RESPONSES TO POSITIVE AFFECT: AN EXAMINATION OF POSITIVE RUMINATION AND DAMPENING

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ABSTRACT

Responses to Positive Affect: An Examination
of Positive Rumination and Dampening

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Recently, Feldman, Joorman, and Johnson (in press) proposed that differences in the ways individuals respond to positive affect (PA) might impact the length and intensity of PA episodes, perhaps leading to changes in long-term mental and physical health. Feldman et al. (in press) suggested that "positive rumination," repetitive positive self- and symptom-focused responses to positive mood, should enhance PA, whereas "dampening" responses should diminish PA. The Response to Positive Affect Scale (RPA; Feldman et al., in press) was created to measure these constructs. Preliminary research has found that measures of positive rumination and dampening help predict mania and depression symptoms.

The current study examined the convergent and predictive criterion validity, and reliability of the constructs of positive rumination and dampening through a combination cross-sectional, experimental, and naturalistic follow-up design. Temple University undergraduates (Phase I N = 1,281, Phase II N = 181, Phase III N = 154) participated in a three-phase study. In Phase I, participants completed the RPA along with a series of positive and negative health and cognition measures. In Phase II, participants were randomly assigned to one of three mood induction groups (negative, neutral, or positive) and completed a series of affect reports over time. One month later, Phase II participants were asked to report on their affect, physical health, mental health, and intervening life events during Phase III.

As expected, positive rumination and dampening demonstrated convergent and divergent validity. However, the predictive criterion validity results were mixed, with the constructs predicting some, but not all, responses to mood inductions. The naturalistic follow-up demonstrated that positive rumination interacted with positive life events to predict hypothesized changes in psychological health, but not physical health. The test-retest reliability of the RPA was not acceptable for a trait measure.

These results suggest that positive rumination and dampening are important constructs involved in both mental health and illness. Future research should consider alternative strategies for measuring responses to PA, including more realistic experimental paradigms.

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CHAPTER 1

INTRODUCTION

Numerous studies have examined how individuals can exacerbate negative affect (NA) by repetitively focusing on their negative feelings. Indeed, depressive rumination can maintain and even heighten depressed moods (Nolen-Hoeksema, 1987). However, less attention has been paid to individual differences in response to *positive* affect (PA). Certain reactions to PA, like positive rumination (e.g., "thinking about how happy you feel"), may enhance the experience, whereas others (e.g., "I don't deserve this") may dampen PA (Feldman, Joorman, & Johnson, in press). Early cross-sectional research suggests that just as *depressive* rumination in response to NA has an important impact on depression, *positive* rumination may also be relevant to mental illness and health (Feldman et al., in press; Hughes, Smith, & Alloy, 2006; S. L. Johnson, McKenzie, & McMurrich, in press). Given the potential clinical relevance of positive rumination and dampening, the current study aimed to address the validity and reliability of a measure of PA response style, the Response to Positive Affect Scale (RPA; Feldman et al., in press). Furthermore, this study was the first to assess whether individual differences in PA response style: 1) interacted with experimentally-induced PA to produce predictable changes in affect and cognition; and 2) prospectively predicted changes in psychological and physical health functioning in conjunction with intervening positive life events.

Background

Although conceptually related constructs have been examined (e.g., enhancing and hopefulness-supporting attributional styles, Needles & Abramson, 1990; savoring and "kill-joy" thinking, Bryant & Veroff, 2007; and meta-regulation, Mayer & Stevens, 1994; see Hughes, 2007 for a discussion), research focused specifically on positive rumination and dampening is in its infancy. Feldman et al. (in press) defined positive rumination as "the tendency to respond to PA states with recurrent thoughts about positive self-qualities, PA experience, and one's favorable life circumstances" (p. 6 of manuscript). Feldman et al. (in press) defined dampening as "the tendency to respond to positive mood states with mental strategies to reduce the intensity and duration of the positive mood state" (p. 6 of manuscript). Initial studies of the constructs will be described below with a focus on their strengths and limitations.

Luminet, Zech, Rime, and Wagner (2000) cited unpublished work that suggested that although *depressive* rumination is frequently involuntary, people often deliberately engage in rumination on past *positive* events. They argued that such positive rumination might act to maintain positive mood (Luminet et al., 2000). Luminet et al. (2000) asked undergraduates to retrospectively report on their reactions to major positive and negative life events over the past six months. The authors measured rumination by counting the number of times individuals thought about a past event (from "never" to "more than 6 times") in the two-week period after it had occurred. Importantly, Luminet et al. (2000) did not find differences in the extent to which individuals ruminated about positive and negative events. However, they did observe that negative rumination was more uncontrollable and disruptive than positive rumination (Luminet et al., 2000), perhaps because negative rumination was associated with suppression attempts (Erber & Wegner, 1996; Gohm, Isbell, & Wyer Jr., 1996; Gold & Wegner, 1995). Furthermore, Luminet et al. (2000) reported that respondents who were lower in the ability to engage in fantasy were also less likely to report having ruminated on PA. Thus, Luminet et al.'s (2000) cross-sectional findings suggest not only that positive rumination occurs with some frequency, but that there are also individual differences in people's ability to use it as a mood regulation strategy. The study provides an important comparison of rumination on positive versus negative events, suggesting that positive rumination is less destructive than negative rumination. However, the study is limited by its sole use of a convenience sample and retrospective self-report. Moreover, the researchers' definition of positive and negative rumination was based solely on the number of times a person reflected on a specific event. This may not be an appropriate measure of the constructs because it is unclear whether thinking about past events is actually involved in the process of rumination.

Lyubomirsky, Sousa, and Dickerhoof (2006) also conducted research that is relevant to positive rumination and dampening. The researchers noted that previous literature had assessed a variety of ways in which individuals respond to NA, including the benefits of writing (Frattaroli, 2006) and talking about trauma (Nemeroff et al., 2006), as well as the negative consequences of repetitively thinking about *negative* events (Thomsen, 2006). However, Lyubomirsky et al. (2006) argued that there has not been as much interest in directly comparing the effects of writing, talking, and thinking about *positive* moods. Lyubomirsky et al. (2006) predicted that strategies that simply replay a past positive event in memory or in conversation would lead to maintained PA, whereas writing about and analyzing a past positive event would lead to reductions in PA. In short, they argued that the processing elements that help organize and reduce NA would also reduce PA (Lyubomirsky et al., 2006).

Lyubomirsky et al. (2006) completed two studies to directly assess responses to PA. In the first study of PA, participants reported on their life satisfaction, affect, and physical health immediately before, and then four weeks after, a randomly assigned condition in which they either wrote, talked aloud, or thought about one of their most joyful memories for fifteen minutes a day for three days. A comparison group supplied the same pre- and post- measures, without engaging in any assigned condition (Lyubomirsky et al., 2006). Participants in the thinking group had significantly higher improvement on life satisfaction than the writing and talking groups. However, they did not differ from the comparison group on PA, NA, or the health measure (Lyubomirsky et al., 2006). The researchers argued that the null findings for PA might be due to the long four-week interval between measurements. They further argued that given that well-being has a PA component, there is at least some evidence to suggest that thinking about past positive events can lead to beneficial outcomes for PA (Lyubomirsky et al., 2006).

In a second study of PA, Lyubomirsky et al. (2006) wanted to address the means by which different responses to PA could impact the maintenance of positive moods. They compared replaying a positive event to evaluating specific pieces of the event. They predicted that repetitive thinking about a past positive event would lead to better PA, well-being, and physical symptom outcomes than writing an analysis of a past positive event (Lyubomirsky et al., 2006). The researchers randomly assigned participants to one of four conditions in a 2 (thinking versus writing) by 2 (replaying versus analyzing) design. Participants completed measures of long-term PA, well-being, and health at the beginning of the study, engaged in their assigned task for eight minutes a day for 3 days, and then completed post measures of PA, well-being, and health four weeks later. The researchers predicted that the think-and-replay group would have the most benefits, the write-and-analyze group would have the least benefits, and the other two groups would fall in between (Lyubomirsky et al., 2006). The results supported the hypotheses for some of these measures. The think-and-replay group had significantly higher PA than the other groups, but there were no other significant differences with respect to PA (Lyubomirsky et al., 2006). The well-being measures provided mixed support for the hypotheses, with the think-and-replay group having reduced environmental mastery (Lyubomirsky et al., 2006). Finally, the health data also supported some of the study hypotheses, with the write-and-analyze group showing poorer health outcomes than the other three groups combined (Lyubomirsky et al., 2006). The health outcomes for the think-and-replay group did not differ from the other three groups combined, but was marginally higher than the write-and-analyze group (Lyubomirsky et al., 2006). Overall, Lyubomirsky et al. (2006) had some initial support for their hypotheses that repetitive thinking and replaying of positive memories can help maintain PA, whereas organizing information or obtaining a greater sense of meaning about positive events can actually be detrimental to PA.

Although this series of studies has implications for positive rumination research, the experiment manipulated responses to positive *memories*, which are not conceptually equivalent to positive *affect*. Furthermore, a true assessment of the impact of individual differences in positive rumination would need to follow natural positive ruminators and dampeners.

Hughes et al. (2006) created a measure of the extent to which individuals repetitively think about positive moods and events in general. The Euphoric Rumination Questionnaire (ERQ) is a 25-item modified version of a commonly used measure of depressive rumination, the Ruminative Responses Scale (RRS; Nolen-Hoeksema & Morrow, 1991). Existing items from the RRS were modified to have a positive valence. For example, the item, “When you feel down, sad, or depressed you [t]hink about a recent situation, wishing it had gone better” was changed to, “When I am in a good mood, I think about a recent situation, and reflect on how smoothly it went.” The ERQ was examined in two large unselected undergraduate samples (*N*s = 281 and 300, respectively) and was positively correlated with measures of subjective well-being and happiness and was negatively correlated with depression and depressive rumination (Hughes et al., 2006). In a small bipolar sample (*N* = 22; as determined from a self-report questionnaire), the ERQ was positively correlated with subjective well-being and marginally negatively correlated with depression (Hughes et al., 2006). The ERQ had no significant correlations with measures of (hypo)manic symptoms. Hughes and Alloy (2007) gave the ERQ to interviewer-diagnosed bipolar and non-bipolar participants. The ERQ did not significantly differentiate the two groups. Thus, preliminary studies of the ERQ demonstrated initial construct validity as a measure of non-clinical-level positive reflection (Hughes et al., 2006).

Although these findings were encouraging, the ERQ had some psychometric weaknesses that may have been associated with the factor structure of the original depressive rumination questionnaire (Bagby & Parker, 2001; Feldman et al., in press; Hughes et al., 2006; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Although this series of studies improved on the measurement of positive rumination by creating a face-valid questionnaire that was based on a widely-used *depressive* rumination questionnaire

(Nolen-Hoeksema & Morrow, 1991), the study was cross-sectional in nature and used an entirely undergraduate sample.

Feldman et al. (in press) created the Responses to Positive Affect Scale (RPA), also based on Nolen-Hoeksema's (1987) depressive rumination measure. Exploratory (Study 1, $N = 403$) and confirmatory (Study 2, $N = 182$) factor analysis of the RPA revealed and supported, respectively, three factors (Feldman et al., in press). The first subscale, Emotion-Focus positive rumination incorporated items on "mood and somatic experiences" (p. 10 of manuscript; e.g., "notice how you feel full of energy"), Self-Focus positive rumination measured "aspects of self and pursuit of personally-relevant goals" (p. 10 of manuscript; e.g., "I am getting everything done"), and Dampening "contained items reflecting thoughts that would likely dampen positive moods" (p. 10 of manuscript; "this is too good to be true"; Feldman et al., in press).

In Study 2, Feldman et al. (in press) examined the RPA's internal consistency and convergent validity with measures of self-esteem, depressive rumination, depression symptoms, mania symptoms, and manic vulnerability. Correlational analyses revealed that the Emotion-Focus RPA subscale was significantly positively correlated with manic symptoms ($r = .19$), mania vulnerability ($r = .30$), depressive rumination reflection (the "healthy form of depressive rumination"; $r = .34$), depressive rumination brooding ($r = .27$), and self-esteem ($r = .19$; Feldman et al., in press). The Self-Focus RPA subscale was significantly negatively correlated with depressive symptoms ($r = .15$) and positively correlated with manic symptoms ($r = .25$), mania vulnerability ($r = .16$), and self-esteem ($r = .20$; Feldman et al., in press). The dampening RPA subscale was significantly positively correlated with depressive symptoms ($r = .40$), depressive rumination reflection ($r = .44$), depressive rumination brooding ($r = .60$), and manic vulnerability ($r = .28$), and negatively correlated with self-esteem ($r = -.35$; Feldman et al., in press). In hierarchical regression analyses, emotion-focus positive rumination was a significant negative predictor of depression symptoms, dampening was a significant positive predictor of depression symptoms, and self-focus positive rumination was a significant positive predictor of mania symptoms (Feldman et al., in press).

These preliminary findings are mixed as to the extent that focusing on positive mood and events is good for mental health (Feldman et al., in press). Despite the findings of Hughes et al. (2006) that positive rumination is associated with healthy levels of PA, Feldman et al. (in press) found that positive rumination is associated with indicators of mania. Given the seemingly beneficial association between positive rumination and higher self-esteem and less depression, it will be important to determine if positive rumination does, indeed, have the potential to drive individuals overboard into symptoms of mania. The findings of Feldman et al. (in press) related to dampening were more transparent, demonstrating that dampening is associated with depressive rumination and negative mood symptoms. Although the RPA was psychometrically superior to the ERQ, the study was similarly limited in design and generalizability.

S. L. Johnson et al. (in press) utilized the RPA in a clinical sample. The authors recruited undergraduates with a history of bipolar disorder ($n = 28$) or major depressive disorder ($n = 35$). Healthy controls ($n = 44$) were assessed as a comparison group. Across all three participant groups, self-focused positive rumination was significantly correlated with current manic symptoms ($r = .22$). Emotion-focused positive rumination was significantly correlated with current manic symptoms ($r = .33$) and all three subscales of depressive rumination (*r* = .20 for brooding, *r* = .32 for depression, *r* = .40 for reflection; S. L. Johnson et al., in press). Dampening was significantly related to depression symptoms (*r* = .44) and the three depressive rumination scales (*r*= .44 for brooding, *r* = .30 for depression, *r* = .22 for reflection). Although neither positive rumination subscale was related to depression scores or diagnoses, emotion-focused positive rumination was endorsed more in individuals with a history of mania than those without such a history (S. L. Johnson et al., in press). However, current manic symptoms accounted for this difference (S. L. Johnson et al., in press). Thus, current experience of high levels of PA may impact the use of strategies involved in maintaining such affect. In the case of mania, positive rumination may then act as a dangerous upward spiral into increasingly more positive affect. Thus, positive rumination may be useful in maintaining appropriate levels of PA, but be less healthy in individuals with dysregulated PA. Although this study is the first to examine the RPA in an interviewer-diagnosed clinical sample, it is limited by its use of a cross-sectional design (S. L. Johnson et al., in press).

Thus far, initial research on the RPA has found it to be a promising measure of responses to PA in cross-sectional studies of both unselected and clinical samples. It appears to add useful information above and beyond a measure of depressive rumination in cross-sectional prediction of depression and manic symptoms (Feldman et al., in press). Previous research is limited by its reliance on cross-sectional strategies. Thus, experimental and longitudinal research is needed to more fully understand how individual differences in responding to PA can impact short-term mood and long-term mental health.

Methodological Considerations

Before presenting the specific aims of the current study, it is necessary to address some methodological considerations in measuring PA. The debate on the precise structure of emotion is highly relevant to its measurement (Diener, 1999). Unfortunately, no simple theory has been able to explain the relationship of both positive and negative emotions across all cultures at all measurement time points. However, some researchers have pointed out that such a theory may not be necessary to effectively conduct research on emotions (e.g., Kahneman, 2003; Lucas, Diener, Larsen, Lopez, & Snyder, 2003). Lucas et al. (2003), for example, argued that researchers should focus on selecting measures that best address the specific goals of their hypotheses, focusing on answering questions about the precise structure of emotion only if that is an important component of their research question. Fredrickson's (1998) “broaden-and-build” theory of positive emotions has provided early evidence that positive emotions lead to broadening of cognition and behavior. Thus, the impact of response styles on moment-by-moment experienced PA was the central question of this study. The current study addressed this aim by utilizing three methods of affect measurement: cued-report of general affect valence and intensity, implicit measures of affect via performance on three cognitive tasks, and retrospective report of specific emotions. The use of multiple methods of measurement is recommended by affect researchers and is considered a particular strength of the current research design (Green, Goldman, & Salovey, 1993; Isen & Erez, 2007; Lucas et al., 2003; Ryff & Singer, 2003).

The primary affect measurement was a simple two-dimensional affect valence (negative to positive) and intensity (low arousal to high arousal) cued-response grid (Russell, Weiss, & Mendelsohn, 1989), completed once before and four times after a mood induction. Schooler, Ariely, and Loewenstein (2003) noted that making quick gut judgments about hedonic experience leads to better assessments of current affect than spending time introspecting and evaluating. This simple, quick report strategy was able to easily capture gut reactions without demanding distracting introspection. By taking multiple cued-recall measures of PA over time, this study allowed for measurement of both the intensity and duration of PA. Research has shown that taking multiple cued reports of affect does not significantly impact emotional experience (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Furthermore, multiple cued-recall measurements are strongly correlated with continuous rating dial measurements (*r*s = .80, .73; Mauss et al., 2005).

The secondary affect measurement was participants' performance on three simple cognitive tasks. Differences in cognitive processing between individuals in positive versus negative moods can be used to measure affect implicitly (for a discussion, see Isen & Erez, 2007) and mounting evidence indicates that cognitive processing variables can be useful supplemental measures of affect (Davey, Bickerstaffe, & MacDonald, 2006; Fredrickson & Branigan, 2005; Halberstadt, Niedenthal, & Kushner, 1995; Isen, Labroo, & Durlach, 2004; Mathews, Richards, & Eysenck, 1989; Rusting, 1999). In the current study, simple tasks were selected, as opposed to more cognitively difficult memory tasks (which have demonstrated less consistency; Rusting, 1998), in order to minimize cognitive load and reduce the likelihood of interfering with the participants' natural affective experience (Erber & Tesser, 1992). Furthermore, the cognitive tasks provided a useful cover story for the study, so that participants were not as focused on their affect (Schooler et al., 2003).

The final affect measurement was retrospective specific emotion reports. Obtaining these reports enabled several interesting comparisons. Researchers have argued that individuals may not utilize their moment-by-moment experiences as their reference point for making judgments of their overall happiness (Schooler et al., 2003; Watson, 2000). For example, the peak-and-end rule suggests that in many situations, individuals rate the global impact of an event based on the peak intensity of the experience and its end, thus largely ignoring the duration of the experienced affect (for a review, see Fredrickson, 2000). However, others suggest that the length of time a person experiences an emotion, not its intensity, is of utmost importance to overall happiness (Diener, Sandvik, & Pavot, 1991; Lucas et al., 2003). This study enabled an examination of the coherence between measures of explicit moment-by-moment affect, implicit affect, and explicit retrospective report.

The use of physiological measurements of affect is a growing area of research. Neuroimaging and examinations of cardiovascular blood flow, changes in facial expression, eye-blink response, and electrical brain activity can all provide useful information on the body's experience of affect. Mauss et al. (2005) examined self-reported experienced affect (continuous rating dial versus repeated cued responses), behavioral responses (facial response), and physiological measures (cardiovascular activation, skin conductance level, and somatic activity) in response to amusing and sad film clips in female undergraduates. Reported emotional experience of amusement and sadness were significantly correlated with facial behavioral response to the stimuli (*r*s = .73, .74). However, the relationships between experienced emotion and physiological response were smaller (for amusement, experienced emotion correlated with a variety of physiological measures ranging from .22 to .51; for sadness, experienced emotion was not correlated with cardiovascular or somatic activation; Mauss et al., 2005). Given the fact that Mauss et al. (2005) argued that self-reported emotion reports were "valid and accurate" measures of affective experience over time (p. 185) and that the goal of this study was to measure experienced affect, psychophysiological measurements were not included.

The Current Study

The current study examined the reliability and the construct and predictive validity of the RPA. The study utilized a three-phase design to achieve this aim. In Phase I, participants completed the RPA and other related measures. This allowed for tests of convergent and divergent validity with other measures, including NA, depression, behavioral inhibition, depressive rumination, PA, manic symptoms, subjective happiness, subjective well-being, self-esteem, behavioral activation, and optimism. In Phase II, participants were invited to the laboratory and randomly assigned to one of three mood induction groups: positive, neutral, or negative mood induction. This allowed for the first examination of how individual differences in RPA (measured at Phase I) predicted actual affective response to positive mood at Phase II. Phase II also allowed for a test of the interaction between trait response style and state mood on cognitive performance, a question that Rusting (1998) suggested is often understudied.

Phase III of the study was a one-month naturalistic longitudinal follow-up designed to examine whether individual differences in positive rumination (measured at Phase I) moderated the impact of intervening positive life events (measured at Phase III) on changes in psychological and physical health symptoms (measured at Phases I and III). Phase III also allowed for an assessment of the test-retest reliability of the RPA.

Hypotheses

Primary Aim

The primary aim of this study was to assess the validity and reliability of the RPA, a measure of two types of responses to PA: positive rumination and dampening.

Phase I Convergent Validity Hypotheses

1) Hypothesis 1 aimed to examine the validity of positive rumination and dampening by assessing their relationships with other related constructs.

a) We expected a significant negative relationship between self-reported emotion-focused positive rumination and concurrent reports of negative affect, depression, and behavioral inhibition.

b) We expected a significant positive relationship between self-reported emotion-focused positive rumination and concurrent reports of positive affect, manic symptoms, ruminative reflection, ruminative brooding, subjective happiness, subjective well-being, self-esteem, behavioral activation (reward responsiveness, drive, and fun-seeking), and optimism.

c) We expected a significant negative relationship between self-reported self-focused positive rumination and concurrent reports of negative affect, depression, and behavioral inhibition.

d) We expected a significant positive relationship between self-reported self-focused positive rumination and concurrent reports of positive affect, manic symptoms, ruminative reflection, ruminative brooding, subjective happiness, subjective well-being, self-esteem, behavioral activation (reward responsiveness, drive, and fun-seeking), and optimism.

e) We expected a significant positive relationship between self-reported dampening and concurrent reports of negative affect, depression, mania symptoms, depressive rumination (reflection and brooding), and behavioral inhibition.

f) We expected a significant negative relationship between self-reported dampening and concurrent reports of positive affect, subjective happiness, subjective well-being, self-esteem, behavioral activation (reward responsiveness, drive, and fun-seeking), and optimism.

Phase II Predictive Criterion Validity Hypotheses

2) Hypothesis 2 aimed to examine the ability of the three RPA scales to prospectively predict individual differences in affective responses to a positive mood induction at Phase II, but not to negative or neutral mood inductions.

a) We expected participants high in self-reported emotion-focused positive rumination at Phase I to demonstrate slower reductions in induced Phase II PA in comparison to individuals low in emotion-focused positive rumination (as measured by the within-participant slope of affect change over time).

b) We expected participants high in self-reported self-focused positive rumination at Phase I to demonstrate slower reductions in induced Phase II PA in comparison to individuals low in self-focused positive rumination (as measured by the within-participant slope of affect change over time).

c) We expected participants high in self-reported dampening at Phase I to demonstrate faster reductions in induced Phase II PA in comparison to individuals low in dampening (as measured by the within-participant slope of affect change over time).

d) We expected that emotion-focused positive rumination would not predict change in affect after a neutral or negative mood induction.

e) We expected that self-focused positive rumination would not predict change in affect after a neutral or negative mood induction.

f) We expected that dampening would not predict change in affect after a neutral or negative mood induction.

3) Hypothesis 3 examined the ability of the three RPA scales measured at Phase I to prospectively predict individual differences in cognitive responses to positive mood inductions at Phase II.

a) We expected participants high in self-reported emotion-focused positive rumination at Phase I to report having engaged in significantly more positive rumination and to have experienced more positive automatic thoughts in response to a PA induction than participants who reported low emotion-focused positive rumination at Phase I. To demonstrate specificity to positive cognitive responses, we expected the Emotion-Focus scale would not be correlated with negative automatic thoughts.

b) We expected participants high in self-reported self-focused positive rumination at Phase I to report having engaged in significantly more positive rumination and to have experienced more positive automatic thoughts in response to a PA induction than participants who reported low self-focused positive rumination at Phase I. To demonstrate specificity to positive cognitive responses, we expected the Self-Focus scale would not be correlated with negative automatic thoughts.

c) We expected participants high in self-reported dampening at Phase I to report having engaged in significantly more dampening and to have experienced more negative automatic thoughts in response to a Phase II PA induction than participants who reported low dampening at Phase I. To demonstrate specificity to negative cognitive responses, we expected the Dampening scale would not be correlated with positive automatic thoughts.

Phase III Predictive Criterion Validity Hypotheses

4) Hypothesis 4 examined the extent to which positive rumination moderated the impact of positive life events on psychological health outcomes at Phase III. Specifically, we expected self-reported positive rumination measured at Phase I to moderate the impact of intervening positive life events (measured at Phase III) on psychological measures (measured at Phases I and III).

5) Hypothesis 5 examined the extent to which positive rumination measured at Phase I moderated the impact of positive life events on physical health outcomes at Phase III. Specifically, self-reported positive rumination measured at Phase I was expected to moderate the impact of intervening positive life events (measured at Phase III) on physical health (measured at Phase I and Phase III).

Phase III Test-Retest Reliability Hypotheses

6) Hypothesis 6 assessed the test-retest reliability of the RPA.

a) We expected emotion-focused positive rumination at Phase I to be significantly positively correlated with emotion-focused positive rumination at Phase III.

b) We expected self-focused positive rumination at Phase I to be significantly positively correlated with self-focused positive rumination at Phase III.

c) We expected composite positive rumination at Phase I to be significantly positively correlated with composite positive rumination at Phase III.

d) We expected self-reported dampening at Phase I to be significantly positively correlated with self-reported dampening at Phase III.

Secondary Aims

The study also addressed two important areas of debate in the literature: the validity of affect measurement and the extent to which traits interact with state mood to impact cognition.

Phase II Mood Measurement Hypothesis

7) Hypothesis 7 examined the extent to which three types of affect ratings correlated with each other within individuals.

a) We expected the average of the four post-induction cued affect ratings, the two retrospective mood measures, and the three cognitive tasks to be positively correlated with each other within individuals.

Phase II State-Trait Interaction Hypotheses

8) Hypothesis 8 tested Rusting's (1998) suggestion that traits and current mood state interact to impact cognitive processing. In this study, the impact of the interaction between trait responses to affect (positive rumination and dampening) and current mood state was examined in relation to three cognitive outcome tasks.

a) *Main effect mood induction.* We expected individuals in the positive mood induction to have more positive bias on three cognitive tasks in comparison to individuals in the neutral condition. Individuals in the negative mood induction were expected to have less positive bias on three cognitive tasks in comparison to individuals in the neutral condition.

b) *Main effect trait.* We expected individuals higher on composite positive rumination to have more positive bias on three cognitive tasks in comparison to individuals lower on composite positive rumination.

c) *Interaction.* We expected positive rumination to have an especially strong impact on positive bias on the three cognitive tasks in the PA condition.

d) *Main effect trait.* We expected individuals higher on self-reported dampening to have less positive bias on three cognitive tasks in comparison to individuals lower on dampening.

e) *Interaction.* We expected dampening to have an especially strong impact on positive bias on the three cognitive tasks in the PA condition.

CHAPTER 2

METHOD

Participants

Participants in this three-phase study were recruited from the Temple University undergraduate research pool and the Temple University undergraduate population at large. See Tables 1 and 2 for a summary of the continuous and categorical demographic characteristics of the participants in each phase of the study. In Phase I ($N = 1{,}281$), participants were an average of 19.36 years old, 74.8% female, 63.5% Caucasian, and 16.0% African American. In Phase II ($N = 181$), participants were an average of 19.04 years old, 61.3% female, 61.3% Caucasian, and 9.9% African American. In Phase III ($N = 154$), participants were an average of 19.05 years old, 64.3% female, 72.1% Caucasian, and 11.0% African American.

Measures

Contact Information

A brief *Contact Information Questionnaire* was used to obtain the telephone number, email address, and mailing address of Phase I participants. This information was used for recruitment to Phases II and III of the study and was stored in compliance with HIPAA regulations.

Demographic Information

A *Demographic Questionnaire* was used to assess the gender, age, ethnicity, native language, and socioeconomic status of the sample. This information was used to determine the generalizability of the sample.

Table 1. Means and Standard Deviations for Continuous Phase I Variables

	Phase I Only				Phase I & II Completers[c]		Phase I, II, & III Completers[d]	
	Phase II Eligible[a] n = 970		Phase II Ineligible[b] n = 130		n = 181		n = 154	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	19.41_a	2.50	19.51_a	2.44	19.04_a	1.45	19.05_a	1.49
SES	15.56_a	4.44	15.13_a	4.62	15.94_a	4.03	15.74_a	4.16
Emotion-focus	13.56_a	3.12	13.16_a	3.11	13.69_a	3.01	13.59_a	3.02
Self-focus	9.86_a	2.71	9.38_a	2.89	10.10_a	2.96	10.05_a	2.97
Composite PR	23.42_a	5.33	22.55_a	5.39	23.79_a	5.44	23.64_a	5.46
Dampening	14.11_a	4.42	18.44_b	5.31	13.62_a	4.25	13.55_a	4.36
BDI-II at PI	8.66_a	7.00	27.80_b	13.54	8.83_a	6.68	8.65_a	6.77
Negative affect	17.88_a	6.70	26.43_b	9.60	16.92_a	5.83	16.95_a	5.77
Behavioral inhibition	20.29_a	3.13	21.52_b	3.48	20.08_a	3.34	20.14_a	3.39
Manic symptoms	4.82_a	3.74	4.78_a	3.56	4.92_a	3.90	4.80_a	3.83
Reflection	9.84_a	3.28	12.11_b	3.83	9.94_a	3.55	9.78_a	3.63
Brooding	10.92_a	3.38	13.61_b	3.72	10.75_a	3.58	10.47_a	3.53

Table 1. (continued)

	Phase I Only				Phase I & II Completers[c]		Phase I, II, & III Completers[d]	
	Phase II Eligible[a] n = 970		Phase II Ineligible[b] n = 130		n = 181		n = 154	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Positive affect	28.33_a	8.54	24.29_b	7.70	29.41_a	8.99	29.66_a	9.06
Subjective happiness	19.46_a	4.47	14.56_b	5.63	19.51_a	4.61	19.57_a	4.57
Subjective well-being	23.15_a	6.15	16.82_b	6.23	23.04_a	6.52	23.27_a	6.43
Self-esteem	20.05_a	4.67	14.26_b	5.09	20.39_a	4.92	20.43_a	5.00
Reward responsive	16.09_a	1.98	15.33_b	2.32	16.31_a	2.00	16.29_a	2.03
Drive	10.51_a	2.06	9.81_b	2.24	10.53_a	2.15	10.54_a	2.16
Fun-seeking	11.58_a	1.89	10.79_b	2.22	11.70_a	2.04	11.50_a	1.98
Optimism	13.88_a	3.91	9.95_b	4.62	14.13_a	3.76	14.14_a	3.78

Note. SES = socioeconomic status composite. PR = positive rumination. PI = Phase I. Responsive = responsiveness.

The data are split into four columns based on the furthest point participants completed in the study and the reasons for their early discontinuation. Means in the same row that share a subscript with the first column do not significantly differ (based on a $p < .05$ Tukey HSD comparison) from the Phase II eligible Phase I completers. Please note that there is overlap between the participants in columns 3 and 4, so analyses were completed separately to preserve independent groups.

[a] Phase I completers who were eligible for Phase II but did not go on to complete Phase II (because they were not invited or due to attrition). [b] Phase I completers who were not eligible for Phase II because of high depression scores, pilot study participation, or missing data. [c] Participants who completed Phases I and II, including 27 who attrited prior to completing Phase III. [d] Participants who completed Phases I, II, and III.

Table 2. Sample Size and Percentages for Categorical Demographic Variables

Variable	Phase I Only: Phase II Eligible[a] *n*	%	Phase I Only: Phase II Ineligible[b] *n*	%	Phase I & II Completers[c] *n*	%	Phase I, II, & III Completers[d] *n*	%
N	970	100.0	130	100.0	181	100.0	154	100.0
Female	745	77.2_a	102	81.0_a	111	61.3_b	99	64.3_b
Caucasian	605	62.4_a	75	57.7_a	133	73.5_b	111	72.1_b
African Amer	166	17.1_a	21	16.2_a	18	9.9_b	17	11.0_b
East Asian	69	7.1_a	11	8.5_a	13	7.2_a	13	8.4_a
South Asian	41	4.2_a	5	3.8_a	6	3.3_a	6	3.9_a
Latino/Hisp	34	3.5	4	3.1[e]	4	2.2[e]	2	1.3[e]
Pacific Isl or Nat Hawaiian	10	1.0	0	0.0[e]	0	0.0[e]	0	0.0[e]
Other/Missing	45	4.6_a	14	10.8_a	7	3.9_a	5	3.2_a

Note. Amer = American. Hisp = Hispanic. Isl = Islander. Nat = Native.

The data are split into four columns based on the furthest point participants completed in the study and the reasons for their early discontinuation. Means in the same row that share a subscript with the first column do not significantly differ (based on Chi Square tests) from the Phase II eligible Phase I completers. Please note that there is overlap between the participants in columns 3 and 4, so analyses were completed separately to preserve independent groups.

[a] Phase I completers who were eligible for Phase II but did not go on to complete Phase II (because they were not invited or due to attrition). [b] Phase I completers who were not eligible for Phase II because of high depression scores, pilot study participation, or missing data. [c] Participants who completed Phases I and II, including 27 who attrited prior to completing Phase III. [d] Participants who completed Phases I, II, and III.
[e] Observed frequency is below 5, so the chi-square test cannot be performed.

Current Affect

The *Affect Grid* (Russell et al., 1989) is a one-item measure of the valence and arousal of an individual's current affect. The Affect Grid is a 9 X 9 grid on which participants selected the one box that best fit the valence of their current affect from "extremely unpleasant" to "extremely pleasant" and their current arousal level from "extreme sleepiness" to "extremely high arousal" (Russell et al., 1989). Higher scores are associated with higher reported valence or arousal. In addition to demonstrating strong validity in undergraduate samples (Russell et al., 1989), Kahneman (2003) argued that the grid is an excellent way to measure changes in moment-by-moment affect and has been particularly useful in a variety of studies as a simple, unobtrusive mood manipulation check (e.g., Herz, Schankler, & Beland, 2004). The Affect Grid used in this study was adapted slightly by K. J. Johnson and Fredrickson (2005) for clarity.

Retrospective Affect

The *Feelings Report* (K. J. Johnson & Fredrickson, 2005) is a 20-item questionnaire used to assess the extent to which an individual experienced a variety of emotions during the experimental portion of the study. Participants recorded a score from "0-None" to "8-A great deal" for positive (e.g., amusement), negative (e.g., anger), and neutral emotions (e.g., surprise; K. J. Johnson & Fredrickson, 2005). The questionnaire instructions were adapted from Ekman, Friesen, and Ancoli (1980) for this experiment to assess the relevant time frame (e.g., "Please respond by noting how strongly you experienced each emotion in the time since you watched the film clip"). Higher scores on each item indicated higher reported emotion. Retrospective emotion reports are sensitive to change and have been used widely as an assessment of mood induction success in experimental studies (e.g., Fredrickson & Levenson, 1998).

The *Positive and Negative Affect Schedule* (PANAS; Watson, Clark, & Tellegen, 1988) is a 20-item self-report scale of current emotional state. The PANAS is designed to be flexible in relation to time scale, and this study utilized both the "moment" ("you feel this way right now, that is, at the present moment") and the "past few days" version ("you have felt this way during the past few days"). Participants recorded the extent to which they had been experiencing each of 20 emotions (e.g., "interested" and "afraid") over the time period denoted. Responses were recorded based on a 5-point Likert scale that ranged from "1-very slightly or not at all" to "5-extremely" (Watson et al., 1988). Scores were computed for both positive and negative scales by summing the individual's Likert scores for the items in each scale.

The PANAS has been validated for use with undergraduate and community-member samples and has demonstrated high internal consistency, test-retest reliability, and construct validity (Crawford & Henry, 2004; Watson et al., 1988). The PANAS was used in this study as an index of positive and negative emotional experience in the current moment and over the past few days.

Mental Illness

The *Beck Depression Inventory-II* (BDI-II; Beck, Steer, & Brown, 1996) is a 21-item self-report questionnaire used to assess the psychological and somatic symptoms of depression. Participants selected one of four statements in an item that best described how they had been feeling in the past week (e.g., "0-I do not feel sad," "1-I feel sad much of the time," "2-I am sad all of the time," and "3-I am so sad or unhappy that I can't stand it”). An overall score was obtained by summing the individual scores for each of the 21 items, with higher scores suggesting more depressive symptomatology. The BDI-II is a revision of the BDI, a widely used self-report instrument that has been extensively validated (Snaith & Taylor, 1985). The BDI-II has demonstrated strong psychometric properties in both paper-and-pencil (Steer, Ball, Ranieri, & Beck, 1997; Steer, Brown, Beck, & Sanderson, 2001; Whisman, Perez, & Ramel, 2000) and computerized (Schulenberg & Yutrzenka, 2001) versions. It was used in this study as an index of the participants’ current level of dysphoria.

The *Altman Self-Rating Scale for Mania* (ASRM; Altman, Hedeker, Peterson, & Davis, 1997) is a five-item self-report questionnaire used to assess current manic symptoms. Participants indicated how they had been feeling over the past week by selecting one of five options for each question (e.g., “0- I do not feel happier or more cheerful than usual,” “1-I occasionally feel happier or more cheerful than usual,” “2-I often feel happier or more cheerful than usual,” “3-I feel happier or more cheerful than usual most of the time,” or “4-I feel happier or more cheerful than usual all of the time”). A score was obtained by summing the responses to the five questions, with higher scores indicating more symptoms. The ASRM has demonstrated strong psychometric properties in a variety of samples (Altman et al., 1997; Farmer et al., 2006; Meyer, Beevers, & Johnson, 2004) and was used in both previous RPA studies (Feldman et al., in press; S. L. Johnson et al., in press). The ASRM was used in this study as an index of the extent to which an individual was experiencing symptoms of mania.

Mental Health

The ***Subjective Happiness Scale*** (SHS; Lyubomirsky & Lepper, 1999) is a four-item self-report measure used to assess trait global subjective happiness. Participants responded to the questions on a 7-point Likert scale. For example, the question, “In general, I consider myself…” would be answered with a scale from “1-not a very happy person” to “7-a very happy person.” Scores were obtained by first reverse-coding a negatively-valenced item and then summing the four scores. Higher scores indicated more reported happiness. An extensive validation study demonstrated strong psychometric properties for the SHS across a variety of age group and cultural samples (Lyubomirsky & Lepper, 1999). The SHS was used in this study as a trait measure of positive affectivity.

The *Satisfaction with Life Scale* (SWLS; Diener, Emmons, Larsen, & Griffin, 1985) is a five-item self-report questionnaire used to assess subjective well-being. The items (e.g., “I am satisfied with my life”) were answered on a 7-point Likert scale ranging from “1-strongly disagree” to “7-strongly agree.” The SWLS examines general well-being, not focused on any particular life domain. Scores were obtained by summing the individual responses on the SWLS with higher scores indicating higher well-being. The initial validation study of the SWLS included both undergraduates and older adults (Diener et al., 1985). More recent research has validated the SWLS in samples across the globe (see Pavot & Diener, 1993 for a review). In this study, it was used as an index of global subjective well-being.

Responses to Positive and Negative Affect

The Responses to Positive Affect Scale (RPA; Feldman et al., in press) is a 17-item self-report measure used to assess the thoughts people have and strategies that they use when they are feeling happy. Exploratory and confirmatory factor analyses found that the questionnaire has three subscales that correspond to both PA maintaining (emotion-focused positive rumination and self-focused positive rumination) and PA reducing (dampening) strategies (Feldman et al., in press). Participants responded to each item ("when you are feeling happy, how often do you…") on a 4-point Likert scale of "1-almost never" to "4-almost always." An example of an emotion-focused item is, "notice how you feel full of energy," a self-focused item is, "think about how proud you are of yourself," and a dampening item is, "think about things that could go wrong." Total scores were obtained by summing the individual responses for each of the three subscales with higher scores suggesting a higher use of the strategy.

As reported in the background section, the RPA has been used in two large unselected undergraduate samples (Feldman et al., in press) as well as in a clinical undergraduate sample diagnosed with bipolar disorder, major depressive disorder, or no mood disorder (S. L. Johnson et al., in press). In unselected Sample 1, the three RPA scales demonstrated relatively low internal consistency (α = .76, .72, .73 for emotion-focus, self-focus, and dampening, respectively). However, the small number of items per factor is probably related to this finding. The factor structure of the scale has been assessed. In both unselected Sample 1 and the clinical undergraduate sample, the two positive response factors, emotion-focus and self-focus, were strongly correlated with each other (r = .50, r = .59), whereas they were not correlated with the dampening factor (*r*s = .03, .06, respectively for the unselected sample; *r*s = .08, .19, respectively for the clinical sample; Feldman et al., in press; S. L. Johnson et al., in press). All samples were cross-sectional, so there is no test-retest reliability information for this measure.

Providing discriminant and convergent validity, dampening was negatively correlated with self-esteem (*r* = -.35) and positively correlated with mania vulnerability (*r* = .28) in unselected Sample 2 and positively correlated with depression symptoms in both unselected Sample 2 (*r* = .40; Feldman et al., in press) and the clinical sample (*r* = .44; S. L. Johnson et al., in press). Convergent validity was also assessed for the self-focused and emotion-focused scales. In unselected Sample 2, both scales were positively correlated with self-esteem (*r*s = .20, .19, respectively), manic symptoms (*r*s = .25, .19, respectively), and mania vulnerability (*r*s = .16, .30, respectively; Feldman et al., in press). In the clinical sample, both emotion-focused and self-focused scales were associated with current manic symptoms (*r*s = .33, .22, respectively; S. L. Johnson et al., in press). The emotion-focused scale, but not the self-focused scale was associated with a lifetime diagnosis of mania (S. L. Johnson et al., in press).

To address incremental validity, the RPA subscales, which measure responses to *positive* affect, were regressed with symptom outcomes to determine if they could provide additional predictive power above and beyond a common measure of one's likelihood to ruminate in response to *negative* events (Feldman et al., in press). After controlling for their likelihood to engage in depressive brooding rumination, the RPA accounted for an additional 10% of the variance in predicting to depression and 8% of the variance in predicting to manic symptoms (Feldman et al., in press). The RPA was used in the proposed study as an index of the extent to which individuals engage in emotion-focused, self-focused, and dampening responses to PA.

The *Reflection and Brooding Subscales of the Ruminative Responses Scale* (RRS-R and RRS-B; Treynor et al., 2003) are two five-item self-report questionnaires that measure the extent to which a person engages in neutrally-focused introspection and "moody pondering," respectively, in response to depressed mood. The full-scale RRS has demonstrated validity and reliability (Bagby, Rector, Bacchiochi, & McBride, 2004; Nolen-Hoeksema & Davis, 1999; Thomsen, 2006). However, Treynor et al. (2003) argued that the full-scale RRS is contaminated by measures of depression symptoms, instead of being focused solely on *responses* to depressed affect. Therefore, the researchers completed an exploratory factor analysis, which revealed the more appropriate RRS-R and RRS-B factors (Treynor et al., 2003). RRS-R items (e.g., "Analyze recent events to try to understand why you are depressed") and RRS-B items (e.g., "Think about a recent situation, wishing it had gone better") are answered on a 4-point Likert scale of '1-almost never' to '4-almost always' (Treynor et al., 2003). Scores for the two scales were summed, with higher scores revealing greater engagement in that response style.

The psychometric properties of the two scales were demonstrated in a large community sample (Treynor et al., 2003) and a clinical sample (Joormann, Dkane, & Gotlib, 2006; see Thomsen, 2006 for a review). The RRS-R and RRS-B were used in this study as an index of an individual's tendency to engage in healthy and unhealthy responses to NA.

Traits

The *Rosenberg Self-Esteem Scale* (RSES; Rosenberg, 1989) is a 10-item self-report questionnaire used to assess global perceived self-worth. The scale includes positively- (e.g., "On the whole I am satisfied with myself") and negatively-valenced (e.g., "I do not have much to be proud of") items that were answered on a four-point scale ranging from "strongly agree" to "strongly disagree." Although the questionnaire originally utilized dichotomous scaling, more recent use of the questionnaire has simply summed the items (accounting for reverse scoring) to obtain a total score, with higher scores indicating higher self-esteem (Tomas & Oliver, 1999). The RSES has demonstrated strong construct validity and reliability in a variety of samples (Griffiths et al., 1999; Schimmack & Diener, 2003; Schmitt & Allik, 2005), and a computerized version has been validated as well (Vispoel, Boo, & Bleiler, 2001).

The *Behavioral Inhibition System and Behavioral Activation System Scales* (BIS/BAS; Carver & White, 1994) consist of 20 items that measure an individual's tendency to avoid punishment and to seek rewards. The questionnaire includes four subscales, BIS (e.g., "I worry about making mistakes"), BAS Reward Responsiveness (BAS-RR; e.g., "When I get something I want, I feel excited and energized"), BAS Drive (BAS-D; e.g., "I go out of my way to get things I want"), and BAS Fun Seeking (BAS-FS; e.g., "I crave excitement and new sensations"). Items were recorded on a 4-point Likert scale ranging from "1-strongly disagree" to "4-strongly agree." To determine the four subscale scores, items for the individual scales are summed (taking reverse-scored items into account). Higher scores on the subscales indicate higher endorsement of each motivation type. The strong psychometric properties of the BIS/BAS scales have been demonstrated in several research studies (Carver & White, 1994; Cooper, Gomez, & Aucote, 2007; A. Gomez & Gomez, 2002). The BIS/BAS scales are widely used in undergraduate populations and were used in this study as an index of motivation to avoid punishment and seek reward.

The *Revised Life Orientation Test* (LOT-R; Scheier, Carver, & Bridges, 1994) is a six-item scale (with four additional filler items) used to assess dispositional optimism. Items include, "In uncertain times, I usually expect the best" and are rated on a 5-point Likert scale from "0-strongly disagree" to "4-strongly agree" (Scheier et al., 1994). Scores are obtained by summing the responses on three positively- and three negatively-valenced items. The LOT-R has been validated for use across a range of age and health groups as well as in undergraduate samples (Herzberg, Glaesmer, & Hoyer, 2006; Scheier et al., 1994; Segerstrom, 2007). The LOT-R was used in this study as an index of trait optimism.

Cognitive Process Measures

The *Shortened Version of the Automatic Thoughts Questionnaire* (ATQ-S; Netemeyer et al., 2002) is a 15-item revised version of the widely-used original self-report questionnaire (Hollon & Kendall, 1980). The ATQ-S is used to measure the frequency an individual engages in negative thinking. Items include "There must be something wrong with me" and are rated on a 5-point Likert scale from "1-Not at all" to "5-All the time" (Netemeyer et al., 2002). A total score was obtained by summing the individual items, with higher scores indicating a more depressive thinking style.

Although the original ATQ demonstrated good psychometric properties overall (Calvete & Connor-Smith, 2005; Dozois, 2007; Kazdin, 1990), especially in its ability to differentiate depressed and nondepressed groups (Hollon & Kendall, 1980), the revised version has a cleaner factor structure (Netemeyer et al., 2002). The ATQ-S was used in the study as a process measure of depressive thinking in response to the mood inductions.

The *Positive Automatic Thoughts Questionnaire* (PATQ; Ingram & Wisnicki, 1988) is a 30-item self-report measure created in the tradition of the ATQ, but focused on positive thinking instead of depressive thinking. Items, including "There is no problem that is hopeless," are rated on a 5-point Likert scale from "1-Not at all" to "5-All the time" (Ingram & Wisnicki, 1988). A total score was determined by summing each individual item score, with high scores indicating more positive thinking.

The reliability and validity of the PATQ has been demonstrated in both clinical (Ingram, Slater, Atkinson, & Scott, 1990) and undergraduate samples (Burgess & Haaga, 1994; for a review, see Ingram, Kendall, Siegle, Guarino, & McLaughlin, 1995). Given its strong psychometric properties, the PATQ was used as a process measure examining the positive thoughts experienced in response to a mood induction.

Positive and Negative Life Events

A modified version of the *Life Events Scale* (Francis-Raniere, Alloy, & Abramson, 2006; Needles & Abramson, 1990), an 184-item checklist, was used to measure positive and negative life events. A sample item is, "Received positive reaction from family or friends about doing well in school (e.g., praised; taken out to dinner; parents agreed to pay tuition because of good grades; etc.) or about being in school (e.g., congratulated; etc.)." The validity of checklist life event questionnaires have been questioned due to the fact that individuals might check off the same item and actually have experienced very different events (e.g., death of a friend could mean one's best friend or a long-lost childhood friend; see Dohrenwend, 2006 for a review of the criticism). However, the Life Events Scale may be less deserving of such criticism based on its focus on detailed item descriptions and validation against daily reports of life events. Furthermore, each item also has an *a priori* objective intensity rating between 1 (e.g., "began a new semester at school") and 3 (e.g., "you experienced a severe natural disaster or human threat") that was incorporated into the scoring of the questionnaire. Each positive life event was multiplied by its objective intensity rating and then summed to create a positive event scale score. The same method was used to determine a negative event scale score. The Life Events Scale has demonstrated convergent and predictive validity in several studies (e.g., Francis-Raniere et al., 2006; Fresco, Alloy, & Reilly-Harrington, 2006; Needles & Abramson, 1990; Safford, Alloy, Abramson, & Crossfield, 2007). The Life Events Scale served as a measure of positive and negative life events experienced over a one-month period of time.

Physical Health

The *Pennebaker Inventory of Limbic Languidness* (PILL; Pennebaker, 1982) is a 54-item self-report questionnaire used to measure physical illness symptoms. Participants report the frequency with which they have experienced health symptoms such as "headaches" and "back pain" (Pennebaker, 1982). Participants can select between "A-Have never or almost never experienced the symptom," "B-Less than 3 or 4 times per year," "C-Every month or so," "D-Every week or so," or "E-More than once every week," for each item. Pennebaker (1982) suggested that the method of scoring 1 point for each item endorsed at a C, D, or E level is highly correlated (r = .96) with a more complicated scoring method (based on the range of time points), but is preferable because it is much easier to compute. The PILL demonstrated strong psychometric properties (Pennebaker, 1982) and an ability to detect change in physical health symptoms over four- (Epstein, Sloan, & Marx, 2005) and six-week (Langens & Schuler, 2007; Richards, Beal, Seagal, & Pennebaker, 2000) periods of time. Full and shortened versions of the PILL have been used in a variety of populations, from undergraduates (Emmons & McCullough, 2003; Epstein et al., 2005) to incarcerated adults (Richards et al., 2000). The PILL was used in this study as an index of changes in reported physical symptoms.

Awareness of Hypothesis

The *Study Hypothesis Questionnaire* is a brief one-item written measure that was created for this study. It was used to examine the participants' awareness of the study hypothesis. The item states, "Please take a moment to write down what your best guess is about the hypothesis of this study. We appreciate your honesty!" It was of particular interest to see if any participants were aware of the mood induction, the randomization, or the hypotheses related to mood regulation.

Cognitive Tasks

H Task

In the first cognitive task, participants were asked to write down the first five words that came to mind that start with the letter H (Isen et al., 2004). Isen et al. (2004) used this task in a study of undergraduates and found that it significantly distinguished between individuals who had been given a positive mood induction and those who had not. Similar word fragment completion tasks with cues (e.g., "what is an example of physical contact that begins with h") have also been found to distinguish people in happier versus sadder moods (Mayer, McCormick, & Strong, 1995). However, given the concern that providing context could have a mild mood impact, the neutrality of the H task was preferable. Thus, the H task was used in this study as an implicit measure of affect. Two judges blind to the participants' condition in the study rated each produced word as either pleasant (1) or not pleasant (0). The inter-rater reliability between the two primary judges was strong ($\kappa = 0.79$). In cases of disagreement, a third judge rated the word and the score that the majority of judges selected was used. A pleasantness score was computed for each participant by summing the ratings (0 or 1) for each of the six words produced. Scores ranged between 0 and 6, with higher scores indicating more pleasant word generation.

Homophone Word Spelling Task

The second cognitive task was a homophone spelling task, in which participants listened to and recorded the spelling of a series of words. This task was first used in anxious adult outpatients, who were significantly more likely to record threat-related interpretations of homophones (e.g., pain vs. pane) than healthy controls (Mathews et al., 1989). Halberstadt et al. (1995) utilized the same task with happy-neutral (e.g., won vs. one) and sad-neutral (e.g., mourning vs. morning) homophones. Halberstadt et al. (1995) found that individuals who had experienced a sad mood induction made more sad interpretations than the participants who had undergone a happy mood induction. However, the two groups did not interpret happy-neutral homophones differently. In a study utilizing happy-neutral homophones, participants in a positive mood induction group reported significantly more happy interpretations than a disgusted mood induction group, but did not differ from neutral or anxious mood induction groups (Davey et al., 2006).

Rusting (1999) examined the interaction of personality traits and current (non-induced) mood on a homophone spelling task. The likelihood of making positive homophone interpretations was significantly positively related to both trait and state PA (*r*s = .27, .18) and significantly negatively related to trait NA (r = -.23; Rusting, 1999). The likelihood of making negative homophone interpretations was significantly positively related to trait and state NA (*r*s = .27, .18; Rusting, 1999). Multiple regression analysis found that personality was a stronger predictor of the cognitive task performance than an interaction between personality and current mood. However, this study did not have a mood induction. In a second study with a mood induction, current PA was significantly related to positive meaning homophone interpretation (r = .22) and negative mood interacted with personality to impact negative homophone interpretation.

Thus, homophone spelling tasks have been used in a variety of experimental paradigms. In the current study, eight positive-neutral homophones, 8 negative-neutral homophones, 16 neutral-neutral homophones, and 28 non-homophones served as the stimuli. The words were presented auditorily through headphones in a random order. Participants heard one word every 3 seconds and were asked to write down each word as they heard it. Only the 16 key homophones were scored, with 1 point given for each positive interpretation (of 8 possible) and 1 point deducted for each negative interpretation (of 8 possible). Scores could range from -8 to 8 with higher scores indicating a stronger positive homophone bias. The task was used as a second measure of implicit affect.

Global-Local Task

In the third cognitive task, participants viewed visual stimuli on a computer and made judgments about the stimuli. The stimuli were pictures used by Gasper and Clore (2002) like that of Kimchi and Palmer (1982), that incorporate smaller elements that make up a larger figure. For example, in a single trial, participants are presented with a stimulus that consists of three small squares that are positioned to form a larger triangle. Participants are shown two options below the stimulus and asked to select the option that most closely approximates the stimulus. An individual with a local bias may select the option consisting of a group of small squares that form a larger square, whereas an individual with a global bias may select the option consisting of a group of small triangles that form a larger triangle. A study of male undergraduates found that a global visual bias was significantly negatively correlated with depression (r = -.45) and anxiety (r = -.65) and positively correlated with optimism (r = .49; Basso, Schefft, Ris, & Dember, 1996). A second undergraduate sample undertook a mood induction task and then completed a global-local task (Gasper & Clore, 2002). Participants in the negative mood condition had significantly less global bias than those in the positive and neutral conditions. Finally, Fredrickson and Branigan (2005) found that individuals in an induced positive mood had a more global visual bias than individuals in an induced neutral or negative mood. Participants were given 1 point for every global interpretation they made and a total global bias score was determined by adding up a participant’s points for each of the 24 trials. The measure was used as a third implicit measure of affect.

Mood Induction

Researchers have utilized music, personal memories, self-referential statements, and a variety of other tasks to induce affect in the laboratory (Westermann, Spies, Stahl, & Hesse, 1996). However, many of these strategies are contaminated by unwanted effects. For example, positive memory inductions may create a contrast effect, in which an individual compares the past favorably to the present, and thus experiences NA (Strack, Schwarz, & Gschneidinger, 1985). Furthermore, positive memories may not differ from neutral memory inductions on valence alone, because they may also differ on the extent to which the memories are self-relevant (e.g., a specific memory of one's wedding day versus a general memory of riding a bus; Silvia & Abele, 2002). Given the obstacles associated with memory-based mood inductions, researchers have suggested alternative mood induction strategies. A meta-analysis of mood induction procedures found that film clips and stories are the two best strategies for inducing a positive mood (the researchers aggregated the film clip and story mood inductions together because they both use a narrative strategy; Westermann et al., 1996). Rottenberg, Ray, and Gross (2007) agreed, discussing why film clips are effective at inducing affect. They noted that films are complex, attention-grabbing stimuli that can be standardized (Rottenberg et al., 2007). Importantly, Rottenberg et al. (2007) noted that the instructions given before watching a film can impact the demand characteristics placed on an individual to report on their affect. Thus, they recommended using a simple statement such as, "Please watch the film carefully," as opposed to instructions that may introduce more demand such as, "Let yourself experience whatever emotions you have as fully as you can, don't try to hold back or hold in your feelings." Given the strength of film mood inductions, negatively-valenced and positively-valenced film clips were used in this study to induce affect, with a neutral film providing an affect control.

A pilot study, using 21 male and female Temple University undergraduates, was performed to select effective positive, neutral, and negative mood induction film clips. Participants watched several randomly ordered film clips and rated their mood and energy levels before and after watching the film clips. They also provided verbal feedback to the experimenter. Based on the data and feedback, the following clips were selected.

Positive Affect

A 182 second clip of situational comedy was used to elicit PA. The "I Love Lucy" clip shows two female characters working in a chocolate-factory assembly line with the conveyer belt moving too quickly for them to keep up (Oppenheimer, Pugh, Carroll, & Asher, 1952). The clip has been used successfully in studies with undergraduates in general (Frazier, Strauss, & Steinhauer, 2004) and Temple University undergraduates (Luterek, 2006).

Neutral Affect

A 164 second neutral film clip, "Sticks" was used to create no change in affect. The clip shows colored sticks stacking up on the screen. The clip has been used in undergraduate samples and demonstrates very little affective impact (Rottenberg et al., 2007). A neutral comparison condition is an important component of any research aimed at examining the impact of induced NA or PA. Without a neutral comparison condition, it cannot be concluded that mood inductions were successful and that the findings are related specifically to high or low affect (Aspinwall, 1998).

Negative Affect

A 164 second clip from "The Champ" (Lovell & Zeffirelli, 1979) was used to elicit NA. This clip shows a young boy witness his father's death. The boy is crying and calls for his father to wake up. This clip has been validated as an effective sadness-inducing induction (Gross & Levenson, 1995), has been used widely in experimental research (e.g., Miranda, Gross, Persons, & Hahn, 1998), and has been used successfully with Temple University undergraduates (Luterek, 2006).

Participant Recruitment and Retention

Participants were recruited for the study in several ways. Phase I of the study was offered on the Temple Psychology Research Participation System (located on the web at http://temple.sona-systems.com/default.asp), "Sona Systems." Every semester, students in several undergraduate-level psychology courses are invited to log in to sona systems in order to participate in research studies as part of the course research requirement. Flyers were posted and distributed on campus in order to notify students outside of these psychology courses of the opportunity to participate in the study.

Phase I Inclusion and Exclusion Criteria

All individuals age 18 and over were eligible to participate in Phase I of the study. There were no other exclusion criteria for Phase I.

Phase II Inclusion and Exclusion Criteria

Given that Phase II included a randomly assigned mood induction, three layers of safety procedures ensured that participants who were either suicidal or were experiencing moderate or severe depression were not put at undue risk by experiencing a negative mood induction.

First, all participants completed a BDI-II as part of Phase I of the study. Participants who scored a 29 or above on the BDI-II at Phase I were not invited to participate in Phase II of the study. Eighty-two participants from the Phase I subject pool met this criterion and were not invited to participate in Phase II.

Second, participants who arrived at the laboratory to participate in Phase II completed a second BDI-II. Participants who had been randomly assigned to the negative mood condition and had a BDI-II score at or above 20, or who endorsed significant suicidality (a score of 2 or higher on the suicidality question) were not given a negative mood induction that day. All other individuals participated as planned. Importantly, if any participant had endorsed significant suicidal ideation at Phase II, the experimenters were prepared to follow the study's suicidality protocol. Four participants who began Phase II had BDI-II scores at or above the threshold score (and had been randomly assigned to the negative mood induction). No participants endorsed significant suicidality at Phase II.

Third, the four participants who were excluded from Phase II due to their depression scores were asked to reschedule in two weeks. Given the sensitive nature of depression, participants were not told that they were rescheduled due to their depression score, but instead were told that the research coordinator was not able to run the study that day. The two-week delay allowed participants who were ineligible for Phase II due to their symptoms of depression to have a second chance to participate in the study. If their BDI-II score was still 20 or above after the two-week delay, then the participants would have been randomized to participate in either the neutral or positive mood induction. Four students were not able to complete Phase II at their first appointment due to high BDI-II scores and none of them chose to return to the laboratory to complete the study on another day.

A cutoff score of 20 on the BDI-II was selected in order to ensure that participants who were experiencing moderate or severe depression would not be exposed to a negative mood induction. Steer et al. (2001) reported that individuals diagnosed with moderate depression have an average BDI-II score of 27 (with a 99% confidence interval of 24 to 29). Although selecting a cutoff score of 23 would lead to a 99% chance of excluding individuals with at least moderate depression, we elected to take a conservative stance and use an even more stringent standard. Thus, we selected a cutoff score of 20, which Beck et al. (1996) described as indicating a “clinically significant” score.

Of the 1,281 participants who participated in Phase I, 36 participants were ineligible for Phase II due to missing data, 8 were ineligible for Phase II due to their participation in the pilot study, and 82 were ineligible for Phase II due to high depression scores at Phase I. This left 1,155 eligible participants for Phase II. Of these, 655 were invited via electronic mail to participate in Phase II. Participants were invited in the order in which they participated in Phase I (with the exception that a higher proportion of men who participated in Phase I were invited to participate in Phase II than were women, in an attempt to even the number of male and female participants in Phase II). Recruitment for Phase II was discontinued when an adequate sample size was reached, leading to a sample of 181 participants (see Appendix for a discussion of the *a priori* power analysis).

Phase III Inclusion Criteria

All students who completed Phase II of the study were invited to complete Phase III. There were no exclusion criteria for Phase III. Due to attrition, 154 participants of the eligible 181 participants completed Phase III.

Retention

Compensation was provided to maximize sample retention. All participants who completed Phase I of the study were given 1 hour of research credit (if applicable) and entered into a raffle with a chance of winning $25. All participants who completed Phase II of the study were given 1 hour of research credit or $10 and had their name put into the raffle a second time. All participants who completed Phase III of the study were given 1 hour of research credit or $15 and their name was entered into the raffle a third time.

Procedure

Phase I Procedure

Participants who elected to participate in the study logged on to the Sona Systems website and selected the study. After reading the informed consent and indicating their agreement, participants completed a series of online questionnaires. The questionnaires included the contact information, demographic information, positive rumination (RPA), depression (BDI-II), manic symptoms (ASRM), subjective happiness (SHS), subjective well-being (SWLS), PA and NA (PANAS), reflection and brooding (RRS), physical illness symptoms (PILL), self-esteem (RSES), behavioral inhibition and activation (BIS/BAS), and optimism (LOT-R) measures. All participants were compensated for their time as previously described. Participants who completed Phase I and met criteria for Phase II (BDI-II < 29) were invited to participate in Phase II through electronic mail contact. No participant was contacted more than three times if they did not express interest in participating in Phase II.

Phase II Procedure

Phase II took place in the laboratory and participants were scheduled at their convenience for this portion of the study. Upon arrival at the laboratory, each participant reviewed the informed consent. The experimenter explained the procedure and responded to any questions at that time. After signing the Phase II informed consent form, participants completed a computerized BDI-II. The computer immediately scored the questionnaire and alerted the experimenter if the participant's score exceeded the exclusion criterion score of 20. Participants meeting this exclusion criterion were given research credit and entered into the raffle to compensate them for their attendance.

The rest of the experiment progressed as follows. The experimenter familiarized the participant with the Affect Grid and with study procedures. Participants were shown the pages to record responses to the two paper-and-pencil cognitive tasks. The experimenter watched the participant put on the ear phones for the audio portions of the tasks. The experimenter set the computer to start the study and left the room. With the exception of the paper-and-pencil H task and the homophone spelling task, all tasks were completed on the computer. Participants recorded current affect on Affect Grid 1 on the computer. The computer provided a message, "Please watch the film carefully" and participants were presented with either a negative, neutral, or positive film clip. Participants then completed Affect Grid 2, the H task, Affect Grid 3, the homophone spelling task, Affect Grid 4, the global-local task, and Affect Grid 5. Next, participants completed the retrospective mood and response style measures, including a retrospective report of their affect (Feelings Report), negative automatic thoughts (ATQ-S), positive automatic thoughts (PATQ), and positive rumination (RPA).

All participants in the negative mood induction group then were presented with the positive mood induction film in order to eliminate any lasting negative impact from the film. Finally, all participants were debriefed and asked to review and provide consent for Phase III. All participants were compensated for their time as previously described.

Phase III Procedure

Participants who consented to participate in Phase III were contacted one month after their Phase II appointment in order to complete the Phase III computerized questionnaires. Access to the secure website with the Phase III questionnaires was limited to participants who had completed Phase II. Participants had already signed informed consent, and therefore did not need to provide consent online. They completed the Affect Grid and measures of their physical illness symptoms (PILL), intervening positive and negative life events (Life Events Scale), PA and NA (PANAS), depression (BDI-II), manic symptoms (ASRM), subjective happiness (SHS), subjective well-being (SWLS), positive rumination (RPA), and guesses about the study's hypothesis (Study Hypothesis Questionnaire). Finally, a debriefing form was presented online with the investigator's contact information. All participants were compensated for their time as previously described.

CHAPTER 3

RESULTS

Preliminary Findings

Participation

See Tables 1 and 2 for a summary of Phase I continuous and categorical variables for all study participants. Analyses were performed to examine whether there were differences in these variables between participants who did and did not go on to complete Phases II and III of the study.

A series of one-way Analysis of Variance (ANOVA) tests and chi-square tests was used to compare the groups. For continuous variables, Tukey honestly significant difference (HSD) adjustments were used to follow up on significant omnibus tests. For the chi-square tests, individual cell mean chi-square tests were used to follow up on the omnibus tests. The analyses revealed that Phase I participants who were eligible for, but did not complete Phases II and III, did not differ on any of the Phase I continuous variables from participants who did go on to complete Phases II and III. However, the Phase I participants who were ineligible for Phase II (due to missing data $n = 36$, high BDI score $n = 82$, pilot participation $n = 8$, and high BDI at beginning of Phase II $n = 4$), did differ from the sample that went on to complete the study. These differences, such as a significantly higher mean BDI-II score at Phase I, were expected, given the nature of the group.

The chi-square analysis revealed that there was a significantly lower proportion of female to male participants in Phases II and III than in Phase I (both Phase I participants who were eligible and ineligible for Phase II). This demonstrated that our attempt to increase the proportion of men into the latter phases of the study was successful. There were significant differences between the ethnicity of the samples that went on to complete Phase II and III, with a higher proportion of Caucasian participants who participated in Phase I going on to complete Phases II and III of the study than African American participants. There were no differences in the proportion of East Asian or South Asian participants who completed the study. Some of the groups could not be tested due to low sample size.

Equivalent Groups Check

Given the fact that individuals were randomly assigned to one of three mood induction conditions in Phase II (positive, neutral, and negative), it was necessary to determine whether the three groups differed on any baseline variables before the mood induction took place. A series of ANOVAs and chi-square tests were used to compare the three groups on Phase I demographic and response style variables (age, composite socioeconomic status score, dampening, emotion-focus positive rumination, self-focus positive rumination, gender, and ethnicity) and Phase II pre-mood induction affect (BDI-II, current mood, and current energy). No correction was made for multiple tests because we did not want to lose the power to detect even small pre-existing differences between the three experimental groups.

Six one-way ANOVA tests were used to examine whether group differences existed among the three groups on a variety of continuous variables (see Table 3). Participants in the three mood induction groups did not differ significantly from each other in age, $F(2, 178) = .34$, *ns*, composite socioeconomic status, $F(2, 130) = .45$, *ns*, dampening, *F*(2, 178) = .68, *ns*, emotion-focused positive rumination, *F*(2, 178) = .17, *ns*, self-focused positive rumination, *F*(2, 178) = .10, *ns*, or past-week depression, *F*(2, 178) = .49, *ns*.

Table 3. Means and Standard Deviations for Experimental Group Continuous Demographic and RPA Variables

	Positive		Neutral		Negative	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Age	19.07	1.44	19.13	1.70	18.92	1.20
SES	16.16	3.93	16.17	3.84	15.44	4.40
Emotion-focus	13.80	2.85	13.75	2.93	13.50	3.29
Self-focus	10.17	2.83	10.18	2.92	9.97	3.16
Dampening	13.58	4.61	14.08	4.40	13.18	3.69
BDI-II at PII	9.00	7.06	9.21	6.78	8.15	4.64

Note. There were no statistically significant differences between groups on these variables before the mood induction. SES = socioeconomic status composite.

Chi-square tests were used to examine group differences between the three mood induction conditions on categorical demographic variables (see Table 4). There was no statistically significant relationship between experimental group and gender, χ^2 (2, *N* = 181) = .02, *ns*. Unfortunately, the sample had a limited number of participants of East Asian, South Asian, and Latino backgrounds. Thus, the sample did not meet the assumption of chi-square that requires at least a frequency of five observations in each cell. Thus, these three ethnic groups were collapsed for this analysis, yielding a comparison of three groups: Caucasian, African American, and Other groups (including East Asian, South Asian, Latino, and others). On this comparison there was no statistically significant relationship between experimental group and ethnicity, χ^2 (4, N = 181) = .72, *ns*.

Table 4. Sample Sizes and Percentages for Experimental Group Categorical Demographic Variables

Variable	Positive		Neutral		Negative	
	n	%	*n*	%	*n*	%
Female	37	61.7	37	60.7	37	61.7
Caucasian	43	71.7	44	72.1	46	76.7
African American	6	10.0	6	9.8	6	10.0
East Asian	5	8.3	5	8.2	3	5.0
South Asian	2	3.3	3	4.9	1	1.7
Latino/Hispanic	2	3.3	1	1.6	1	1.7
Other/Missing	2	3.3	2	3.3	3	5.0

Note. There were no statistically significant differences between groups on these variables before the mood induction.

Mood Manipulation Check

A two-way ANOVA test for mixed groups was performed to examine the impact of the mood induction on the valence mood rating (see Table 5). The results were analyzed using Maxwell and Delaney's (1990) guidelines. The 2 (pre- vs. post-mood valence rating) X 3 (positive vs. neutral vs. negative mood induction) mixed groups

ANOVA revealed a significant interaction effect between affect measurement time and mood induction type, $F(2, 178) = 76.20$, $p < .001$. The simple effect of film type was examined across the two mood measurement times using a Bonferroni-adjusted p value of .025. As expected, there was no significant difference between mood induction groups *before* the mood induction, $F(2, 178) = .85$, *ns.* However, the omnibus test revealed a significant difference in affect between the three mood induction groups *after* the mood induction, $F(2, 178) = 70.27$, $p < .001$. A Tukey HSD adjustment was used in comparing the individual cell means for post-induction mood in the positive, neutral, and negative mood induction groups. All three groups had significantly different post-mood induction affect from each other at the Tukey-adjusted .05 level. The positive mood induction group had significantly more positive affect ($M = 7.72$) than the neutral mood induction group ($M = 5.70$), which had significantly higher affect than the negative mood induction group ($M = 3.93$). Finally, three Bonferroni-adjusted paired sample t tests revealed that the simple effect of mood measurement time (pre- vs. post- mood induction) was significant at the .017 level for all three mood induction conditions: positive, t (59) = -7.48, $p < .001$, neutral, t (60) = 5.70, $p < .001$, and negative, $t(59) = 9.54$, $p < .001$. Overall, the mood induction was successful. As expected, mood scores became more positive for individuals in the positive mood induction and more negative for individuals in the negative mood induction condition. Unexpectedly, the neutral mood induction condition led to a significant decrease in mood during the mood induction, but participants in the neural condition were still less positive than the positive mood induction and more positive than the negative mood induction groups.

Importantly, participants did significantly differ on their affect grid current energy level report *before* the mood induction took place, $F(2, 178) = 3.71$, $p < .05$. This omnibus test was followed up by the *post-hoc* Tukey HSD comparison. The Tukey test revealed that the group of participants who would go on to have a neutral mood induction had a significantly higher energy level ($M = 5.69$) than participants who would go on to have a negative mood induction ($M = 4.80$) at the .05 level. The group that would go on to have a positive mood induction ($M = 5.43$) did not differ from either the neutral or the negative groups in pre-mood induction energy level. Of note, after the mood induction, an omnibus test with a Tukey HSD test revealed that the positive mood induction group had a statistically significantly lower energy level than the neutral and negative mood induction groups (*p*s < .05).

Table 5. Affect and Energy Level Before and After Mood Induction (MI)

	Positive		Neutral		Negative	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Pre-MI affect	6.57_{a}	1.48	6.89_{a}	1.52	6.57_{a}	1.66
Post-MI affect	7.72_{a}	1.24	5.70_{b}	1.86	3.93_{c}	2.05
Pre-MI energy	$5.43_{a,b}$	1.77	5.69_{a}	1.70	4.80_{b}	2.05
Post-MI energy	4.20_{a}	1.89	5.28_{b}	1.78	5.30_{b}	2.09

Note. Means in the same row having the same subscript are not significantly different at $p < .05$ in the Tukey HSD comparison.

Hypothesis Testing

In order to preserve power in tests of some hypotheses, a composite positive rumination score was utilized. The composite score was computed by adding the emotion-focused positive rumination and self-focused positive rumination scores together. In general, demographic variables were not used as covariates (see Miller & Chapman, 2001).

Hypothesis 1

Recall that Hypothesis 1 aimed to demonstrate the convergent validity of the RPA by examining the subscales' correlations with other related constructs measured at Phase I. In these analyses, all three RPA subscales (Emotion-focus, Self-focus, and Dampening) were used to examine their correlations with NA, depression, depressive rumination (reflection and brooding), behavioral inhibition, PA, manic symptoms, subjective happiness, subjective well-being, self-esteem, behavioral activation (reward responsiveness, drive, and fun-seeking), and optimism. An assessment of the data revealed that three variables, the BDI-II, the ASRM, and the NA violated the assumptions of correlation. Thus, the Spearman rank-order correlation was used instead for all correlations with these variables (B. H. Cohen, 2001). Pearson product moment correlation coefficients were used to compute correlations with the remaining variables. Given the large number of tests, a Bonferroni correction (.05/14 = .0036) was used to correct for multiple comparisons for each of the three RPA scales. See Table 6 for the sample sizes and internal consistencies for Phase I variables. See Table 7 for the correlation results for Hypothesis 1.

Table 6. Sample Size and Internal Consistency for Phase I Variables

Variable	*N*	α
Emotion-focus	1,256	.75
Self-focus	1,259	.78
Composite PR	1,253	.85
Dampening	1,260	.84
Negative affect	1,260	.89
Depression	1,255	.92
Behavioral inhibition	1,244	.76
Manic symptoms	1,260	.73
Reflection	1,260	.80
Brooding	1,261	.84
Positive affect	1,262	.91
Subjective happiness	1,263	.86
Subjective well-being	1,265	.86
Self-esteem	1,249	.89
Reward responsiveness	1,258	.75
Drive	1,212	.78
Fun-seeking	1,251	.69
Optimism	1,261	.82

Note. PR = positive rumination

Table 7. Correlations of RPA Scales with Phase I Variables

Variable	Emotion-focus	Self-focus	Dampening
Negative affect	-.03	-.05	.43†
Depression	-.07	-.15†	.40†
Behavioral inhibition	.05	-.05	.27†
Manic symptoms	.19†	.21†	.07
Reflection	.14†	.07	.33†
Brooding	.08	.01	.51†
Positive affect	.26†	.37†	-.03
Subjective happiness	.26†	.32†	-.34†
Subjective well-being	.26†	.33†	-.29†
Self-esteem	.18†	.30†	-.46†
Reward responsiveness	.37†	.35†	-.04
Drive	.23†	.33†	.02
Fun-seeking	.29†	.24†	-.01
Optimism	.23†	.31†	-.47†

Note. RPA = Responses to Positive Affect Scale. †significant at Bonferroni-adjusted level of .003.

In contrast to expectations for Hypothesis 1a, emotion-focused positive rumination was not significantly associated with negative affect (NA), depression (BDI-II), and behavioral inhibition (BIS). In support of Hypothesis 1b, after using the Bonferroni correction, emotion-focused positive rumination was significantly positively associated with symptoms of mania, [ASRM; r_s (1,248) = .19], reflection [RRS-R; *r*(1,247) = .14], PA [PA; *r*(1,245) = .26], subjective happiness [SHS; *r*(1,246) = .26], subjective well-being [SWLS; *r*(1,247) = .26], self-esteem [RSES; *r*(1,236) = .18], reward responsiveness [BAS-RR; *r*(1,244) = .37], drive [BAS-D; *r*(1,200) = .23], fun-seeking [BAS-FS; *r*(1,240) = .29], and optimism [LOT-R; *r*(1,245) = .23]. Contrary to Hypothesis 1b, there was no significant relationship between emotion-focused positive rumination and brooding (RRS-B).

In support of Hypothesis 1c, after using the Bonferroni correction, self-focused positive rumination was significantly negatively associated with depression [BDI-II; r_s (1,247) = -.15]. However, self-focused positive rumination was not correlated with negative affect (NA) or behavioral inhibition (BIS). Consistent with Hypothesis 1d, self-focused positive rumination was significantly positively associated with symptoms of mania [ASRM; r_s (1,250) = .21], positive affect [PA; *r*(1,247) = .37], subjective happiness [SHS; *r*(1,248) = .32], subjective well-being [SWLS; *r*(1,249) = .33], self-esteem [RSES; *r*(1,239) = .30], reward responsiveness [BAS-RR; *r*(1,247) = .35], drive [BAS-D; *r*(1,202) = .33], fun-seeking [BAS-FS; *r*(1,242) = .24], and optimism [LOT; *r*(1,248) = .31]. Contrary to hypotheses, self-focused positive rumination was not associated with either reflection or brooding (RRS-R and RRS-B).

Consistent with Hypothesis 1e, after using the Bonferroni correction, dampening was significantly positively associated with negative affect [NA; r_s (1,248) = .43], depression [BDI-II; r_s (1,248) = .40], ruminative reflection [RRS-R; *r*(1,251) = .33], ruminative brooding [RRS-BR; *r*(1,252) = .51], and behavioral inhibition [BIS; *r*(1236) = .27]. In support of Hypothesis 1f, dampening was significantly negatively associated with subjective happiness [SHS; *r*(1,249) = -.34], subjective well-being [SWLS; *r*(1,252) = -.29], self-esteem [RSES; *r*(1,239) = -.46], and optimism [LOT; *r*(1,249) = -.47]. Contrary to expectations, dampening was not significantly associated with manic symptoms (ASRM), positive affect (PA), and the three behavioral activation subscales (BAS-DR, BAS-RR, and BAS-FS).

Hypothesis 2

Recall that Hypotheses 2a-2f aimed to examine the extent to which the RPA subscales measured at Phase I would demonstrate predictive criterion validity. We hypothesized that the RPA subscales would prospectively predict individual differences in responses to a positive mood induction at Phase II, but be unrelated to a negative or neutral mood induction at Phase II.

Given that each participant completed four Affect Grid valence scores in the 9 minutes after the mood induction, it was possible to use a hierarchical linear change model with full maximum likelihood estimation to examine each individual's slope of affect change over time (J. Cohen, Cohen, West, & Aiken, 2003; Raudenbush & Bryk, 2002). To provide the clearest test of the hypotheses, three separate analyses were conducted, one each for individuals in the positive, negative, and neutral mood induction groups. Each model of change had two levels, the first for within-person change over time and the second for inter-individual change based on the predictor variables (Singer & Willett, 2003). Therefore, Level 1 included each individual's four affect valence scores which together acted as one variable, the linear time trend. At Level 2, the three time-invariant response style measures (Emotion-Focus, Self-Focus, Dampening) were entered as covariates.

The assumptions of regression were examined, but residuals were not expected to be independent, due to the likely clustering of individuals' repeated affect measures at Level 1 (J. Cohen et al., 2003). First, we examined the individual mood change slopes for each participant to examine if the mood data appeared to follow a linear trajectory. Although there were some deviations from linearity, they may have been due to measurement error and were not significant enough to suggest that the data followed a non-linear trajectory (Singer & Willett, 2003). Furthermore, the data did not meet the homoscedasticity assumption, indicating that the regression's variance was not consistent. For this reason, we used standard errors robust to violations of homoscedasticity, which corrected for this violation. The reliability estimates for all three analyses were above .05, suggesting that the estimates for the intercept and slope for each individual were reliable, and that we could allow them to vary randomly across individuals.

We used the HLM full maximum likelihood method to test the following model:

(1) [i]

Level 1 *Model*

$$Y_{ij} = \pi_{0i} + \pi_{1i}TIME_{ij} + E_{ij}$$

Level 2 *Model*

$$\pi_{0i} = \gamma_{00} + \gamma_{01}EF_i + \gamma_{02}SF_i + \gamma_{03}D_i + \zeta_{0i}$$

(2) [ii]

$$\pi_{1i} = \gamma_{10} + \gamma_{11}EF_i + \gamma_{12}SF_i + \gamma_{13}D_i + \zeta_{1i}$$

Following Singer and Willett's (2003) protocol for HLM analyses, both the unconditional means model and the unconditional growth models were fit for each of the

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[i] In the Level 1 Model (see Equation 1), an individual's affect grid mood score at j time point is represented by Y_{ij}. The symbol π_{0i} is the individual's first mood measurement after the mood induction. The rate at which an individual's mood changes during the 9-minute follow-up is represented by π_{1i}. Finally, E_{ij} is the error in the prediction of the individual's outcome (Singer & Willett, 2003).

[ii] In the level 2 model (see Equation 2), γ_{00} is the average population first mood measurement score. The symbol γ_{10} is the average population rate of mood change during the 9-minute follow-up. The symbols γ_{01} and γ_{11} represent how adding the Emotion-Focus scale to the prediction model impacts the person-level intercept and change slope, respectively. The symbols γ_{02} and γ_{12} represent how adding the Self-Focus scale to the prediction model impacts the person-level intercept and change slope, respectively. The symbols γ_{03} and γ_{13} represent how adding the Dampening scale to the prediction model impacts the person-level intercept and change slope, respectively. Finally, the symbols ζ_{0i} and ζ_{1i} are the error in the prediction of Level 2 model (Singer & Willett, 2003).

mood induction groups before examining the full model with the Level 2 covariates.[iii] See Figure 1 for a visual display of the unconditional growth model. The variance components for these models were significantly different than 0, indicating that the model would benefit from additional variables. Given this evidence, it was appropriate to test the full model to examine the ability of response styles to account for this variance.

See Table 8 for a summary of the means, standard deviations, and internal consistencies for the variables used in these analyses. See Table 9 for the intercorrelations between the variables. See Table 10 for a summary of the HLM analyses for the positive mood induction group. In response to the positive mood induction, the average participant (on the dampening and positive rumination measures) had an initial mood rating of 7.43, which was significantly higher than 0, $z(56) = 45.83$, $p < .001$. The average participant's mood decreased at a statistically significant rate of -.54 mood score

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[iii] By comparing the unconditional models to the covariate models with a chi-square difference test, we were able to determine if it was of significant benefit to include the covariates as predictors in the model (Raudenbush & Bryk, 2002). For the positive mood induction group, the unconditional growth model was a significantly better fit to the data than the unconditional means model, χ^2 (3, $N = 240$) = 82.84, $p < .001$. The full model was a marginally better fit to the data than the unconditional growth model, χ^2 (6, $N = 240$) = 11.32, $p = .08$. For the neutral mood induction group, the unconditional growth model was not a significantly better fit to the data than the unconditional means model, χ^2 (3, $N = 244$) = 6.35, *ns*. However, the full model was a significantly better fit to the data than the unconditional growth model, χ^2 (3, $N = 244$) = 13.97, $p < .05$. Furthermore, the full model was a significantly better fit to the data than the unconditional means model, χ^2 (9, $N = 244$) = 20.32, $p < .05$. Finally, for the negative mood induction group, the unconditional growth model was a significantly better fit to the data than the unconditional means model, χ^2 (3, $N = 240$) = 66.09, $p < .001$. The full model was a significantly better fit to the data than the unconditional growth model, χ^2 (6, $N = 240$) = 14.97, $p < .05$ (Singer & Willett, 2003).

points every three minutes, $z(56) = -8.72$, $p < .001$. None of the dampening or rumination measures significantly impacted either the mood starting point or rate of mood change

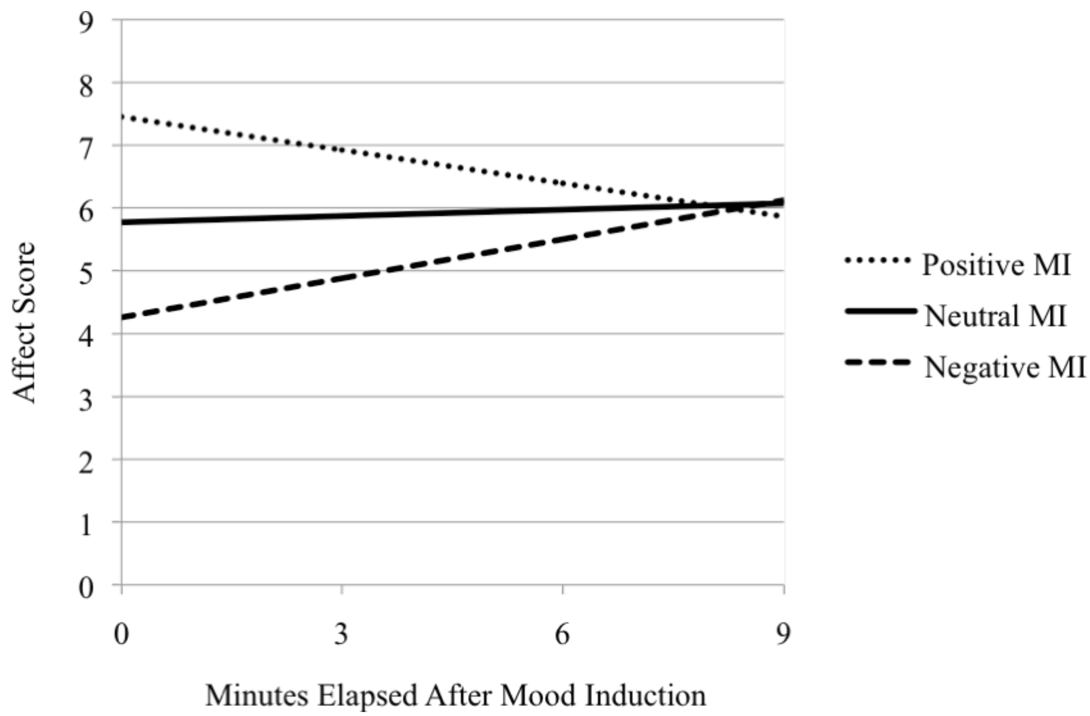

Figure 1. Unconditional affect growth model for the three mood induction groups.

over the follow-up period. However, the Emotion-Focus score had a marginally significant impact of a .06 increase in mood score points over each three-minute interval, $z(56) = 1.82$, $p = .07$. See Figure 2 for a graphical display of the prototypical change trajectories for the positive mood induction group data.

See Table 11 for a summary of the HLM analyses for the neutral mood induction group. In response to the neutral mood induction, the average participant (on the dampening and positive rumination measures) had an initial mood score of 5.79, which was significantly higher than 0, $z(57) = 25.23$, $p < .001$. The average neutral induction participant's mood did not significantly change over the follow-up period $z(57) = 1.44$, *ns*. The Emotion-Focus score had a marginally significant impact on the mood intercept in response to the neutral mood induction, predicting a .23 *lower* initial mood score, $z(57) = -1.91$, $p = .06$ and had a significantly positive impact on mood change over the follow-up period of an increase of .09 mood score points for every 3-minute period, $z(57) = 2.45$, $p < .05$. Neither the Dampening nor the Self-Focus scales significantly impacted the intercept or rate of change of mood scores in response to the neutral mood induction. See Figure 3 for a graphical display of the prototypical change trajectories for the neutral mood induction group data.

Table 8. Means, Standard Deviations, and Internal Consistencies for Multilevel Model for Change Variables

	Positive			Neutral			Negative		
Variable	*M*	*SD*	α	*M*	*SD*	α	*M*	*SD*	α
Phase I RPA									
Emotion-focus	13.80	2.85	.69	13.75	2.93	.67	13.50	3.29	.76
Self-focus	10.17	2.83	.80	10.18	2.92	.81	9.97	3.16	.83
Dampening	13.58	4.61	.83	14.08	4.42	.82	13.18	3.69	.73
Phase II Affect									
0 Min	7.72	1.24		5.70	1.86		3.93	2.05	
3 Min	6.67	1.63		5.90	1.89		5.15	1.67	
6 Min	6.07	1.72		6.11	1.91		5.92	1.48	
9 Min	6.15	1.59		5.98	1.74		5.75	1.47	

Note. RPA = Responses to Positive Affect Scale. 0, 3, 6, and 9 Min = affect grid score immediately after mood induction, and 3, 6, and 9 minutes after mood induction, respectively.

Table 9. Multilevel Model for Change Variable Intercorrelations for Participants in the Phase II Positive and Negative Mood Induction (MI)

Variable	1	2	3	4	5	6	7
1. Emot-focus	--	.56***	.11	.16	.34**	.33**	.33*
2. Self-focus	.71***	--	-.26*	.26*	.20	.18	.17
3. Dampening	-.12	-.14	--	-.04	-.12	.00	-.03
4. AG 0 Min	-.04	-.26*	-.23	--	.67***	.39**	.53***
5. AG 3 Min	.13	-.10	-.10	.57***	--	.71***	.70***
6. AG 6 Min	-.09	-.23	-.13	.29*	.58***	--	.84***
7. AG 9 Min	.05	-.21	-.25	.42**	.43**	.48***	--

Note. Intercorrelations for the positive mood induction (n = 60) are presented above the diagonal. The intercorrelations for negative mood induction participants (n = 60) are presented below the diagonal. Emot = emotion. AG = affect grid score. Min = minutes elapsed since mood induction. *$p < .05$, **$p < .01$, ***$p < .001$

See Table 12 for the HLM analyses for the negative mood induction group. In response to the negative mood induction, the average participant had an initial mood score of 4.18, which was significantly higher than 0, $z(56) = 19.65$, $p < .001$. The average participant's mood increased at a statistically significant rate of .63 mood score points every three minutes, $z(56) = 7.58$, $p < .001$. All three of the predictor variables had a significant impact on the initial mood score of participants, with higher emotion-focused positive rumination leading to .18 higher initial mood scores, self-focused positive rumination leading to .28 *lower* initial mood scores, and dampening leading to .11 lower initial mood scores, $z(56) = 2.10$, $p < .05$, $z(56) = -2.96$, $p < .01$, and $z(56) = -2.43$, $p < .05$, respectively. None of the predictors significantly impacted the rate of change in response to the negative mood induction. See Figure 4 for a graphical display of the prototypical change trajectories for the negative mood induction group data. Below, we will use these results to address each of the study's hypotheses.

In partial support of Hypothesis 2a, Phase I emotion-focused positive rumination was a moderate-sized but only *marginally* significant predictor of mood change in response to a Phase II positive mood induction, $z(56) = 1.82$, $p = .07$. Contrary to Hypothesis 2b, Phase I self-focused positive rumination was not a significant predictor of mood change in response to a Phase II positive mood induction, $z(56) = -1.29$, *ns.* Contrary to Hypothesis 2c, Phase I dampening was not a significant predictor of mood change in response to a Phase II positive mood induction, $z(56) = -.49$, *ns.* In contrast to Hypothesis 2d, Phase I Emotion-Focus was predictive of changes in mood over time in response to a neutral mood induction, $z(57) = 2.45$, $p < .05$. However, consistent with Hypothesis 2d, Phase I Emotion-Focus was not predictive of changes in mood over time in response to a negative mood induction, $z(56) = -0.50$, *ns*. In support of Hypothesis 2e, Self-Focus was not predictive of changes in mood over time in response to a neutral mood induction or a negative mood induction, $z(57) = -0.77$, *ns* and $z(56) = 0.79$, *ns*, respectively. In support of Hypothesis 2f, Phase I dampening was not a significant predictor of rate of mood change in response to a neutral or negative mood induction at Phase II, $z(57) = -1.08$, *ns*, and $z(56) = 0.50$, *ns* respectively. Importantly, the variance components for the model were significantly different than 0, indicating that the model may benefit from additional covariates.

Table 10. Results of Fitting a Multilevel Model for Change to the Positive MI Data (n = 60)

Effects	Component	Par.	Estimate	*SE*	β	*z*
Fixed Effects						
Initial status, π_{0i}	Intercept	γ_{00}	7.43***	0.16	--	45.83
	Emotion-focus	γ_{01}	0.07	0.08	.12	0.91
	Self-focus	γ_{02}	0.07	0.07	.12	1.04
	Dampening	γ_{03}	-0.01	0.04	-.03	-0.35
Rate of change, π_{1i}	Intercept	γ_{10}	-0.54***	0.06	--	-8.72
	Emotion-focus	γ_{11}	0.06ǂ	0.03	.14	1.82
	Self-focus	γ_{12}	-0.04	0.03	-.09	-1.29
	Dampening	γ_{13}	-0.01	0.01	-.04	-0.49
Variance Components						
Level 1	Within-person, E_{ij}	σ_{ε}^2	0.81			
Level 2	In initial status, ζ_{0i}	σ_0^2	0.94***			
	In rate of change, ζ_{1i}	σ_1^2	0.07**			

Note. Full Maximum Likelihood, HLM. MI = mood induction. Par. = parameter. *$p < .05$, **$p < .01$, ***$p < .001$, ǂp=.07

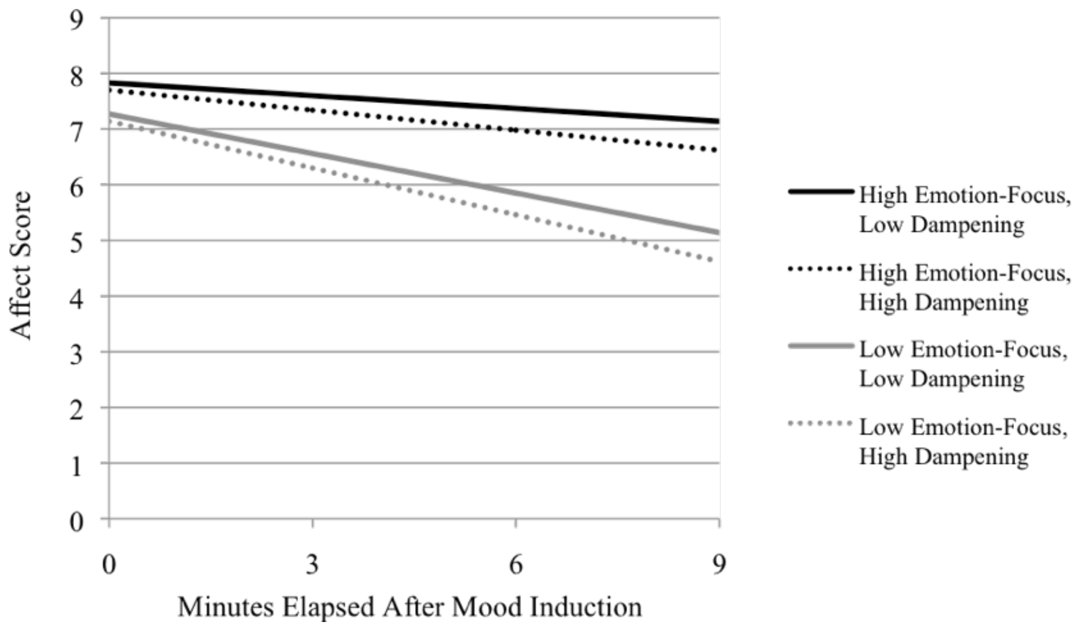

Figure 2. Prototypical change trajectories in response to a positive mood induction.

Table 11. Results of Fitting a Multilevel Model for Change to the Neutral MI Data (n = 61)

Effects	Component	Par	Estimate	*SE*	β	*z*
Fixed Effects						
Initial status, π_{0i}	Intercept	γ_{00}	5.79***	0.23	--	25.23
	Emotion-focus	γ_{01}	-0.23 ǂ	0.12	-.36	-1.91
	Self-focus	γ_{02}	0.15	0.11	.24	1.35
	Dampening	γ_{03}	-.03	0.06	-.07	-0.59
Rate of change, π_{1i}	Intercept	γ_{10}	0.10	0.07	--	1.44
	Emotion-focus	γ_{11}	0.09*	0.04	.14	2.45
	Self-focus	γ_{12}	-0.03	0.04	-05	-0.77
	Dampening	γ_{13}	-0.02	0.02	-.05	-1.08
Variance Components						
Level 1	Within-person, E_{ij}	σ_{ε}^2	1.20			
Level 2	In initial status, ζ_{0i}	σ_0^2	2.26***			
	In rate of change, ζ_{1i}	σ_1^2	0.07*			

Note. Full Maximum Likelihood, HLM. MI = mood induction. Par = parameter. *p < .05, **p < .01, ***p < .001, ǂp=.06

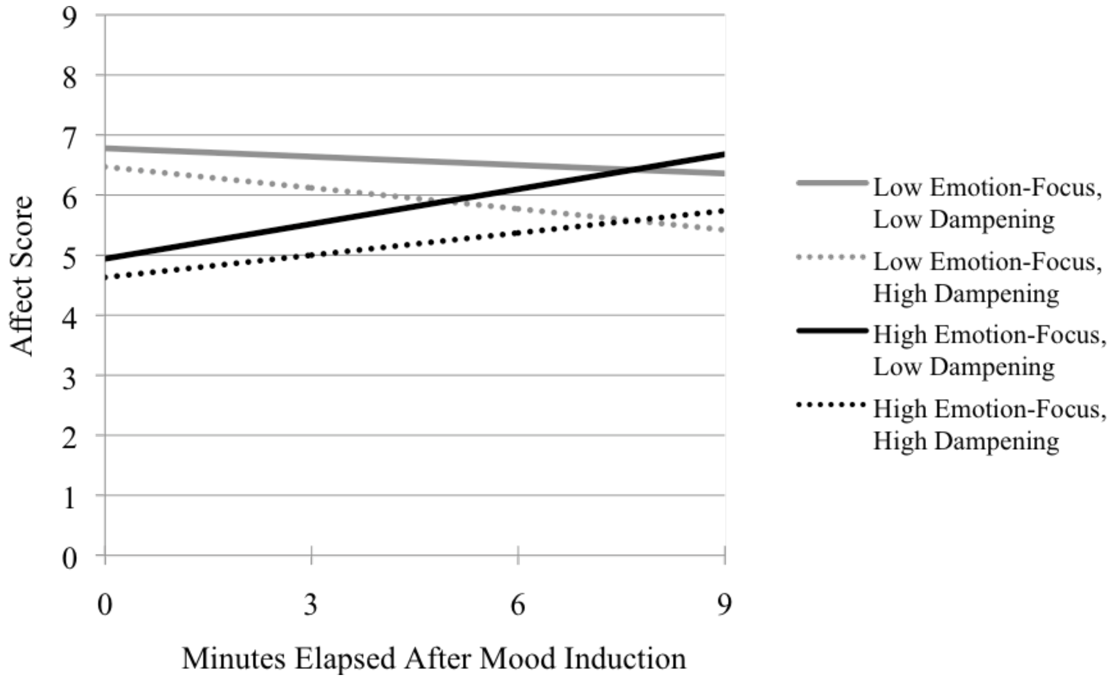

Figure 3. Prototypical change trajectories in response to a neutral mood induction.

Table 12. Results of Fitting a Multilevel Model for Change to the Negative MI Data (n = 60)

Effects	Component	Par	Estimate	*SE*	β	*z*
Fixed Effects						
Initial status, π_{0i}	Intercept	γ_{00}	4.18***	0.21	--	19.65
	Emotion-focus	γ_{01}	0.18*	0.09	.32	2.10
	Self-focus	γ_{02}	-0.28**	0.10	-.48	-2.96
	Dampening	γ_{03}	-0.11*	0.05	-.22	-2.43
Rate of change, π_{1i}	Intercept	γ_{10}	-0.63***	0.08	--	7.58
	Emotion-focus	γ_{11}	-0.02	0.03	-.03	-0.50
	Self-focus	γ_{12}	0.03	0.04	.05	0.79
	Dampening	γ_{13}	0.01	0.02	.02	0.50
Variance Components						
Level 1	Within-person, E_{ij}	σ_{ε}^2	1.49			
Level 2	In initial status, ζ_{0i}	σ_0^2	1.77***			
	In rate of change, ζ_{1i}	σ_1^2	0.12**			

Note. Full Maximum Likelihood, HLM. MI = mood induction. Par = parameter. *p < .05, **p < .01, ***p < .001.

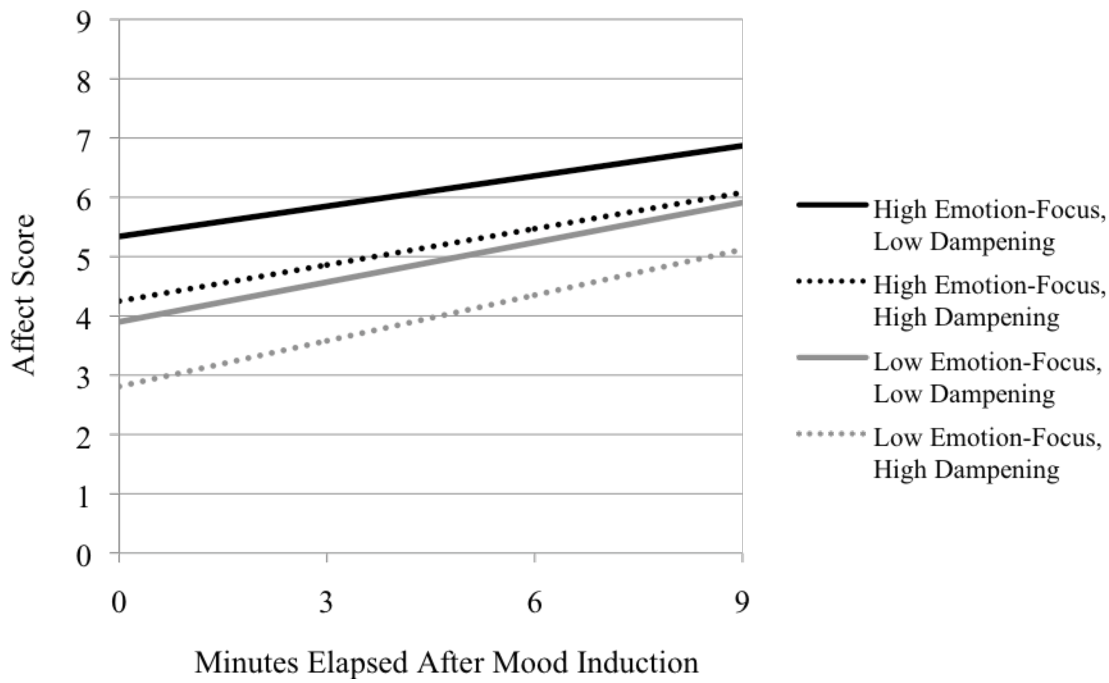

Figure 4. Prototypical change trajectories in response to a negative mood induction.

Hypothesis 3

Recall that Hypotheses 3a-3c aimed to examine the RPA subscales' ability to predict actual cognitive responses to positive mood inductions. Only participants in the positive mood condition were used in these analyses. To address this question, at Phase II, participants were asked to retrospectively report information about their cognitive experience in the 9-minute interval after the mood induction. These self-report questionnaires included measures of positive and negative automatic thoughts, as well as a "state" RPA that referred only to their cognitions in that 9-minute period of time. After determining that the assumptions of correlation were met, Pearson product moment correlations were conducted on most of the variables. Due to concerns about the positive skew of the Phase II negative automatic thoughts data (ATQ-S), the Spearman rank-order correlation was used for this questionnaire (B. H. Cohen, 2001). To test the hypothesis that Phase I positive rumination scales would predict actual Phase II response to PA, Phase I emotion-focused and self-focused positive rumination were correlated with reports of experienced positive and negative automatic thoughts and "state" positive rumination at Phase II. Phase I dampening was correlated with reports of experienced positive and negative automatic thoughts and "state" RPA dampening at Phase II. Due to the number of tests (9), a Bonferroni correction was applied, yielding an alpha level of .006. See Table 13 for the means, standard deviations, and internal consistencies of the variables in these analyses.

Table 13. Sample Sizes, Means, Standard Deviations, and Internal Consistencies for State RPA and Automatic Thoughts in Response to a Positive Mood Induction

Phase II Variable	*n*	*M*	*SD*	α
State emotion-focus	60	14.22	3.32	.77
State self-focus	60	9.75	3.03	.82
State Dampening	60	13.88	4.64	.82
Positive automatic thoughts	60	72.92	34.74	.99
Negative automatic thoughts	60	17.87	6.32	.92

Consistent with Hypothesis 3a, Phase I emotion-focused positive rumination was statistically significantly correlated with Phase II emotion-focused positive rumination,

$r(58) = .45$, and marginally significantly correlated with positive automatic thoughts, $r(58) = .35$ ($p = .007$), in response to a positive mood induction at Phase II. It was not significantly correlated with negative automatic thoughts, $r_s(58) = -.06$, *ns*. In support of Hypothesis 3b, Phase I self-focused positive rumination was statistically significantly correlated with "state" self-focused positive rumination, $r(58) = .61$, and positive automatic thoughts, $r(58) = .43$, in response to a Phase II positive mood induction. It was not significantly correlated with negative automatic thoughts, $r_s(58) = -.10$, *ns*. In partial support of Hypothesis 3c, Phase I "trait" dampening was statistically significantly correlated with "state" dampening, $r(58) = .77$, but not negative or positive automatic thoughts in response to the positive mood induction at Phase II, $r_s(58) = .28$, *ns*, $r_s(58) = -.12$, *ns*. Thus, as self-reported Phase I dampening increased, Phase II dampening, but not negative automatic thoughts, increased as well.

Hypothesis 4

Of the 154 participants who began Phase III, 6 participants did not complete all of the measures and two participants were excluded for not having experienced any positive life events. This yielded a total of 146 participants in the final sample for both Hypotheses 4 and 5. For this sample, the range of days between Phase I and Phase III was between 30 and 138, with a mean of 82.28 days. See Table 14 for a display of the means, standard deviations, and reliabilities of each measure included in Hypothesis 4, as well as the correlations between measures for the 146 participants who were included in the Hypothesis 4 data.

Table 14. Sample Sizes, Means, Standard Deviations, and Intercorrelations for Phase III Psychological Health and Predictor Variables

Variable	*n*	*M*	*SD*	1	2	3	4
PIII Psych health	146	203.89	61.59	.57***	.15*	.32***	.16*
Predictor Variable							
1. PI Psych health	146	208.53	61.11	--	.06	.44***	.12
2. Days betw PI & PIII	146	82.28	24.92		--	.01	.11
3. Positive rumination	146	23.51	5.41			--	.08
4. Positive life events	146	29.08	22.12				--

Note. Psych = psychological. Betw = between. **p* < .05, ***p* < .01, ****p* < .001

Recall that Hypothesis 4 aimed to examine the extent to which positive rumination moderates the impact of positive life events on psychological health outcomes. To examine this hypothesis, a composite psychological health score (CPH) was computed which included subjective happiness, well-being, and the PA scale from the PANAS. All variables were examined for normality, and residuals were examined to determine if they met the assumptions of regression (constant variance and a normal and independent distribution). All continuous variables were centered to reduce nonessential multicollinearity. A hierarchical setwise regression analysis, as is commonly used in studies of cognitive vulnerability to depression (e.g., Fresco et al., 2006), was used to examine a *positive* “diathesis-stress” model.

Phase III CPH was used as the dependent variable. Phase I CPH was entered in the first step, days elapsed between Phase I and Phase III was entered in the second step, the positive rumination composite score was entered in the third step, the intervening positive life events score was entered in the fourth step, and a two-way interaction term was entered in the fifth step (positive rumination X positive life events).

Table 15 summarizes the regression results for the analysis. When all five steps were included in the model, R = .62, F (5, 140) = 17.56, p < .001. After Step 1, with Phase I psychological health in the equation, R^2 = .33, F_{inc} (1, 140) = 69.73, p < .001. After Step 2, with days between Phase I and Phase III included in the equation, R^2 = .34, F_{inc} (1, 140) = 2.81, *ns*. The addition of this variable did not significantly increase R^2. After Step 3, with composite positive rumination included in the equation, R^2 = .34, F_{inc} (1, 140) = 1.12, *ns*. The addition of this variable did not significantly increase R^2. After Step 4, with positive life events included in the equation, R^2 = .35, F_{inc} (1, 140) = 1.27, *ns*. The addition of this variable did not significantly increase R^2. Finally, after Step 5, with the interaction between composite positive rumination and positive life events included, R^2 = .39, F_{inc} (1, 140) = 8.00, p < .01. The addition of this variable did significantly improve prediction of Phase III psychological health, ΔR^2 = .04, p < .01, with a small effect size.

Follow-up analyses were conducted on a median split of the data in order to interpret the significant interaction between composite positive rumination and positive life events (see Figure 5 for a visual representation of the interaction). The follow-up analyses demonstrated that participants who were in the top half of the sample in Phase I positive rumination and who were in the top half of intervening positive life events, had the highest mean centered CPH reported at Phase III (M = 20.81). Participants who were in the high positive rumination group but were in the bottom half of positive life events

Table 15. Summary of Hierarchical Regression Analysis Testing Positive Rumination as a Moderator of the Relationship Between Positive Life Events and Psychological Health (*n* = 146)

Step and predictor variable	*B*	*SEB*	*β*	Part *r*	R^2	Δ R^2	Δ *F*	f^2
Step 1					.33	.33***	69.73**	.49
PI CPH	0.58	0.07	.57***	.57				
Step 2					.34	.01	2.81	.02
PI CPH	0.57	0.07	.56***	.57				
PI-PIII days	0.28	0.17	.11	.14				
Step 3					.34	.01	1.12	.00
PI CPH	0.53	0.08	.53***	.51				
PI-PIII days	0.29	0.17	.12	.14				
PI PR	0.91	0.86	.08	.09				
Step 4					.35	.01	1.27	.02
PI CPH	0.53	0.08	.52***	.50				
PI-PIII days	0.27	0.17	.11	.13				
PI PR	0.89	0.86	.08	.09				
Pos life events	0.22	0.19	.08	.10				
Step 5					.39	.04**	8.00**	.07
PI CPH	0.53	0.08	.52***	.51				
PI-PIII days	0.30	0.17	.12	.15				
PI PR	3.54	1.26	.31**	.23				
Pos life events	2.55	0.85	.92**	.25				
PR X Pos life events	-0.10	0.03	-.91**	-.23				

Note. Part = partial. CPH = composite psychological health. PI-PIII days = days between Phase I and Phase III. PI PR = Phase I composite positive rumination. Pos life events = positive life events. PR X Pos life events = the interaction between positive rumination and positive life events. *$p < .05$, **$p < .01$, ***$p < .001$

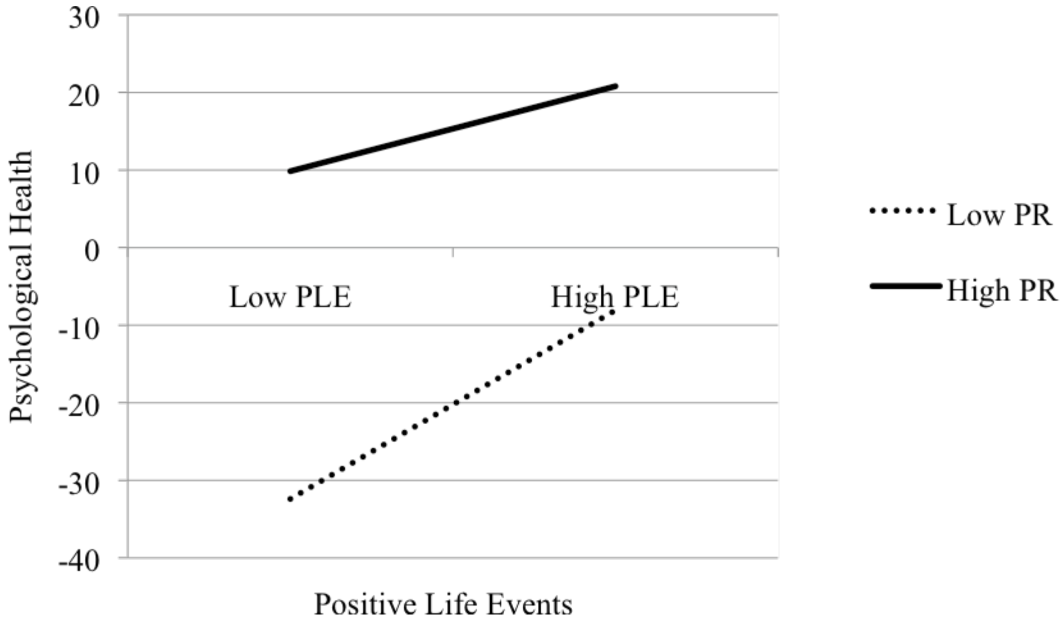

Figure 5. Positive rumination as a moderator of the relationship between positive life events and psychological health.

had the next highest centered CPH (*M* = 9.86). Participants who were low on positive rumination but had high positive life events reported the next level of centered CPH (*M* = -8.07). Finally, participants who reported low levels of positive rumination and low levels of positive life events reported the lowest centered CPH at Phase III (*M* = -32.40).

The results of these analyses support Hypothesis 4 in that positive rumination at Phase I did moderate the impact of intervening positive life events on psychological health. Namely, even after controlling for Phase I psychological health and time between Phase I and Phase III, individuals who were high in both positive rumination and positive life events had especially high psychological health at Phase III.

Hypothesis 5

Recall that Hypothesis 5 aimed to examine the extent to which positive rumination moderates the impact of positive life events on physical health outcomes. The analysis was structured in the same way as for Hypothesis 4, but the total score from the physical health measure, the PILL, was used as the dependent variable. Phase I physical health was entered in the first step, days elapsed between Phase I and Phase III was entered in the second step, composite positive rumination was entered in the third step, positive life events was entered in the fourth step, and a two-way interaction term was entered in the fifth step (composite positive rumination X positive life events).

The data were examined to determine if they met the assumptions of regression. Although Mahalanobis distances were used to assess for outliers, and there were three, these data appeared to be valid data points of individuals who reported a high number of positive life events, and thus, were not eliminated from the analyses (Tabachnick & Fidell, 2001).

See Table 16 for a display of the means and standard deviations of each measure, as well as the correlations between measures for the 146 participants who were included in the Hypothesis 5 analyses. Table 17 summarizes the regression results for the analysis. When all five steps were included in the model, $R = .69$, $F(5, 140) = 25.15$, $p < .001$.

After Step 1, with Phase I physical health in the equation, $R^2 = .46$, $F_{inc}(1, 140) = 120.30$, $p < .001$. After Step 2, with days between Phase I and Phase III included in the equation, $R^2 = .46$, $F_{inc}(1, 140) = 1.32$, *ns*. The addition of this variable did not significantly increase R^2. After Step 3, with composite positive rumination included in the equation, $R^2 = .47$, $F_{inc}(1, 140) = 1.26$, *ns*. The addition of this variable did not significantly increase R^2. After Step 4, with positive life events included in the equation, $R^2 = .47$, $F_{inc}(1, 140) = 1.13$, *ns*. The addition of this variable did not significantly increase R^2. Finally, after Step 5, with the interaction between composite positive rumination and positive life events included, $R^2 = .47$, $F_{inc}(1, 140) = 1.08$, *ns*. The addition of this variable did not significantly increase R^2.

Table 16. Sample Sizes, Means, Standard Deviations, and Intercorrelations for Phase III Physical Health and Predictor Variables

Variable	*n*	*M*	*SD*	1	2	3	4
PIII Phys health	146	15.63	10.08	.68***	.05	.00	-.03
Predictor Variable							
1. PI Phys health	146	14.76	8.73	--	-.03	-.11	.04
2. Days betw PI & PIII	146	82.28	24.92		--	.01	.11
3. Positive rumination	146	23.51	5.41			--	.08
4. Positive life events	146	29.08	22.12				--

Note. Phys = physical. Betw = between. *$p < .05$, **$p < .01$, ***$p < .001$

Given the fact that there was a non-significant interaction, no follow-up analyses were warranted. For this hypothesis, only the impact of Phase I PILL was significantly associated with Phase III PILL scores. The results did not support Hypothesis 5. There was no significant interaction between positive rumination and positive life events in predicting Phase III physical health.

Table 17. Summary of Hierarchical Regression Analysis Testing Positive Rumination as a Moderator of the Relationship Between Positive Life Events and Physical Health (n = 146)

Step and predictor variable	B	SEB	β	Part r	R^2	ΔR^2	ΔF	f^2
Step 1					.46	.46***	120.30***	.85
PI Phys health	0.78	0.07	.68***	.68				
Step 2					.46	.01	1.32	.00
PI Phys health	0.78	0.07	.68***	.68				
PI-PIII days	0.03	0.03	.07	.10				
Step 3					.47	.01	1.26	.02
PI Phys health	0.79	0.07	.68***	.68				
PI-PIII days	0.03	0.03	.07	.10				
PI PR	0.13	0.12	.07	.09				
Step 4					.47	.00	1.13	.00
PI Phys health	0.79	0.07	.69***	.68				
PI-PIII days	0.03	0.03	.08	.10				
PI PR	0.14	0.12	.07	.10				
Pos life events	-0.03	0.03	-.07	-.09				
Step 5					.47	.00	1.08	.00
PI Phys health	0.79	0.07	.68***	.68				
PI-PIII days	0.03	0.03	.08	.11				
PI PR	0.29	0.18	.15	.13				
Pos life events	0.10	0.13	.22	.07				
PR X Pos life events	-0.01	0.01	-.31	-.09				

Note. Part = partial. Phys = physical. PI-PIII days = days between Phase I and Phase III. PI PR = Phase I composite positive rumination. Pos life events = positive life events. PR X Pos life events = the interaction between positive rumination and positive life events. *p < .05, **p < .01, ***p < .001

Hypothesis 6

Recall that Hypothesis 6 aimed to examine the test-retest reliability of the RPA. In these analyses, all three RPA subscales (emotion-focused positive rumination, self-focused positive rumination, and dampening) as well as the emotion-focused/self-focused positive rumination composite were used. After examining the data to determine that the assumptions were met, Pearson product moment correlation coefficients were computed for the Phase I and Phase III scores for each of the four measures. A Bonferroni-corrected alpha level of .0125 was used for these four correlations. See Table 18 for a display of the means, standard deviations, and internal consistencies of each measure.

Table 18. Sample Sizes, Means, Standard Deviations, and Internal Consistencies for Phase III Trait RPA Scales

Phase III Trait Variable	*n*	*M*	*SD*	α
Emotion-focus	152	10.86	4.34	.93
Self-focus	151	8.17	3.20	.89
Positive rumination comp	151	18.99	7.28	.95
Dampening	152	14.62	4.66	.82

Note. Comp. = composite.

Phase I emotion-focused positive rumination was significantly positively related to Phase III emotion-focused positive rumination, $r(150) = .30$. Phase I self-focused positive rumination was significantly positively related to Phase III self-focused positive rumination, $r(149) = .36$. Phase I positive rumination composite score was significantly positive related to the Phase III positive rumination composite, $r(149) = .33$. Although significant, all of these correlations were unacceptably low to demonstrate test-retest reliability. Finally, in support of Hypothesis 6d, Phase I dampening was significantly positively related to Phase III dampening, $r(150) = .59$.

Given that the time between Phase I and Phase III varied among the 152 individuals who participated in these analyses ($M = 81.22$, $SD = 25.06$), we examined whether the correlations were consistent even after controlling for the days between Phase I and Phase III. There was no significant impact of controlling for time between Phase I and Phase III.

Hypothesis 7

Recall that Hypothesis 7 aimed to examine the correlations between three types of affect ratings within individuals at Phase II. For each individual, a composite cued affect rating was computed from the four post-induction affect grid valence ratings.[iv] For each individual, a composite retrospective mood measure score was computed for the two retrospective mood measures (RMM and PANAS).[v] For each individual, a composite cognitive task score was computed for positive affectivity bias on the three cognitive

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[iv] A composite cued affect rating was created for participants by computing the mean of their four post-induction affect grid valence scores.

[v] A composite retrospective mood measure score was computed for each participant in two steps. First, we rescaled each of the positive and negative RMM and PANAS subscales onto an 80-point scale. Then, the four rescaled scores were summed.

tasks.[vi] After determining that the assumptions of correlation were met, Pearson product moment correlation coefficients were computed to examine the relationships between the composite cued affect, retrospective mood, and cognitive task measures. A Bonferroni-corrected alpha level of .017 was used for these three correlations. See Table 19 for the means, standard deviations, and intercorrelations between these measures.

Table 19. Sample Sizes, Means, Standard Deviations, and Correlations for Multi-Method Affect Measures

Phase II Variable	*n*	*M*	*SD*	1	2	3
1. Comp affect grid	180	23.74	5.99	--	.10	.60†
2. Comp cognitive task	163	65.29	20.54		--	.07
3. Comp retrospective report	179	36.82	32.24			--

Note. Comp = composite. †significant at Bonferroni-adjusted level of .017.

In support of Hypothesis 7a, after using the Bonferroni correction, the composite affect grid mood score and the retrospective mood composite scores were strongly and significantly positively associated with each other, $r(176) = .60$. However, the composite cognitive task score was not significantly associated with either the composite affect grid score, $r(160) = .10$, or the retrospective mood composite score, $r(159) = .07$.

[vi] A composite cognitive task score was computed for each participant in two steps. First, we rescaled each of the three individual cognitive task scores onto a 48-point scale. Then, the three rescaled scores were summed.

Hypothesis 8

Recall that Hypothesis 8 aimed to examine the interaction between trait response to PA and current mood on positive biases from the cognitive tasks. Of the 181 participants in Phase II, only 163 completed all of the required measures in their entirety (several participants missed the first word on the homophone spelling task, which resulted in them being eliminated from these analyses). Two moderated multiple regressions were performed to assess the interaction between trait response style and current induced mood on cognitive task performance (West, Aiken, & Krull, 1996). Moderated multiple regressions are the preferred analysis for interactions between categorical (mood induction type) and continuous (response style) variables (West et al., 1996). As recommended by West et al. (1996), continuous variables were centered before the analyses in order to clarify the meaning of main effects in the data. Mood induction groups were dummy coded into two variables (D1 and D2) as recommended by J. Cohen et al. (2003). Using the neutral mood induction as the comparison group allowed us to address the hypotheses by comparing both the positive and negative conditions to the neutral group but not to each other. The residuals were examined and they met the assumptions of regression in that they had a constant variance and a normal and independent distribution.

For these analyses, a composite cognitive task score was computed for each individual that was used as the dependent variable. See Table 20 for the means and standard deviations of the cognitive task measure scores for each of the mood induction groups.[vii] For the first regression, Block 1 included composite positive rumination, D1 (positive compared to neutral mood induction), and D2 (negative compared to neutral mood induction). Block 2 included the interaction terms "composite positive rumination X D1," and "composite positive rumination X D2." For the second regression, Block 1 included dampening, D1 (positive compared to neutral), and D2 (negative compared to neutral). Block 2 included the interaction terms "dampening X D1," and "dampening X D2."

Table 20. Means and Standard Deviations for Cognitive Task Measures in the Three Experimental Groups

	Positive		Neutral		Negative	
Variable	*M*	*SD*	*M*	*SD*	*M*	*SD*
Cognitive task 1	1.97	1.19	1.57	1.23	1.83	1.51
Cognitive task 2	-1.82	1.59	-1.60	1.68	-1.28	1.68
Cognitive task 3	15.83	8.59	14.93	9.21	15.12	9.05
Composite score	65.86	19.06	63.43	19.55	66.69	23.18

Note. There were no statistically significant differences between mood induction groups on the cognitive task variables.

A Bonferroni-adjusted family error rate set to .05/2 (.025) was used to assess the predictions for each family of regressions (dampening and positive rumination). To further reduce Type I error in each of the three groups, the increment of R^2 was examined

[vii] Post-hoc Bonferroni-corrected ANOVA tests revealed that there were no significant differences between mood induction groups on any of the cognitive task measures.

from the main effects-only model to the full model (main effects + interactions). We decided *a priori* to only examine interactions if the increment in R^2 indicated that adding the interaction significantly improved the fit of the model. The first interaction allowed us to determine if the slope of the RPA variables' impact on the cognitive task differs between the positive and neutral mood induction. The second interaction allowed us to determine if the slope of the RPA variables' impact on the cognitive task differs between the negative and neutral mood induction.

The first regression examined the interaction of trait positive rumination with mood induction on cognitive task performance (see Table 21). When both steps were included in the model, $R = .09$, F (5, 157) = .24, *ns*. After Step 1, with composite positive rumination and the two mood induction variables in the equation, $R^2 = .01$, F_{inc} (3, 159) = .29, *ns*. After Step 2, with the two interaction terms added in the equation, $R^2 = .01$, F_{inc} (2, 157) = .16, *ns*. The addition of the interaction did not significantly increase R^2. Thus, we stopped analyses there.

Table 22 summarizes the regression examining the interaction of trait dampening with mood induction on cognitive task performance. When both steps were included in the model, $R = .09$, F (5, 157) = .25, *ns*. After Step 1, with dampening and the two mood induction variables in the equation, $R^2 = .01$, F_{inc} (3, 159) = .26, *ns*. After Step 2, with the two interaction terms included in the equation, $R^2 = .01$, F_{inc} (2, 157) = .24, *ns*. The addition of the interaction terms did not significantly increase R^2. Thus, we stopped analyses there. These findings did not support any components of Hypothesis 8.

Table 21. Summary of Moderated Multiple Regression Analysis Testing the Interaction Between Trait Positive Rumination and Current Mood (N = 163)

Step and predictor variable	*B*	*SEB*	β	Part *r*	R^2	ΔR^2	ΔF	f^2
Step 1					.01	.01	.29	.01
Pos rumination	-0.11	0.29	-.03	-.03				
D1: Neu vs. pos MI	2.42	3.93	.06	.05				
D2: Neu vs. neg MI	3.21	3.99	.07	.06				
Step 2					.01	.00	.16	.00
Pos. rumination	-0.12	0.32	-.03	-.03				
D1: Neu vs. pos MI	2.42	3.95	.06	.05				
D2: Neu vs. neg MI	3.49	4.04	.08	.07				
Pos rum X D1	-0.13	0.61	-.02	-.02				
Pos rum X D2	0.26	0.52	.04	.04				

Note. Part = partial. Pos = positive. Neu = neutral. Neg = negative. Rum = rumination. *p < .05, **p < .01, ***p < .001

Table 22. Summary of Moderated Multiple Regression Analysis Testing the Interaction Between Trait Dampening and Current Mood (N = 163)

Step and predictor variable	B	SEB	β	Part r	R^2	ΔR^2	ΔF	f^2
Step 1					.01	.01	.26	.01
Dampening	0.09	.38	.02	.02				
D1: Neu vs. pos MI	2.48	3.93	.06	.05				
D2: Neu vs. neg MI	3.36	4.01	.08	.07				
Step 2					.01	.00	.24	.00
Dampening	0.35	0.63	.08	.05				
D1: Neu vs. pos MI	2.61	3.96	.06	.05				
D2: Neu vs. neg MI	3.23	4.04	.07	.06				
Dampening X D1	-0.26	0.87	-.04	-.02				
Dampening X D2	-0.70	1.00	-.07	-.06				

Note. Part = partial. Neu = neutral. Pos = positive. Neg = negative. *$p < .05$, **$p < .01$, ***$p < .001$

CHAPTER 4

DISCUSSION

The primary aim of this study was to examine the validity and reliability of the RPA measures. Participants in Phase I completed the RPA and a variety of related measures in order to provide data on the RPA's convergent and divergent validity. Next, Phase II participants were randomly assigned to a positive, negative, or neutral mood induction and their affect and cognitive task performance were measured during a nine-minute follow-up. The results allowed us to test whether the RPA subscales measured at Time I were able to predict individuals' responses to the varying affect-induction conditions. Finally, Phase III data were collected after at least a one-month naturalistic follow-up. At this time, participants reported on intervening life events and psychological and physical health outcome measures. We used these data to examine whether individual differences in Phase I RPA scale scores moderated the impact of positive life events on health outcomes at Phase III and to examine the RPA's test-retest reliability.

The study also addressed two secondary aims. First, the Phase II affect ratings were analyzed to determine the extent to which implicit and explicit measures of affect were correlated. Second, the Phase II data were used to assess whether trait rumination and dampening interacted with state mood to impact cognitive performance. The discussion that follows will review the main findings of this study and their implications, as well as suggest future directions for work in this area.

Convergent Validity

Convergent validity was demonstrated for the positive rumination scales by their significant positive relationships with concurrent indicators of mental health, positive traits, and approach motivation. The mental health and positive traits results are consistent with Feldman et al.’s (in press) findings and the relationship with BAS scales is supported by previous studies demonstrating that individuals high on behavioral activation measures seem to be particularly proficient at seeking out and extending positive events (Gable, Reis, & Elliot, 2000) and stimuli (A. Gomez & Gomez, 2002).

Although we expected distinct negative relationships with measures of negative affect, depression, and behavioral inhibition, the majority of these relationships were not significant. However, these null relationships are in line with the general intention behind the hypothesis. We were surprised to find that the emotion-focused positive rumination measure did not have as strong associations with the depressive rumination scales as were found in past research (Feldman et al., in press; S. L. Johnson et al., in press). It is not clear why our samples would differ in this regard. This surprising finding highlights the need for more research on the RPA with a variety of samples.

In line with previous research (Feldman et al., in press), and as hypothesized, the Dampening scale had medium and large positive correlations with negative affect and cognitions. Providing further construct validity and demonstrating the generalizability of Feldman et al.'s (in press) findings, dampening had medium and large significant negative correlations with positive cognitions and constructs. Although dampening was not significantly correlated with PA or the behavioral activation scales, this lack of relationship is in line with the intention behind the hypothesis.

The positive relationship between manic symptoms and the two positive rumination scales is of interest, particularly in light of its null relationship with depressive rumination. Although small-to-medium, these relationships corroborate S. L. Johnson et al.'s (in press) suggestion that positive rumination may play a role in maintaining manic episodes. The lack of relationship between dampening and manic symptoms in this study may be explained by Feldman et al.'s (in press) findings that dampening is positively associated with manic vulnerability, but not current manic symptoms. It is possible, then, that individuals with bipolar disorder utilize dampening and positive rumination at varying levels during different stages in the illness.

As a whole, the results for Hypothesis 1 provided support for the convergent and divergent validity of the RPA by demonstrating that the RPA scales are associated with related constructs in a theoretically coherent way. However, the results are limited by their cross-sectional nature.

Experimental and Naturalistic Predictive Criterion Validity

Several of this study's hypotheses addressed the ability of the RPA scales to predict future outcomes. Hypothesis 2 examined the RPA's capacity to predict participants' affective responses to actual mood inductions. In the positive affect condition, emotion-focused positive rumination was a marginally significant predictor of mood change in response to a positive mood induction. These findings suggest that higher positive rumination can lead to slightly higher affect in the period of time directly after a positive event. Self-Focus and Dampening did not impact mood change over time. These latter findings were unexpected and did not support the predictive criterion validity of the RPA scales in short-term response to PA.

In the neutral affect condition, emotion-focused positive rumination was a predictor of initial mood in response to the neutral mood condition, predicting a lower affect intercept than individuals with lower Emotion-Focus scores (a moderate effect). However, participants with higher emotion-focused positive rumination had significantly more positive slopes of mood change than the average participant (a moderate effect). This is surprising because we did not expect the RPA scores to have any impact on response to a neutral mood induction (especially in light of the fact that the neutral mood induction actually led to a significant decrease in affect immediately post-induction).

Finally, in the negative affect condition, all three RPA scales impacted an individual's initial response to the mood induction, but not their change over time. Emotion-focused positive rumination predicted a higher initial intercept (a large effect), whereas Self-Focus and Dampening predicted lower initial intercepts (large effects). We did not expect the RPA scales to have an impact on either intercept or slope of individuals' responses to a negative mood induction.

There are several potential explanations for the unexpected results of the tests of Hypothesis 2. It is possible that responses to PA tend to act over a longer period of time than was measured (recall that we only measured for the nine minutes immediately following the mood induction). Perhaps, PA response style has its effects over hours or days. It is also possible that responses to PA vary over time or with mood symptomatology. Thus, there may have been too much change between Phase I RPA scores and Phase II to have accurate predictions (although the test-retest reliability results for Hypothesis 6 support this suggestion, the construct validity findings for Hypothesis 3 argue against this point). Alternatively, individuals may have had difficulty measuring and reporting on their affect. Finally, it is also possible that the experiment itself was not a valid assessment of how individuals respond to PA in the real world. Future research could address these possibilities by examining responses to PA over longer periods of time and in more naturalistic settings.

The results of Hypothesis 3, for the most part, provided support for the ability of the RPA scales to predict, with specificity, actual positive rumination, dampening, and automatic thoughts in response to a mood induction. There were medium to strong significant positive correlations between trait emotion- and self-focused positive rumination at Phase I and participants' reports of their actual responses to the positive mood induction at Phase II. Furthermore, both the Emotion-Focus and State-Focus trait scales had medium-sized positive correlations with reported positive automatic thoughts at Phase II, but no relationships to negative automatic thoughts. The results for the Dampening scale were not as supportive. Although trait Dampening was strongly positively correlated with state Dampening and not correlated with positive automatic thoughts, it did not predict negative automatic thoughts in response to a positive mood induction. However, it is important to note that the correlation was in the predicted direction, but the hypothesis itself was underpowered (see Appendix).

In the Hypothesis 3 analyses, participants' reports of what they typically do in response to PA were compared to how they report actually having responded to PA. Although the findings support the validity of the RPA scales, it is important to remember that these data are all based on the participants' self-report. Given that we currently do not have a way to measure the actual content of thoughts other that asking about them, these results provide strong support for the validity of the positive rumination measures.

It was surprising, however, that the Dampening scale was not significantly correlated with negative automatic thoughts (although they were correlated at .28, this was not a strong enough relationship to be detected with the power available in the positive mood induction subsample). Thus, it will be important for future research to address this question to determine what types of cognitions are associated with dampening.

The last set of criterion validity hypotheses explored the ability of the RPA scales to predict interactions between positive rumination and positive life events. The results of Hypothesis 4 provided support for the predictive criterion validity of the construct of positive rumination. The analyses suggest that a tendency to engage in positive rumination interacts with actual positive life events to result in especially high psychological health (in comparison with individuals who reported lower levels of positive rumination). This interaction suggests that despite positive rumination's association with higher symptoms of mania, it did predict psychological health in our unselected undergraduate sample. These findings are important because they demonstrate that an individual's typical response to PA can prospectively predict the impact on psychological health factors like subjective happiness, well-being, and PA. This is the first study to utilize the RPA in prospective predictions.

The null results for Hypothesis 5, that there was no significant impact of positive rumination or positive life events on physical health outcomes, were surprising. However, it is possible that the time between measurement was not long enough to demonstrate meaningful naturalistic change in physical health, or that the physical health measure was not a valid indicator of changes in health status for this sample. Future research should address these limitations by measuring impact on physical health over longer periods of time or by using physician records to record sicknesses in the intervening time period instead of a self-report measure.

Overall, the data on the predictive criterion validity of the RPA scales is mixed. The RPA was successful in predicting the use of positive rumination as a response to experimentally-induced PA and in predicting changes in psychological health in response to naturally-occurring positive life events over a follow-up period. However, the RPA scales did not successfully predict affective responses to experimentally-induced PA or physical health responses to naturally-occurring positive life events. It will be important for future research to consider alternative ways to measure how individuals utilize positive response styles in the moment, and to improve the measurement of PA response styles.

Test-Retest Reliability

Unexpectedly, the test-retest reliabilities for the RPA measures over a period of time (M = 81.22 days) were unacceptably low, with rs ranging from .30 to .59. Even after controlling for the number of days between measurements, these low correlations persisted. It is possible that the reliability is stronger for shorter spans of time such as a week or two. However, these findings are not consistent with the idea that the RPA is a stable, trait measure. It is also possible that individuals are not good at reporting on their typical response to PA. Thus, it might be necessary to utilize alternative measurement strategies other than face-valid self-report, such as obtaining the report of family or friends. Although these findings were unexpected, they demonstrate that there may be variability in one's response to PA. It will be important to examine other constructs, such as current mood and symptomatology, that may moderate an individual's response to PA.

Mood Measurement

We were able to examine two secondary aims in this study. The aim of Hypothesis 7 was to assess the relationship between three types of mood measurement. We were surprised that the cognitive tasks used in the study were not significantly correlated with explicit affect grid and retrospective mood reports. Thus, it appears that our attempts to measure affect implicitly were unsuccessful. Although the cognitive tasks were not successful implicit measures of affect in the study, they played an important role as part of the cover story of the experiment. The strong relationship between the affect grid and retrospective mood reports provides validity to our use of explicit measures of affect as the dependent variable for the primary aims of the study. It will be important for researchers to continue to search for successful and generalizable methods of measuring affect implicitly.

State-Trait Interaction

Finally, in Hypothesis 8, we examined the interaction of trait response style and state affect on implicit affect reports (as measured by cognitive task performance). Our findings did not confirm that trait response style interacted with state mood to impact performance on cognitive tasks. However, given the findings for Hypothesis 7, it is likely that the cognitive tasks were not successful measures of implicit affect. Thus, future examinations of Rusting's (1998) hypothesis should utilize valid dependent variables.

Limitations

There were several limitations to this study. First, the sample was limited by the fact that it was a convenience sample of undergraduates. In addition to this limit to generalizability, the study had few participants of Latino and Asian descent. Second, the Phase II mood induction samples differed on energy level before the mood induction. Surprisingly, the positive mood induction group had the lowest energy level after the mood induction. Although energy was not used as a dependent variable, it is possible that the participants' energy levels impacted their responses on the questionnaires. Furthermore, the neutral mood induction led to a significant decrease in affect, instead of leading to no change at all. Given that people's moods are generally above neutral, (Diener & Diener, 1996) it is possible that the neutral affect condition brought people down to a more truly "neutral" mood.

Next, the study's cognitive tasks did not appear to have adequately measured affect. These tasks were expected to be an important validator of the affect grid and retrospective emotion reports. Given that past research has had success utilizing these methodologies, it is surprising that these tasks were not effective implicit mood measures in this study. In light of the failure of the cognitive tasks, perhaps this study would have benefited from utilizing psychophysiological measures of affect.

The number of days between Phases I, II, and III varied between participants. Although we controlled for this difference in relevant analyses, in future research, it would be best to have less variability in time between phases. Finally, the results of the experiment portion of the study may not be generalizable to real-world situations due to its short time-span, generalized mood induction, and use of computerized self-report.

Future research should consider more naturalistic ways of measuring an individual's typical response to PA.

Conclusion and Implications

PA is an important, but often neglected, component of well-being and mental health. Fredrickson's (1998) "broaden-and-build" theory suggests that positive emotions lead to an expansion of attention and cognition, which, in turn, lead to the development of new intellectual, physical, social, and psychological skills. In fact, recent research has found that there are significant benefits to PA (see Hughes, 2007 for a review) and that individuals engage in strategies to maintain their PA. For example, happy individuals engage automatic cognitive responses that lead to a preference for positive information (Handley, Lassiter, Nickell, & Herchenroeder, 2004), find humor even in negative stimuli, like death (Hirt & McCrea, 2000), and may protect their mood by avoiding risky bets that would lead to true loss (Nygren, Isen, Taylor, & Dulin, 1996). Thus, although PA is generally fleeting, the ability to maintain PA for longer periods of time can have important consequences for mental health.

The current study addressed whether individual differences in response to PA can maintain PA and lead to beneficial mental and physical health outcomes. Although the results of this study were mixed, the findings that positive rumination was associated with psychological health cross-sectionally and interacted with positive life events to increase psychological health over time, have important implications for both literature on psychopathology and well-being. For example, cognitive vulnerability researchers might examine whether a diminished level of positive rumination is a cognitive component of anhedonia in depression, whereas a high level of positive rumination is a cognitive component of mania. Treatment intervention researchers could examine whether depressive ruminators can change the content of their repetitive thinking to positive topics, thereby engaging in positive rumination, more easily than eliminating their repetitive thinking style altogether. Although more research is needed to develop reliable measures of PA response styles, the results of this study suggest that positive rumination and dampening are two important constructs to consider in the treatment of depression and mania.

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APPENDIX

POWER ANALYSIS

The following *a priori* power analysis was completed separately for each hypothesis of the study during the proposal-writing stage of this project. Due to the nature of the study's data, some modifications were made to the data analysis after this power analysis was complete. We have used footnotes below to note any relevant modifications.

Although no study has examined the RPA scales in an experimental or longitudinal design, several similar studies were used to estimate an expected effect size for this study. Each of the correlational hypotheses (1, 3, 6, and 7) required a smaller sample size than the regression analyses to obtain adequate power, so only the specific regression power analyses are described in detail below.[viii]

Hypothesis 2 examined whether individual differences in RPA predict responses to a mood induction. Studies of the RPA scales found emotion-focused positive rumination to be significantly positively correlated with a history of mania with a small to medium effect size (η^2 = .04; S. L. Johnson et al., in press). Both emotion-focused and self-focused positive rumination were significantly correlated with current manic symptoms with small-to-medium effect sizes (η^2 = .06, .04; Feldman et al., in press). Incorporating the RPA scales into a regression predicting to depression symptoms had a medium-sized effect (ΔR^2 = .10) and to mania symptoms had a medium-sized effect

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[viii] The correlational analyses required a sample size of 82 to be fully powered. Hypothesis 3, with a sample size of 60, was underpowered.

(ΔR^2 = .08; Feldman et al., in press). Given the RPA's ability to predict measures of *severe* mood disturbance (depression and mania) with a small-to-medium effect size, it could be expected to have at least a medium-sized association with short-term *normal*-range mood, especially in the face of a mood induction. In order to perform a conservative test of Hypothesis 2, the number of predictors (8), alpha level (.05), a small-to-medium effect size (f = .10), and desired power (.80) were entered into a sample size calculator (Erdfelder, Faul, & Buchner, 1996). The resulting sample size for Phase II was 159.[ix]

Hypothesis 4 examined the moderating impact of positive rumination on psychological responses to intervening positive events. Some similar studies of individual differences predicting to changes in symptomatology have found small effects (e.g., attributional style, Fresco et al., 2006; positive thinking, Lightsey, 1994). However, Needles and Abramson (1990) found a medium effect for the interaction of positive events and attributional style on hopelessness (ΔR^2 = .14). Thus, a small-to-medium effect size could be expected for this hypothesis. A power analysis was computed to find the sample size required to adequately test this hypothesis (Erdfelder et al., 1996). Given

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[ix] Please note that after creating the *a priori* power analysis, we decided that HLM would be a more sophisticated test of our study hypothesis that those outlined above. Therefore, we referred to Singer and Willett (2003) who state that a sample size of 30 or more is considered large for HLM analyses. Each of the mood induction groups had at least 60 participants, which exceeds these recommendations.

a small-to-medium effect (*f* = .10), an alpha of .05, and 4 predictors, the sample size required for Phase III was 125.[x]

Hypothesis 5 examined the moderating impact of positive rumination on physical responses to intervening positive events. With respect to health outcomes, although much research has found medium to large effect sizes for the impact of experimental writing paradigms on health (e.g., Epstein et al., 2005; *r* = .40), there are fewer studies that examine individual difference variables on health outcomes. Pettit, Kline, Gencoz, Gencoz, and Joiner (2001) found a small-to-medium effect size (*pr* = 0.18) for PA at Time 1 predicting improvement in health over a five-week interval. Benyamini, Idler, Leventhal, and Leventhal (2000) found a small-to-medium effect size (*pr* = -.17) for PA predicting to five-year longitudinal health decline in an older adult sample. S. Cohen, Doyle, Turner, Alper, and Skoner (2003) found a small-to-medium effect for individuals with a positive emotional style being less likely to develop a cold after being exposed to a virus than those with a less positive emotional style (OR = 2.3; S. Cohen et al., 2003). Thus, a small-to-medium effect size would be expected for this hypothesis and, thus, as in Hypothesis 4, a sample of 125 was required for Phase III.[xi]

To examine the sample size required for Hypothesis 8, the interaction between RPA and mood inductions as a predictor of cognitive performance, similar studies were

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[x] Please note that after the data were collected, we decided to add the days between Phase I and Phase III as an additional predictor to the model. Thus, we had a total of 5 predictors in the model, instead of the 4 we expected. Fortunately, our final sample size of 146 still exceeded the sample size required for 5 predictors (132). Despite the change, this hypothesis was still fully powered.

[xi] Footnote x for Hypothesis 4 applied to this hypothesis as well.

reviewed. Although no study has examined trait RPA with respect to a mood induction, research has applied mood inductions to individuals with conceptually similar traits. R. Gomez, Cooper, and Gomez (2000) found a large effect for trait extraversion in response to a positive mood induction ($\beta = .27$). Conway, Csank, Holm, and Blake (2000) found a large effect ($d = .68$) for the impact of trait depressive rumination in response to a negative mood induction. Rusting (1998) found small-to-medium main effects for the impact of extraversion on cognitive tasks (*r*s range from .19 to .22). Mikulincer and Sheffi (2000) found a large effect for the interaction between mood induction and attachment style on performance on a cognitive task ($f = .48$). In order to perform a conservative test of Hypothesis 8, the number of predictors (5), alpha level (.025), a small-to-medium effect size ($f = .10$), and desired power (.80) were entered into a power calculator (Erdfelder et al., 1996). The resulting sample size was 158 for Phase II.