences uncontrollable, unwanted thoughts in daily life (Rachman & de Silva, 1978), most individuals seem to be relatively unaffected by these thoughts. In contrast, persistent and recurrent unintentional thoughts are a significant source of distress and dysfunction in many forms of psychopathology (Clark, 2005). Understandably, psychopathology researchers have sought to grasp how thought suppression may relate to cognitive theories of clinical disorders such as major depressive disorder (MDD).

Unfortunately, MDD is one of the most common public health problems affecting more than 350 million people globally (World Health Organization, 2008). In the United States, lifetime prevalence rates are estimated to be anywhere from 13% (Hasin, Goodwin, Stinson, & Grant, 2005) to almost 20% (Kessler & Wang, 2009). Additionally, more than 75% of the individuals who experience a clinically significant episode of

depression will go on to experience a subsequent episode (Boland & Keller, 2009). Depression is also a leading cause of disability (Lopez & Mathers, 2006) and is associated with reduced quality of life (Kessler & Wang, 2009; World Health Organization, 2008). Accordingly, substantial research has been conducted to examine the cognitive processes underlying the onset, maintenance, and recurrence of depression.

Depression is characterized by various emotional, behavioral, and cognitive symptoms with persistent depressed mood and loss of interest or pleasure in usually enjoyable activities being the core features (American Psychiatric Association, 2000). Cognitive therapy techniques have often focused on controlling the persistent negative cognitions inherent in depression (Beck, 1976). However, as discussed above, mental control over unwanted thoughts is not always easy or successful. Research investigating mental control in depression has revealed that although depressed individuals may be successful at suppressing negative material initially, they experience a resurgence of unwanted negative thoughts, and this seems to be related to an increased accessibility of negative thoughts that are highly interconnected (Wenzlaff, Wegner, & Roper, 1988). Other research suggests that stress can undermine mental control attempts and result in the ironic activation of depressive rumination (Wenzlaff & Luxton, 2003). Taken together, these studies suggest that in depressed individuals negative thoughts can be ironically enhanced during thought suppression due to an increased accessibility of interconnected negative thoughts and conditions such as stress that limit cognitive capacity.

Other research suggests that depression is also associated with inefficient cognitive control, such as difficulties in attentional disengagement and inhibition (Foland-Ross & Gotlib, 2012), and that these impairments can persist even after depressive symptom remission (Vanderhasselt & De Raedt, 2009). Most studies investigating this line of research utilize paradigms such as the Stroop task, in which incongruent trials require the participant to inhibit the prepotent response (i.e., word reading) and perform the subdominant response (i.e., color naming) to complete the trail correctly (West, Choi, & Travers, 2010). These studies draw attention to the observation that behavioral performance is often similar for depressed compared to non-depressed individuals although neuroimaging data suggest that those with depression are utilizing more cognitive control resources (Krompinger & Simons, 2011). If depressed individuals are utilizing more cognitive control resources compared to non-depressed individuals in such tasks, one can hypothesize that the depressed individuals may be more likely to experience ironic effects during mental control attempts if mental capacity is burdened sufficiently by stress or mental load.

Cognitive Biases in Depression

In addition to difficulties in mental control, cognitive biases have been identified as a contributing factor to the development and maintenance of intrusive thoughts in depression (Clark, 2005). Research focused specifically on understanding the cognitive restructuring that occurs with depression can be traced back to the seminal work of Dr. Aaron Beck (1976) which set in motion over four decades of research on the cognitive

factors in depression. Beck's cognitive model of depression (1976), posits that depression is both marked and maintained by negative patterns of information processing (i.e., biases) such that negative aspects of experience are highlighted and positive aspects are minimized. Much of the research on depression suggests the presence of negative biases influencing attention, memory, and cognition (Foland-Ross & Gotlib, 2012). Importantly, other research suggests that depression may more accurately be characterized as an absence of a positivity bias, which is generally observed in non-depressed individuals (Atchley et al., 2012).

These findings have been supported by electrophysiological studies utilizing event-related potentials (ERPs) which provide precise temporal resolution of recorded brainwave activity (Woodman, 2010). For example, Yang, Zhu, Wang, Wu, and Yao (2011) utilized a three-stimulus semantic oddball task to investigate if specific stages of information processing are impacted by MDD. The P1, P2, and N2 components were chosen as ERP indices of early sensory information processing. MDD participants showed relatively shorter P1 latencies to negative words, which the researchers suggest may indicate that the negativity bias in depression begins in preconscious processing stages. Additionally, MDD participants showed a trend for enhanced P2 amplitude to target stimuli. As this component may reflect the initial engagement of cortical networks, these results may indicate that the MDD subjects were utilizing more cortical resources in this task. No significant effects were found for the latency or amplitude of the N2 component, which is believed to reflect evaluative processes. Taken together, these

results suggest that affective biases in depression operate in the early sensory stages of information processing. In contrast, a study conducted by Mingtian, Xiongzhao, Jinyao, Shuqiao, and Atchley (2011) examined the P1 and N1 components utilizing a dot-probe task with valenced pictures and found MDD subjects to attend less to positive pictures when the pictures were presented for 500 ms. The researchers suggest that these results indicate that the affective bias in depression may be better characterized as a lack of attention to positive information. Other research evaluating later cognitive ERP components (such as the P3) also indicate a decreased processing ability of positive information in depression (Cavanagh & Geisler, 2006). Taken together, research utilizing ERPs suggest that depression may be characterized by both a negativity bias as well as an absence of a positivity bias.

EEG and the Localization of Emotional Processing

Similarly to the ERP research, electroencephalographic (EEG) studies have revealed differences in cortical activity between depressed and non-depressed individuals (Allen, Urry, Hitt, & Coan, 2004). EEG alpha power, defined as the average power in the 8-13 Hz frequency band, has been employed as an inverse index of cortical activity, with an increase in alpha power indicating a decrease in brain activation (Lindsley & Wicke, 1974). Research investigating the localization of emotional processing suggests the anterior left frontal cortex is specialized for the experiential aspects of positive/approach-related affect (PA), whereas the anterior right frontal cortex is specialized for negative/withdrawal-related affect (NA; Davidson, 1998; Davidson & Henriques, 2000).

It is important to note that in this line of research, depression has been uniquely associated with a loss of PA, possibly suggesting that depression is distinguished from other psychopathology by a loss of pleasurable engagement (Watson, Clark, & Cary, 1988). Summarizing this model, Davidson and Henriques (2000) suggest that "sadness and depression which are associated with decreased PA, should be associated with decreased left frontal activation, and individuals who are characterized by a relatively stable pattern of left anterior hypoactivation should be more susceptible to the elicitation of sad mood and increased risk for depression" (p. 270). Utilizing alpha power as an inverse index of cortical activity, one would expect to observe increased alpha power in the left frontal cortex indicating decreased activation and decreased PA in depressed individuals. Given this research, it may be more accurate to view the affective bias observed in depression as a general lack of a positivity bias, combined with the presence of a negativity bias.

Comorbidity, Mental Control, and Cognitive Biases

What confounds this research is the fact that anxiety and depression frequently co-occur (Brown, Campbell, Lehman, Grisham, & Mancill, 2001) with approximately one third of individuals diagnosed with depression also having an anxiety disorder (Hasin et al., 2005). Unfortunately, individuals with this comorbidity can often experience more severe depression (Kessler, Chiu, Demler, Merikangas, & Walter, 2005). Consequently, research on cognitive processing in depression should also assess for anxiety.

Research specifically investigating the co-occurrence of depression and anxiety has revealed complications for the EEG research discussed above. Under the PA/NA model, anxiety reflects a general subjective distress or prototypical withdrawal-related emotion and thus would be associated with increased NA, unlike depression which is associated with decreased PA (Watson et al., 1988). Along these lines, Davidson and Henriques (2000) suggest that "depressed individuals who have increased right frontal activity would be expected to be at risk for withdrawal-related emotions as well and would typically present a clinical picture of depressed and anxious mood" (p. 270). This is supported by research examining resting state alpha activity which found that the co-occurrence of anxiety and depression is related to increased right frontal activation (Bruder et al., 1997; Pizzagalli et al., 2002). In research examining alpha power during tasks, greater right central-parietal activation was observed in those with depression and high anxiety during the spatial task but not during the verbal task (Manna et al., 2010). It is important to note that this study evaluated posterior activation, which has had mixed results across different studies (Davidson & Henriques, 2000; Stewart, Towers, Coan, & Allen, 2011), and that these tasks did not have an affective component. Clearly, anxiety needs to be included in studies on depression as discrepancies in previous research may be the result of inconsistencies in distinguishing depression and anxiety (Engels et al., 2010). Additionally, further EGG research is needed to investigate the laterality patterns of depression and anxiety in the context of an affective challenge (Engels et al., 2010).

Although depression and anxiety may differ on approach-withdrawal dimensions, cognitive theories suggest the two disorders share similarities in mental control and affective biases that may provide opportunities for better understanding the cognitive processing that underlies these disorders. For example, difficulty regulating recurrent, unwanted thoughts is a characteristic of both depression and anxiety (American Psychiatric Association, 2000; Beck, 1976; Clark, 2005; Clark & Beck, 2010; Hersen & Turner, 2003; Nitschke, Heller, & Miller, 2000). Although the nature of the thoughts are different in the two clinical disorders—depression is characterized by automatic, negative thoughts about the self, world, and future (Beck, 1976), whereas anxiety is defined as uncontrollable, excessive worry about threat, danger, and vulnerability (Clark & Beck, 2010)—in both depression and anxiety the unwanted thoughts are difficult to control and can be a significant source of distress and impaired functioning (American Psychiatric Association, 2000; Hersen & Turner, 2003; Clark, 2005). Additionally, individuals with depression and anxiety often exhibit preferential processing of negative information that impacts attention, memory, and cognition (Clark & Beck, 2010; Foland-Ross & Gotlib, 2012; Mogg & Bradley, 2005; Nitschke et al., 2000). Lastly, as previously reviewed above, depression has been associated with diminished cognitive control, specifically difficulties in attentional disengagement and inhibition of negative information (Foland-Ross & Gotlib, 2012). Similarly, anxiety has been found to impair attentional control which can manifest as increased distractibility and deficits in inhibition and attention shifting (Attentional Control Theory, Derakshan & Eysenck, 2009). These findings may

be related to rumination, a thought style defined as recursive and passive self-focused thinking, which has been found to predict higher levels of both depression and anxiety symptoms (Nolen-Hoeksema, 2000). Research has shown that difficulties inhibiting negative information in depressed individuals were significantly associated with severity of rumination, even after controlling for levels of depressive symptoms (Joormann & Gotlib, 2010; Foland-Ross & Gotlib, 2012).

Cognitive models of depression and anxiety unify these observations by suggesting that repeated patterns of biased information processing result in preferential encoding and retrieval of negative information. These negativity biases increase the accessibility (or even automaticity) of interconnected negative thoughts that can then perpetuate the emotional state. Additionally, the repeated activation of these negative biases can lead to weakened cognitive control over emotion as more adaptive, alternative modes of thinking become less accessible (Clark and Beck, 2010). In the context of Wegner's theory of ironic processes of mental control (1994), one could imagine an individual with depression and anxiety who is highly motivated to avoid negative thoughts and consequently engages more frequently in negative thought suppression thus producing an increase in unwanted negative thoughts through ironic monitoring. Additionally, the clinical disorder itself could act as an internal stressor that limits cognitive capacity enough to increase the individual's susceptibility to the ironic activation of negative thoughts (Wegner et al., 1993; Wegner, 1994). Further investigation of the processes involved in the suppression of negative, unwanted thoughts

in both depression and anxiety could provide valuable insights into the cognitive mechanisms underlying the onset, maintenance, and recurrence of these clinical disorders.

The Reflexive Imagery Task

It seems numerous factors contribute to the development and maintenance of intrusive thoughts in depression and anxiety, including cognitive biases and difficulties in cognitive control (Clark, 2005). Therefore, research investigating cognitive processing in these disorders should take into consideration both mental control and affective biases. The recent development of a new paradigm, the Reflexive Imagery Task (RIT; Allen et al., 2013) provides a new model for evaluating cognitive control.

In the RIT, participants are instructed to *not* think of the name of an image presented for 4 s. Importantly, a majority of participants experience unintentional subvocalizations of the name of the object on a majority of the trials. In the first experiment utilizing the RIT, the by-subject mean proportion of trails with subvocalizations was high ($M = .86$, $SD = .24$) and only four participants out of 14 experienced subvocalizations on less than 90% of the trials (Allen et al., 2013). Thus, the RIT presents an interesting paradigm to test cognitive control (specifically, the suppression of an unintentional thought).

Currently, it remains to be seen whether there are individual differences in suppressing an unintentional thought in the RIT. Specifically, the RIT has yet to be adapted to assess affective biases by utilizing valenced (positive and negative) images.

Given that negative cognitive biases and difficulty controlling unwanted thoughts are believed to be characteristic factors in depression and anxiety (Clark & Beck, 2010), are there differences between individuals with and without risk for negative cognitive biases in suppressing an unintentional valenced thought in the RIT?

We hypothesize that the occurrence of unintentional cognitions will reflect a negativity bias in individuals with a higher risk for negative cognitive biases (such as individuals with higher scores on assessments of depression, anxiety, and rumination) and a positivity bias in individuals without risk. Specifically, a negativity bias would reflect preferential processing of the negatively valenced images and would be observed as a greater occurrence of unintentional cognitions of negative images. In contrast, we hypothesize that individuals without risk will show a positivity bias that would be observed as a greater occurrence of unintentional cognitions for positively valenced images. Additionally, we hypothesize that those at risk for negative cognitive biases will also have more difficulty in suppressing unintentional thoughts for both positive and negative images compared to those not at risk due to deficits in cognitive control and/or limited cognitive capacity. If it is true, as both the cognitive models (Clark & Beck, 2010) and Wegner's theory of ironic processes (Wegner, 1994) suggest, that individuals with depression and anxiety are preferentially processing negative information and possibly activating more negative thoughts through interconnected systems or ironic processes, then we should see higher occurrences of unintentional thoughts for negative images. It is possible, however that suppressing an unintentional thought in the RIT may be

sufficiently difficult such that differences in affective biases between the two groups are not observable. Given that the first experiment utilizing the RIT had only four participants out of 16 that experienced subvocalizations on less than 90% of the trials (Allen et al., 2013), it may be that no cognitive biases are observed in the valenced RIT due to high occurrences of subvocalizations by all participants for all images.

Accordingly, the current study was conducted to evaluate behavioral and electrophysiological indices of affective cognitive control in the context of a valenced variation of the RIT. Specifically, the current study utilized behavioral responses (i.e., occurrence and rate of unintentional cognitions) with the aim of investigating stimuli valence and affective biases in individuals with higher levels of depressed, anxious, and ruminative symptomology (Risk for Negativity Bias [RNB] group) compared to individuals without this symptomology (Control group). Lastly, as previous research investigating the localization of emotional processing suggests the left frontal cortex is specialized for the experiential aspects of positive/approach-related emotion, whereas the right frontal cortex is specialized for negative/withdrawal-related emotion (Davidson & Henriques, 2000), EEG will be recorded during the task to investigate associations between EEG alpha power, image valence, and participant group. Given the discrepancies across EEG alpha power findings with this population (Davidson & Henriques, 2000; Bruder et al., 1997; Pizzagalli et al., 2002), and that this study is utilizing a novel paradigm, our EEG investigation is exploratory and has no formal hypotheses. Behaviorally, we hypothesize that those in the RNB group will have more

unintentional cognitions with negative images and those in the Control group will have more unintentional cognitions with positive images. Additionally, we hypothesize that individuals in the RNB group will have more unintentional cognitions overall compared to individuals in the Control group. This pattern of results would suggest that individuals at risk for depression and anxiety display negative cognitive biases and difficulties suppressing unintentional thoughts in a valenced variation of the RIT. These results would be in line with existing research on cognitive theories of depression and anxiety (Clark & Beck, 2010) as well as Wegner's theory of ironic processes (Wegner, 1994).

Method

Participants

San Francisco State University students ($N = 26$; $M_{age} = 23.08$; $SD = 4.90$; 20 female) participated for course credit after being informed of the study procedures and providing written consent. All participants were right-handed, fluent English speakers with normal or corrected-to-normal vision who were at least 18 years old and had no history of neurological trauma. None of the participants reported taking prescription medication. Data from eight participants were excluded from analysis due to excessive eye blinks or noisy data quality resulting in insufficient artifact-free EEG trials. In addition, the data from one participant were excluded due to not following instructions and failing to provide sufficient information on the questionnaires. The data from another participant were excluded due to systematic, aberrant valence ratings of the stimuli used

in the task (see below in Procedures). This resulted in a final sample of 16 participants (M_{age} = 23.75; SD = 5.57; 12 female).

Materials and Apparatus

The valence variation of the RIT was adapted from Allen, Wilkins, Gazzaley, & Morsella (2013) and consisted of two counterbalanced blocks of black line-drawings, representing concrete nouns, presented on a grey background. A majority of the images were selected from a larger pool of images that had been successfully used in previous research (Morsella & Miozzo, 2002; Snodgrass & Vanderwart, 1980). The remaining images were adapted from clipart or created by a graphic artist in the style of the selected images. One block included 38 positive images (e.g., bird, candy, house). The other block included 38 negative images (e.g., gun, poison, spider; see Table 1 for the list of images; see Figure 1 for examples of the images).

The set of positive and negative images used for the task was determined by pilot testing (n = 24). Lists of concrete nouns were taken from the Affective Norms for English Words (ANEW; Bradley & Lang, 1999) such that words with average valence ratings greater than 5.00 were selected as potential positive items and words with average valence ratings less than 5.00 were selected as potential negative items. Participants rated all items on valence (i.e., positive, neutral, or negative) and threat (i.e., safe, neutral, or dangerous). Items rated by over 60% of the participants as positive and/or safe

constituted the final set of 38 positive images. Items rated by over 60% of the participants as negative and/or dangerous constituted the final set of 38 negative images.

The images in the two blocks were matched for word frequency (Kucera-Francis written frequency [Kučera & Francis, 1967], $t[62] = 1.69, p = .097$; $SUBTLEX_{US}$ word frequency [Brysbaert & New, 2009], $t[74] = 1.99, p = .051$), word length ($t[74] = 1.01, p = .314$), semantic category (i.e., artifact, animal/nature, or food; based on Warrington & Shallice, 1984; $p = .881$, two-tailed, Freeman-Halton extension of Fisher's exact test [Freeman & Halton, 1951; Soper, 2014]), and image darkness ($p > .999$, two-tailed, Fisher's exact test [Preacher & Briggs, 2001]).

The block order was fully counterbalanced across participants. The order of the presentation of the images was pseudo-randomized within the two blocks. This was accomplished by first randomizing the order of the images in each block. The images were then either presented in the original randomized order (forward) or in the reversed order of the original randomized order (backward). Thus, each participant was randomly assigned to one of four conditions: (1) positive-then-negative forward, (2) positive-then-negative backward, (3) negative-then-positive forward, or (4) negative-then-positive backward.

All instructions and stimuli were presented on a Dell Optiplex GX620 monitor (43.18 cm) with a viewing distance of approximately 70 cm. Stimuli presentation was controlled by SuperLab 4.0 software (Cedrus Corporation, Phoenix, Arizona). The

stimuli were standardized to 600 x 600 pixels. Each image was presented individually in the center of the screen with subtended visual angles of 12.88° x 12.88° (7 cm x 7 cm).

Procedures

All participants completed the study procedures individually. After providing written informed consent (see Appendix A) and completing a general health questionnaire to assess inclusion and exclusion criteria (see Appendix B), eligible participants were fitted with an electrode sensor cap and fourteen individual electrodes to record brainwave activity. The participants then completed the valence variation of the RIT. For the task, participants were instructed to try to *not* think of the name of the image presented. Participants were instructed to (a) press a button with the index finger of their left hand if they did, in fact, think of the name of the object during the trial and (b) to continue to hit the button each and every time they thought of the name of the object. Each trial proceeded as follows. Participants were presented with the prompt "*Do not think of the name of the object*." Directly after participants initiated the trial, a fixation cross (+) appeared for 700 ms in the middle of the screen, follow by the image which remained on the screen for 4000 ms. After the image, participants were asked to rate the amount of effort they felt they expended during the previous trial on a scale ranging from 1 (*no effort*) to 8 (*all effort*). See Figure 2 for the time course of a single trial. The experimenter verbally repeated the presented instructions and ensured that participants understood the task. Additionally, participants completed three practice trials consisting of neutral images (i.e., fork, stool, umbrella) before beginning the two critical blocks.

After completing the task with EEG recording, participants completed several questionnaires. First, participants responded to a series of funneled debriefing questions (following the procedures of Bargh and Chartrand [2000]; see Appendix C), which included general questions to assess whether participants (a) were aware of the purpose of the study, (b) had any strategies for completing the task, (c) intended to follow the instructions on each trial, and (d) experienced anything that interfered with their performance on the task. Inspection of the funneled debriefing data showed that no participants ascertained the purpose of the study and that participants did intend to follow the instructions.

Participants then completed the Image Naming Questionnaire and Image Rating Questionnaire (see Appendices D and E), as these measures provided a manipulation check of the stimuli. The Image Naming Questionnaire required participants to write the English name of each image used in the task. The Image Rating Questionnaire required participants to rate each image for valence (i.e., positive, neutral, or negative) and threat (i.e., safe, neutral, or dangerous). The data from the Image Naming Questionnaire were used to identify any cases in which a participant misperceived an image in a way that would impact the valence rating (e.g., misperceiving a positive image as a negative image or misperceiving a negative image as a positive image). Such cases were excluded from all analyses. For example, a participant misinterpreting the "jail" image as "bedroom" would lead to data loss; however, interpreting "spider" as "insect" would not result in data loss (see Appendix F for the list of excluded trials). Analysis of the data from the

Rating Questionnaire confirmed that participants perceived the images in the two blocks as statistically significantly different in valence and threat: The images in the Positive block were perceived as positive and safe, whereas the images in the Negative block were perceived as negative and dangerous (see Table 2 for the average image ratings). As mentioned above, the data from one participant were excluded from analysis due to aberrant, systematic valence ratings; this participant rated 19 of the images contrary to the averages presented in Table 2.

After completing the Naming and Rating Questionnaires, participants completed several self-report measures to assess depression, anxiety, rumination, and self-control. The Beck Depression Inventory-II (BDI-II; Beck, Steer, & Brown, 1996) and the Patient Health Questionnaire (PHQ-9; Kroenke, Spitzer, & Williams, 2001) were used to assess depressive symptomology. The State-Trait Anxiety Inventories (STAI-S, STAI-T; Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983) and the Generalized Anxiety Disorder Assessment (GAD-7; Spitzer, Kroenke, Williams, & Lowe, 2006) were used to assess anxious symptomology. The Ruminative Response Scale (RRS; Treynor, Gonzalez, & Nolen-Hoeksema, 2003) was used to assess rumination. The Self-Control Scale (SCS; Tangney, Baumeister, & Boone, 2004) was used to assess self-control, which has been found to be negatively correlated with reports of psychopathology including depression and anxiety. See Appendices G through L for the measures. See Table 3 for Pearson's r correlations of the measures. Participants then completed the Demographic Questionnaire (see Appendix M). Lastly, participants were debriefed (see Appendix N)

and provided with mental health referrals (see Appendix O). The total experiment duration was approximately two hours.

EEG Recording

Each participant completed the task individually in a sound attenuated and electrically shielded room. EEG activity was recorded at electrode sensor sites Fz, Cz, Pz, FP1, FP2, F3, F4, F7, F8, C3, C4, P3, P4, and O1 according to the International 10-20 system for electrode placement using a Lycra electrode cap with tin electrodes (Electro-Cap International, Inc., Eaton, OH). Two additional Grass gold-plated electrodes were placed at locations below and beside the participant's left eye to detect artifacts caused by eye blinks. All electrodes were referenced to linked mastoids by means of recording from two additional Grass gold-plated electrodes placed behind the participant's right and left ear. Data were recorded for each trial during the four seconds the stimulus was on the screen (bandpass .01 - 30 Hz, digitized at 500 Hz, amplified 20,000 times) using the Biopac MP150 acquisition unit, Grass Model 12 Neurodata Acquisition System amplifiers, and Acqknowledge 4.0 software (Biopac, Goleta, California). All impedances were below 20 KΩ. Trials contaminated with eye movement or muscular activity greater than 100 μV were not included in the analysis.

Results

Our primary aim was the investigation of differences in the occurrence of unintentional cognitions (i.e., thinking of the name of the object when instructed to not

think of the name of the object) as a function of stimuli valence (positive or negative) and affective biases. Specifically, we hypothesized that individuals with higher ratings of depression, anxiety, and ruminative thinking would be at greater risk for negative cognitive biases (i.e., preferential processing of negative over positive information [Beck, 1976; Foland-Ross & Gotlib, 2012; Mogg and Bradley, 2005; Ward et al. 2003]); thus, these individuals would have less success suppressing unintentional cognitions of negative images. In contrast, we hypothesized that individuals without risk would exhibit a positive cognitive bias observed as less success in inhibiting unintentional cognitions of positive images and more success inhibiting unintentional cognitions of negative images.

Given the high comorbidity of depression, anxiety, and rumination (Brown et al., 2001; Hasin et al., 2005; Nolen-Hoeksema, 2000), and the high correlations between these measures in our sample (see Table 3), we defined the groups as follows: Individuals with moderate to severe depressive symptomology (defined as PHQ9 $\geq$ 10 or BDI-II $\geq$ 14), or moderate to severe anxious symptomology (defined as GAD7 $\geq$ 10 or STAI-T $\geq$ 47 or STAI-S $\geq$ 47), or high in ruminative thinking (defined as individuals in the top 33% of RRS total scores in this sample) were included in the Risk for Negativity Bias (RNB) group (n = 7; 6 female).; Individuals without depressive symptomology (defined as PHQ9 < 10 and BDI-II < 14), without anxious symptomology (defined as GAD7 < 10 and STAI-T < 47 and STAI-S < 47), and low in ruminative thinking (defined as individuals in the bottom 33% of RRS total scores in this sample) were included in the Control group (n = 9; 6 female).

Proportion of Trials with Unintentional Cognitions

Our primary dependent measure was whether participants experienced unintentional cognitions. On average, across both blocks, all participants (n = 16) reported unintentional cognitions on a high proportion of trials (M = .73, SE = .05). To normalize the data for analysis, an arcsine transformation was performed on the raw proportion means of every participant for both stimuli blocks (Positive and Negative). To examine potential differences between the groups as a result of the valence of the images in each block, a mixed model analysis of variance (ANOVA) was conducted with participant Group (RNB or Control) as the between subjects factor and stimuli Block (Positive or Negative) as the within subjects factor (see Table 4 for the proportion of unintentional cognitions by participant group and stimuli block; see Table 5 for descriptive statistics). The analysis revealed a significant Group X Block interaction, $F(1,14) = 8.88$, $p = .010$, $\eta^2_p = .39$. Post-hoc analyses revealed that individuals in the Control group were more successful at suppressing unintentional cognitions of negative images (M = .71, SE = .09) compared to positive images (M = .94, SE = .15), $t(14) = 3.60$, $p = .003$. In contrast, individuals in the RNB group were more successful at suppressing unintentional cognitions of positive images (M = .89, SE = .08) compared to negative images (M = .95, SE = .10), however, this difference was not significant, $t(14) = 0.77$, $p = .453$ (see Figure 3). These results are in line with our hypotheses and suggest that, for this task, the ability to suppress unintentional cognitions is influenced by individual differences in cognitive control and cognitive biases.

Rate of Unintentional Cognitions

A supplementary dependent measure was the rate at which unintentional cognitions occurred within each trial. For this analysis, only trials in which the participant thought of the name of the object at least once were included. To examine potential differences in the rate of unintentional cognitions as a result of group and valence, a mixed model ANOVA was conducted with participant Group (RNB or Control) as the between subjects factor and stimuli Block (Positive or Negative) as the within subjects factor. The analysis did not reveal any significant differences. Descriptively, participants in the RNB group had higher rates of unintentional cognitions for negative images (M = 1.29, SE = .11) compared to positive images (M = 1.25, SE = .09), and participants in the Control group had higher rates of unintentional cognitions for positive images (M = 1.33, SE = .17) compared to negative images (M = 1.25, SE = .13), however this difference was not significant, $F(1, 14) = 1.88$, $p = .192$, $\eta^2_p = .118$ (see Figure 4).

Effort

To examine potential differences in the reported effort expended between the groups and as a result of image valence, a mixed model ANOVA was conducted with participant Group (Control or RNB) as the between subjects factor and stimuli Block (Positive or Negative) as the within subjects factor. Although individuals in the RNB reported expending less effort across both stimuli blocks (M = 4.02, SE = .66) compared

to individuals in the Control group ($M = 5.40$, $SE = .58$), this difference was not significant, $F(1,14) = 2.48$, $p = .138$, $\eta^2_p = .15$ (see Figure 5).

Groups Based on the PHQ9 and RRS

The behavioral analyses reported above were based on participant groups defined by all the depression, anxiety, and rumination measures. See Table 6 for the participant characteristics based on these measures. Most likely due to the small sample size, the Control and RNB groups differed significantly only on the STAI-T and RRS at $p < .05$. Examination of the data revealed that defining the groups more narrowly, by including in the RNB group only those individuals with a PHQ9 score greater than or equal to 10 and a RRS score in the top 33% of the sample, resulted in the removal of two participants from the RNB group; these individuals had been previously included in the RNB due to meeting the established cutoff on only one of the six measures of interest. Redefining the RNB group in this way resulted in the RNB and Control groups differing significantly on the PHQ9, STAI-T, and RRS at $p < .05$ (see Table 7). Importantly, the behavioral results for these new groups (RNB: $n = 5$, $M_{age} = 23.20$, $SD_{age} = 2.59$, 4 female; Control: $n = 11$, $M_{age} = 24.00$, $SD_{age} = 6.60$, 8 female) remained similar to the above reported results (see Table 8). Analyses with these new groups revealed a significant Group X Block interaction, $F(1,14) = 7.70$, $p = .015$, $\eta^2_p = .36$, for the proportion of trials with unintentional cognitions. Identical to the results reported above, post-hoc analyses revealed that individuals in the Control group were more successful at suppressing unintentional cognitions of negative images ($M = .71$, $SE = .07$) compared to positive

images (M = .91, SE = .13), $t(14) = 3.34$, $p = .005$. In contrast, individuals in the RNB group were more successful at suppressing unintentional cognitions of positive images (M = .95, SE = .06) compared to negative images (M = 1.04, SE = .09), however, this difference was not significant, $t(14) = -1.10$, $p = .291$. Similar to the behavioral results reported above, the analyses of rate and effort did not reveal any significant differences.

Electrophysiological Data

To explore the localization of emotional processing during this task, EEG alpha power was analyzed by frontal cortex region (F3 = left hemisphere; F4 = right hemisphere). The first 2000 ms of each 4000 ms trial were analyzed. Trials contaminated with eye movement or muscular activity greater than 100 μV were not included in the analysis. Participants with less than 18 artifact-free trials per block were not included in the analysis. Alpha band frequency was derived from the raw EEG and was defined as 8.01-13 Hz. Alpha power (μV/ Hz) was calculated by taking the standard deviation of the alpha wave for the first 2000 ms of the trial and averaging it for each participant across trials with and without unintentional cognitions. Examination of alpha power for positive trials in which participants experienced an unintentional cognition revealed that cortical activity was higher (relative lower alpha power) in the left frontal cortex (M = 1.86, SE = .10) compared to the right (M = 1.96, SE = .09), $F(1,14) = 6.41$, $p = .024$, $\eta^2_p = .31$ (see Figure 6). These results are in line with previous research suggesting that the left frontal cortex is specialized for the experiential aspects of positive (i.e., approach-related)

emotion (Davidson, 1998, Davidson & Henriques, 2000). No other analyses were significant.

Discussion

The present study sought to investigate differences between individuals with and without risk for negative cognitive biases in suppressing an unintentional valenced thought. We hypothesized that individuals in the RNB group would have more unintentional cognitions of negative images compared to positive images and that individuals in the Control group would have more unintentional cognitions of positive images compared to negative images. Additionally, we hypothesized that individuals in the RNB group would have more unintentional cognitions overall compared to those in the Control group.

Analyses revealed a significant interaction between group and image valence for the proportion of trails with unintentional cognitions (see Figure 3). Specifically, individuals in the Control group were found to be more successful at suppressing unintentional cognitions of negative images compared to positive images. Although individuals in the RNB group were less successful at suppressing unintentional cognitions of negative images compared to positive images, this difference was not significant. Additionally, although those in the RNB had more unintentional cognitions of both positive and negative images compared to those in the Control group, this difference

was not significant. Although not statistically significant, these patterns are as we predicted.

Importantly, this pattern of results emphasizes that those in the Control group were surprisingly successful at suppressing unintentional thoughts of negative images: the by-subject mean raw proportion of trails with unintentional cognitions was .63 (*SE* = .06). In the first experiment utilizing the RIT, the by-subject mean proportion of trails with unintentional cognitions was higher (*M* = .86, *SD* = .24) (Allen et al., 2013). In the context of the theory of ironic processes (Wegner, 1994), this success may be related to greater cognitive control resources, possibly due to fewer conditions that reduce cognitive capacity, such as stress, distraction, and mental load. With greater cognitive capacity, the more effortful operating process is able to successfully suppress the unintentional thought. In the context of cognitive theories (Clark and Beck, 2010), positive cognitive biases may also support the successful suppression of unintentional negative images because these images may be less accessible in comparison to highly interconnected positive thoughts. It seems that individuals in the Control group exhibit more successful cognitive control over images that are inconsistent with a positive cognitive bias and that this is in direct contrast with individuals in the RNB group.

We also explored associations between EEG alpha power, image valence, and participant group. Given that the comorbidity of depression and anxiety can influence EEG alpha power (Davidson & Henriques, 2000; Bruder et al., 1997; Pizzagalli et al., 2002), and that recording during a task impacts findings (Manna et al., 2010), our

investigation was exploratory and we did not establish formal hypotheses. Examination of alpha power for positive trials in which participants experienced an unintentional cognition revealed that cortical activity was significantly higher in the left frontal cortex compared to the right (see Figure 6). These results are in line with previous research suggesting the left frontal cortex is specialized for the experiential aspects of positive/approach-related emotion (Davidson, 1998, Davidson & Henriques, 2000). Future studies utilizing the valence variation of the RIT will need to investigate if these findings generalize to other populations and experimental manipulations.

This study deviated from past research in that it evaluated individual differences in cognitive biases and cognitive control in the context of a valence variation of the RIT (adapted from Allen et al., 2013). To our knowledge, this is the first study to evaluate valenced thought suppression using the RIT. Accomplishing this necessitated the selection, adaptation, and creation of images representing concrete positive and negative nouns (see Table 1 and Figure 1). Although the majority of the images were selected from a larger pool of images that had been successfully used in previous research (Morsella & Miozzo, 2002; Snodgrass & Vanderwart, 1980), we pilot tested ($n = 24$) the images on valence and threat to determine the final set of positive and negative images. Additionally, the final images in the two blocks were matched for word frequency (Kučera & Francis, 1967; Brysbaert & New, 2009), word length, semantic category (based on Warrington & Shallice, 1984), and image darkness. Lastly, we had participants complete naming and rating questionnaires (see Appendices D and E) of the images after

the RIT as a manipulation check of the stimuli. This allowed us to exclude from analyses any cases in which a participant misperceived an image in a way that would impact the valence rating (see Appendix F). Analysis of the manipulation check data confirmed that participants perceived the images in the Positive block as positive and safe, whereas the images in the Negative block were perceived as negative and dangerous (see Table 2). With these precautions, we hope to have avoided any confounds with the stimuli that could undermine the validity of our results.

As a similar precaution, we utilized two self-report measures of depressive symptomology (the BDI-II [Beck et al., 1996] and PHQ-9 [Kroenke et al., 2001]) and two of anxious symptomology (the STAI-S, STAI-T [Spielberger et al., 1983] and GAD-7 [Spitzer et al., 2006]) to hopefully counteract any difficulties with introspective ability, question interpretation, or honesty on the part of the participant. Table 3 confirms that the measures were highly correlated, as predicted. Although we were not able to conduct structured clinical interviews to determine clinical diagnoses of depression and anxiety, the agreement of multiple measures suggests the defined groups accurately represented the constructs intended (those with and without risk for negative biases). Importantly, these measures were completed after the RIT in order not to prime participants' mood states. Thus, participants' reactions to the positive and negative images in the RIT were not induced or influenced by asking participants about depressive and anxious symptomology. Lastly, given research that suggests rumination predicts higher levels of both depression and anxiety symptoms (Nolen-Hoeksema, 2000), and that difficulties

inhibiting negative information in depressed individuals was significantly associated with severity of rumination (Joormann & Gotlib, 2010; Foland-Ross & Gotlib, 2012), we included individuals with high rumination in the RNB group (RRS; Treynor et al., 2003). Conducting analyses with the RNB group more broadly defined (i.e., based on all measures, see Table 5 and 6) and also more narrowly defined (i.e., based only on the PHQ9 and RRS measures, see Table 7 and 8) did not alter the results suggesting that the groups accurately represented individuals with and without risk for negative biases.

Some potential caveats should be kept in mind when interpreting the results of this study. First, this study utilized a nonclinical, student population. Further studies should attempt to replicate these findings with individuals with a clinical MDD and Generalized Anxiety Disorder diagnoses, as well as with formally depressed and anxious individuals across different age groups. Such studies will contribute to our understanding of potential differences among subgroups and possible changes in cognitive processing over time. Second, the limitation of a small sample size could increase variability and vulnerability to spurious effects, or prevent differences in the groups from being detected. Thus, caution should be taken when generalizing these results. Although small, this study provides preliminary evidence that the valence variation of the RIT can be utilized to assess cognitive processing in those with and without risk for psychopathology. Third, due to limitations in resources, this study utilized one assessment time point. It is possible that the results of this study are more indicative of state-like depressive or anxious symptoms rather than stable depressive or anxious symptomology over time.

Additionally, some research suggests that EEG recordings should be taken at multiple time points to accurately reflect stable individual results (Davidson, 1998). Employing a second assessment time point as well as utilizing clinical diagnosis measures could potentially avoid these limitations. Fourth, there are limitations regarding introspective reports of mental control processes. It is possible that participants failed to report all unintentional cognitions during the task. Although this might not undermine the validity of our primary finding, it is possible that in clinical populations such as depression, motivation deficits (American Psychiatric Association, 2000; Magee, Harden, & Teachman, 2012) could result in inaccuracies in the self-report of unintentional cognitions however, given the high rate of cognitions reported, we do not believe this is the case in this study. Additionally, although the difference in effort expended was not significant, individuals in the RNB group reported expending less effort across both positive and negative stimuli blocks compared to individuals in the Control group (see Figure 5). This could be related to motivation deficits and could be a contributing factor to the (non-significant) observation that those in the RNB group were less successful at suppressing unintentional cognitions across all trials. It is important to note that successful suppression in the RIT seems challenging and results could reflect a ceiling effect that limits variance and makes differences between the two participant groups difficult to detect. A final limitation is that this study did not test unintentional cognitions with neutral stimuli. Given the possible influence of experiment burden and motivation,

specifically in depressed individuals, we purposefully restrained the task to stimuli that were mood-congruent to the two groups of interest.

Importantly, the use of the RIT in this study expands upon previous research on thought suppression and provides a new model for evaluating cognitive control. In the first experiment utilizing the RIT, Allen et al. (2013) reflect that the paradigm allows for the observation of "the involuntary entry of high-level contents into consciousness" and reveals that "conscious contents can be elicited in a manner that is unintentional, reflex-like, and nontrivial" (p. 1328). Building on the work of Wegner's ironic processing theory and others (Wegner, 1994; Wenzlaff & Luxton, 2003; Wenzlaff et al., 1988), findings from the RIT suggest mental control attempts at suppression can illicit ironic, high-level cognitions in a seemingly 'automatic', uncontrollable manner. Similarly, cognitive theories of depression and anxiety suggest that cognitive biases can become highly organized, elaborate, and coherent to the point that negative thoughts can be 'automatically' activated by a range of stimuli (Beck, 1976; Clark & Beck, 2010). Taken together, these two distinct lines of psychological research both suggest that "once certain [cognitive] sets are induced, responses to environmental stimuli can resemble reflex-like processes, even when the responses depend on sophisticated unconscious inferences" (Allen et al., 2013, p. 1329). This phenomenon has implications for psychopathology research as characteristic and recurrent, unintentional thoughts can be a significant source of distress (American Psychiatric Association, 2000; Clark, 2005; Hersen & Turner,

2003). By adapting the RIT to include a valence manipulation, the paradigm becomes an important tool for evaluating cognitive models of clinical disorders.

Additionally, this study adds to a growing research literature linking depression, anxiety, and rumination with deficits in cognitive control, specifically difficulties in attentional disengagement and inhibition (Foland-Ross & Gotlib, 2012; Clark and Beck, 2010). Although our results show that the suppression of an unintentional thought in the RIT is difficult, those in the control group had some success with negative images. This was not observed in the risk group. Specifically, our results suggest that those with higher levels of depressed, anxious, and ruminative symptomology do not display the positive cognitive biases that contributed to less unintentional cognitions of negative images seen in the control group. In line with the theory of ironic processes (Wegner, 1994) and cognitive models of depression and anxiety (Clark and Beck, 2010), it may be that limited cognitive resources and highly accessible, interconnected negative thoughts undermined attempts at suppressing unintentional thoughts for those with symptomology.

Our findings emphasize the influence of cognitive biases in suppressing unintentional negative thoughts. Similarly, research investigating Cognitive Behavioral Therapy (CBT), an empirically supported and effective treatment that has been rigorously studied, suggests that it "produces symptom relief in anxiety and depression by correcting biased information processing" (Clark & Beck, 2010, p. 419). More specifically, recent behavioral and neuroimaging studies provide initial evidence that CBT "could lead to symptom reduction by change in both bottom-up (i.e., automatic [cognitive bias]

deactivation) and top-down (i.e., strengthen reflective cognitive control) systems (Clark & Beck, 2010, p. 421). Strengthening cognitive control is essential as effective emotion regulation strategies such as cognitive reappraisal (i.e., reinterpreting the meaning of information so as to make it less distressing) are dependent on cognitive control (Foland-Ross & Gotlib, 2012). Importantly, "individuals who more frequently use cognitive reappraisal have fewer depressive symptoms than do individuals who use other regulation strategies, such as emotion suppression and rumination (Foland-Ross & Gotlib, 2012, pp. 8-9). Similar to the conclusions of Wegner, suppression seems to cause the ironic opposite of the intention (1994). Likewise, the current study suggests that those with low levels of rumination are the most successful at cognitive control with negative stimuli. Thus, further research is needed to evaluate effective therapeutic interventions and connect symptom relief with underlying cognitive processes.

In the future, researchers may wish to extend these findings by utilizing clinical populations, specifically individuals with a clinical MDD or Generalized Anxiety Disorder diagnoses. It would be meaningful to examine the impact of number of depressive episodes, as well as remission of depressive and anxious symptoms, as research suggests that "deficits in cognitive control increase with each depressive episode and persist after symptom remission" (Vanderhasselt & De Raedt, 2009, p. 169). Lastly, longitudinal investigations into possible treatment impacts could provide context for the role cognitive control plays in the maintenance and recurrence of depression. Although not much research has been conducted to examine the impact of cognitive control

training on depressive symptoms, it seems promising in decreasing not only mood symptoms but also rumination (Foland-Ross & Gotlib, 2012), and the valence RIT could provide a useful paradigm for exploring changes over time.

Given the global public health impact (World Health Organization, 2012) and the reduced quality of life that can result from depression and anxiety (Kessler & Wang, 2009; World Health Organization, 2008), developing a more comprehensive and integrative model of the etiology, maintenance, and recurrence of these clinical disorders is needed. The valence variation of the RIT provides a useful tool for evaluating the affective biases and cognitive control mechanisms implicated in various clinical disorders. Additionally, our results suggest that individuals at risk for depression and anxiety lack the positive cognitive biases that contributed to less unintentional negative cognitions seen in those without risk. Thus, future exploration of these mechanisms and treatments, such as CBT, that alter the cognitive control of negative emotion, has the potential to greatly improve the lives of those impacted by depression and other mental health disorders.

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Table 1

List of the Visual Objects (Line Drawings) in the Two Stimuli Blocks

Positive Block	Negative Block
Angel	Ambulance
Ball	Axe
Balloon	Bomb
Bed	Bullet
Bicycle	Cannon
Bird	Cigarette
Butterfly	Claws
Cake	Cockroach
Candy	Coffin
Crown	Devil
Dog	Dynamite
Fireworks	Fire
Flower	Fly
Guitar	Gravestones
Heart	Grenade
House	Guillotine
Jewel	Gun
Kite	Jail
Kitten	Jaws
Lips	Knife
Necklace	Lightning
Paintbrush	Lion
Pumpkin	Mosquito
Rabbit	Motorcycle
Rainbow	Noose
Ring	Poison
Snowflake	Razor
Snowman	Robber
Star	Scorpion
Sun	Shark
Swan	Snake
Swing	Spider
Top	Tank
Tree	Thorns
Trophy	Tiger
Wagon	Tornado
Waterfall	Volcano
World	Wasp

Table 2

Contrast of Positive Block Images with Negative Block Images for Valence and Threat Ratings

		Positive Block		Negative Block			
		M	*SD*	*M*	*SD*	*t*(74)	*p*
Valence	Positive	80.14	12.36	9.26	14.03	23.37	< .001
	Neutral	19.31	11.85	30.43	18.12	-3.17	.002
	Negative	0.44	1.31	60.31	27.92	-13.20	< .001
Threat	Safe	65.29	19.42	3.23	8.08	18.19	< .001
	Neutral	31.29	16.47	25.76	20.78	1.29	.202
	Dangerous	3.31	7.71	71.01	24.52	-16.23	< .001

Note. Each block consists of 38 images. *Means* (*M*) represent the block-averaged percentage of participants ($N = 24$) who rated the image as positive, neutral, or negative on Valence and rated the same image as safe, neutral, or dangerous on Threat. *SD* = standard deviation.

Table 3

Pearson's r Correlations for Depression, Anxiety, Rumination, and Self-Control Measures (n =16)

Measure	1	2	3	4	5	6	7
1. BDI-II	–						
2. PHQ-9	.879**	–					
3. STAI-T	.631**	.615*	–				
4. STAI-S	.699**	.570*	.789**	–			
5. GAD-7	.718**	.833**	.656**	.624**	–		
6. RRS	.672**	.614*	.598*	.598*	.436	–	
7. SCS	-.158	-.122	-.317	-.249	-.195	-.085	–

Note. BDI-II = Beck Depression Inventory II (Beck et al., 1996); PHQ-9 = Patient Health Questionnaire (Kroenke et al., 2001); STAI-T = State-Trait Anxiety Inventory, Trait Scale (Spielberger et al., 1983); STAI-S = State-Trait Anxiety Inventory, State Scale (Spielberger et al., 1983); GAD-7 = Generalized Anxiety Disorder Assessment (Spitzer et al., 2006); RRS = Ruminative Response Scale (Treynor et al., 2003); SCS = Self-Control Scale (Tangney et al., 2004).

* $p < .05$, two-tailed. ** $p < .01$, two-tailed.

Table 4

Number of Trials in which Unintentional Cognitions Occurred by Participant Group and Stimuli Block (n = 16)

Group	Participant	Positive Block	Negative Block
	4	29 (38)	30 (38)
	6	33 (38)	33 (38)
	8	34 (38)	37 (38)
RNB	10	33 (38)	29 (37)
	11	27 (38)	27 (38)
	13	30 (38)	34 (38)
	14	17 (37)	19 (37)
	1	17 (38)	16 (37)
	2	14 (38)	14 (38)
	3	33 (38)	26 (37)
	5	37 (38)	30 (38)
Control	7	37 (38)	33 (37)
	9	21 (37)	18 (37)
	12	19 (38)	19 (36)
	15	38 (38)	32 (38)
	16	35 (38)	25 (38)

Note. Total number of trials is listed in parentheses. There were 38 trials in each block; however, trials in which the participant misinterpreted the image were excluded from analysis. RNB = Risk of Negativity Bias.

Table 5

Behavioral By-subject Means (Standard Errors) by Stimuli Block and Participant Group Based on All Measures

	Control (n = 9)		RNB (n = 7)	
	Positive Block	Negative Block	Positive Block	Negative Block
Raw Proportion	.74(.09)	.63(.06)	.76(.06)	.79(.06)
Arcsine Proportion	.94(.15)	.71(.09)	.89(.08)	.95(.10)
Rate	1.33(.17)	1.25(.13)	1.25(.09)	1.29(.11)
Effort	5.47(.68)	5.33(.70)	3.91(.42)	4.14(.53)

Note. Proportion refers to the number of trials in which a participant experienced an unintentional cognition. The Risk of Negativity Bias (RNB) group includes participants who scored 10 or higher on the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001); or 10 or higher on the Generalized Anxiety Disorder Assessment (GAD-7; Spitzer et al., 2006); or 14 or higher on the Beck Depression Inventory II (BDI-II; Beck et al., 1996); or 47 or higher on the State-Trait Anxiety Inventory, Trait Scale (STAI-T; Spielberger et al., 1983); or 47 or higher on the State-Trait Anxiety Inventory, State Scale (STAI-S; Spielberger et al., 1983); or scored in the top 33% of the sample on the Ruminative Response Scale (RRS; Treynor et al., 2003).

Table 6

Participant Characteristics by Group Based on All Measures

	Control (n = 9)		RNB (n = 7)				
	M	*SD*	*M*	*SD*	$F(1, 14)$	p	η^2_p
Age	24.33	7.23	23.00	2.59	0.21	.651	.015
BDI-II	7.00	3.32	11.14	10.98	1.17	.298	.077
PHQ-9	3.56	1.59	6.86	4.63	4.03	.064	.224
STAI-T	35.78	5.67	46.57	9.93	7.56	.016*	.351
STAI-S	34.33	7.28	39.43	10.21	1.36	.262	.089
GAD-7	3.44	2.30	7.14	5.18	3.71	.075	.210
RRS	28.33	4.42	43.57	12.82	11.21	.005*	.445
SCS	121.78	19.42	118.86	12.42	0.12	.735	.008

Note. Participant (n =16) characteristics by group (Risk of Negativity Bias [RNB] or Control). The RNB group includes participants who scored 10 or higher on the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001); or 10 or higher on the Generalized Anxiety Disorder Assessment (GAD-7; Spitzer et al., 2006); or 14 or higher on the Beck Depression Inventory II (BDI-II; Beck et al., 1996); or 47 or higher on the State-Trait Anxiety Inventory, Trait Scale (STAI-T; Spielberger et al., 1983); or 47 or higher on the State-Trait Anxiety Inventory, State Scale (STAI-S; Spielberger et al., 1983); or scored in the top 33% of the sample on the Ruminative Response Scale (RRS; Treynor et al., 2003). SCS = Self-Control Scale (Tangney et al., 2004).

* $p < .05$

Table 7

Participant Characteristics by Group Based on the PHQ9 and RRS

	Control (n = 11)		RNB (n = 5)				
	M	*SD*	*M*	*SD*	$F(1, 14)$	p	η^2_p
Age	24.00	6.60	23.20	2.59	0.07	.800	.005
BDI-II	6.82	3.74	13.20	12.24	2.65	.126	.159
PHQ-9	3.82	2.04	7.60	5.03	4.82	.046*	.256
STAI-T	37.27	6.63	47.60	11.19	5.45	.035*	.280
STAI-S	33.72	7.02	42.80	9.71	4.56	.051	.246
GAD-7	4.00	2.86	7.40	5.81	2.56	.132	.155
RRS	29.00	4.31	48.20	12.28	22.49	<.001*	.616
SCS	122.00	17.94	117.20	13.00	0.29	.602	.020

Note. Participant (n =16) characteristics by group (Control or Risk of Negativity Bias [RNB]). The RNB group includes only those participants who scored 10 or higher on the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) and scored in the top 33% of the sample on the Ruminative Response Scale (RRS; Treynor et al., 2003). BDI-II = Beck Depression Inventory II (Beck et al., 1996); GAD-7 = Generalized Anxiety Disorder Assessment (Spitzer et al., 2006); STAI-T = State-Trait Anxiety Inventory, Trait Scale (Spielberger et al., 1983); STAI-S = State-Trait Anxiety Inventory, State Scale (Spielberger et al., 1983); SCS = Self-Control Scale (Tangney et al., 2004).

* $p < .05$

Table 8

Behavioral By-subject Means (Standard Errors) by Stimuli Block and Participant Group Based on the PHQ9 and RRS

	Control (n = 11)		RNB (n = 5)	
	Positive Block	Negative Block	Positive Block	Negative Block
Raw Proportion	.72(.08)	.64(.05)	.81(.03)	.85(.05)
Arcsine Proportion	.91(.13)	.71(.07)	.95(.06)	1.04(.09)
Rate	1.28(.15)	1.21(.10)	1.34(.10)	1.38(.13)
Effort	5.26(.57)	5.28(.58)	3.75(.58)	3.77(.60)

Note. Participant (n =16) characteristics by group (Control or Risk of Negativity Bias [RNB]). The RNB group includes only those participants who scored 10 or higher on the Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) and scored in the top 33% of the sample on the Ruminative Response Scale (RRS; Treynor et al., 2003). Proportion refers to the number of trials in which a participant experienced an unintentional cognition.

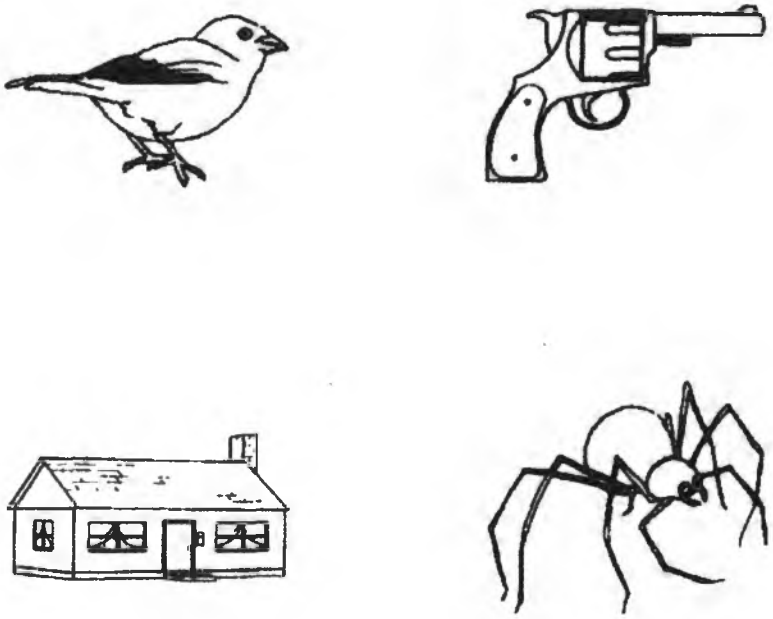

Figure 1. Sample visual objects. (Not drawn to scale).

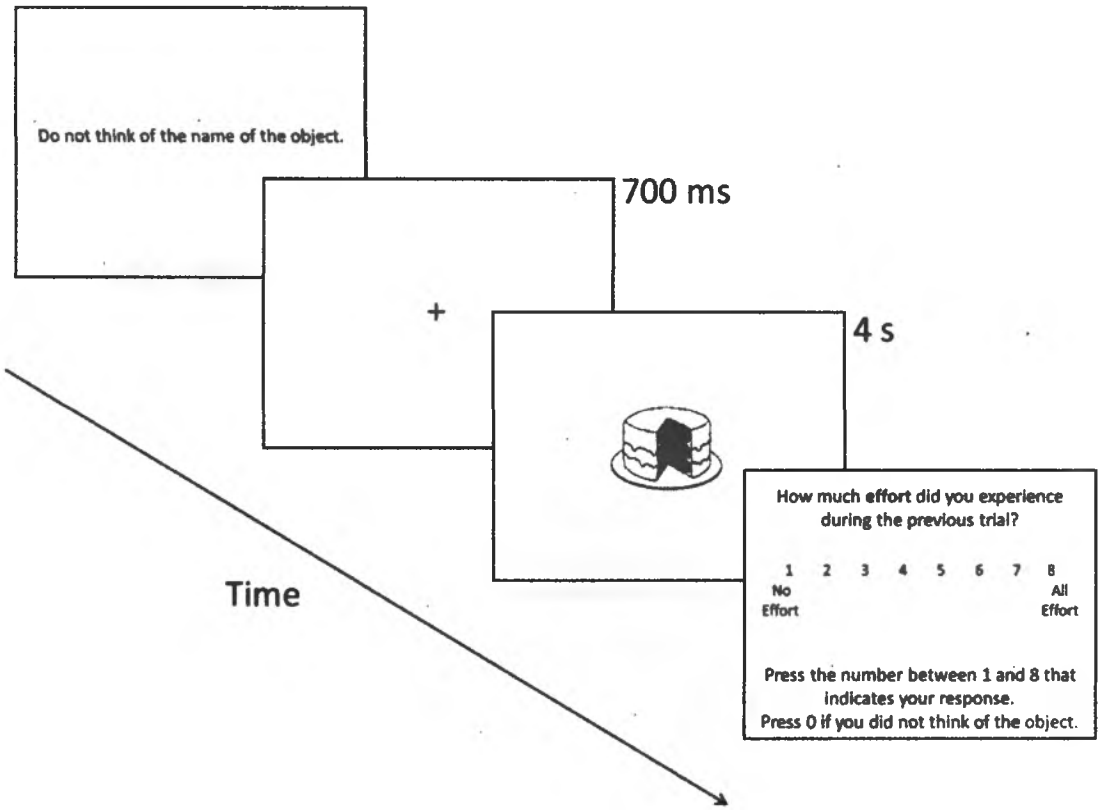

Figure 2. Time course of a single trial of the valence variation of the RIT. The task consisted of two counterbalanced blocks of black-line drawings. One block included 38 positive images and the other block included 38 negative images for a total of 76 trials.

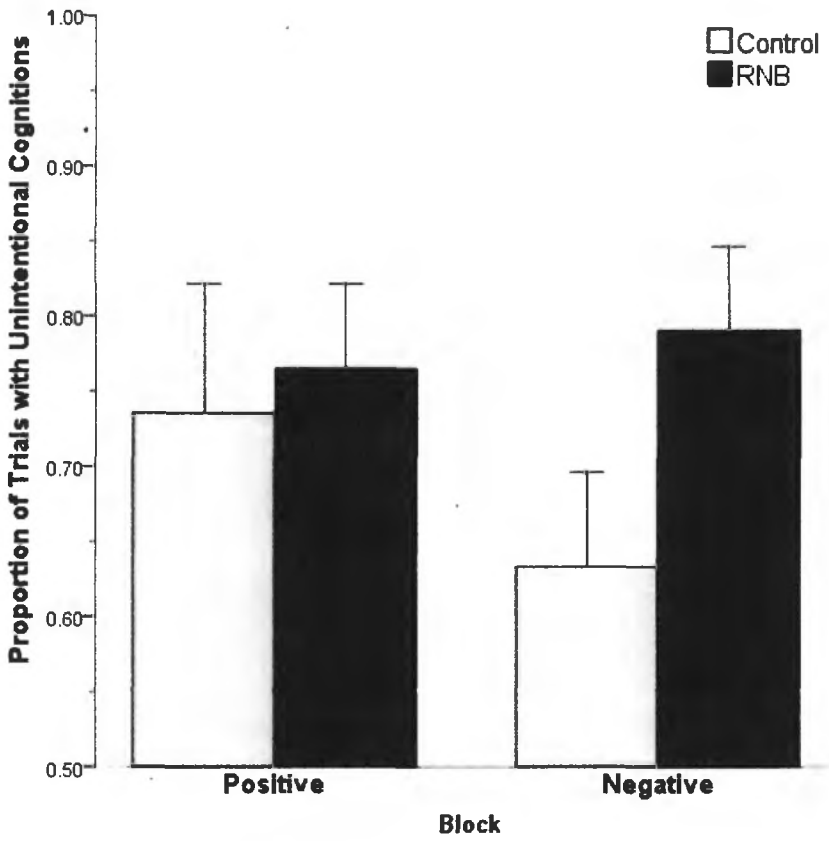

Figure 3. Raw proportion of trials in which at least one unintentional cognition occurred, as a function of group (RNB = Risk of Negativity Bias; $n_{RNB} = 7$; $n_{Control} = 9$) and stimuli block (Positive or Negative). Error bars represent +/- 1 *SE*. The Group X Block interaction is significant at $p < .05$.

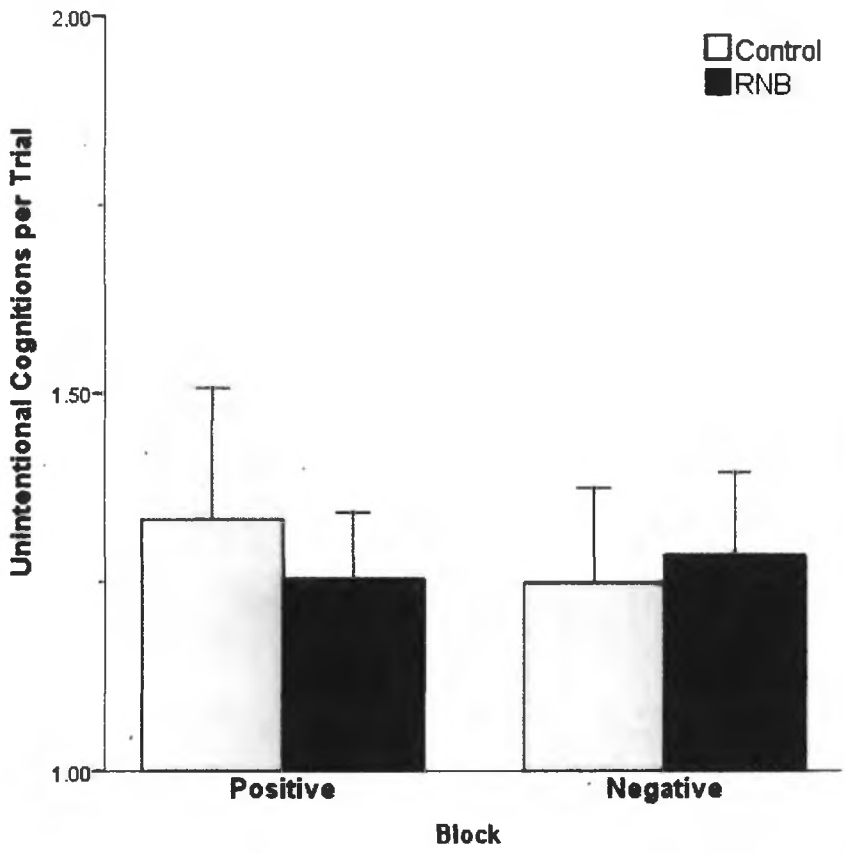

Figure 4. Mean rate of unintentional cognitions per trial, as a function of group (RNB = Risk of Negativity Bias; $n_{RNB} = 7$; $n_{Control} = 9$) and stimuli block (Positive or Negative). Only trials in which the participant unintentionally thought of the name of the object at least once are included. Error bars represent +/- 1 *SE*.

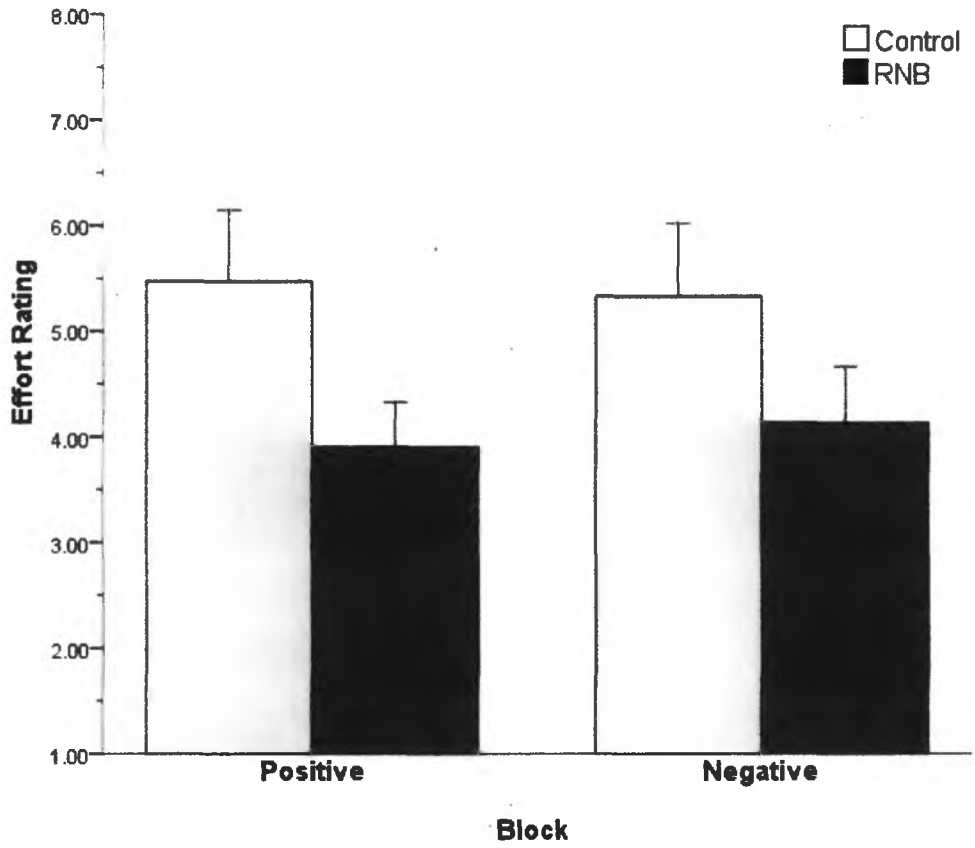

Figure 5. Mean effort experienced, as a function of group (RNB = Risk of Negativity Bias; $n_{RNB} = 7$; $n_{Control} = 9$) and stimuli block (Positive or Negative). After each image, participants indicated the amount of effort they felt they experienced during the previous trial on a scale ranging from 1 (*no effort*) to 8 (*all effort*). Error bars represent +/- 1 *SE*.

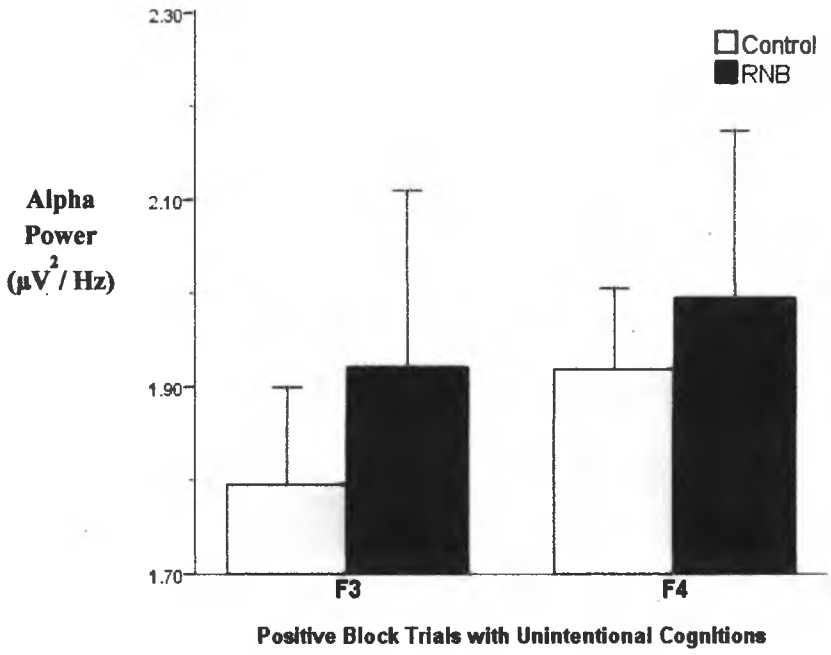

Figure 6. Alpha power for positive block trials with unintentional cognitions represented by frontal cortex region (F3 = left; F4 = right) and group (RNB = Risk of Negativity Bias; $n_{RNB} = 7$; $n_{Control} = 9$). Alpha power is defined as 8.01-13.00 Hz. Higher levels of alpha power indicate decreased cortical activation. Error bars represent +/- 1 *SE*. Lower alpha power in the left frontal cortex (F3) compared to the right (F4) is significant at $p < .05$.

Appendix A

Consent Form

San Francisco State University

Informed Consent to Participate in a Research Study

(Brainwave Activity during and Imagery Task)

A. PURPOSE AND BACKGROUND

The purpose of this research is to examine behavioral and brainwave activity during an imagery task. Additionally, we will ask you questions about your experiences and perspective. The researcher, Sheila Pugh, is a graduate student at San Francisco State University conducting research for a master's degree in psychology. You are being asked to participate in this study because you are a student currently enrolled at SFSU, at least 18 years old, a fluent English speaker, and right-handed with normal to corrected-to-normal vision.

B. PROCEDURES

If you agree to participate in this research, the following will occur:

1. You will be briefed on the purpose of the study, procedures, and any risks. After your questions have been answered, and if you decide to participate and sign the consent form,

Appendix A Continued

Consent Form

you will complete the General Health Questionnaire. This step will take about 10 minutes.

2. In order to measure brainwaves during an imagery task, the researcher will be using an electrode sensor cap as well as four individual sensors attached with a water-soluble gel and semi-adhesive tape. The researcher will start this procedure by having you remove all earrings and hairpins and will then put on the sensors. The researcher will fill each of the electrode sensors with a small amount of water-soluble gel. The gel, which the researcher will later clean off, is used to ensure a good connection with the scalp through the hair. Twenty three (23) sensors will be attached: one on each ear, two on the cheek beside the participant's left eye, and 19 across the top of the scalp. This step will take about 30 minutes.

3. You will then be asked to perform an imagery task at the computer station during which you will view black line- drawings and respond during each trial by pressing a button or numbers on the keyboard. This task will last about 30 minutes.

4. After the imagery task, the researcher will remove the electrodes and clean off the gel from the head via warm water. This step will take about 10 minutes.

5. You will then be asked to complete a series of questionnaires asking you about your experiences and perspective. This step will take about 35 minutes.

Appendix A Continued

Consent Form

6. Immediately following the study, you will be debriefed and any questions you might have will be answered. This step will take about 5 minutes.

7. The researcher may contact any participant within one month of the study session via email to clarify his/her questionnaire answers.

8. Total time commitment will be approximately 2 hours.

Participation will take place in the Cognitive Psychophysiology Lab, Room 308, in the Ethnic Studies and Psychology building at San Francisco State University, 1600 Holloway Avenue, San Francisco, Monday through Friday between the hours of 8:00am and 9:00pm.

C. RISKS

There is a potential risk of loss of privacy. However, no names or identities will be used in any published reports of the research. Only the researcher and the academic advisors Professor Mark Geisler and Professor Ezequiel Morsella will have access to the research data. There is also a potential risk of discomfort. Discomfort might come from the sticky residue left from the electrodes. In order to minimize this discomfort, the electrode gel is water soluble and easily removed with water and will be removed to the best of the researcher's ability. The researcher will also have a bottle of calamine lotion on hand for

Appendix A Continued

Consent Form

those participants with sensitive skin. There is also a potential risk of discomfort due to the nature of answering questions about your health, personal history, experiences, and perspective. In order to minimize this risk, participants can choose to decline to answer any question at any time and can stop participation in the research study at any time. Additionally, participants will be provided with a list of referrals at the end of the study. Participants' answers to the questionnaires will be kept on password protected computers, and only the researcher and the academic advisors, Professor Mark Geisler and Professor Ezequiel Morsella, will have access to the passwords. Research designs often require that the full intent of the study not be explained prior to participation. When your participation in the study is complete, you will receive a full debriefing on the purpose and the procedures of the research and you will have the option of removing your data.

D. CONFIDENTIALITY

The association of the Participant ID number to any contact information will be used only in scheduling and clarifying participants' questionnaire answers and will not be transferred to any health or evaluation information. This number will be the only identifier for the participant for the duration of the experiment. The key used to coordinate identities and the assigned three-digit number used throughout the project will

Appendix A Continued

Consent Form

be kept in a separate locked file in the Cognitive Psychophysiology Lab run by Professor Mark Geisler and will be destroyed following the completion of the experiment (expected summer 2014). At no time will identifiable information or the key be kept with the student researcher. Only the researcher and the academic adviser, Professor Mark Geisler, will be able to have access to the key to the cabinet. Reaction times, reaction responses, and brain wave data will be recorded and kept on password protected computers in the experiment chamber. Data from questionnaires will be kept in a locked file and only the researcher and the academic adviser, Professor Mark Geisler, will be able to have access the data. All electronic data will be kept in an encrypted document on a password protected computer. Only the researcher and the academic advisers, Professor Mark Geisler and Professor Ezequiel Morsella, will be able to have access to the passwords to the databases and computers. At the conclusion of the study (expected summer 2014) all identifying information will be removed and destroyed. The final data will be kept in password protected computers in the Cognitive Psychophysiology Lab run by Professor Mark Geisler at San Francisco State University up to 7 years.

Exceptions to Confidentiality:

The State of California mandates that we must report physical abuse of a child, elder, or dependent adult; the abandonment, isolation, neglect, or financial abuse of an elder;

Appendix A Continued

Consent Form

and/or instances in which a participant indicates that he/she has plans to harm themselves or others. These instances represent exceptions to confidentiality for participation in this research study.

E. DIRECT BENEFITS

There will be no direct benefits to the participant.

F. COSTS

There will be no cost to you for participating in this research.

G. COMPENSATION

Academic Credit

If participants are students at San Francisco State University, they may be eligible for credit toward a psychology class in which they are enrolled. Credit will be received following the research session.

Any class that offers credit for participation should also offer students alternative means of earning extra-credit, such as writing research papers or attending lectures, to reduce any coercion that may be felt.

Appendix A Continued

Consent Form

H. ALTERNATIVES

The alternative is not to participate in the research.

I. QUESTIONS

You have spoken with Sheila Pugh about this study and have had your questions answered. If you have any further questions about the study, you may contact the researcher at spugh@mail.sfsu.edu or 415-338-6026, or you may contact the researcher's advisor, Professor Mark Geisler at mgeisler@sfsu.edu or 415-338-6026. Questions about your rights as a study participant, comments, or complaints about the study may also be addressed to the Office of Human and Animal Protections at 415-338-1093 or protocol@sfsu.edu.

J. CONSENT

You have been given a copy of this consent form to keep.

PARTICIPATION IN THIS RESEARCH IS VOLUNTARY. You are free to decline to participate in this research study, or to withdraw your participation at any point, without

Appendix A Continued

Consent Form

penalty. Your decision whether or not to participate in this research study will have no influence on your present or future status at San Francisco State University.

Signature: _____ Date: _____
Research Participant

Print Name: _____
Research Participant

Signature: _____ Date: _____
Researcher

Appendix B

General Health Questionnaire

Please answer all of the following questions to the best of your ability to circling your answer. It is important that you are as honest as possible, as this can affect the validity of this research if the questions are not honestly answered. You will be asked only about things that may affect your response times and brainwaves. None of your identifying information will be attached to this form in any way.

Exclusion criteria: Answering "NO" to the following questions will exclude interested individuals from participating in the study.

1. Are you at least 18 years old?	YES	NO
2. Are you a fluent speaker of English?	YES	NO
3. Are you right-handed?	YES	NO
4. Do you have normal or corrected-to-normal vision?	YES	NO

Please specify by circling one of the following: Normal or Correct-to-Normal

Inclusion criteria: Answering "YES" to the following questions will exclude interested individuals from participating in the study.

1. Do you have difficulty pressing buttons with any of the fingers of your left hand?

YES NO If yes, which finger?_____

Appendix B Continued

General Health Questionnaire

2. Have you ever had an allergic response to common facial cleansing products?

YES NO

If yes, please specify which product(s):_____

3. Have you consumed any alcohol within the past 6 hours?

YES NO

4. Do you have a history of substance abuse?

YES NO

5. Are you currently on medications for ADD (Attention Deficit Disorder) or ADHD (Attention Deficit Hyperactivity Disorder)?

YES NO

If yes, please specify:_____

6. Do you have a history of seizures?

YES NO

Appendix B Continued

General Health Questionnaire

7. Have you ever sustained a skull fracture?

YES NO

If yes, please specify details and location on head:_____

_____

8. Have you ever had a serious head injury resulting in a loss of consciousness or any condition that might alter your ability to think clearly?

YES NO

If yes, please specify location and the functioning affected: _____

_____

_____

General Information: Please answer the following questions to the best of your ability by circling your answer.

1. Did you sleep well last night?

YES NO

Appendix B Continued

General Health Questionnaire

2. Approximately, how many hours of sleep would you say you got last night? (Please circle one)

Less than More than

1 hour 2 hours 3 hours 4 hours 5 hours 6 hours 7 hours 8 hours

3. Approximately, how many hours of sleep on average have you gotten in the last two weeks? (Please circle one)

Less than More than

1 hour 2 hours 3 hours 4 hours 5 hours 6 hours 7 hours 8 hours

4. Do you have a psychiatric illness or personality disorder?

YES NO

If yes, please specify: _____

_____

5. Are you currently on medications for depression?

YES NO

If yes, please specify: _____

Appendix B Continued

General Health Questionnaire

6. Are you currently on any other type of medications that might affect your alertness, such as allergy or cold medication?

YES NO

If yes, please specify the name of the medication(s): _____

_____

7. Have you consumed any caffeinated beverages (e.g. coffee, soda, etc.) today?

YES NO

If yes, how long ago: _____hours

How much did you consume: _____

Is this a normal amount for you: _____

Appendix C

Funneled Debriefing Questionnaire

Please answer the following questions.

1. What do you think the purpose of this experiment was?

2. What do you think this experiment was trying to study?

3. Did you have a strategy and/or goal in completing this experiment?

4. Was there anything that interfered with your performance on the task?

5. Did you have a strategy and/or goal for completing trials that you were instructed to not think the name of the object?

6. On each trial, did you feel that you tried (intended) to follow instructions?

7. Did you ever think of the name of the object in a language other than English? (circle one) Yes No

8. If yes, did you press the button when you thought of the name of the object in the other language? (circle one) Yes No

9. If you happened to think of the name of the object in more than one language, did you have a strategy for when you pressed the button?

Appendix D

Sample Questions from the Image Naming Questionnaire

For each of the images below, please write the name of the image in English:

1.  _____

2.  _____

Appendix E

Sample Questions from the Image Rating Questionnaire

For each of the images below, please rate the image on both A. and B. by circling your answer. Please circle only one answer for A. and only one answer for B. for each image.

	**A. Please circle one:**	Positive	Neutral	Negative
	B. Please circle one:	Safe	Neutral	Dangerous

	**A. Please circle one:**	Positive	Neutral	Negative
	B. Please circle one:	Safe	Neutral	Dangerous

Appendix F

Excluded Trials due to a Misperception of the Stimulus

Participant	Group	Positive Block	Negative Block
1	Control		Jail (room)
3	Control		Jail (door)
7	Control		Jail (bedroom)
9	Control	Swing (glass)	Thorn (roots)
10	RNB		Jail (doorway)
12	Control		Jail (room); Guillotine (window)
14	RNB	Top (left blank)	Jail (room)

Note. Out of the total sample (n = 16), only the participants with misperceptions are listed above. Accurate stimuli names are capitalized. Participants' incorrect responses are listed in parentheses. These trials represent the cases in which the misperception of the stimulus could potentially impact valence ratings and thus these trials were excluded from all analyses. RNB = Risk of Negativity Bias.

Appendix G

Beck Depression Inventory II

This questionnaire consists of 21 groups of statements. Please read each group of statements carefully, and then pick out the one statement in each group that best describes the way you have been feeling during the past two weeks, including today. Circle the number beside the statement you have picked. If several statements in the group seem to apply equally well, circle the highest number for that group. Be sure that you do not choose more than one statement for any group, including Item 16 (Changes in Sleeping Pattern) or Item 18 (Changes in Appetite).

1. Sadness

0 I do not feel sad.

1 I feel sad much of the time.

2 I am sad all the time.

3 I am so sad or unhappy that I can't stand it.

2. Pessimism

0 I am not discouraged about my future.

1 I feel more discouraged about my future than I used to be.

2 I do not expect things to work out for me.

3 I feel my future is hopeless and will only get worse.

Appendix G Continued

Beck Depression Inventory II

3. Past Failure

0 I do not feel like a failure.

1 I have failed more than I should have.

2 As I look back, I see a lot of failures.

3 I feel I am a total failure as a person.

4. Loss of Pleasure

0 I get as much pleasure as I ever did from the things I enjoy.

1 I don't enjoy things as much as I used to.

2 I get very little pleasure from the things I used to enjoy.

3 I can't get any pleasure from the things I used to enjoy.

5. Guilty Feelings

0 I don't feel particularly guilty.

1 I feel guilty over many things I have done or should have done.

2 I feel quite guilty most of the time.

3 I feel guilty all of the time.

Appendix G Continued

Beck Depression Inventory II

6. Punishment Feelings

0 I don't feel I am being punished.

1 I feel I may be punished.

2 I expect to be punished.

3 I feel I am being punished.

7. Self-Dislike

0 I feel the same about myself as ever.

1 I have lost confidence in myself.

2 I am disappointed in myself.

3 I dislike myself.

8. Self-Criticalness

0 I don't criticize or blame myself more than usual.

1 I am more critical of myself than I used to be.

2 I criticize myself for all of my faults.

3 I blame myself for everything bad that happens.

Appendix G Continued

Beck Depression Inventory II

9. Suicidal Thoughts or Wishes

0 I don't have any thoughts of killing myself.

1 I have thoughts of killing myself, but I would not carry them out.

2 I would like to kill myself.

3 I would kill myself if I had the chance.

10. Crying

0 I don't cry any more than I used to.

1 I cry more than I used to.

2 I cry over every little thing.

3 I feel like crying, but I can't.

11. Agitation

0 I am not more restless or wound up than usual.

1 I feel more restless or wound up than usual.

2 I am so restless or agitated that it's hard to stay still.

3 I am so restless or agitated that I have to keep moving or doing something.

Appendix G Continued

Beck Depression Inventory II

12. Loss of Interest

0 I have not lost interest in other people or activities.

1 I am less interested in other people or things than before.

2 I have lost most of my interest in other people or things.

3 It's hard to get interested in anything.

13. Indecisiveness

0 I make decisions about as well as ever.

1 I find it more difficult to make decisions than usual.

2 I have much greater difficulty in making decisions than I used to.

3 I have trouble making any decisions.

14. Worthlessness

0 I do not feel I am worthless.

1 I don't consider myself as worthwhile and useful as I used to.

2 I feel more worthless as compared to other people.

3 I feel utterly worthless.

Appendix G Continued

Beck Depression Inventory II

15. Loss of Energy

0 I have as much energy as ever.

1 I have less energy than I used to have.

2 I don't have enough energy to do very much.

3 I don't have enough energy to do anything.

16. Changes in Sleeping Pattern

0 I have not experienced any change in my sleeping pattern.

1a I sleep somewhat more than usual.

1b I sleep somewhat less than usual.

2a I sleep a lot more than usual.

2b I sleep a lot less than usual.

3a I sleep most of the day.

3b I wake up 1-2 hours early and can't get back to sleep.

Appendix G Continued

Beck Depression Inventory II

17. Irritability

0 I am no more irritable than usual.

1 I am more irritable than usual.

2 I am much more irritable than usual.

3 I am irritable all the time.

18. Changes in Appetite

0 I have not experienced any change in my appetite.

1a My appetite is somewhat less than usual.

1b My appetite is somewhat greater than usual.

2a My appetite is much less than before.

2b My appetite is much greater than before.

3a I have no appetite at all.

3b I crave food all the time.

Appendix G Continued

Beck Depression Inventory II

19. Concentration Difficulty

0 I can concentrate as well as ever.

1 I can't concentrate as well as usual.

2 It's hard to keep my mind on anything for very long.

3 I find I can't concentrate on anything.

20. Tiredness or Fatigue

0 I am no more tired or fatigued than usual.

1 I get more tired or fatigued more easily than usual.

2 I am too tired or fatigued to do a lot of the things I used to do.

3 I am too tired or fatigued to do most of the things I used to do.

21. Loss of Interest in Sex

0 I have not noticed any recent change in my interest in sex.

1 I am less interested in sex than I used to be.

2 I am much less interested in sex now.

3 I have lost interested in sex completely.

Appendix H

Patient Health Questionnaire

Over the *last 2 weeks*, how often have you been bothered by any of the following problems? Please circle your answer.	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling asleep, staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself—or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed. Or the opposite—being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead, or of hurting yourself	0	1	2	3

10. If you checked off *any problems*, how *difficult* have the have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not difficult at all Somewhat difficult Very difficult Extremely difficult

Appendix I

State-Trait Anxiety Inventory

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right now*, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	Not At All	**Somewhat**	**Moderately So**	**Very Much So**
1. I feel calm.	1	2	3	4
2. I feel secure.	1	2	3	4
3. I feel tense.	1	2	3	4
4. I feel strained.	1	2	3	4
5. I feel at ease.	1	2	3	4
6. I feel upset.	1	2	3	4
7. I am presently worrying over possible misfortunes.	1	2	3	4
8. I feel satisfied.	1	2	3	4
9. I feel frightened.	1	2	3	4
10. I feel comfortable.	1	2	3	4
11. I feel self-confident.	1	2	3	4

Appendix I Continued

State-Trait Anxiety Inventory

12. I feel nervous.	1	2	3	4
13. I am jittery.	1	2	3	4
14. I feel indecisive.	1	2	3	4
15. I am relaxed.	1	2	3	4
16. I feel content.	1	2	3	4
17. I am worried.	1	2	3	4
18. I feel confused.	1	2	3	4
19. I feel steady.	1	2	3	4
20. I feel pleasant.	1	2	3	4

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel.

	Almost Never	**Sometimes**	**Often**	**Almost Always**
21. I feel pleasant.	1	2	3	4
22. I feel nervous and restless.	1	2	3	4
23. I feel satisfied with myself.	1	2	3	4
24. I wish I could be as happy as others seem to be.	1	2	3	4

Appendix I Continued

State-Trait Anxiety Inventory

25. I feel like a failure.	1	2	3	4
26. I feel rested.	1	2	3	4
27. I am "calm, cool, and collected."	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them.	1	2	3	4
29. I worry too much over something that really doesn't matter.	1	2	3	4
30. I am happy.	1	2	3	4
31. I have disturbing thoughts.	1	2	3	4
32. I lack self-confidence.	1	2	3	4
33. I feel secure.	1	2	3	4
34. I make decisions easily.	1	2	3	4
35. I feel inadequate.	1	2	3	4
36. I am content.	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me.	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind.	1	2	3	4
39. I am a steady person.	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests.	1	2	3	4

Appendix J

Generalized Anxiety Disorder Screener

Over the *last 2 weeks*, how often have you been bothered by the following problems? Please circle your answer.	**Not at all**	**Several days**	**More than half the days**	**Nearly every day**
1. Feeling nervous, anxious or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritated	0	1	2	3
7. Feeling afraid as if something awful might happen	0	1	2	3

8. If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?	Not at all difficult Somewhat difficult Very difficult Extremely difficult

Appendix K

Ruminative Responses Scale

People think and do many different things when they feel depressed. Please read each of the items below and indicate whether you almost never, sometimes, often, or almost always think or do each one when you feel down, sad, or depressed. Please indicate what you *generally* do, not what you think you should do.

	Almost never	**Sometimes**	**Often**	**Almost always**
1. Think about how alone you feel.	1	2	3	4
2. Think "I won't be able to do my job if I don't snap out of this".	1	2	3	4
3. Think about your feelings of fatigue and achiness.	1	2	3	4
4. Think about how hard it is to concentrate.	1	2	3	4
5. Think "What am I doing to deserve this?"	1	2	3	4
6. Think about how passive and unmotivated you feel.	1	2	3	4
7. Analyze recent events to try to understand why you are depressed.	1	2	3	4
8. Think about how you don't seem to feel anything anymore.	1	2	3	4
9. Think "Why can't I get going".	1	2	3	4
10. Think "Why do I always react this way?"	1	2	3	4

Appendix K Continued

Ruminative Responses Scale

11. Go away by yourself and think about why you feel this way.	1	2	3	4
12. Write down what you are thinking about and analyze it.	1	2	3	4
13. Think about a recent situation, wishing it had gone better.	1	2	3	4
14. Think "I won't be able to concentrate if I keep feeling this way".	1	2	3	4
15. Think "Why do I have problems other people don't have?"	1	2	3	4
16. Think "Why can't I handle things better?"	1	2	3	4
17. Think about how sad you feel.	1	2	3	4
18. Think about all your shortcomings, failings, faults, mistakes.	1	2	3	4
19. Think about how you don't feel up to doing anything.	1	2	3	4
20. Analyze your personality to try to understand why you are depressed.	1	2	3	4
21. Go someplace alone to think about your feelings.	1	2	3	4
22. Think about how angry you are with yourself.	1	2	3	4

Appendix L

Self Control Scale

Using the scale provided, please indicate how much each of the following statements reflects how you typically are.

	Not at all				Very much
1. I am good at resisting temptation.	1	2	3	4	5
2. I have a hard time breaking bad habits.	1	2	3	4	5
3. I am lazy.	1	2	3	4	5
4. I say inappropriate things.	1	2	3	4	5
5. I never allow myself to lose control.	1	2	3	4	5
6. I do certain things that are bad for me, if they are fun.	1	2	3	4	5
7. People can count on me to keep on schedule.	1	2	3	4	5

Appendix L Continued

Self Control Scale

	Not at all				Very much
8. Getting up in the morning is hard for me.	1	2	3	4	5
9. I have trouble saying no.	1	2	3	4	5
10. I change my mind fairly often.	1	2	3	4	5
11. I blurt out whatever is on my mind.	1	2	3	4	5
12. People would describe me as impulsive.	1	2	3	4	5
13. I refuse things that are bad for me.	1	2	3	4	5
14. I spend too much money.	1	2	3	4	5
15. I keep everything neat.	1	2	3	4	5
16. I am self-indulgent at times.	1	2	3	4	5

Appendix L Continued

Self Control Scale

	Not at all				Very much
17. I wish I had more self-discipline.	1	2	3	4	5
18. I am reliable.	1	2	3	4	5
19. I get carried away by my feelings.	1	2	3	4	5
20. I do many things on the spur of the moment.	1	2	3	4	5
21. I don't keep secrets very well.	1	2	3	4	5
22. People would say that I have iron self- discipline.	1	2	3	4	5
23. I have worked or studied all night at the last minute.	1	2	3	4	5
24. I'm not easily discouraged.	1	2	3	4	5

Appendix L Continued

Self Control Scale

	Not at all				Very much
25. I'd be better off if I stopped to think before acting.	1	2	3	4	5
26. I engage in healthy practices.	1	2	3	4	5
27. I eat healthy foods.	1	2	3	4	5
28. Pleasure and fun sometimes keep me from getting work done.	1	2	3	4	5
29. I have trouble concentrating.	1	2	3	4	5
30. I am able to work effectively toward long-term goals.	1	2	3	4	5
31. Sometimes I can't stop myself from doing something, even if I know it is wrong.	1	2	3	4	5

Appendix L Continued

Self Control Scale

	Not at all				Very much
32. I often act without thinking through all the alternatives.	1	2	3	4	5
33. I lose my temper too easily.	1	2	3	4	5
34. I often interrupt people.	1	2	3	4	5
35. I sometimes drink or use drugs to excess.	1	2	3	4	5
36. I am always on time.	1	2	3	4	5

Appendix M

Demographic Questionnaire

AGE: _____

GENDER: _____

RACE: _____

MAJOR: _____

What is the highest level of education your mother has achieved? (Circle One)

Less than 7th Grade	Junior High School	Some High School	High School Graduate	Some College	4-Year College Degree	Graduate or Professional Degree

What is the highest level of education your father has achieved? (Circle One)

Less than 7th Grade	Junior High School	Some High School	High School Graduate	Some College	4-Year College Degree	Graduate or Professional Degree

Were you born in the United State of America? (Circle One)

YES or NO

If no, how long have you lived in the United State of America? _____

Appendix N

Debriefing Script

Research designs often require that the full intent of the study not be explained prior to participation. The informed consent you filled out at the beginning of the experiment stated that you would complete questionnaires on your experiences and perspective. In actuality, all participants completed questionnaires about their mood.

The present research aims to further investigate cognitive processing in depression. Substantial research has been conducted to examine the cognitive restructuring that occurs with depression including behavioral and neuroimaging research suggesting that individuals with depression process information differently than individuals without depression (Atchley et al., 2012; Beck, 1976; Cavanagh & Geisler, 2005; Foland-Ross & Gotlib, 2012). Further investigation of the cognitive processing differences seen in depression could potentially lead to more effective treatments (Atchley et al., 2012; Foland-Ross & Gotlib, 2012).

Your participation in this study is greatly appreciated. If you have any questions after leaving the lab, please do not hesitate to contact the researcher, Sheila Pugh, at spugh@mail.sfsu.edu or her advisor Professor Mark Geisler at mgeisler@sfsu.edu.

Appendix N Continued

Debriefing Script

If you feel that your participation in this study made you uncomfortable in any way and you want to talk to someone about it, there is counseling available at the SFSU Counseling and Psychological Services Center in the Student Service Building, Room #208; (415) 338- 2208 or on the web at http://www.sfsu.edu/~psyservs/.

If you have any complaints or further concerns regarding this study, you may contact the SFSU Office of Protection for Human and Animal Subjects at (415) 338-1093 or at protocol@sfsu.edu.

Do you allow us to use your data now that you understand the true purpose of this research?

Yes _____ No_____

Appendix O

Mental Health Referrals

SFSU Counseling and Psychological Services Center (415) 338- 2208

SFSU Student Service Building, Room #208, http://www.sfsu.edu/~psyservs/

Access Mental Health Unit (*Referrals available 24 hours a day, by phone)*

San Francisco (415) 255-3737 or East Bay [Alameda County] (800) 491-9099

San Francisco Suicide Prevention 24 Hours (415) 781-0500

Crisis & Suicide Intervention of Alameda County (510) 849-2212

Crisis Support Services of Alameda (800) 309-2131

Contra Costa Crisis Center (800) 833-2900

National Suicide Prevention Lifeline (800) 273-TALK

National HopeLine Network/ National Crisis Hotline (800) SUICIDE