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Life Events and Psychopathology: The Explanatory Role of Affect and Emotion Regulation

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Julia Sumner Yarrington

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ABSTRACT OF THE DISSERTATION

Life Events and Psychopathology: The Explanatory Role of Affect and Emotion Regulation

by

Julia Sumner Yarrington

Doctor of Philosophy in Psychology

University of California, Los Angeles, 2024

Professor Michelle Craske, Chair

Most studies on significant life events have examined deleterious mental health outcomes resulting from stressful or negative events. Recent work examining both negative and positive aspects of life events has found that positive aspects of significant life events protect against psychopathology. However, mechanisms by which positive aspects of events confer their beneficial effects are unclear. Clarifying mechanisms of protection may aid in the identification of novel intervention targets. The current studies examined affective states and cognitive reappraisal, an emotion regulation strategy, as possible explanatory factors. Study 1 tested longitudinal relationships between positive and negative aspects of life events, affective states, cognitive reappraisal, and transdiagnostic symptoms. Study 2 assessed whether experimental manipulation of affective states alters cognitive appraisals, represented by interpretive bias. Study 3 explored the role of positive affect and cognitive reappraisal as predictors of treatment response within a novel treatment aimed at promoting positive affect, compared to a treatment

targeting reductions in negative affect. Study 1 found that positivity of interpersonal, but not non-interpersonal events promoted positive affect, and offered preliminary support for positive affect as a mediator of the relationship between positivity of events and symptomatology. Study 2 found that a positive mood induction produced more positive interpretive bias to non-social situations than a negative induction condition, whereas a negative induction condition demonstrated greater negative response bias for social scenarios and a greater positive response bias for non-social scenarios. Study 3 demonstrated that positive affect, but not cognitive reappraisal, predicted symptom reduction across treatment conditions, and higher average positive affect predicted higher average cognitive reappraisal and vice versa. The current studies examined affective states and emotion regulation as possible mechanisms of protection against psychopathology originating from positive aspects of life events. Findings suggest that interventions which seek to upregulate positive emotional states may facilitate emotion regulation and reduce risk for psychopathology.

The dissertation of Julia Sumner Yarrington is approved.

Julienne Elizabeth Bower

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2024

Table of Contents

I. List of Figures and Tables vi

II. Acknowledgements vii

III. Vita viii

IV. Introduction 1

V. Study 1: Positive Affect and Cognitive Reappraisal: Intervening Mechanisms in the Relationship Between Life Events and Transdiagnostic Symptoms of Depression and Anxiety
- a. Abstract 14
- b. Introduction 16
- c. Method 18
- d. Results 29
- e. Discussion 38

VI. Study 2: Effects of Positive and Negative Affect Inductions on Interpretive and Response Bias
- a. Abstract 47
- b. Introduction 48
- c. Method 53
- d. Results 61
- e. Discussion 66

VII. Study 3: The Role of Positive Affect and Cognitive Reappraisal in Treatment Response
- a. Abstract 73
- b. Introduction 74
- c. Method 75
- d. Results 80
- e. Discussion 85

VIII. Summary and Implications 91

IX. Appendices 97

X. References 147

I. List of Tables and Figures

1. Table 1: Frequencies and Descriptions of Most Commonly Endorsed Events. 23

2. Table 2: Descriptive Statistics for Life Events, Affect, Reappraisal, and General Distress. 25

3. Figure 1: Conceptual Model of Path Analysis. 28

4. Table 3: Results for Cross-Lagged Paths in Positivity of Events Models. 32

5. Table 4: Results for Cross-Lagged Paths in Positivity of Events Models. 36

6. Figure 2: Overview of the Experimental Procedure. 54

7. Figure 3: Depiction of Mood Induction Instructions for Positive Condition. 56

8. Figure 4: Mood Induction and Positive Mood Ratings. 63

9. Figure 5: Mood Induction and Negative Mood Ratings. 64

10. Table 5: Descriptive Statistics for Interpretive Bias 65

11. Table 6: Descriptive Statistics for Response Bias 66

12. Table 7: Regression Coefficients for Positive Affect Predicting DASS-Total Symptoms. 81

13. Table 8: Regression Coefficients for Cognitive Reappraisal Predicting DASS-Total Symptoms. 82

14. Table 9: Regression Coefficients for Positive Affect Predicting Cognitive Reappraisal. 83

15. Table 10: Regression Coefficients for Cognitive Reappraisal Predicting Positive Affect. 84

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III. Vita

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IV. Introduction

Stress Exposure

Exposure to stress is a ubiquitous experience of human life. While all people will inevitably experience stress throughout their lifetimes, a variety of epidemiological evidence suggests that some individuals both experience and perceive a greater number of stressors than others (Epel et al., 2018; Crosswell & Lockwood, 2020). Greater exposure to stress has been linked to poorer physical and mental health outcomes, including inflammation, cardiovascular disease, metabolic syndromes, depression, and anxiety (Monroe & Simons, 1991; Krantz & McCeney, 2002; Cohen et al., 2007; Slavich & Irwin, 2014; Crosswell & Lockwood, 2020). Stressors vary widely in content (e.g., life events, discrimination, caregiving, trauma), context (e.g., workplace, neighborhood, home, relationships) and consequence (e.g., mild impact on one's life, severe disruption and impact on one's life, onset of psychological or physical conditions). While many facets of stress are relevant to health, some of the most robust links between stress and mental and physical health have been observed in the context of experiencing significant or stressful life events.

Life Events

The measurement of life events has been complicated by the fact that in the field, language used to describe these events has been at times non-specific or contradictory. Furthermore, self-report checklists of events have confounded life events with symptoms of psychopathology (e.g., changes in sleep or eating) or with consequences of psychopathology (e.g., losing a job because of symptoms impairing performance; Monroe & Reid, 2009). However, at the broadest level, significant life events can be considered to be those that have a notable impact on a person's life. Within the context of depression, studies have often equated

life events with life stressors, or those events that are associated with pressure, strain, or conflict, among other things (Monroe & Depue, 1991). A more general approach appreciates that life events can be significant (i.e., have an impact on one's life) or stressful, while also having objectively positive contextual features (e.g., getting married, moving to a new place, graduating college, ending a toxic romantic relationship).

Life events are also typically described by their time course. Discrete events with a clear beginning and end have been described as episodic events. Prolonged events have been categorized as chronic (Hammen, 2005), although there is not a clear, cross-disciplinary consensus surrounding the minimum duration of time necessary to label an event as chronic, with some studies suggesting events lasting more than one month (e.g., Crosswell & Lockwood, 2020), and others defining chronic events as those lasting for at least six months (Brown & Harris, 1978) or even one year (e.g., Hammen, 2005).

Finally, life events have been conceptualized based upon both their content as well as the degree to which individuals have contributed to the occurrence of events. Particularly in the context of psychopathology research, studies have examined interpersonal events, or those related to social relationships, and non-interpersonal events, which are those unrelated to connections with others (e.g., Rudolph et al., 2000; Shih et al., 2006; Buitron et al., 2016; Metts et al., 2021). Additionally, dependence of life events have been a significant focus in the literature, with studies assessing differential prediction of psychopathology from independent life events, which are fateful events beyond one's control (e.g., death of a relative), and dependent events, defined as events to which a person contributes, or those that are influenced by an individual's characteristics (e.g., getting fired from a job, getting into an argument; Rudolph et al., 2000; Hammen, 2005; Liu & Alloy, 2010).

Although life events vary significantly in their content and measurement, a robust literature has demonstrated that life events have an important relationship with both mental and physical health.

Life Events and Mental Health

Life Events and Affective States. Positive affect can be understood as the experience of pleasurable emotions, such as happiness, excitement, or tranquility, whereas negative affect is the experience of unpleasant emotional states, such as sadness, anxiety, guilt, or shame. The measurement of affect varies widely in terms of time frame and content. For example, one might assess trait positive affect as an indicator of a more stable predisposition to positive emotions, past week positive affect in the form of positive mood, or current moment positive affect, representative of a state measure (Pressman et al., 2019). State measures, mood, and trait affect are all related (Pressman et al., 2019; Shackman et al., 2016), although trait assessments tend to be more stable predictors of long-term outcomes (Pressman et al., 2019). Arousal is a factor that also differentiates between affective states. Some of the most widely used and well validated measures of positive and negative affect (e.g., Positive and Negative Affect Schedule (PANAS); Watson et al., 1988) use high arousal adjectives (e.g., excited, inspired, active, distressed, upset, afraid) to assess positive and negative affect. Importantly, lower arousal states (e.g., calm, tranquil, worried, bored) also represent positive and negative affect, but tend to be used less frequently, perhaps in part because high arousal affective states have more commonly been studied and found to be related to long-term health outcomes (Lahey, 2009; Pressman et al., 2019). As such, careful and intentional selection of measures of affect is important.

Life events have been associated with both positive and negative affect. For example, positive daily life events and negative daily life events have been linked to positive and negative

affect, respectively (Bolger et al., 1989; Clark & Watson, 1988; Gentzler et al., 2013; Larsen, 2002; Stone, 1987). Furthermore, brief longitudinal studies have found that on days that participants experienced a greater number of stressful or positive life events, they also experienced greater levels of negative or positive affect, respectively (Kuiper & Martin, 1998; Machell et al., 2014; Montpetit et al., 2010). Some evidence suggests that positive affect and negative affect have an interactive relationship, where positive affect might buffer against negative affect in response to daily events (Congard et al., 2011; Longua et al., 2009) or daily stressors (e.g., Montpetit et al., 2010). In sum, extant work suggests that life events may predict affect, especially given longitudinal work examining daily events and related affect states. However, most work has examined associations between events and affect on given days, limiting conclusions about the causal effects of life events on affect.

Events and Psychopathology. In part due to evidence that life events predict affect, a considerable body of research has examined the degree to which life events predict psychopathology. The experience of negative or stressful life events has been shown to predict an array of psychopathology outcomes, including alcohol or substance use disorders, bipolar disorder, psychotic episodes and schizophrenia, and personality disorders (Armstrong et al., 2018; Beards et al., 2013). In addition, an extensive literature suggests that the occurrence of stressful life events serves as a potent risk factor for the onset of anxiety and major depressive disorders (Armstrong et al., 2018; Blazer et al., 1987; Hammen, 2005; Monroe & Depue, 1991; Monroe & Harkness, 2005).

In the context of anxiety disorders, evidence suggests that the quantity of stressful life events predicts disorder onset, with four or more life stressors being more likely to predict the onset of generalized anxiety disorder (GAD) in men (Blazer et al., 1987). The same study found

that severity of events impacted risk for GAD, where individuals who reported one or more unexpected, negative, and very important life events had an increased risk of developing GAD, regardless of gender. More recent work has extended findings among anxiety disorders, finding that social anxiety is associated with chronic life stress in the interpersonal domain (Uliaszek et al., 2010). This work has since been replicated and extended, both linking chronic interpersonal stress to anxiety disorders, and demonstrating associations between episodic life stress and anxiety disorders (Uliaszek et al., 2012). A related line of research has assessed dependence of stressful events and anxiety disorders. Independent events, or those that are cannot be attributed to a person's behavior, predicted anxiety disorders in children (Eley & Stevenson, 2000), although associations between dependent events and anxiety disorders have also been demonstrated in child samples (Allen & Rapee, 2009). Studies assessing dependence of life events and anxiety among adult samples are sparse, although some data has demonstrated reciprocal relationships between neuroticism, a trait predictive of anxiety, and non-interpersonal dependent and independent stressful life events (Metts et al., 2021). Overall, the literature regarding life stress and anxiety is less developed than that for life stress and depression, although extant work has offered support for a relationship between life events and anxiety disorders.

As far as depressive disorders, evidence suggests that stressful life events precede the onset of major depressive episodes (Brown & Harris, 1989; Hammen, 2005; Mazure, 1998). In fact, data from community samples suggest among individuals with a diagnosis of depression, nearly 80% of diagnoses were preceded by a major life event (Mazure, 1998). Consistent with the anxiety literature, studies focusing on depression have demonstrated a link between quantity of stressful life events and psychopathology; individuals who have experienced a greater number

of stressful events are more likely to experience an onset of depression or more severe depressive symptoms (e.g., Ge et al., 1994; Kendler et al., 1998). Events of greater severity are also predictive of depressive onsets (Kendler et al., 1998). Notably, content and dependence or independence of events also appear to be important factors which may exacerbate risk for depression posed by stressful events more generally. For example, stressful events related to interpersonal relationships, rather than non-interpersonal factors, are especially predictive of depression. Interpersonal events capturing loss (e.g., bereavement, break-ups, divorces) have been found to be uniquely relevant to the onset of depression (e.g., Hammen, 2005; Krackow & Rudolph, 2008; Rudolph et al., 2000). Dependent events, or those to which a person contributes, tend to encompass the majority of these interpersonal events. Perhaps unsurprisingly, given the relationship between interpersonal stress and depression, dependent events are linked to depression as well (Hammen, 2005; Kendler et al., 1999; Williamson et al., 1995). Furthermore, Hammen (1991) found that women with histories of recurrent major depressive disorder were significantly more likely to experience dependent episodic events, especially within the interpersonal domain, compared to women with bipolar disorder, medical illnesses, or no disorder. This foundational research led to the notion that individuals with depression not only experience greater numbers of life stressors, but also seem to contribute to their experience of stressful life events, a process referred to as stress generation.

Evidently, an extensive literature has examined the relationship between significant life events and psychopathology. However, a disproportionate amount of attention has been paid to the negative consequences of significant life events. As noted above, significant life events are not globally negative. An essential but emerging literature has begun to examine positive features of life events, even among events that may be stressful, in an effort to understand

whether positivity associated with these events might buffer against negativity attributable to stress.

Events and Protection Against Psychopathology. Positive affect, which may result from positive events, has been associated with numerous beneficial resources, including cognitive flexibility, problem-solving, adaptive coping, social resources, and overall enhanced well-being (Fredrickson, 2004; Panaite et al., 2021). Given the numerous benefits associated with positive affect, it is plausible that experiencing positive events may protect against the onset or severity of psychopathology, to the degree that positive events prospectively predict positive affect. Of note, a broader literature on stress and coping has examined perceived resources to manage stressors (e.g., Lazarus & Folkman, 1984). The positivity of events literature is distinct in its consideration of context of events themselves and psychopathology outcomes, rather than coping strategies oriented towards managing stress. Some evidence supports the notion that positivity of events may predict a protective pathway, in that positive life events have been found to predict lower depression and anxiety symptom severity longitudinally (Hovenkamp-Hermelink et al., 2019). To date, a limited number of studies have examined the degree to which positive events may buffer against negativity of events in predicting psychopathology. For example, high levels of positive events predicted reduced depressive symptoms among young adults with high levels of negative events (Dixon & Reid, 2000). More recent work has found that high levels of positive events buffer against depressive effects of stressful events among individuals at risk for depression (Haeffel & Vargas, 2011). These findings have since been replicated in a longitudinal study of women, which found that positive events buffered against negative events in predicting risk for depression, but not risk for anxiety (Kandler & Ostendorf, 2016). In a related study, Sewart et al. (2019) found that positive affect buffered the impact of chronic stress on the

development of mood and anxiety disorders, although in the study, mood and life events were assessed separately.

Together, these studies offer preliminary evidence that positivity, either of events themselves or of affect, may buffer against negativity of life events in predicting mood and anxiety symptomatology or disorders. However, past work has been limited by an over-reliance on self-report measures of life events, including perceived stress, which have the potential to be obscured by respondents' symptomatology (Hammen, 2018). Additionally, past studies have assessed positivity and negativity of life events separately, often designating events as either positive or negative, ignoring the fact that events may possess features of both. Finally, the majority of past work has assessed depression and anxiety independently, rather than employing dimensional models that account for covariation among symptoms of depression and anxiety. Recent work from our laboratory sought to fill these gaps in the literature by examining objective, consensus ratings of positivity and negativity of interpersonal and non-interpersonal episodic life events and their relationship to several dimensional symptom factors (i.e., Fears, Anhedonia-Apprehension, General Distress) of a tri-level model (Naragon-Gainey et al., 2016; Prenoveau et al., 2010;), which captures depressive and anxious presentations. We found that positivity of non-interpersonal life events buffered against negativity in predicting General Distress, a transdiagnostic symptom factor related to both anxiety and depression (Yarrington et al., 2023). This work further supports the notion that positivity may buffer against negativity. However, mechanisms by which positivity confers protection against negativity of events in predicting psychopathology have yet to be explored.

Intervening Mechanisms Between Life Events and Mental Health

Positive Affect. As noted above, evidence suggests that positive affect is related to the experience of life events. Positive affect is a construct that is also highly relevant to mental health. However, positive affect has been understudied in the psychopathology literature for two primary reasons. First, much of the psychopathology literature has sought to elucidate risk factors, and therefore, has primarily examined negative affect and neuroticism, a trait disposition toward negative affect. Second, in part because depression has long been understood as a disorder characterized by low positive affect, the literature has often examined low positive affect as a predictor of psychopathology, or at least, has interpreted negative associations in that direction. Consequently, the literature examining main effects of higher positive affect protecting against psychopathology is relatively sparse. That being said, several studies have demonstrated either cross-sectional or longitudinal relationships between positive affect and reductions in psychopathology or promotion of positive mental health outcomes. For example, early work found that among adults, positive affect, reported over the past three weeks, was negatively correlated with depressive symptoms (Headey et al., 1993). Other evidence suggests that individuals with broadly positive mental health, defined as flourishing, or living within an optimal range of human functioning related to goodness, growth, and resilience, experienced a higher positivity ratio, or quotient of total positive affect items endorsed by total negative emotions endorsed, over the course of a month (Fredrickson & Losada, 2005). Additionally, in a sample of high school students, positive affect, measured by the PANAS, predicted lower general and situational depression (Lindahl & Archer, 2013). Finally, Bos et al. (2013) examined the relationship between positive affect during pregnancy and postpartum depression among Portuguese women and found that in analyses which excluded participants who had depression during the first assessment period, positive affect measured during the last trimester of pregnancy

predicted fewer cases of postpartum depression, suggesting potential protective features of positive affect. A related literature has examined positive affect as a potential resilience factor, or a construct that can promote adaptive outcomes in the context of risk. For example, in a study of undergraduates, positive affect, measured by the PANAS, buffered against negative affect in predicting depressive symptoms (Riskind et al., 2013).

Therefore, positive affect is associated with both life events and psychopathology and may represent part of a protective pathway against risk for psychopathology. Positive affect has also been linked to emotion regulatory processes, which similarly may be implicated in protection against psychopathology.

Cognitive Reappraisal. Cognitive reappraisal has been described as a component of emotion regulation. Cognitive reappraisal is a form of cognitive change, in which a person construes a potentially emotion-eliciting situation in a way that changes its emotional impact (Gross & John, 2003). Reappraisal differs from typical models of appraisals in that appraisals refer to estimates about an environment, which tend to result in an emotion (Smith & Ellsworth, 1985). Reappraisal involves changing one's thoughts about a situation (i.e., appraisals) to alter an emotional response. Cognitive reappraisal has been posited to be an antecedent-focused regulation strategy, in that reappraisal typically occurs early in emotional processes and has the capability to change an emotion trajectory (Gross, 1998). Specifically, in the context of negative emotion, reappraisal might aid in downregulating an unpleasant emotional state and subsequently alter a person's experience of that negative emotion (Gross & John, 2003). An example of the process of cognitive reappraisal is as follows: an individual sees someone that they know across a parking lot and waves to that person, but the other person does not wave back. A related maladaptive appraisal might be to think, "They must be mad at me." Typical emotional

responses in that case might be to feel hurt, embarrassed, or sad. However, an effective cognitive reappraisal would be to think, "They must not have seen me," which could downregulate initial negative emotions that arose.

Cognitive reappraisal, by definition, entails reframing an event (Troy et al., 2010), and is therefore highly relevant to the experience of significant life events. Adaptive coping in the face of significant change may necessitate the use of reappraisal strategies which help individuals to downregulate unpleasant emotional states. Empirical evidence supports this notion. For example, Troy et al. (2010) found that among women who experienced high levels of stressful life events, those who were more adept at using cognitive reappraisal strategies experienced reductions in depressive symptoms, although more recent evidence suggests that perceived controllability of stress may be an important moderator of this relationship (Troy et al., 2013). That being said, this work provides early support for the relevance of cognitive reappraisal to significant life events.

Relationship Between Positive Affect and Cognitive Reappraisal. Cognitive reappraisal has been found to be an effective strategy in reducing negative emotion, but evidence suggests that reappraisal may also be linked to the experience of greater positive affect. For example, a cross-sectional study found a positive association between cognitive reappraisal and positive affect (Andreotti et al., 2013), consistent with previous work demonstrating links between cognitive reappraisal and positive affect (Folkman & Moskowitz, 2000). More recent work has found that daily engagement in reappraisal was associated with greater daily positive affect (Brockman et al., 2017).

Due to its conceptualization as an emotion regulation strategy, is has generally been assumed, and subsequently demonstrated, that cognitive reappraisal predicts positive affect, rather than vice versa. However, it is also plausible that the experience of positive affect might

promote reappraisal strategies. For example, positive affect has been found to enhance flexible thinking (Fredrickson, 2004). Flexible thinking encompasses the emergence of cognitive processes as they relate to changing situational demands (e.g., Hayatbini et al., 2021). Similarly, cognitive reappraisal entails altering an interpretation of a situation, and therefore, may be implicated in responding to changing situational demands. As such, cognitive reappraisal may be conceptualized as a type of cognitive flexibility which could result from the experience of positive affect.

In support of the relationship between cognitive and emotion regulatory processes, evidence suggests that a number of cognitive processes are related to emotion regulation strategies, such as cognitive reappraisal (Ochsner & Gross, 2005). Furthermore, mindfulness, a process tied to psychological flexibility (Silberstein et al., 2012), has been found to promote cognitive reappraisal (Garland et al., 2009). Therefore, affective, cognitive, and regulatory processes appear to be highly related, but connections between positive affect and cognitive reappraisal have been understudied. Exploring the degree to which positive affect and cognitive reappraisal may have a reciprocal relationship is essential.

Aim of Studies

Given the transdiagnostic relevance of life events to psychopathology, understanding mechanisms by which positive psychological processes may protect against onset of disease after experiencing a significant life event is exceptionally important. Therefore, the overarching aim of this dissertation is to examine mechanisms that explain the relationship between life events and psychopathology across three studies in an effort to identify malleable targets for intervention. In Study 1, I assess affective and emotional mechanisms which may explain the link between positivity and negativity of significant life events as predictors of symptomatology.

General study aims are to assess whether positivity and negativity of interpersonal and non-interpersonal life events predict a bidirectional relationship between positive affect and cognitive reappraisal, and whether the aforementioned pathways are associated with severity of transdiagnostic symptoms of depression and anxiety.

In Study 2, I examine the relationship between positive affect and appraisals more directly. The primary study aim is to examine whether a positive mood induction, based upon an autobiographical memory about a life event, promotes more positive interpretations of ambiguous stimuli compared to interpretations of events following a negative mood induction. A secondary study aim is to assess whether positive affect states promote response bias compared to negative affective states.

Finally, in Study 3, I assess mechanisms of change during a positive affect treatment. Study 3 assesses whether positive affect and cognitive reappraisal are associated treatment response and to examine the degree to which increases in positive affect relate to increases in reappraisal and vice versa over the course of treatment.

V. Study 1: Positive Affect and Cognitive Reappraisal: Intervening Mechanisms in the Relationship Between Life Events and Transdiagnostic Symptoms of Depression and Anxiety.

Abstract

Positivity of significant life events may buffer against negativity in predicting psychopathology. Mechanisms by which positivity of life events confers beneficial effects are unexplored. Positive affect and cognitive reappraisal are two mechanisms which may play a role in protecting against psychopathology. The present study examined these mechanisms in a longitudinal sample of 373 young adults. Path analyses assessed relationships between positivity or negativity of life events, positive affect or negative affect, cognitive reappraisal, and psychopathology. Results demonstrated that positivity of interpersonal events predicted positive affect (b = .24; p = .006); positive affect predicted General Distress (b = -.02; p = .014). A marginal mediational effect was observed from positivity of interpersonal events to General Distress through positive affect (b = -.003, p = .066). Positivity of non-interpersonal events did not significantly predict positive affect; the indirect effect of positive affect in this model was nonsignificant (ps > .05). Mediation through both positive affect and cognitive reappraisal was nonsignificant across positivity models (ps > .05). Results of negativity models were consistent with stress generation; General Distress predicted negative affect (b = .62; ps = .001), cognitive reappraisal (b = -.58; p = .023), and negativity of interpersonal events (b = .27; p = .009). The effect of General Distress on negativity of non-interpersonal events was marginally significant (b = .27; p = .054). All indirect paths in negativity models were non-significant (ps > .05). Findings suggest positive affect resulting from events may lead to reductions in psychopathology, and that interventions focused on attending to and savoring positive aspects of events may promote

positive mood. Conversely, interventions involving instructed reappraisal may interrupt stress generation.

Keywords: life events; affect; reappraisal; transdiagnostic symptoms

Study 1: Introduction

A robust literature has linked negativity of significant or stressful life events to risk for and maintenance of depression and anxiety (e.g., Hammen, 2005; Uliaszek et al., 2012). While this work was foundational in identifying risks for psychopathology, this line of research has nearly exclusively focused on the potential deleterious effects of significant life events by examining severity, or negativity, associated with these events. In focusing on negativity of these events, past work has not accounted for the fact that many significant life events have objectively positive contextual features, even if they may also be subjectively stressful (e.g., having a baby, moving into a new home).

Given the dearth of evidence surrounding possible beneficial effects of significant life events, we recently examined the relationship between positivity and negativity of interpersonal and non-interpersonal episodic life events and dimensional symptom factors associated with depression and anxiety (i.e., Fears, Anhedonia-Apprehension, General Distress; Prenoveau et al., 2010; Naragon-Gainey et al., 2016). We found that positivity of non-interpersonal life events buffered against negativity in predicting General Distress, a transdiagnostic symptom factor related to both anxiety and depression (Yarrington et al., 2023). Although this work supports the notion that positivity may buffer against negativity, the mechanisms by which positivity buffers against negativity of events in predicting psychopathology have yet to be explored. The present study sought to address this gap in the literature by assessing affective and emotional mechanisms which may explain the beneficial effects of positivity.

Positive life events may increase positive affect (Clark & Watson, 1988; Fredrickson, 2004; Gentzler et al., 2013). Positive affect has also been linked to cognitive reappraisal (Andreotti et al., 2013), an emotion regulation strategy which can be elicited after the experience

of significant life events (Troy et al., 2010). Therefore, positive affect and cognitive reappraisal may represent a cognitive emotional pathway through which positivity of significant life events buffers against negativity and reduces the likelihood that one experiences psychopathology.

The Present Study

The present study examined the affective and emotional mechanisms that may explain the relationship between positivity and negativity of significant life events and psychopathology. **Aim 1**: Replicate and extend prior work (Yarrington et al., 2023) by examining the longitudinal relationship between positivity and negativity of interpersonal and non-interpersonal significant life events and transdiagnostic symptoms of depression and anxiety, as indicated by the General Distress factor of the tri-level model. *Hypothesis 1*: Positivity and negativity of interpersonal and non-interpersonal life events will predict lower and higher levels of General Distress, respectively. **Aim 2**: Examine whether positivity and negativity of interpersonal and non-interpersonal life events predict positive affect and negative affect, respectively. *Hypothesis 2*. Positivity of events will predict higher levels of positive affect and negativity of events will predict higher negative affect. **Aim 3**: Assess whether positive and negative affect predict General Distress. *Hypothesis 3*: Positive affect will predict lower levels of General Distress, while negative affect will predict higher levels. **Aim 4**: Examine whether positive or negative affect mediates the relationship between positivity and negativity of life events and General Distress. *Hypothesis 4*: Positive affect will partially mediate the relationship between positivity of life events and General Distress. Negative affect will partially mediate the relationship between negativity of life events and General Distress. **Aim 5**: Test whether positive or negative affect and cognitive reappraisal mediate the link between positivity and negativity of life events and General Distress. *Hypothesis 5*: Positive affect and cognitive reappraisal will mediate the

relationship between positivity of life events and General Distress. It is expected that positivity of life events will promote higher levels of positive affect and cognitive reappraisal and will subsequently be associated with a reduction in General Distress. Negative affect and cognitive reappraisal will mediate the relationship between negativity of life events and General Distress. We expect that negativity of life events will be associated with higher levels of General Distress, and that this relationship will be mediated by the presence of higher levels of negative affect and lower levels of cognitive reappraisal.

Method

Participants

Late adolescents and young adults were recruited as part of the longitudinal, two-site Brain, Motivation, and Personality Development (BrainMAPD) study (R01MH100117), led by the University of California, Los Angeles (UCLA) and Northwestern University. The BrainMAPD study examined positive and negative valence systems, using a Research Domain Criteria (RDoC; Insel et al., 2010) approach. At time of enrollment, participants (N = 373) were between 18-19 years old. However, average age at time of baseline diagnostic interview was 19.43 (SD = 5.01). The sample was primarily female (67.0%) and White (33.1%, 28.5% Asian, 18.5% Hispanic, 9.9% Black, 7.5% Multiracial, 2.2% American Indian/Native Alaskan, 0.3% Not Reported). Gross family incomes varied in the sample, although the majority reported higher incomes (18.2% < $19,999, 19.2% between $20,000-$99,000, 18.0% between $100,000-$199,999, 29.7% ≥ $200,000). Participants provided written consent to participate in the study. Study procedures were approved by Institutional Review Boards at UCLA (Protocol #13-001606) and Northwestern (Protocol #STU00086226).

Procedure

Recruitment for the study took place at UCLA and Northwestern through activity fairs, flyers, and posts on Facebook pages for incoming classes at each university. Prospective participants were recruited for this study based upon self-reported scores of trait Neuroticism (Eysenck Personality Questionnaire-Neuroticism (EPQ-N); Eysenck & Eysenck, 1975), and Reward Sensitivity (Behavioral Activation Scale (BAS); Carver & White, 1994), and therefore, entered a screening period prior to enrollment in the study. Participants were oversampled from the two diagonals of the bivariate space defined by the EPQ-N and BAS scales; those who fell in the high, mid, and low regions on each scale were represented in the sample to ensure inclusion of individuals at risk for the onset of depression and anxiety. Therefore, the sample comprised individuals with scores that were high on each measure, low on each measure, mid-range on each measure, or high on one measure and low on the other.

After completing screening measures and consenting to participate in the study, participants completed baseline (Time 1) assessments including self-report and interview measures. Participants returned for assessments at Time 2 (7-10 months after baseline), Time 3 (17-20 months after baseline), and Time 4 (27-30 months after baseline) for self-report and interview measures.

Measures

Life Events. A modified version of the UCLA Life Stress Interview (LSI; Hammen et al., 1987; Hammen, 1991) assessed episodic life events. Doctoral-level and post-baccalaureate interviewers inquired about significant events (date, nature and surrounding context) that occurred in the year prior to the interview. Interview prompts were general, such that events reported could be positive or negative. Probes were added to capture potentially positive events, including accomplishments, improvements, or new relationships. Interviewers subsequently

presented a narrative account of life events to a team of two or more independent raters, who were blind to participant's diagnoses. Ratings of events that significantly impacted participants' lives were provided by the consensus team to reduce the likelihood that ratings were obscured by participants' subjective interpretations of events. Raters provided several ratings for significant events: domain, code, and severity.

Events were considered within two primary domains, interpersonal (i.e., close friendships, social life, romantic relationships, family relationships) and non-interpersonal (i.e., neighborhood/dorm environment, school/academic experiences, work, finances, health, miscellaneous), consistent with prior work (Uliaszek et al., 2010). Event codes are labels added to describe event content more specifically (e.g., changing schools, traffic accident, becoming engaged), based upon a modified Paykel and Mangen (1980) event list. Finally, "severity ratings" for were provided by the consensus team. These ratings have historically been described as severity ratings because in the past, they have exclusively captured negativity of events. However, in the present study, this rating was expanded to include a rating of positivity. Therefore, each life event received two "severity" ratings: one of positivity and one of negativity. Negativity was rated on a scale from 1 (not or only minimally negative) to 5 (extremely negative, most catastrophic conditions imaginable) in half-point increments. Positivity was also rated on a 1 (minimally positive or not at all positive) to 5 (extremely positive) scale in half-point increments. Ratings of 4 or 5 are exceptionally rare by design. Ratings accounted for context surrounding events. Importantly, positivity and negativity ratings may not be entirely independent because context surrounding events was considered for both positivity and negativity ratings.

Four life event variables were considered in analyses: interpersonal positivity, interpersonal negativity, non-interpersonal positivity, and non-interpersonal negativity. Reliability ratings were performed on a subset of interviews ($N = 33$) across sites; analyses demonstrated good to excellent reliability (ICC = .86 - .95; see Yarrington et al., 2023, for details). See Table 1 for most commonly endorsed events in the sample.

Table 1.

Frequencies and Descriptions of Most Commonly Endorsed Events

Time 1 Event (%)	**Time 2 Event (%)**	**Time 3 Event (%)**	**Time 4 Event (%)**
		Interpersonal	
End Dating Relationship (6.0%)	Begin Dating Relationship (6.2%)	Begin Dating Relationship (4.8%)	Begin Dating Relationship (6.0%)
Begin Dating Relationship (4.6%)	End Dating Relationship (5.9%)	End Dating Relationship (4.2%)	End Dating Relationship (5.5%)
Serious Argument with Friend (4.1%)	Death of Family Member, Friend, or Acquaintance (5.3%)	Death of Family Member, Friend, or Acquaintance (4.1%)	Serious Argument with Friend (3.7%)
Death of Family Member, Friend, or Acquaintance (3.6%)	Serious Argument with Friend (4.3%)	Major or Minor Illness, Injury, or Accident (not leading to death) to Loved One (4.1%)	Serious Argument with Family Member (2.8%)

Major or Minor Illness, Injury, or Accident (not leading to death) to Loved One (3.2%)	Major or Minor Illness, Injury, or Accident (not leading to death) to Loved One (3.9%)	Serious Argument with Friend (3.8%)	Major or Minor Illness, Injury, or Accident (not leading to death) to Loved One (2.4%)
Start New Friendship (2.9%)	Serious Argument with Family Member (2.1%)	Serious Argument with Family Member (1.7%)	Death of Family Member, Friend, or Acquaintance (2.2%)
Serious Argument with Family Member (2.3%)	Start New Friendship (1.6%)	Start New Friendship (0.9%)	Start New Friendship (0.7%)
	Non-Interpersonal		
Generic Other (16.9%)	Starting New Job (21.2%)	Starting a New Job (20.2%)	Starting a New Job (18.6%)
Starting, Changing, or Leaving Schools, Academic Issue or Failure, Graduation (16.0%)	Generic Other (16.1%)	Generic Other (19.8%)	Move to a New Location (13.8%)
Starting New Job (11.9%)	Move to a New Location (7.0%)	Move to a New Location (10.2%)	Generic Other (12.9%)

Move to a New Location (8.9%)	Major or Minor Personal Illness, Assault, Injury, or Accident (6.0%)	Work-Related Change (4.8%; e.g., change in hours, promotion, fired, quit)	Starting, Changing, or Leaving Schools, Academic Issue or Failure, Graduation (8.7%)
Work-Related Change (3.9%; e.g., change in hours, promotion, fired, quit)	Work-Related Change (5.6%; e.g., change in hours, promotion, fired, quit)	Major or Minor Personal Illness, Assault, Injury, or Accident (4.3%)	Work-Related Change (4.3%; e.g., change in hours, promotion, fired, quit)
Major or Minor Personal Illness, Assault, Injury, or Accident (3.4%)	Financial Issue or Improved Finances (3.0%)	Financial Issue or Improved Finances (2.4%)	Major or Minor Personal Illness, Assault, Injury, or Accident (3.2%)
Financial Issue or Improved Finances (2.7%)	Starting, Changing, or Leaving Schools, Academic Issue or Failure, Graduation (2.8%)	Starting, Changing, or Leaving Schools, Academic Issue or Failure, Graduation (2.9%)	Financial Issue or Improved Finances (2.9%)

Note. Events are reported if more than 2.0% of the sample endorsed events at Time 1. Generic other generally includes non-interpersonal events that did not fit within pre-determined event code categories, such as joining a club in college.

Positive and Negative Affect. Positive and negative affect were assessed at each time point using the positive and negative affect subscales of an internationally reliable short form of the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988). The I-PANAS-SF is a 10-item version of the original PANAS (Thompson, 2007), which yields a 5-item positive affect subscale (α = .84) and a 5-item negative affect subscale (α = .78). Participants were asked to rate the extent to which they felt different emotions at the time that they filled out the questionnaire (i.e., state positive and negative affect) on a five-point scale (1 = very slightly or not at all; 5 = extremely). Items comprising the positive affect subscale included adjectives such as "attentive" and "alert," while items comprising the negative affect subscale included adjectives such as "afraid" or "hostile." The present study used I-PANAS-SF scores from all time points. The I-PANAS-SF has demonstrated acceptable internal reliability, temporal stability, and convergent and discriminant validity (Thompson, 2007).

Cognitive Reappraisal. Cognitive reappraisal was measured using the reappraisal subscale of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003; α = .84), a widely used and well-validated measure of emotion regulation techniques (Preece et al., 2019). The ERQ is a 10-item questionnaire; six items make up the reappraisal subscale of the ERQ. Participants rated to what extent they agree or disagree with statements on a seven-point scale (1 = strongly disagree; 4 = neutral; 7 = strongly agree). An example of a reappraisal statement is: "When I want to feel more positive emotion, I change the way I'm thinking about the situation." The ERQ was administered at all time points. The ERQ has demonstrated good internal consistency, temporal stability, and convergent and discriminant validity (Ioannidis & Siegling, 2015).

Tri-Level Model. Participants completed self-report measures assessing a variety of anxiety and depressive symptoms (Prenoveau et al., 2010). The 22-item Albany Panic and Phobia Questionnaire examined fears of sensation-producing activities and agoraphobic situations (Rapee et al., 1994). Three subscales of the Fear Survey Schedule-II (Geer, 1965) assessed specific fears. For both the APPQ and FSS, participants indicated expected fear levels upon encountering a specific situation, activity, or stimulus in the coming week. The Self-Consciousness subscale of the Social Phobia Scale assessed social fears in the past week (Mattick & Clarke, 1998). The 21-item Inventory to Diagnose Depression probed past week anhedonia, dysphoria, hopelessness, and self-deprecation (Zimmerman et al., 1986). Finally, the 90-item Mood and Anxiety Symptom Questionnaire (Watson et al., 1995) assessed symptoms of anxiety, including generalized anxiety and panic, and symptoms of depression in the past week.

The tri-level model was derived using items on these self-report measures (see Prenoveau et al., 2010 for original model specification). Factor scores were developed using Confirmatory Factor Analysis in M*plu*s version 5.0 (Muthén & Muthén, 1998-2007). The broadest factor of the model, General Distress, was used in the present study. The General Distress factor is characterized by depressive (e.g., low positive affect, depression) and anxious presentations (e.g., social, specific and interoceptive/agoraphobic fears, obsessive-compulsive symptoms, anxious arousal, and somatic tensions); depression and worry are the strongest markers for this factor (Naragon-Gainey et al., 2016). The tri-level model was estimated based upon self-report measures from each time point. See Table 2 for descriptive statistics for each variable at each study timepoint.

Table 2.

Descriptive Statistics for Life Events, Affect, Reappraisal, and General Distress.

Variable	Time 1	Time 2	Time 3	Time 4
	M (*SD*)	*M* (*SD*)	*M* (*SD*)	*M* (*SD*)
Positivity of Interpersonal Events	1.80 (2.03)	1.81 (1.72)	1.53 (1.61)	2.07 (2.24)
Positivity of Non-Interpersonal Events	4.40 (3.47)	3.81 (2.71)	3.83 (2.78)	4.96 (3.41)
Negativity of Interpersonal Events	2.24 (2.51)	2.28 (2.51)	1.83 (1.87)	2.53 (2.59)
Negativity of Non-Interpersonal Events	3.92 (3.24)	3.82 (2.89)	3.80 (2.73)	4.02 (3.03)
Positive Affect	13.19 (4.40)	12.91 (4.54)	12.43 (4.41)	11.39 (4.43)
Negative Affect	6.42 (2.40)	6.99 (2.95)	6.67 (2.92)	6.14 (1.74)
Cognitive Reappraisal	30.08 (6.39)	28.74 (7.32)	29.23 (5.95)	30.35 (5.69)
General Distress	0.05 (1.06)	0.16 (0.93)	0.06 (0.97)	-0.12 (0.96)

Note. Abbreviations: *M* = Mean. *SD* = Standard Deviation.

Analyses

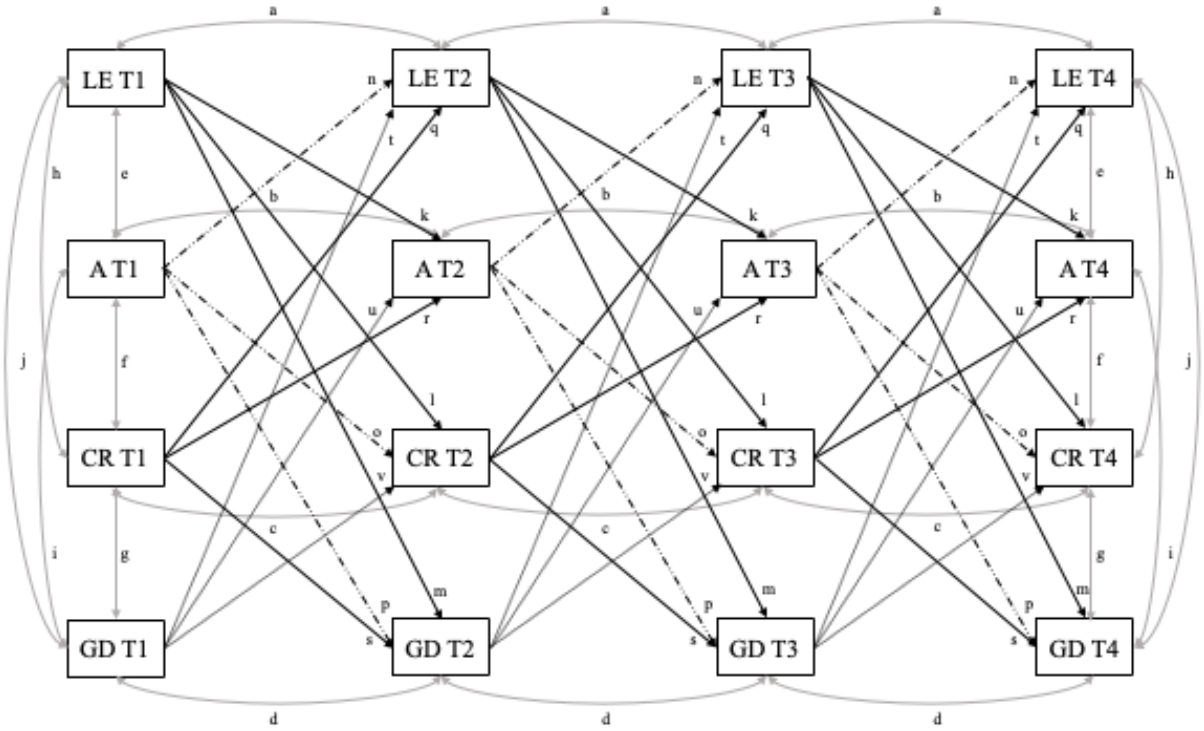
Analyses were conducted in Mplus version 8.0 (Muthén & Muthén, 2017). Four path models were specified to examine the relationships, between positivity or negativity of life events, positive or negative affect, cognitive reappraisal, and General Distress.

See Figure 1 for a conceptual model of pathways tested in Models 1 through 4. The structural equation models were designed to estimate the following regression coefficients: (1) autoregressive paths from each predictor (i.e., life events, affect, cognitive reappraisal, General Distress) at wave t-1 to the same predictor at wave t, (2) effects of life events at wave t-1 on affect, reappraisal, and General Distress at wave t, (3) effects of affect at wave t-1 on life events, reappraisal, and General Distress at wave t, (4) effects of reappraisal at wave t-1 on life events,

affect, and General Distress, (5) effects of General Distress at wave t-1 on life events, affect, and reappraisal at wave t. We also sought to estimate indirect effects of life events on General Distress through positive affect and cognitive reappraisal jointly, and positive affect alone. The first indirect path examined life events at wave t-1 on affect at wave t, affect at wave t-1 on reappraisal at wave t, and reappraisal at wave t-1 on General Distress at wave t. The second indirect path estimated life events at wave t-1 on affect at wave t, and affect at wave t-1 on General Distress at wave t. Different models were specified to account for the use of interpersonal and non-interpersonal positivity and negativity life events and relatedly, the inclusion of either positive or negative affect (i.e., models examining positivity of life events included positive affect, whereas models examining negativity of events included negative affect). Model 1 examined positivity of interpersonal life events, positive affect, cognitive reappraisal, and General Distress across Times 1 through 4. Model 2 assessed positivity of non-interpersonal events, instead of interpersonal events. All other variables were identical as those in the first model. Model 3 tested negativity of interpersonal events, negative affect, cognitive reappraisal, and General Distress. Model 4 instead tested effects of negativity of non-interpersonal events, although other variables and model structure were otherwise identical to Model 3.

Model selection was performed iteratively. We assumed stationarity for all paths of the same type. Stationarity was imposed given that the degree to which predictors produce change in outcomes is expected to remain constant over time (Cole & Maxwell, 2003). However, we tested deviations from stationarity, although we had no theoretical reason to suspect deviations from stationarity. First, we compared models with repeated paths constrained to equality to a model in which all paths were estimated freely. In cases where the assumption of stationarity was violated,

we attempted to localize the source of misfit by comparing a model in which stationarity was imposed to a model in which one type of path was freed. Across all models, maximum likelihood



estimation was used to accommodate missing data. The threshold for significance was considered to be $p \leq .05$.

Figure 1.

Conceptual Model of Path Analysis.

Note. Abbreviations: LE = Life Events. A = Affect. CR = Cognitive Reappraisal. GD = General Distress. T = Time. Depending upon the model, the life event variable was either positivity of interpersonal life events, positivity of non-interpersonal life events, negative of interpersonal life events, or negativity of non-interpersonal life events. Similarly, depending on whether the model was specified for positivity or negativity of life events, affect was either positive or negative affect, correspondingly. Paths a through d represent autoregressive paths. Cross-sectional correlations are represented by paths e through j. For the purpose of readability, cross-sectional

correlations are not pictured for times 2 or 3, although they were modeled analytically. The solid bold black lines indicate paths for which life events were a predictor; they correspond to paths k, l, and m, which are cross-lagged paths between life events and affect, cognitive reappraisal, and General Distress, respectively. The dotted and dashed black lines indicate paths for which affect was a predictor, corresponding to paths n, o, and p, which represent cross-lagged paths from affect to life events, reappraisal, and General Distress, respectively. The solid black lines indicate paths for which cognitive reappraisal was a predictor; they correspond to paths q, r, and s, which are cross-lagged paths between cognitive reappraisal and life events, affect, and General Distress, respectively. Finally, the dotted black lines indicate paths for which General Distress was a predictor, corresponding to paths t, u, and v, which represent cross-lagged paths from General Distress to life events, affect, and reappraisal, respectively.

Results

Interpersonal Positivity, Positive Affect, Reappraisal and General Distress

Stationarity Assumption and Model Fit

We tested the assumption of stationarity by comparing a model with repeated paths constrained to equality to a model in which all paths were estimated freely. We found that the assumption of stationarity was violated overall ($\Delta\chi^2(50) = 100.35$, $p < .001$, ΔRMSEA = .016, ΔCFI = -.042, ΔTLI = .096). We attempted to localize the source of misfit with additional model comparisons in which a model with paths constrained to equality was compared to a model without one type of path constrained. Relaxing equality constraints on the General Distress ($\Delta\chi^2(2) = 11.90$, $p = .002$, ΔRMSEA = -.072, ΔCFI = .002, ΔTLI = .006) and interpersonal positivity ($\Delta\chi^2(2) = 8.71$, $p = .01$, ΔRMSEA = -.001, ΔCFI = .006, ΔTLI = .003) autoregressive paths significantly improved model fit. Model fit also improved significantly after relaxing

equality constraints on cross-sectional correlational paths between positive affect and General Distress ($\Delta\chi^2(2) = 7.59$, $p = .02$, ΔRMSEA < .001, ΔCFI = .004, ΔTLI = -.001), positive affect and cognitive reappraisal ($\Delta\chi^2(2) = 6.82$, $p = .03$, ΔRMSEA < .001, ΔCFI = .003, ΔTLI = -.002), and cognitive reappraisal and General Distress ($\Delta\chi^2(2) = 11.54$, $p = .003$, ΔRMSEA = -.001, ΔCFI = .007, ΔTLI = .003). Relaxing equality constraints on all other paths did not significantly improve model fit.

Model Results

The autoregressive paths to and from General Distress (average $\beta = .69$; all ps < .001), positive affect ($\beta = .50$; all ps < .001), and cognitive reappraisal ($\beta = .51$; all ps < .001) were significant. Autoregressive paths for positivity of interpersonal events were significant from times 2 to 3 ($\beta = .18$; $p = .004$) and 3 to 4 ($\beta = .43$; $p < .001$) but were nonsignificant from time 1 to 2 ($\beta = .08$; $p = .133$).

The cross-lagged paths from positive affect to General Distress ($\beta = -.02$; $p = .014$), positivity of interpersonal events to positive affect ($\beta = .24$; $p = .006$), and General Distress to cognitive reappraisal ($\beta = -.49$; $p = .033$) were significant. Positive affect predicted lower levels of General Distress, positivity of interpersonal events predicted higher levels of positive affect, and General Distress predicted lower engagement with reappraisal. Cross-lagged paths from positivity of interpersonal events to cognitive reappraisal and General Distress were nonsignificant, as were cross-lagged paths from positive affect to positivity of interpersonal events and cognitive reappraisal, and cross-lagged paths from cognitive reappraisal to positive affect, positivity of interpersonal events, and General Distress (all ps > .05). Finally, cross-lagged paths from General Distress to positivity of interpersonal events and positive affect were nonsignificant (all ps > .05).

The indirect path from positivity of interpersonal events to positive affect, cognitive reappraisal, and ultimately General Distress was nonsignificant ($p > .05$). However, the mediational path from positivity of interpersonal events to positive affect to General Distress was marginally significant, with positivity of interpersonal events predicting higher levels of positive affect which in turn predicted lower levels of General Distress ($\beta = -.003$, $p = .066$).

Non-Interpersonal Positivity, Positive Affect, Reappraisal and General Distress

Stationarity Assumption and Model Fit

The assumption of stationarity was violated overall ($\Delta\chi^2(50) = 108.17$, $p < .001$, ΔRMSEA = .015, ΔCFI = .049, ΔTLI = -.089). Examining the source of model misfit suggested that relaxing equality constraints on the General Distress autoregressive paths significantly improved model fit ($\Delta\chi^2(2) = 10.92$, $p = .004$, ΔRMSEA = -.001, ΔCFI = .008, ΔTLI = .005), as did relaxing constraints on the cross-lagged paths from positive affect to positivity of non-interpersonal events ($\Delta\chi^2(2) = 6.54$, $p = .04$, ΔRMSEA < .001, ΔCFI = .004, ΔTLI = .001) and General Distress to positivity of non-interpersonal events ($\Delta\chi^2(2) = 7.99$, $p = .02$, ΔRMSEA < .001, ΔCFI = .005, ΔTLI = .002). Finally, freeing cross-sectional correlational paths between positive affect and General Distress ($\Delta\chi^2(2) = 7.64$, $p = .02$, ΔRMSEA < .001, ΔCFI = .004, ΔTLI = .001), cognitive reappraisal and General Distress ($\Delta\chi^2(2) = 11.21$, $p = .004$, ΔRMSEA = -.001, ΔCFI = .007, ΔTLI = .002), positivity of non-interpersonal events and General Distress ($\Delta\chi^2(2) = 6.09$, $p = .047$, ΔRMSEA < .001, ΔCFI = .003, ΔTLI = -.003), and cognitive reappraisal and positive affect ($\Delta\chi^2(2) = 7.08$, $p = .03$, ΔRMSEA < .001, ΔCFI = .003, ΔTLI = -.002). Model fit did not improve as a result of relaxing equality constraints on all other paths.

Model Results

The autoregressive paths to and from General Distress (average β = .69; all ps < .001), positive affect (β = .50; all ps < .001), cognitive reappraisal (β = .51; all ps < .001), and positivity of non-interpersonal events (β = .09; all ps < .05) were significant.

The cross-lagged paths from positive affect to General Distress (β = -.02; p = .015) and General Distress to cognitive reappraisal (β = -.49; p = .034) were significant, with positive affect predicting lower levels of General Distress and lower levels of General Distress predicting increased engagement with cognitive reappraisal. Cross-lagged paths from positivity of non-interpersonal events to positive affect, cognitive reappraisal, and General Distress were nonsignificant, as were cross-lagged paths from positive affect to positivity of non-interpersonal events and cognitive reappraisal, from cognitive reappraisal to positive affect, positivity of non-interpersonal events, and General Distress, and from General Distress to positivity of non-interpersonal events and positive affect (all ps > .05).

Tests of indirect effects of positivity of non-interpersonal events on General Distress through positive affect and cognitive reappraisal together, and through positive affect alone, were non-significant (all ps > .05). See Table 3 for full results of cross-lagged paths within positivity of interpersonal and non-interpersonal events models.

Table 3.

Results for Cross-Lagged Paths in Positivity of Events Models.

Positivity of Interpersonal Events				
Predictor	Outcome	Estimate	*SE*	*p*-value
InPos $^{(t-1)}$	GD $^{(t)}$	-.013	.014	.356
PA $^{(t-1)}$	GD $^{(t)}$	-.015	.006	.014
CR $^{(t-1)}$	GD $^{(t)}$	-.004	.004	.342

InPos $^{(t-1)}$	PA $^{(t)}$	.235	.085	.006
GD $^{(t-1)}$	PA $^{(t)}$	-.091	.168	.588
CR $^{(t-1)}$	PA $^{(t)}$	.019	.024	.427
InPos $^{(t-1)}$	CR $^{(t)}$	-.077	.117	.510
PA $^{(t-1)}$	CR $^{(t)}$	.052	.049	.287
GD $^{(t-1)}$	CR $^{(t)}$	-.488	.230	.033
PA $^{(t-1)}$	InPos $^{(t)}$	.011	.017	.510
GD $^{(t-1)}$	InPos $^{(t)}$	.097	.078	.216
CR $^{(t-1)}$	InPos $^{(t)}$	.009	.011	.409

Positivity of Non-Interpersonal Events

Predictor	Outcome	Estimate	*SE*	*p*-value
NInPos $^{(t-1)}$	GD $^{(t)}$	-.001	.009	.951
PA $^{(t-1)}$	GD $^{(t)}$	-.015	.006	.015
CR $^{(t-1)}$	GD $^{(t)}$	-.004	.004	.384
NInPos $^{(t-1)}$	PA $^{(t)}$	-.036	.054	.496
GD $^{(t-1)}$	PA $^{(t)}$	-.083	.170	.626
CR $^{(t-1)}$	PA $^{(t)}$	.015	.024	.548
NInPos $^{(t-1)}$	CR $^{(t)}$	-.047	.074	.524
PA $^{(t-1)}$	CR $^{(t)}$	.054	.049	.269
GD $^{(t-1)}$	CR $^{(t)}$	-.487	.230	.034
PA $^{(t-1)}$	NInPos $^{(t)}$	-.057[a]	.049[a]	.356[a]
GD $^{(t-1)}$	NInPos $^{(t)}$	-.058[b]	.228[b]	.302[b]
CR $^{(t-1)}$	NInPos $^{(t)}$	.022	.018	.229

Note. Abbreviations: SE = Standard Error; InPos = positivity of interpersonal events; GD = General Distress; PA = positive affect; CR = cognitive reappraisal; NInPos = positivity of non-interpersonal events.

$^{(t)}$ Represents a given timepoints, with $^{(t-1)}$ indicating the preceding timepoint.

^{a,b} Represents an average across three paths given that stationarity was relaxed.

Interpersonal Negativity, Negative Affect, Reappraisal and General Distress

Stationarity Assumption and Model Fit

Again, the assumption of stationarity was violated ($\Delta\chi^2(50) = 134.39$, $p < .001$, ΔRMSEA = .008, ΔCFI = .069, ΔTLI = -.044). Model fit improved significantly when relaxing equality constraints on the General Distress ($\Delta\chi^2(2) = 16.31$, $p < .001$, ΔRMSEA = -.002, ΔCFI = .012, ΔTLI = .010), negative affect ($\Delta\chi^2(2) = 29.89$, $p < .001$, ΔRMSEA = -.005, ΔCFI = .023, ΔTLI = .023), and negativity of interpersonal events ($\Delta\chi^2(2) = 8.80$, $p = .012$, ΔRMSEA = -.001, ΔCFI = .006, ΔTLI = .003) autoregressive paths. Model fit also improved when freeing the cross-lagged path from General Distress to negative affect ($\Delta\chi^2(2) = 19.14$, $p < .001$, ΔRMSEA = -.003, ΔCFI = .014, ΔTLI = .013) and negativity of interpersonal events to cognitive reappraisal ($\Delta\chi^2(2) = 7.29$, $p = .026$, ΔRMSEA < .001, ΔCFI = .005, ΔTLI = .001). Similarly, fit improved when relaxing constraints on cross-sectional correlational paths between negative affect and General Distress ($\Delta\chi^2(2) = 17.44$, $p < .001$, ΔRMSEA = -.002, ΔCFI = .012, ΔTLI = .008) and cognitive reappraisal and General Distress ($\Delta\chi^2(2) = 9.93$, $p = .007$, ΔRMSEA < .001, ΔCFI = .006, ΔTLI = .001).

Model Results

Autoregressive paths to and from General Distress (average $\beta = .69$; all ps < .001), negative affect (average $\beta = .34$; all ps < .05), and cognitive reappraisal ($\beta = .51$; all ps < .001)

were significant. Autoregressive paths for negativity of interpersonal events were significant from times 1 to 2 (β = .17; p = .002) and 3 to 4 (β = .48; p < .001) but were marginally significant from time 2 to 3 (β = .12; p = .06).

The cross-lagged paths from General Distress to negative affect from times 1 to 2 and 3 to 3 (average β = .62; ps = .001) were significant, while the path from times 3 to 4 was marginally significant (β = .29; p = .070). General Distress predicted higher levels of negative affect. Cross-lagged paths from General Distress to cognitive reappraisal (β = -.58; p = .023) and negativity of interpersonal events (β = .27; p = .009) were significant, with General Distress predicting lower levels of reappraisal and higher levels of negativity of interpersonal events. Paths from cognitive reappraisal to negative affect were marginally significant (β = -.03; p = .054), with lower levels of reappraisal predicting elevated negative affect. All other cross-lagged paths were nonsignificant, as were both tests of indirect effects (all ps > .05).

Non-Interpersonal Negativity, Negative Affect, Reappraisal and General Distress

Stationarity Assumption and Model Fit

The assumption of stationarity was violated ($\Delta\chi^2(50) = 129.05$, p < .001, ΔRMSEA = .008, ΔCFI = .067, ΔTLI = -.042). Model fit improved significantly when relaxing equality constraints on the General Distress ($\Delta\chi^2(2) = 16.35$, p < .001, ΔRMSEA = -.002, ΔCFI = .013, ΔTLI = .011) and negative affect ($\Delta\chi^2(2) = 31.12$, p < .001, ΔRMSEA = -.005, ΔCFI = .025, ΔTLI = .026) autoregressive paths, as well as the cross-lagged paths from General Distress to negative affect ($\Delta\chi^2(2) = 21.09$, p < .001, ΔRMSEA = -.003, ΔCFI = .017, ΔTLI = .016) and from negativity of non-interpersonal events to General Distress ($\Delta\chi^2(2) = 7.00$, p = .03, ΔRMSEA < .001, ΔCFI = .005, ΔTLI = .001), and finally when relaxing constraints on cross-sectional correlational paths between negative affect and General Distress ($\Delta\chi^2(2) = 18.50$, p <

.001, ΔRMSEA = -.002, ΔCFI = .014, ΔTLI = .010), and cognitive reappraisal and General Distress ($\Delta\chi^2(2) = 10.09$, $p = .003$, ΔRMSEA < .001, ΔCFI = .006, ΔTLI < .001)

Model Results

The autoregressive paths to and from General Distress (average $\beta = .69$; all ps < .001), negative affect (average $\beta = .34$; all ps < .05), cognitive reappraisal ($\beta = .51$; $p < .001$), and negativity of non-interpersonal events were significant ($\beta = .08$; $p = .047$).

The cross-lagged paths from General Distress to negative affect from times 1 to 2 and 3 to 3 (average $\beta = .44$; ps < .001) were significant, while the path from times 3 to 4 was marginally significant ($\beta = .27$; $p = .086$). Across each time point, elevations in General Distress predicted higher levels of negative affect. Cross-lagged paths from General Distress to cognitive reappraisal ($\beta = -.51$; $p = .047$) and negative affect to negativity of non-interpersonal events were significant ($\beta = -.12$; $p = .012$), with General Distress predicting lower levels of reappraisal, and negative affect predicting lower levels of negativity of non-interpersonal events. Cross-lagged paths from General Distress to negativity of interpersonal events were marginally significant ($\beta = .27$; $p = .054$) as were paths from cognitive reappraisal to negative affect ($\beta = -.03$; $p = .061$), with General Distress predicting more negativity and lower engagement with reappraisal predicting increased negative affect. The cross-lagged path from negativity of interpersonal events to cognitive reappraisal was significant from times 1 to 2 ($\beta = -.30$; $p = .045$), but not 2 to 3 or 3 to 4 (ps > .05), where negativity of events predicted less engagement with reappraisal. All other cross-lagged paths were nonsignificant, as were both tests of indirect effects (all ps > .05). See Table 4 for full results of cross-lagged paths within negativity of interpersonal and non-interpersonal events models.

Table 4.

Results for Cross-Lagged Paths in Negativity of Events Models.

Negativity of Interpersonal Events				
Predictor	Outcome	Estimate	*SE*	*p*-value
InNeg $^{(t-1)}$	GD $^{(t)}$	-.007	.012	.575
NA $^{(t-1)}$	GD $^{(t)}$	.006	.011	.559
CR $^{(t-1)}$	GD $^{(t)}$	-.007	.004	.109
InNeg $^{(t-1)}$	NA $^{(t)}$	-.042	.042	.313
GD $^{(t-1)}$	NA $^{(t)}$	.597	.173	.001
CR $^{(t-1)}$	NA $^{(t)}$	-.027	.014	.054
InNeg $^{(t-1)}$	CR $^{(t)}$	.027[a]	.168[a]	.510[a]
NA $^{(t-1)}$	CR $^{(t)}$	-.039	.089	.663
GD $^{(t-1)}$	CR $^{(t)}$	-.577	.254	.023
NA $^{(t-1)}$	InNeg $^{(t)}$	-.031	.034	.356
GD $^{(t-1)}$	InNeg $^{(t)}$	.265	.101	.009
CR $^{(t-1)}$	InNeg $^{(t)}$	.007	.013	.597
Negativity of Non-Interpersonal Events				
Predictor	Outcome	Estimate	*SE*	*p*-value
NInNeg $^{(t-1)}$	GD $^{(t)}$	-.022	.014	.110
NA $^{(t-1)}$	GD $^{(t)}$	.008	.011	.481
CR $^{(t-1)}$	GD $^{(t)}$	-.006	.004	.151
NInNeg $^{(t-1)}$	NA $^{(t)}$	-.026	.031	.403
GD $^{(t-1)}$	NA $^{(t)}$	.505[b]	.175[b]	.029[b]
CR $^{(t-1)}$	NA $^{(t)}$	-.026	.013	.061

NInNeg $^{(t-1)}$	CR $^{(t)}$	-.026	.031	.403
NA $^{(t-1)}$	CR $^{(t)}$	-.047	.089	.594
GD $^{(t-1)}$	CR $^{(t)}$	-.508	.253	.045
NA $^{(t-1)}$	NInNeg $^{(t)}$	-.118	.047	.012
GD $^{(t-1)}$	NInNeg $^{(t)}$	.268	.140	.054
CR $^{(t-1)}$	NInNeg $^{(t)}$	.008	.018	.651

Note. Abbreviations: SE = Standard Error; InNeg = negativity of interpersonal events; GD = General Distress; NA = negative affect; CR = cognitive reappraisal; NInNeg = negativity of non-interpersonal events.

$^{(t)}$ Represents a given timepoints, with $^{(t-1)}$ indicating the preceding timepoint.

^{a,b} Represents an average across three paths given that stationarity was relaxed.

Discussion

The present study sought to examine affect and emotion regulation as possible mechanisms in the relationship between positive and negative aspects of life events and transdiagnostic symptoms of depression and anxiety. Primary aims of the study were to examine direct relationships between positive and negative aspects of life events and affective states, to assess direct relationships between aspects of life events and transdiagnostic symptoms, to test whether affective states mediate a relationship between aspects of life events and symptoms, and to examine whether affect and reappraisal mediate the relationship between aspects of life events and transdiagnostic symptoms. Results partially supported a risk reduction pathway from positivity of events, whereby positivity of interpersonal events predicted greater positive affect, and greater positive affect predicted reductions in General Distress. Results for negativity of events were inconsistent with hypotheses, but consistent with stress generation, in which General

Distress predisposed participants to heightened negative affect, lower engagement in reappraisal, and greater negativity of events. Contrary to hypotheses, direct effects of positivity and negativity of events upon General Distress were nonsignificant, as was joint mediation by positive affect and reappraisal across all models.

The finding that positivity and negativity of events did not significantly predict General Distress was contrary to our hypothesis and to a broader literature on life events and symptomatology. Our prior cross-sectional study established that positivity of non-interpersonal buffered against harmful effects of negativity of events in predicting General Distress. We also found a relationship between negativity of interpersonal life events and anhedonia-apprehension, a symptom factor characterized by low levels of positive affect, depression, and worry (Yarrington et al., 2023). Given these findings, previous work demonstrating beneficial effects of positive life events on psychopathology outcomes (e.g., Hovenkamp-Hermelink et al., 2019), and a large body of evidence linking negativity of events to risk for psychopathology (e.g., Hammen, 1991, 2005; Mazure, 1998; Uliaszek et al., 2012) we expected to observe direct effects of events positivity and negativity upon General Distress. Several possible explanations for nonsignificant direct effects of positivity of events exist. It may be that positivity of events does not directly protect against psychopathology. Much of the work on life events and protection against psychopathology has examined buffering effects either of positive aspects of events themselves (e.g., Dixon & Reid, 2000; Haeffel & Vargas, 2011; Kandler & Ostendorf, 2016; Yarrington et al., 2023), or emotional (e.g., Sewart et al., 2019; Shimizu & Pelham, 2004), cognitive (e.g., Haeffel & Vargas, 2011), or social factors (e.g., Cohen et al., 1984). As one exception, Hovenkamp-Hermelink et al. (2019) found direct effects of positive life events upon psychopathology longitudinally. However, the effects of positive life events were inconsistent

over time. Thus, it is possible that direct effects of positive aspects of significant events on psychopathology outcomes are limited. Instead, positive aspects of life events may reduce the potency of negative aspects of major events in predicting psychopathology outcomes. Future work examining buffering effects of positive aspects of life events over time is essential. Another possible explanation for a lack of direct effects may be temporal effects of events on mental health. Events in the present study were episodic and occurred in the year preceding the interview date. Therefore, in some cases, events could have occurred well over a year before symptom measurement. It is possible that there are direct effects of positivity of events on symptomatology, but that effects are proximal. Due to both the fact that episodic events are time-limited in nature, and latency between event and symptom measurement, only distal effects were assessed in the present study.

A lack of effects of negativity of events on General Distress was also contrary to our hypothesis. This finding is counter to some prior work suggesting that episodic interpersonal stress is predictive of depressive disorders (Vrshek-Schallhorn et al., 2015), and that dependent episodic stress is associated with first onset psychiatric disorders, including depression, among daughters of depressed mothers (Gershon et al., 2011). However, the literature on effects of broad episodic events on psychopathology, and especially on anxiety, is lacking. Instead, we found that elevations in General Distress predicted negativity of both interpersonal and non-interpersonal events, consistent with studies of stress generation. The theory of stress generation originated in a study of women with depression, wherein women with diagnoses of depression experienced heightened levels of stressful or negative life events (Hammen, 1991). Numerous studies since have found that diagnoses of depression and anxiety prospectively predict negative or stressful life events (e.g., Daley et al., 1997; Hammen, 2006; Rudolph et al., 2000; Uliaszek et

al., 2011). Therefore, our finding that General Distress predicts negativity of both interpersonal and non-interpersonal events builds upon a broader literature by demonstrating that transdiagnostic symptoms also contribute to stress generation.

Consistent with our hypothesis, positivity of interpersonal events predicted positive affect, although positivity of non-interpersonal events did not. Positivity of interpersonal events predicting positive affect is consistent with evidence that positive life events promote positive affect (Clark & Watson, 1988; Fredrickson, 2004; Gentzler et al., 2013). Findings specific to interpersonal events, rather than non-interpersonal events, were surprising. These results may be explained by continuity of beneficial relationships. For example, beginning a new dating relationship was a common interpersonal episodic event in the sample. Although the start of the relationship was considered to be an episodic event, some relationships likely continued beyond initial dates. Ongoing positive relationships in turn may have continued to exert beneficial effects on affect, whereas positive non-interpersonal events (e.g., achieving high marks in a class) may have more time-limited effects on affect. Contrary to our hypothesis, we did not observe direct effect of negativity of interpersonal or non-interpersonal events on negative affect. Some previous work has demonstrated that negative life events are cross-sectionally or prospectively predictive of negative affect (e.g., Kuiper & Martin, 1998; Moberly & Watkins, 2008; Montpetit et al., 2010), which informed the hypothesis of a directional relationship from events to affect. However, a more robust literature has demonstrated that negative affect or traits characterized by high levels of negative affect (i.e., neuroticism) are predictive of negative life events (e.g., Bolger et al., 1989; Bolger & Schilling, 1991; Brown & Rosellini, 2011; Metts et al., 2021), consistent with the stress generation literature. Results in the present study found that negative affect predicted negativity of non-interpersonal, but not interpersonal, events. Counterintuitively,

results suggested that negative affect predicted lower levels of negativity of events. This result is inconsistent with the notion of stress generation, and also inconsistent with previous work which has found that negative affectivity predicted negativity of non-interpersonal events (i.e., Metts et al., 2021). Reasons for negative effects of negative affectivity on non-interpersonal events are unclear. It may be that temporary affective states are weak predictors of events in the sample, and that more stable mood would be a more robust and accurate predictor of life events. Replication and further examination of this effect is important.

The finding that positive affect negatively predicted General Distress longitudinally was consistent with our hypothesis. That higher levels of positive affect predicts lower levels of symptomatology is aligned with the broader positive affect literature, which has demonstrated a relationship between positive affect and psychopathology; studies have found that positive affect is associated with lower levels of depression and anxiety cross-sectionally (Brown et al., 1998; Watson et al., 1988), and that positive affect prospectively predicts lower levels of depression (Headey et al., 1993; Lindahl & Archer, 2013). Relatedly, intervention studies have shown that treatments which aim to increase positive affect yield decreases in both depressive and anxiety or stress symptoms (e.g., Taylor et al., 2017; Craske et al., 2019). Inconsistent with hypotheses, we found that negative affect did not predict General Distress. The finding that negative affect did not predict General Distress was surprising due to a variety of evidence that negative affectivity is a prospective risk factor for depressive and anxious presentations (e.g., Aldinger et al., 2014; Kendler et al., 2004; Zinbarg et al., 2016), and previous work from our lab demonstrating that neuroticism predicts General Distress (Vinograd et al., 2020). It is possible that the particular negative affective states measured are not those that most closely predict broad psychopathology outcomes. Specifically, the I-PANAS-SF negative affect subscale only measured fear,

nervousness, shame, upset, and hostility, which are higher arousal states, and some of which may be more relevant to anxious presentations than depressive presentations. Negative affect states such as sadness, fatigue, and apathy may be more likely to capture depressive symptoms and exert effects on General Distress. However, we found that higher levels of General Distress prospectively predicted elevations in negative affect, consistent with the notion that both depressive and anxious presentations are characterized by high levels of negative affectivity (Watson & Clark, 1984). It may be that the experience of transdiagnostic symptoms of depression and anxiety through General Distress maintains a breadth of negative affective states, and also exacerbates negative affectivity in reaction to situational stressors (Shackman et al., 2016), leading to chronic elevations in negative affect observed in the sample.

We also expected that positive affect would mediate the relationship between positivity of life events and General Distress, and that negative affect would mediate the relationship between negativity of events and General Distress. We observed a marginally significant mediational effect of positive affect as it relates to positivity of interpersonal events and General Distress; positivity of interpersonal events predicted increases in positive affect and subsequent decreases in General Distress. This finding is consistent with literature that links positive affect to positive life events and to reductions in psychopathology (Fredrickson, 2004; Lindahl & Archer, 2013; Watson et al., 1988). The present study builds upon the literature by demonstrating that positive affect may represent a mechanism by which positivity of interpersonal events exerts its beneficial effects upon symptom outcomes. A nonsignificant mediational effect of positive affect for positivity of non-interpersonal events and General Distress is likely due to the fact that positive aspects of non-interpersonal events did not significantly predict positive affect. Contrary to our hypothesis, we did not observe mediational effects of negative affect in either model.

Tests of mediation examined effects from life events to General Distress through negative affect, whereas results from direct cross-lagged paths demonstrated that General Distress predicted negative affect and negativity of events. Therefore, testing the mediation role of negative affect in a model with negativity of events as the predictor of General Distress may have precluded the ability to observe significant effects.

Finally, we did not observe that positive or negative affect and cognitive reappraisal mediated the link between positivity and negativity of life events and General Distress. Within positivity of events models, we did not observe a significant relationship between positive affect and reappraisal, inconsistent with prior work has found positive affect to be associated with cognitive reappraisal (Andreotti et al., 2013; Brockman et al., 2017; Folkman & Moskowitz, 2000). In the present study, it is possible that measurement of positive affect and reappraisal limited the ability to observe either a unidirectional or bidirectional relationship between these constructs, and subsequent significant mediation. Positive affect was measured as state-like construct, whereas reappraisal was measured at the trait level. Relationships between these constructs might be more readily observed at a state level. However, across positivity models, cognitive reappraisal was not significantly associated with most variables in the model, so it may be that reappraisal is simply not a construct closely related to beneficial effects of life events. However, it is also possible that the measure of emotion regulation used in the study was too narrow and did not capture other forms of emotion regulation which may also be relevant and beneficial (e.g., Gratz & Roemer, 2004). Within negativity models, again, affect did not predict reappraisal, which may explain the nonsignificant mediational pathway. However, lower tendencies toward reappraisal marginally significantly predicted negative affect, and higher levels of General Distress predicted lower tendencies toward reappraisal. An issue of

directionality may have limited the ability to observe significant mediational pathways, but nonetheless, results seem to suggest that lower engagement in reappraisal may maintain negative affective states, although prospective effects of negative affect and reappraisal on future events were not observed in the present study.

Results from the present study have several clinical implications. First, findings that positive aspects of life events promote positive affect suggest that attentional training, which promotes acknowledgement of positive aspects of events, may facilitate improved mood. Second, results suggest that deepening reward learning via savoring of pleasant emotions in reaction to positive aspects of life events might promote both positive affect and downregulation of symptoms. Novel interventions aimed at increasing positive affect have taken such an approach with recounting of events engaged in during behavioral activation (Craske et al., 2019; Craske et al., 2023). Taking a similar approach to significant life events may also yield beneficial effects. Third, results highlight that General Distress contributes to maintenance of negative affect, less engagement with reappraisal, and ultimately the experience of more negativity associated with significant life events. It is possible that therapies which train reappraisal strategies (e.g., Denny & Ochsner, 2014) might disrupt this stress generation pathway.

The present study had several strengths. First, the study used an objective measure of life events, reducing the likelihood that symptomatology may impact ratings of either positivity or negativity of events. Second, longitudinal data allowed for assessment of relationships between positive and negative aspects of life events, affect, reappraisal, and symptoms over time. Third, this study used dimensional symptoms associated with depression and anxiety, rather than relying on diagnoses or narrow symptom measures, capturing the comorbidity so often observed between depressive and anxious presentations. However, this study was not without limitations.

The sample size was small given the number of parameters in each model (Kline, 1998), which likely limited power to detect significant effects. Second, measures of affect, reappraisal, and symptoms were based upon self-report, which may have contributed to response biases conflated with symptoms and shared method variance. Third, the measure of positive and negative affect used in the present study generally focused on higher arousal affective states. Measurement of a greater breadth of affective states may yield different results. Additionally, the measure of cognitive reappraisal used in the present study assesses general tendencies towards selecting an emotion regulation strategy. Assessing engagement in, rather than global tendency towards, cognitive reappraisal may more readily relate to aspects of episodic life events, affective states, and symptomatology. Finally, the sample was relatively demographically homogenous, due to age, race, and socioeconomic status.

The present study examined the relationships between positive and negative aspects of life events, affective states, reappraisal, and transdiagnostic symptoms associated with depression and anxiety. Results demonstrated that positivity of interpersonal life events, but not non-interpersonal life events, predicted higher levels of positive affect and that positive affect marginally mediates the relationship between positivity of interpersonal events and General Distress was observed. A stress generation pathway of sorts was observed, such that General Distress predicted higher levels of negative affect, lower levels of cognitive reappraisal, and greater negativity of events longitudinally. Findings suggest that interventions focused on attending to and savoring positive aspects of events may promote positive mood, while instructed reappraisal of unpleasant events (e.g., encouraging participants to think about events in a different way) may reduce negative affect and interrupt stress generation.

VI. Study 2: Effects of Positive and Negative Affect Inductions on Interpretive and Response Bias

Abstract

Affective states and interpretations of ambiguous stimuli are inherently related constructs, although effects of induced affective states on interpretive biases have not been comprehensively explored. The present study examined the relationship between induced affective states and interpretive bias in a sample of 189 undergraduates. Participants were randomized into one of two mood induction conditions and subsequently completed an interpretive bias task. Results demonstrated significant condition differences in affect after the mood induction; the positive induction condition demonstrated significantly more positive mood and the negative condition demonstrated more negative mood. A marginally significant difference between conditions emerged with respect to positive interpretive bias for non-social scenarios, with the positive mood induction condition demonstrating more positive interpretive bias to non-social situations than the negative induction condition ($p = .07$). The negative induction condition approached a significantly greater negative response bias for social scenarios ($p = .06$) and, unexpectedly, a significantly higher positive response bias for non-social scenarios ($p = .03$). Findings offer some support for the notion that inducing positive affect may promote more positive interpretations of ambiguous scenarios.

Keywords: interpretive bias; response bias; positive affect; negative affect

Study 2: Introduction

Interpretive bias is a cognitive process involving tendencies to interpret ambiguous stimuli, such as words or scenarios, as having a particular emotional valence, which may be positive or negative (Mathews & MacLeod, 2005). Seminal work has examined negative interpretive bias and differentiates this cognitive process from more general response biases due to the mechanisms by which negative interpretive bias emerges. Specifically, in the case of negative interpretive bias, it has been posited that individuals selectively deploy processing resources to threatening information at a pre-attentive stage of processing (Mathew & MacLeod, 1985). This purported bias is thought to have its strongest effect on memory in the case of ambiguous material. Given that ambiguous scenarios may have both a threatening and nonthreatening interpretation, selective processing of threatening information should result in differential memorial representations of scenarios, which ultimately contribute to implicit memory biases favoring threatening information, and subsequent threatening interpretations of ambiguous stimuli (e.g., Mathews et al., 1989; Eysenck et al., 1991). Therefore, negative interpretive bias represents a processing bias that relates to encoding of threatening information. Response bias, in contrast, refers to endorsement of any valenced interpretations regardless of the information stored in memory.

Although interpretive biases can encompass positive interpretations of ambiguous scenarios, the literature has largely examined negative interpretation biases. Many studies have assessed negative interpretive biases as they relate to trait negative affective states, such as depression and anxiety, given theoretical reason to believe that high levels of negative affect may contribute to cognitive biases. In support, early work found that subjects with depression were more likely than non-depressed control subjects to make threatening interpretations of

ambiguous scenarios (Butler & Mathews, 1983). Results of this study have been replicated among samples of adults with diagnoses of depression (Nunn et al., 1997), and both adolescents and adults with depressive symptoms (Hindash & Amir, 2012; Orchard et al., 2016; Sears et al., 2011), compared to asymptomatic or no-diagnosis control subjects. Limited evidence that exists to the contrary may be attributable to methodological differences. For example, Hindash and Amir (2012) found the expected bias towards negative interpretations of self-referent ambiguous textual stimuli in individuals with high levels of depressive symptoms; failure to use self-referent scenarios explain opposite findings in other work (e.g., Lawson & MacLeod, 1999). Subsequent work found that individuals with depressive symptoms, compared to those without, showed an augmented magnitude of the eye blink reflex to ambiguous text stimuli, which was interpreted as evidence for more negative interpretations (Lawson et al., 2002). Thus, the literature broadly suggests that depressive symptoms and diagnoses are associated with a negative interpretive bias.

Links have been observed between anxiety and negative interpretive bias as well. Individuals with social anxiety demonstrated a negative interpretive bias for ambiguous social scenarios, especially those that were self-relevant (e.g., referred to the self in scenarios rather than a generic other), compared to non-anxious controls and participants with diagnoses of obsessive-compulsive disorder (Amin et al., 1998). Similar results have been found in other studies of subjects with high versus low social anxiety (Constans et al., 1999). Negative interpretation biases also have been observed among individuals with generalized anxiety disorder (Eysenck et al., 1991) and agoraphobia (McNally & Foa, 1987) compared to no-diagnosis control subjects. Finally, individuals with high levels of trait anxiety have been shown

to demonstrate significantly more negative interpretive bias than those with low trait anxiety (Byrne & Eysenck, 1993; MacLeod & Cohen, 1993).

Anxiety and depression share negative affectivity as a symptom dimension (Griffith et al., 2010). Several studies have demonstrated that neuroticism, or a trait disposition toward negative affect, is associated with negative interpretive bias (e.g., Byrne & Eysenck, 1993; Salemink & van den Hout, 2010; Vinograd et al., 2020). Trait negative affectivity is characterized by both tonic features (i.e., tendency to experience and express more frequent, intense, and long-lasting negative mood), and state negative affectivity (Shackman et al., 2016). Individuals with dispositional negative affect experience elevated levels of state negative affect, but also demonstrate heightened negative affect in response to stressors. This heightened reactivity, manifested via elevations in state negative affect, predicts future internalizing symptoms, episodes, and disorders (Shackman et al., 2016). Given that state negative affectivity is an important feature of dispositional negative affect, and evidence that presentations characterized by negative affectivity (e.g., depression, anxiety, neuroticism) are associated with interpretive bias, it might also be that state affectivity is predictive of interpretive biases. Indeed, studies have found that that induced negative mood states are associated with negative interpretations. For example, prior work suggests that individuals exposed to a negative mood induction produced more threat interpretations of homophones (e.g., die as opposed to dye) in spelling tasks and lexical ambiguity tasks than those exposed to a positive mood manipulation (Halberstadt et al., 1995; Richards et al., 1993). Null findings from another study of negative mood induction among participants with trait high and low negative affect may be attributable to lack of comparison to a control or positive mood condition (Bisson & Sears, 2007). Rather, authors compared effects of a mood induction to a prior experiment in which a mood induction

had not been applied among individuals with high and low negative affect. Moreover, state negative affectivity and negative interpretive biases have shown convergent decreases over the course of psychotherapeutic interventions (Eysenck et al., 1991). Thus, overall, there seems to be a relationship between state negative affect and negative interpretive biases.

Far fewer studies have examined the relationship between positive affect and positive interpretive biases, although early work has suggested that trait positive affectivity is associated with positive interpretations (Byrne & Eysenck, 1993). Relatedly, trait optimism, a facet of positive affect, has been associated with positive interpretations (Gordon et al., 2016). In contrast, a study of positive mood induction failed to show expected effects for lexical ambiguity tasks (Halberstadt et al., 1995). To our knowledge, no other studies of positive mood inductions and interpretive biases have been published. A greater proportion of studies in this area have examined the effects of trained interpretive bias upon mood (e.g., Holmes et al., 2006).

There are several gaps in the literature that the current study aims to fill. First, a persistent challenge has been to disentangle interpretive bias from more general response biases. There is a need to for paradigms that can disentangle the two. Each are relevant since they may contribute to the maintenance of depressogenic or anxious mood states through either a general tendency to interpret stimuli as threatening, or a tendency to selectively process, remember, and in turn interpret stimuli as threatening (e.g., MacLeod et al., 1986; Mineka & Tomarken, 1989; Roiser & Sahakian, 2013). Therefore, understanding the relationship between state affect and both interpretive and response biases may guide interventions aimed at reducing such biases. Second, compared to the evaluation of trait affect, effects of state affect on interpretive bias and response bias have been understudied. Given the link between affective states and psychopathology (Shackman et al., 2016), and trait negative affect and cognitive biases (e.g., Bradley et al., 1993;

Grafton et al., 2012), parsing state effects on such biases may shed light on novel interventions focused on state affect. Positive affective states have been especially understudied. A growing literature has demonstrated that positive affect is associated with a broadened scope of attentional filters and also positively predicts working memory performance (Brose et al., 2014; Rowe et al., 2007). Thus, there are theoretical reasons to believe that promoting positive affect might predict more benign interpretations of ambiguous stimuli. Third, most mood induction studies rely upon generic strategies such as positive versus negative music or pictorial images. Yet, mood induction via specific self-relevant experiences, such as autobiographical memories, may be particularly potent (e.g., Holmes & Mathews, 2010) and may have greater relevance to the cognitive processes involved in interpretation of ambiguous situations. For example, the same memory processes involved in contributing to interpretive biases may lead to disproportionate recall of valenced memories (e.g., Sanchez et al., 2017).

The Present Study

The present study seeks to fill these gaps in the literature by assessing the effects of induced positive and negative affective states tied to autobiographical memories on interpretive and response biases. This work may inform to what extent interventions aimed at processing either positive or negative autobiographical memories may shift cognitive biases that contribute to psychopathology. Specifically, we examine the effects of an autobiographical memory-based mood induction procedure on interpretations of ambiguous scenarios. **Aim 1**: Assess whether induced positive mood predicts positive interpretations and positive response bias. *Hypothesis 1:* Induced positive mood will predict more positive interpretations and positive response bias than negative mood. **Aim 2**: Examine whether induced negative mood predicts negative

interpretations and negative response bias. *Hypothesis 2:* Consistent with prior work, negative mood will predict more negative interpretations and negative response bias than positive mood.

Method

Participants

Participants ($N = 189$) were recruited through the UCLA undergraduate psychology subject pool. The sample size for the present study was determined through an a priori power analysis conducted in G*power (Faul et al., 2007), which indicated that a sample size of 180 (45 per condition) would be sufficient to detect a significant effect of mood induction on interpretive bias with power of .80 and an alpha-level of .05. Participants were compensated for their time with course credit. Prospective participants completed pre-screening questionnaires online to determine eligibility for the study. Specifically, participants were asked to complete an 8-item version the Patient Health Questionnaire-9 (PHQ-9; Kroenke et al., 2001), which excluded an item probing suicidality, and the Generalized Anxiety Disorder-7 (GAD-7; Spitzer et al., 2006). Individuals who received scores $\geq$ 9 or 10 respectively (the clinical cut-off) on each measure were excluded to prevent ceiling effects and due to ethical concerns related to mood inductions among a clinically severe population. Participants with mild levels of low mood or anxiety were retained in the study sample in service of capturing a range of cognitive styles and baseline affective states. Other exclusion criteria included a lifetime history of psychosis, intellectual disability or organic brain damage. Participants were eligible for the study if they did not meet exclusion criteria, were fluent in English, were at least 18 years old.

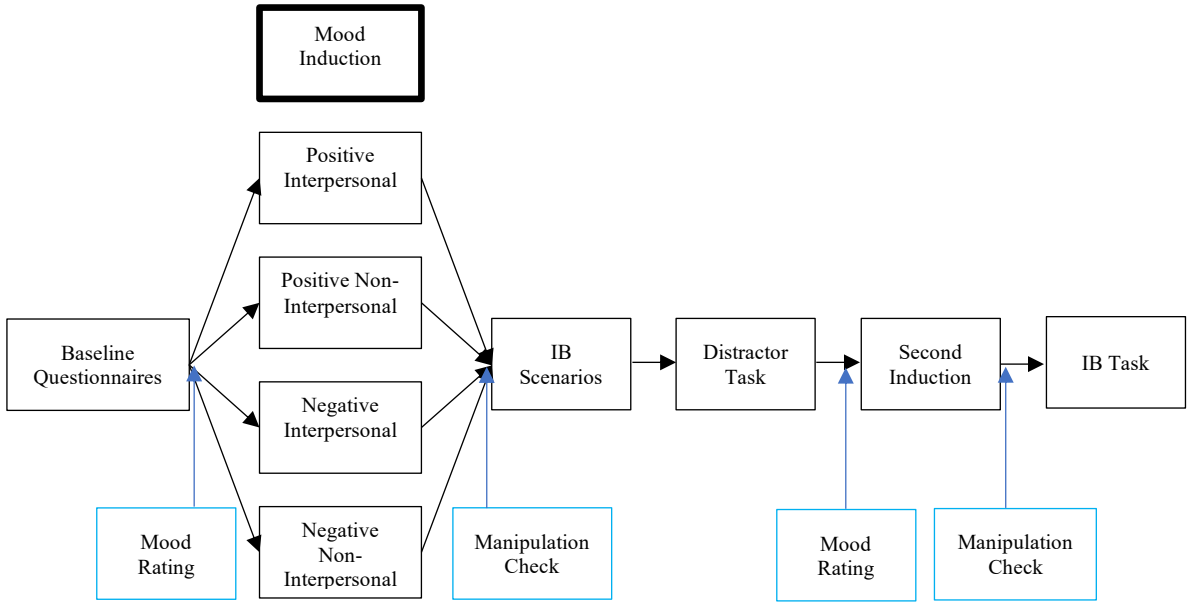
Procedure

Upon completing pre-screening, eligible participants were automatically invited to complete the study electronically via PsyToolkit, a web-based software program that can run

online questionnaires and reaction-time experiments and subsequently save experiment data (Stoet, 2010; Stoet, 2017). Before beginning the study, participants were presented with a study description, including the requirement for them to have a device that could record and play back audio during the study, and completed informed consent. A schematic of the experimental procedure can be found in Figure 2.

Figure 2.

Overview of the Experimental Procedure.



Note. Abbreviations: IB = Interpretive Bias.

Upon initiating the study, participants were asked to complete several baseline questionnaires, and ratings of positive and negative mood. They were subsequently randomized to one of four mood induction conditions. After the mood induction procedure, they re-rated positive and negative moods as a manipulation check. Next, all participants read scenarios from an interpretive bias task modeled after that used by Mathews and Mackintosh (2000) and answered comprehension questions, before completing a brief distractor task. Given that mood

inductions have temporary effects (e.g., several minutes; Gillies & Dozois, 2021), participants underwent a second, abbreviated mood induction and manipulation check prior to completing the interpretive bias task.

Mood Induction Conditions and Procedure

Participants were randomized into one of four mood induction procedures. The procedure induced either positive or negative moods, and within each mood state, the induction focused on autobiographical memories of events. A secondary intent of the induction was for participants to select either interpersonal (i.e., related to other people, such as starting a new romantic relationship or having a fight with a friend) or non-interpersonal (i.e., unrelated to relationships with other people, such as breaking a bone or receiving a high grade in a class) events to recall, given evidence from the life event literature that interpersonal and non-interpersonal events might differentially impact mood (e.g., Uliaszek et al., 2012). Thus, this study had four possible conditions: positive interpersonal, positive non-interpersonal, negative interpersonal, and negative non-interpersonal.

The mood induction in the present study mirrored script-driven imagery procedures developed by Pitman et al. (1987) for autobiographic events. Script-driven imagery procedures are a well-established methodology for eliciting and studying emotion and its physiological correlates in a laboratory setting (Bujarski et al., 2015). Participants were asked to first identify an autobiographical memory of an event. Instructions differed by condition only in that participants were instructed to either identify a positive or negative event and were also asked to select events that involved either relationships with other people (i.e., interpersonal condition) or were unrelated to relationships with other people (i.e., non-interpersonal condition). Participants were provided with condition-congruent examples of events in all cases. Next, participants were

asked to generate a brief, 5-7 sentence script in which they described the event in greater detail. Then, participants made a recording of their scripts and were subsequently instructed to listen to their recording with their eyes closed. Finally, participants were asked to spend one minute imagining the event in vivid detail. See Figure 3 for detailed induction instructions.

Figure 3.

Depiction of Mood Induction Instructions for Positive Condition.

Note. Sequential instructions for mood induction task. The audio file for step 6 played a tone after one minute elapsed to cue participants to stop the imagery exercise.

Interpretive Bias Task: Encoding Phase

The interpretive bias task in the present study was modeled after the recognition task used by Mathews and Mackintosh (2000). The task involves the presentation of 20 ambiguous scenarios, 10 of which are social[1] (e.g., giving a speech at a wedding reception) and 10 of which are nonsocial (e.g., deciding to go to the doctor for a checkup due to dizziness). Scenarios were presented one by one, and each scenario was presented with a title (e.g., "Visiting the Doctor") and ended with a target word with missing letters, which are represented with blank spaces (e.g., "Your doctor takes your blood pressure and listens to your chest, and then tells you to relax while giving you his O P _ N _ O N."). This target word is presented to facilitate encoding of the scenario, not to resolve ambiguity. See Appendices for a full list of scenarios.

Participants were asked to read each scenario carefully and to imagine themselves in the scenario. After completing the target word, they were presented with the correct answer, and asked to indicate if their response was correct. Next, participants were presented with a simple yes or no question meant to further improve encoding (e.g., "Did you delay going to the doctor? Enter Y or N.").

Second Mood Induction

For the second induction, participants repeated the final two steps of the mood induction procedure detailed above. That is, participants listened to their audio recording and spent one minute imagining the event in detail.

Distractor Task

[1] Due to a coding error, ratings for one social scenario were not recorded. Thus, analyses included ratings for 19 scenarios, 9 of which were social and 10 of which were non-social.

The distractor task followed procedures described by Mathews and Mackintosh (2000). Participants were presented with 20 true or false questions (e.g., "Rats have teeth," "Desks wear clothes") and asked to respond to these questions as quickly as possible. See Appendices for distractor task questions.

Interpretive Bias Task: Test Phase

Participants were presented with the title of each scenario accompanied by four response options simultaneously and rated each option in terms of degree of similarity to the corresponding scenario using a 4-point Likert scale (1 = very different in meaning; 4 = very similar in meaning). Response options included a positive interpretation (e.g., "The doctor tells you that there is absolutely nothing to worry about"), a negative interpretation (e.g., "The doctor tells you to relax and gives you an opinion on your disease"), a positive foil (e.g., "The doctor tells you that you have made a complete recovery") and negative foil response (e.g., "The doctor tells you that you will need another course of treatment"). The foil options were intended to be positive or negative in valence, but not the most accurate resolution of scenarios. The positive and negative interpretation bias responses were indicative of interpretive bias specifically, while the foil responses were indicative of response bias. Response bias has typically referred to a tendency to endorse threatening interpretations regardless of information stored in memory (e.g., Eysenck et al., 1991). Participants were instructed not to rank order the response options, but rather, to rate each option independently. See Appendices for detailed response options.

Measures

Baseline Questionnaires. Participants completed a set of baseline questionnaires to evaluate baseline differences in symptoms of psychopathology, positive and negative affect, and emotion regulation, and for the purposes of potential secondary moderator analyses, which are

not reported herein. The Depression Anxiety Stress Scales-21 (DASS-21; α = .87; Brown, 1997) is a 21-item scale that assesses depression, anxiety, and stress over the past week. Participants responded to a series of statements indicating to what degree the statements were true of them on a 4-point Likert scale (0 = did not apply to me at all; 3 = applied to me very much, or most of the time). Seven items comprise each of the subscales (α_{stress} = .72; $\alpha_{anxiety}$ = .68; $\alpha_{depression}$ = .84). The Positive and Negative Affect Schedule-X (PANAS-X; α = .88; Watson & Clark, 1994) is a 60-item measure of positive and negative affect. Participants were presented with adjectives and asked to respond to each based upon how they have felt in the last week on a 5-point Likert scale (1 = very slightly or not at all; 5 = extremely). The PANAS-X yields a 10-item positive emotion subscale (α = .89) and a 10-item negative emotion subscale (α = .85). The measure also yields a series of specific positive and negative emotion subscales (e.g., fear, hostility, joviality, serenity) which can be used to generate a basic positive affect subscale (α = .93) and a basic negative affect subscale (α = .91). Participants also completed the Emotion Regulation Questionnaire (ERQ; (α = .91); Gross & John, 2003), a 10-item questionnaire which yields a 6-item cognitive reappraisal subscale (α = .85) and a 4-item expressive suppression subscale (α = .82). Participants rated to what extent they agree or disagree with statements on a seven-point scale (1 = strongly disagree; 4 = neutral; 7 = strongly agree).

Interpretive Bias. As noted above, participants were presented with the title of each scenario accompanied by four response options simultaneously, two of which indicated interpretive biases which were either positive or negative. Participants then rated each response option in terms of degree of similarity to the corresponding scenario. To generate interpretive bias variables across scenarios, similarity scores for positive and negative interpretations were summed within social and non-social scenarios. For example, each similarity rating for positive

interpretations across the 10 non-social scenarios were summed for each participant to create a positive interpretive bias variable for non-social scenarios. Thus, in total, the task generated four sum variables: positive interpretations for social scenarios, positive interpretations for non-social scenarios, negative interpretations for social scenarios, and negative interpretations for non-social scenarios.

Response Bias. As with interpretive bias, the task yields similarity ratings for both positive and negative response bias within each scenario. Similarity scores were summed for each participant within social and non-social scenarios. Therefore, the task yielded the following response bias variables: positive response bias for social scenarios, positive response bias for non-social scenarios, negative response bias for social scenarios, and negative response bias for non-social scenarios.

Manipulation Checks. Before the mood induction and after each of the two inductions, participants provided two ratings of their mood: one of how positive their mood is and one of how negative their mood is on a 1 to 5 scale (1 = not at all; 2 = a little; 3 = moderately; 4 = very; 5 = extremely).

Analyses

All analyses were conducted in SPSS version 27.0 (IBM Corp., 2020). We tested effects of our manipulation using a repeated measures ANOVA. Specifically, we examined the effects of condition (i.e., positive vs. negative induction) on four negative and positive mood ratings (i.e., pre-induction, post-induction, pre-second brief induction, post-second brief induction).

In our assessment of condition differences in interpretive bias, we sought to parse the effects of response bias, evidenced by an effect of the foil variables, from the effects of interpretive bias, represented by an effect of the non-foil variables. For positive and negative

interpretive bias scores separately, we regressed interpretive bias scores on foil bias scores, and subsequently saved the residuals from each regression, which yielded a measure of interpretive bias that is independent of response bias variance (Vinograd et al., 2020). Next, independent samples t-tests were used to examine condition differences in positive and negative interpretive bias for social and non-social scenarios, represented by residuals from the aforementioned regression models. A separate analysis assessed differences between conditions in positive and negative foil responses as an exploratory analysis of response bias, given evidence of mood-congruent response biases (e.g., Dowens & Calvo, 2003; Egidi & Gerrig, 2009; Hunter et al., 2011; Surguladze et al., 2004). In interpretive and response bias analyses, participants for whom the induction did not work effectively (e.g., a participant in the positive condition reporting an increase in negative mood) were excluded.[2]

Results

Descriptive Statistics: Demographics

Participants were an average age of 20.48 years old (SD = 2.48). The sample was 67.3% female and 23.2% male (0.5% not reported). The sample self-identified racially/ethnically as 45.8% Asian, 32.1% White, 11.6% Latinx/Hispanic, 3.7% Multiracial, 2.6% Black, 4.2% not reported.

Manipulation Check

Given that the mood induction procedure was a novel approach, it was unclear to what extent autobiographical memories related to interpersonal and non-interpersonal events might differentially impact mood. Results demonstrated that interpersonal and non-interpersonal

[2] A small proportion of participants (n = 26) did not respond to the mood induction in accordance with their condition. Due to concerns that these participants systemically differed from those for whom the mood induction functioned as expected, these participants were excluded from analyses of biases.

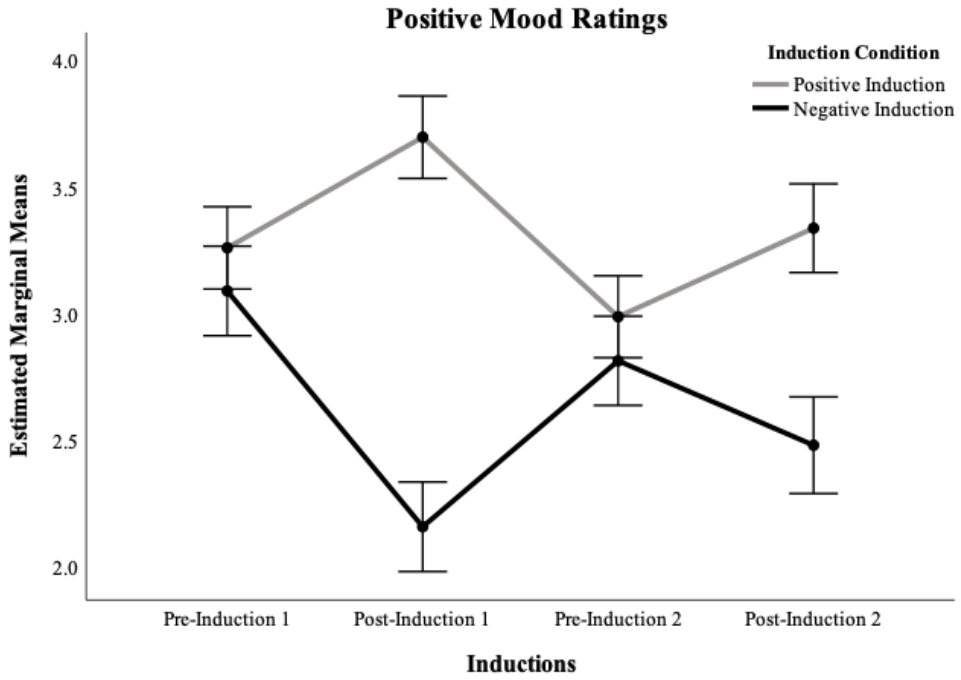
conditions did not impact either positive (M_{int} = 3.73, SD_{int} = .87; M_{nint} = 3.69, SD_{nint} = .93; p = .81) or negative mood (M_{int} = 2.85, SD_{int} = 1.01; M_{nint} = 2.76, SD_{nint} = .90; p = .60) differently. Additionally, visual inspection of the data suggested that a proportion of participants failed to accurately identify interpersonal or non-interpersonal events in alignment with condition, although all participants effectively selected events that were a valence match for their condition (i.e., positive vs. negative). For example, in the positive non-interpersonal condition, one participant reported forming a close friendship with a roommate. A team of trained raters coded the data to determine whether events identified by participants were a condition match. Raters were trained to differentiate between interpersonal and non-interpersonal events using the same criteria employed for episodic life events in the UCLA Life Stress Interview (Hammen et al., 1987; Hammen, 1991), where interpersonal events included those related to close friendships, social life, romantic relationships, and family relationships, and non-interpersonal events captured those related to the neighborhood/dorm environment, school/academic experiences, work, finances, and health. In cases of disagreement between raters, author J.S.Y. provided a final rating. Results of the coding demonstrated that 10.1% of participants selected an event that was not an interpersonal/non-interpersonal condition match. Given the significant proportion of participants who did not produce an event that was a condition match for interpersonal vs. non-interpersonal events, and the fact that the groups did not differ in terms of their effects upon mood, we opted to compare groups based upon only valence, yielding two study conditions: positive mood induction (N = 102) and negative mood induction (N = 87).

Positive Mood Ratings. See Figure 4 for a depiction of results. Results from a one-way repeated measures ANOVA demonstrated a significant interaction between condition and time (F(2.68, 504.36) = 64.18; p < .001). Tests of simple effects demonstrated that conditions did not

significantly differ in positive mood ratings prior to the first induction (p = .12) or second brief induction (p = .15). However, after the first induction, the positive condition demonstrated significantly higher average positive mood ratings (M_{pos} = 3.70) than the negative condition (M_{neg} = 2.16; p < .001; η^2 = .01), although the effect was small. The same was true after the second brief induction, albeit again, with a small effect size (M_{pos} = 3.34; M_{neg} = 2.48; p < .001; η^2 = .01).

Figure 4.

Mood Induction and Positive Mood Ratings.



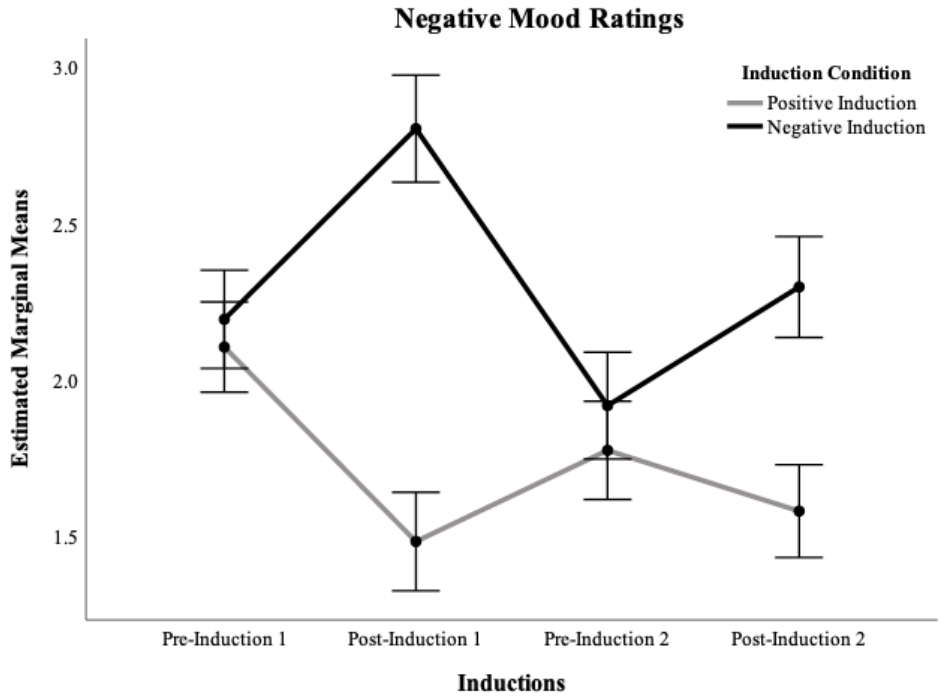
Note. Error Bars = 95% Confidence Interval.

Negative Mood Ratings. See Figure 5 for a depiction of results. Results from a one-way repeated measures ANOVA demonstrated a significant interaction between condition and time (F(2.59, 487.24) = 44.62; p < .001). Tests of simple effects demonstrated that conditions did not significantly differ in negative mood ratings prior to the first induction (p = .41) or second brief

induction (p = .22). However, after the first induction, the negative condition demonstrated significantly higher average negative mood ratings (M_{neg} = 2.81) than the positive condition (M_{pos} = 1.49; p < .001; η^2 = .40). The same was true after the second brief induction (M_{neg} = 2.30; M_{pos} = 1.58; p < .001; η^2 = .18).

Figure 5.

Mood Induction and Negative Mood Ratings.



Note. Error Bars = 95% Confidence Interval.

Conditions and Baseline Questionnaires. To assess systematic differences between study conditions, we also compared conditions on baseline questionnaires. Differences between conditions in the DASS-21 (Brown, 1997) subscales and total score were non-significant (all ps ≥ .27). Non-significant differences were observed for the ERQ (Gross & John, 2003) for both the cognitive reappraisal (p = .32) and expressive suppression (p = .28) subscales. Finally, there

were non-significant condition differences on the PANAS-X (Watson & Clark, 1994) basic positive affect (p = .37) and basic negative affect (p = .49) subscales.

Interpretive Bias

Positive Interpretive Bias for Social and Non-Social Scenarios. There were not significant differences between conditions in positive interpretive bias for social scenarios (t(161) = .91; p = .182). A significant difference between conditions emerged with respect to positive interpretive bias for non-social scenarios, with the positive mood induction condition demonstrating more positive interpretive bias to non-social situations than the negative induction condition (t(161) = 1.83; p = .035; d = .29). See Table 5 for summary statistics for interpretive bias ratings.

Negative Interpretive Bias for Social and Non-Social Scenarios. No significant differences between conditions emerged in interpretive bias for negative social (t(161) = .09; p = .465) or non-social scenarios (t(161) = .83; p = .205).

Table 5.

Descriptive Statistics for Interpretive Bias.

Interpretive Bias	Mean	SD	Minimum	Maximum
Positive Social	0.00	4.35	-12.86	8.82
Positive Non-Social	0.00	4.56	-12.72	14.77
Negative Social	0.00	4.64	-11.96	9.31
Negative Non-Social	0.00	5.04	-13.00	12.00

Note. SD = Standard Deviation. To parse effects of response bias, interpretive bias scores were regressed on foil bias scores. Interpretive bias scores are represented by residuals from

regressions of raw interpretive bias data on foil bias scores yielding a measure of interpretive bias independent of response bias variance.

Response Bias

Positive Response Bias for Social and Non-Social Scenarios. The positive induction condition demonstrated significantly lower positive response bias for non-social ($t(161) = -1.66$; $p = .049$; $d = .26$), and marginally significantly lower positive response bias for social scenarios ($t(161) = -1.64$; $p = .051$; $d = .26$), than the negative induction condition. See Table 6 for summary statistics for response bias ratings.

Negative Response Bias for Social and Non-Social Scenarios. Individuals in the negative induction condition demonstrated significantly greater negative response bias for social ($t(161) = -1.96$; $p = .026$; $d = .31$) and a marginally significant effect for non-social scenarios ($t(161) = -1.48$; $p = .07$; $d = .23$).

Table 6.

Descriptive Statistics for Response Bias.

Response Bias	Mean	SD	Minimum	Maximum
Positive Social	14.85	4.63	9.00	27.00
Positive Non-Social	18.52	5.12	10.00	37.00
Negative Social	14.90	4.12	9.00	26.00
Negative Non-Social	19.02	5.14	10.00	38.00

Note. SD = Standard Deviation.

Discussion

The present study sought to examine whether an experimental manipulation of positive as opposed to negative mood differentially predicted interpretive biases and response biases.

Results demonstrated a significant effect for the positive induction condition to yield more positive interpretive bias for non-social scenarios than the negative mood induction condition. Results also demonstrated significant response biases among individuals who underwent a negative mood induction, to non-social and social scenarios.

Consistent with hypotheses, the positive mood induction produced a significant effect of more positive interpretive biases compared to the negative mood induction. However, the results were limited to non-social scenarios and did not extend to interpretive biases of social scenarios. Results may be explained in part due to content of these two types of scenarios. Non-social scenarios broadly included situations such as taking a flight, hearing a sound at night, walking home alone, moving boxes, and seeing a doctor. The study sample of undergraduate students is likely to have experienced each of these situations, that could facilitate benign interpretations (e.g., an undergraduate may have had experience with a fasten seat belt sound on a plane). Conversely, social situations included speaking at a wedding, meeting a friend at a bar, taking a local bus, and attending a neighbor's housewarming party. It may be that undergraduate students had less personal experience given their age, making it more challenging to endorse a benign interpretation. It may also be the case that positive mood induction has only weak effects upon ambiguous scenarios, particularly social ones, although research in this area is lacking.

Our methodology separates interpretive bias from response bias, but in contrast to hypotheses, positive mood induction was not associated with an increased positive response bias, and as such was at odds with other studies of positive affective states and response bias (Schwarz & Clore, 1988). In fact, we found that positive mood induction was associated with a weaker positive response bias than the negative mood induction. Reasons are unclear this finding are unclear. One possibility may be the response biases in the present study, both positive and

negative, were characterized by some degree of inaccuracy. Given that positive affect promotes working memory and broadened attentional capacity (e.g., Brose et al., 2014; Rowe et al., 2007), it may be that positive affective promoted a logical approach to the task, reducing the likelihood that participants endorsed extreme or inaccurate response options, and thus mitigating general response biases.

Should the effects of positive mood induction upon positive interpretive biases for non-social scenarios be replicated, they point to affective manipulations as an intervention opportunity. Specifically, brief positive affect manipulations based upon autobiographical memories could function as a novel and personalized intervention that may facilitate cognitive shifts wherein individuals are more likely to interpret ambiguous scenarios through a positive lens. In that way, promoting positive affect could function as an adjunct to typical cognitive restructuring approaches.

In contrast to hypotheses, induced negative mood did not produce more negative interpretive biases, a finding that is inconsistent with several prior studies (e.g., Halberstadt et al., 1995; Richards et al., 1993), although consistent with one other report in the literature (Bisson & Sears, 2007). Instead, the results indicated stronger response biases following the negative mood induction. The foil responses, used to indicate a response bias, had either a negative or positive valence, but were generally characterized by either an intensified interpretation of a situation (e.g., everyone in the audience bursts into applause (positive foil) vs. people in the audience laugh appreciatively (positive interpretation)) or situations in which details were incorrect (e.g., in a scenario regarding a picture: you overhear your friends making fun of your taste in furniture (negative foil) vs. you overhear some friends making critical remarks about your picture (negative)). The negative mood induction condition led to more positive and more negative

response biases, compared to the positive mood induction condition, for positive non-social and social (marginal significance) scenarios and negative social and non-social (marginal significance) scenarios. Few studies have examined the relationship between induced affective states and response biases, as most have focused on trait negative affectivity (e.g., Butler & Mathews, 1983; Salemink & van den Hout, 2010). The effects of mood induction upon response bias may be partially explained by mood-congruent intensity bias, wherein individuals perceive the intensity of emotional stimuli in accordance with their mood (e.g., individuals induced to feel sad interpret faces as being sadder vs. individuals induced to feel happy interpret faces as being happier) (Schwarz & Clore, 1988). Mood-congruent intensity bias has been attributed to use of perceived affective reactions as relevant information when making evaluative judgments. Specifically, rather than basing responses on an analysis of facts, one might take a "cognitive shortcut" and consult their emotions as a source of relevant information, especially in the case of complex tasks (Schwarz & Clore, 1988). Given the ambiguous and thus complex nature of the interpretive bias task scenarios subjects may have been prone to use their emotions as guides. This could explain why the negative induction led to more negative response biases but does not explain the higher rate of positive response biases. Future work examining positive response bias and its relation to temporary affective states is needed.

Results regarding state negative affectivity and interpretive and response bias have several implications. Given that state negative affect related to response bias rather than interpretive bias and given that response bias reflected either catastrophized or inaccurate response tendencies, it may be that using emotions as a guide induced depressogenic motivational and attentional deficits and ultimately, biased selections. While depressive mood states cannot explain endorsement of inaccurate but positive response options (i.e., positive

response bias), lower mood may have led participants to experience reduced motivation to discriminate between response options. Impaired motivational or attentional capacity in turn may ultimately account for both inaccurate (i.e., positive or negative) or extreme (i.e., negative) responses. Therefore, clinical interventions aimed at regulating negative affect such that individuals can more effectively identify and evaluate evidence for conclusions may be optimal.

This study had several strengths. First, the study demonstrated the effectiveness of a novel mood induction procedure that utilized autobiographic memory. Future work comparing this methodology for mood induction to others is essential. Second the study used a well-validated measure of interpretive bias, which allowed for the separation of interpretive bias from response bias. Third, the study sample was non-clinical and racially diverse, which may enhance generalizability of results. However, this study was not without limitations. The study sample comprised mostly undergraduate students majoring in psychology. Future work should examine these constructs in a broader sample. Additionally, the study took place entirely virtually. Therefore, participant engagement with tasks could only be approximated through data inspection. Some participant data may be less reliable than if participants has been asked to complete the study in person with an experimenter. Furthermore, the present study demonstrated small and fleeting effects of the positive induction and large effects of the negative induction. Prior studies which induced state affect neglected to report the magnitude of induction effects. Therefore, it is challenging to discern the consistency of effects of this induction with prior relevant work. Future exploration of cognitive bias related to mood inductions that yield equivalent effects across valence are warranted. Finally, the interpretive bias task used was an offline measure. Offline measures can be affected by selection bias, in that participants are tasked with rating interpretations that are provided in the task rather than responding with the

inferences that they may generate, as well as response bias, in that participants may preferentially endorse negative items, for example, or responses may be biased because of participants' past experiences (Hirsch et al., 2016).

The present study sought to examine effects of a mood induction using autobiographical positive or negative memories on interpretive bias. Results demonstrated that individuals who underwent a positive mood induction demonstrated a trend toward more positive interpretive bias to positive non-social scenarios than those in the negative mood induction condition. Individuals in the negative mood induction condition demonstrated both negative and positive response biases. Findings from the present study have implications for brief interventions which promote positive affect and in turn more adaptive appraisals of ambiguous situations, and for negative affect regulation, which may allow individuals to more effectively identify and evaluate evidence for conclusions.

Acknowledgements

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VII. Study 3: The Role of Positive Affect and Cognitive Reappraisal in Treatment Response

Abstract

Positive Affect Treatment (PAT), developed to address the need for psychotherapies which target deficits in reward processing, has been found to be a promising intervention that raises positive affect and may also outperform traditional cognitive behavioral approaches which seek to reduce negative affect only. Given the demonstrated efficacy of PAT, it is important to explore mechanisms which may explain treatment response. In addition to positive affect, cognitive reappraisal, a facet of emotion regulation, may also explain treatment response to this intervention. The present study used mixed effects models to test whether positive affect and cognitive reappraisal are associated with treatment outcomes in a positive affect treatment (PAT) compared to a negative affect treatment (NAT), and whether change in positive affect predicts change in cognitive reappraisal and vice versa. Results demonstrated that positive affect ($p <$ .001), but not cognitive reappraisal ($p > .05$), predicted symptom reduction across treatment conditions, and that symptoms reduced throughout treatment ($p < .001$). Additionally, higher average positive affect predicted higher average cognitive reappraisal ($p = .02$) and vice versa ($p = .003$), and both positive affect ($p = .02$) and cognitive reappraisal increased throughout treatment ($p < .001$). Findings suggest that both PAT and NAT promote positive affect and emotion regulation, but that only positive affect significantly predicts symptom reduction. Future work examining situational application of emotion regulation strategies may shed light on reappraisal as a potential mechanism of treatment response.

Keywords: positive affect treatment; negative affect treatment; affect; reappraisal

Study 3: Introduction

The experience of positive affect offers numerous benefits, including promoting flexible thinking, problem-solving, effective coping, well-being, and social resources (Fredrickson, 2004). Therefore, enhancing positive affect holds promise as an intervention that can markedly improve one's quality of life. However, psychotherapeutic interventions for depression and anxiety have disproportionately focused on reducing negative affect, rather than raising positive affect. Recently, Positive Affect Treatment (PAT) was developed to address the need for psychotherapies which target deficits reward processing, in turn, promoting positive affect (Craske et al., 2016). PAT is a 15-session intervention which includes psychoeducation, behavioral activation with imaginal recounting of pleasant events, cognitive exercises focused on attending to the positive, and cultivating the positive exercises including gratitude and loving-kindness. Data from a randomized controlled trial showed that compared to a cognitive behavioral therapy condition focused on reducing negative affect (i.e., Negative Affect Treatment (NAT)), PAT led to greater improvements in positive affect, as well as less negative affect, and reduced symptoms of depression, stress, anxiety, and suicidality at six-month follow-up (Craske et al., 2019; Craske et al., 2023). Therefore, PAT appears to be a promising intervention that raises positive affect, with preliminary evidence suggesting that PAT may also outperform traditional cognitive behavioral approaches which seek to reduce negative affect only.

Given the demonstrated efficacy of PAT, it is important to further explore mechanisms which may explain treatment response. Cognitive reappraisal is one factor which, in addition to positive affect, may explain treatment response in this intervention. It is also possible that change in positive affect during treatment has diffuse effects, promoting effective emotion regulation.

Therefore, understanding the extent to which change in positive affect relates to change in cognitive reappraisal and vice versa is essential.

The Present Study

The present study examined whether positive affect and cognitive reappraisal are associated with treatment outcomes in a positive affect treatment (PAT) compared to a negative affect treatment (NAT). **Aim 1**: Assess whether positive affect and cognitive reappraisal predict treatment outcomes, measured by the DASS-21 total score, and whether effects vary between PAT and NAT. *Hypothesis 1:* Higher positive affect and cognitive reappraisal scores will be associated with lower DASS-21 total scores in PAT. We expect that the same relationships may hold in NAT, albeit to a weaker extent, given that NAT does not specifically target positive affect, but has demonstrated efficacy in reducing symptoms of psychopathology. **Aim 2**: Assess whether positive affect predicts cognitive reappraisal over the course of treatment and vice versa. *Hypothesis 2*: Increases in positive affect in treatment will predict greater capacity for cognitive reappraisal and vice versa in PAT. We do not have a priori hypothesis regarding changes in positive affect and related changes in reappraisal in NAT, given that NAT focuses on reducing negative affect, rather than raising positive affect.

Method

Participants

Preliminary data was collected as part of the two-site Treatment of Affective Dimensions (TAD) study (R61MH115138-01), led by the University of California, Los Angeles, and Southern Methodist University (SMU). Study procedures were approved by Institutional Review Boards at both sites (UCLA IRB #21-001788; SMU IRB #21-131). Participants were eligible for the study if they were between 18 and 65 years old and speak English fluently, received a score

of 24 or less on the Positive and Negative Affect Schedule Positive Affect Subscale (PANAS-P; Watson et al., 1988), met a clinical cut-off for at least one of the subscales of the Depression Anxiety Stress Scales (DASS-21; Brown, 1997; depression subscale ≥ 11, anxiety subscale ≥ 6; stress subscale ≥ 10), and met a clinical cut-off (≥ 5) on any of the three subscales of the Sheehan Disability Scale (SDS: Sheehan, 1983; Leon et al., 1992), and were seeking treatment for emotional distress. Exclusion criteria included a lifetime history of bipolar disorder, psychosis, cognitive impairment, organic brain damage, or cocaine or stimulant use, as well as a substance use disorder in the last six months, serious medical conditions (e.g., uncontrolled medical illness), chronic smoking (i.e., ≥ 11 cigarettes, or nicotine equivalent, per week), pregnancy, current active suicide ideation, or refusal to be video or audio recorded.

Procedure

Participants (N = 100) are being recruited at each site through advertisements or brochures, which encourage participants to visit the study website and complete and initial prescreening online. Of note, the present study used preliminary data collected by Spring of 2023 (n = 56). Analyses in the present study will be replicated with the full sample upon completion of data collection. In prescreening, participants provided demographic and medical information and completed the DASS-21, PANAS-P (Watson et al., 1988), and SDS (Sheehan, 1983; Leon et al., 1992). Participants who met initial symptom inclusion criteria then underwent a diagnostic evaluation using the Structured Clinical Interview for DSM-5 (SCID-5; First et al., 2016). Subsequently, eligible participants were added to a waitlist for the study and assigned a therapist when there was availability. Participants did not remain on the waitlist for more than four weeks.

Treatment included 15 weekly therapy sessions that lasted 60 minutes each, except for the first session, which was 90 minutes long, and the second session, which was 75 minutes long.

Participants were randomized into either a Positive Affect Treatment (PAT; *n* = 29) or a Negative Affect Treatment (NAT; *n* = 27). PAT included: one psychoeducation session, six behavioral activation and positive event scheduling sessions, three cognitive restructuring sessions, four compassion training sessions, and one relapse prevention session. NAT included: one psychoeducation session, six exposure-based sessions, three cognitive restructuring sessions, four breathing retraining sessions, and one relapse prevention session.

Therapy sessions took place over HIPAA-secure Zoom. Therapists were senior graduate students, post-doctoral fellows, or experienced CBT therapists. All sessions were videotaped for the purpose of supervision and adherence checks, and therapists received weekly supervision from a licensed clinical psychologist. Therapy recordings were stored on a highly secure server accessible only to trained study personnel.

Measures

Inclusion Measures. As part of screening for study inclusion, participants completed several measures. They completed the PANAS-P (Watson et al., 1988). The PANAS-P is a 10-item positive affect subscale of the 20-item PANAS. Participants reported the degree to which they have experienced positive mood states (represented by adjectives such as "interested" and "determined") in the past week using a 5-point Likert scale (1 = very slightly or not at all; 3 = moderately; 5 = extremely). The PANAS has demonstrated sound psychometric properties including internal consistency and construct validity (Crawford & Henry, 2004; Watson et al., 1988). Participants also completed the DASS-21 (Brown, 1997), a 21-item scale that assessed depression, anxiety, and stress over the past week. Participants responded to a series of statements indicating to what degree the statements were true of them on a 4-point Likert scale (0 = did not apply to me at all; 3 = applied to me very much, or most of the time). The measure

yields three subscales: depression, anxiety, and stress. Seven items comprise each of the subscales. The DASS-21 has demonstrated strong psychometric properties including internal consistency, convergent and discriminant validity, and concurrent validity (Antony et al., 1998; Brown et al., 1997; Henry & Crawford, 2005; Osman et al., 2012). Finally, participants completed the Sheehan Disability Scale (SDS; Sheehan, 1983; Leon et al., 1992), a 3-item measure of global functioning across three domains: work/school, social life, and family life/home responsibilities. Participants rated the degree to which symptoms have disrupted their functioning within each domain over the past five weeks on an 11-point Likert scale (0 = not at all; 5 = moderately; 10 = extremely). The SDS has demonstrated adequate reliability and construct validity (Leon et al., 1992).

Treatment Measures. Although a variety of measures were administered throughout treatment, those pertinent to the present study are the Positive and Negative Affect Schedule-X (PANAS-X; Watson & Clark, 1994) and the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003). The PANAS-X was administered as part of a weekly battery of questionnaires, given at pre-treatment, prior to each therapy session (i.e., weekly), as well at post-treatment (i.e., week 16) and at follow up (i.e., week 20). The PANAS-X (α = .92) is a 60-item measure of positive and negative affect. Participants were presented with adjectives and asked to respond to each based upon how they have felt in the last week on a 5-point Likert scale (1 = very slightly or not at all; 5 = extremely). The PANAS-X yields a series of specific positive and negative emotion subscales (e.g., fear, hostility, joviality, serenity), although only the basic positive affect subscale (α = .96) was used in the present study. The PANAS-X has demonstrated strong convergent and discriminant validity, as well as temporal stability (Watson & Clark, 1994). The Emotion Regulation Questionnaire (α = .76) is a 10-item measure that asks participants to what

degree they engage in general tendencies toward cognitive reappraisal and expressive suppression on a 7-point Likert scale (0 = strongly disagree; 4 = neutral; 7 = strongly agree). The present study examined only the cognitive reappraisal subscale (α = .91). The ERQ was administered at lab sessions, which occurred at pre-treatment and weeks 1, 5, 10, 15, 16, and 20. The ERQ has demonstrated good internal consistency and temporal stability as well as good convergent and discriminant validity (Ioannidis & Siegling, 2015).

Outcome Measure. Participants completed the DASS-21 (Brown, 1997) as part of a weekly questionnaire battery at pre-treatment, weekly over the course of the study, and at post-treatment (i.e., week 16) and follow-up (i.e., week 20). As noted above, the measure yields three subscales indicating symptoms of depression, anxiety, and stress. The measure also yields a total scale score (α = .90), indicative of transdiagnostic symptomatology, which was be used as a primary outcome measure for treatment response in the present study.

Analyses

Analyses were conducted in Stata version 17.0 (StataCorp, 2021). Multilevel models were used to account for nesting of ratings within sessions within subjects within treatment conditions. We tested effects of positive affect and cognitive reappraisal on treatment outcomes, measured by the DASS-21 total score, in separate models (Aim 1). Specifically, random intercept mixed models were employed, to account for differences in average levels of outcomes across subjects. Models also included random coefficients for subjects across sessions, given potential person-specific changes throughout treatment, and random effects of affect or reappraisal, depending upon the model. Random slopes were removed if they did not provide superior model fit. Models were estimated with an unstructured covariance structure, wherein all variances and covariances can be distinct. In cases where this structure led to misfit due to

estimating correlations between intercepts and slopes, the independent covariance structure was used instead, which allows for distinct variances of random effects but assumes covariances to be zero. Across all models, an interaction between a predictor of interest and condition was estimated. In the event that the interaction term was non-significant, the interaction term was removed from the model. Fixed effects in the first model included (1) an interaction between positive affect, centered within person to represent within-person change, and treatment condition, (2) average positive affect, and (3) the effect of time (Model 1). Fixed effects of the second model included (1) an interaction between cognitive reappraisal, centered within person to represent within-person change, and treatment condition, (2) average cognitive reappraisal, and (3) time (Model 2). Subsequently, a model tested whether increases in positive affect predicted increases in cognitive reappraisal. Fixed effects included (1) an interaction between person centered positive affect and treatment condition, (2) average positive affect, (3) time, and (4) DASS-21 total scores (Model 3). A final model tested whether increases in reappraisal predicted increases in positive affect. Fixed effects of the included (1) an interaction between person centered cognitive reappraisal and treatment condition, (2) average cognitive reappraisal, (3) time, and (4) DASS-21 total scores (Model 4).

Results

Sample Demographics

The sample comprised adults between ages 18 and 65 (M_{age} = 32.68; SD = 12.61). The sample included a majority of White participants (50.9%; 21.8% Asian; 14.5% “Other” Racial Identification; 7.2% Multiracial; 5.5% Black). 23.6% of the sample self-identified as Hispanic. The sample was majority female assigned at birth (72.7%; 23.7% male) and the entire sample was cisgender. A majority of the sample self-identified as heterosexual (61.8%), although the

sample also included participants who identified as bisexual (14.5%), homosexual, gay, or lesbian (7.3%), questioning or unsure (5.5%), queer (3.6%), asexual (1.8%), or identity not listed or prefer not to disclose (5.4%). The sample was highly educated; many participants had received a 4-year college degree (40.0%) or had completed post-graduate work (16.4%). A large percentage of the sample was currently attending college or had completed some college or a 2-year degree (30.9%), although others completed a high school degree or GED (12.7%).

Positive Affect and Treatment Response

Results of a likelihood ratio test demonstrated that inclusion of random slopes for positive affect and time provided superior model fit ($\chi^2(5) = 46.08$; $p < .001$). Thus, random slopes were retained. Results demonstrated a non-significant interaction effect between condition and positive affect ($\beta = -.001$, $SE = .01$, $p = .86$). Thus, a main effects model was estimated. A main effect of person centered positive affect was observed, such that increases in positive affect were associated with decreases in total symptoms, over and above effects of condition, average positive affect, and time ($\beta = -.41$, $SE = .09$, $p < .001$) A main effect of time was also observed, suggesting that symptoms decreased over the course of treatment ($\beta = -40$, $SE = .07$, $p < .001$), controlling for the aforementioned variables. There were non-significant effects of condition ($p = .52$) and average positive affect ($p = .31$). See Table 7 for model results.

Table 7.

Regression Coefficients for Positive Affect Predicting DASS-Total Symptoms.

Predictor	Coefficient	*SE*	*p*-value	95% CI
Person-Centered PA	-.41	.09	<.001	[-.58, -.23]
Mean PA	.15	.15	.31	[-.14, .45]
Condition	-1.10	1.72	.52	[-4.46, 2.27]

Time	-.38	.07	<.001	[-.53, -.27]

Note. *Abbreviations*: SE = Standard Error. CI = Confidence Interval. PA = Positive Affect.

Cognitive Reappraisal and Treatment Response

Inclusion of a random slopes for session and reappraisal did not provide superior model fit ($\chi^2(2) = 3.20$; $p = .20$). Thus, random slopes for session and reappraisal were removed from the model. Results of the model demonstrated a non-significant interaction between condition and cognitive reappraisal ($\beta = .32$, $SE = .24$, $p = .18$). Therefore, a main effects model was estimated. Treatment conditions did not differentially predict symptoms ($p = .32$), controlling for within person effects of cognitive reappraisal, average effects of cognitive reappraisal, and time. Additionally, neither increases in cognitive reappraisal ($p = .64$) nor higher average cognitive reappraisal ($p = .35$) significantly predicted reductions in symptoms, controlling for covariates. As expected, given the prior model, a significant main effect of time was observed, with symptoms decreasing over time, controlling for effects of reappraisal and condition ($\beta = -.55$, $SE = .10$, $p < .001$). See Table 8 for full model results.

Table 8.

Regression Coefficients for Cognitive Reappraisal Predicting DASS-Total Symptoms.

Predictor	Coefficient	*SE*	*p*-value	95% CI
Person-Centered CR	-.06	.14	.64	[-.33, .20]
Mean CR	-.14	.15	.35	[-.43, .15]
Condition	-1.95	1.95	.32	[-5.81, 1.91]
Time	-.55	.10	<.001	[-.75, -.34]

Note. *Abbreviations*: SE = Standard Error. CI = Confidence Interval. CR = Cognitive Reappraisal.

Positive Affect and Cognitive Reappraisal

A likelihood ratio test demonstrated that inclusion of random slopes did not provide superior model fit ($\chi^2(2) = 4.40$; $p = .11$), and therefore random slopes for session and positive affect were removed from the model. Additionally, the interaction between condition and positive affect was non-significant ($\beta = -.20$, $SE = .18$, $p = .26$), so a main effects model was specified instead. Increases in positive affect did not significantly predict reappraisal over and above average effects of positive affect, and effects of symptoms, condition, and time ($p = .24$). However, higher average positive affect was associated with higher average cognitive reappraisal scores, accounting for other fixed effects ($\beta = .38$, $SE = .16$, $p = .02$). There was a non-significant effect of treatment condition ($p = .78$) and symptoms, accounting for other fixed effects ($p = .50$). However, a significant effect of time was observed, suggesting that cognitive reappraisal increased throughout treatment, accounting for other fixed effects ($\beta = .35$, $SE = .07$, $p < .001$). See Table 9 for full model results.

Table 9.

Regression Coefficients for Positive Affect Predicting Cognitive Reappraisal.

Predictor	Coefficient	*SE*	*p*-value	95% CI
Person-Centered PA	.12	.10	.24	[-.08, .31]
Mean PA	.38	.16	.02	[.06, .69]
Condition	.40	1.77	.82	[-3.06, 3.87]
Time	.35	.07	<.001	[.20, .49]
DASS Total	-.04	.06	.50	[-.16, .08]

Note. *Abbreviations*: SE = Standard Error. CI = Confidence Interval. PA = Positive Affect. DASS = Depression, Anxiety, Stress Total Symptoms.

Cognitive Reappraisal and Positive Affect

Inclusion of random slopes for reappraisal and session did not improve model fit ($\chi^2(5) = 7.01$; $p = .22$); these random slopes were removed from the model. The interaction between condition and cognitive reappraisal was non-significant ($\beta = -.09$, $SE = .16$, $p = .58$). Therefore, a main effects model was estimated. Increases in cognitive reappraisal did not significantly predict positive affect over and above average effects of reappraisal, and effects of symptoms, condition, and sessions ($p = .41$). However, higher average cognitive reappraisal predicted higher average positive affect scores, accounting for other fixed effects ($\beta = .38$, $SE = .13$, $p = .003$). The effect of condition was non-significant, accounting for effects of covariates ($p = .65$). A significant effect of symptoms was observed, over and above other fixed effects ($\beta = -.12$, $SE = .06$, $p = .04$). Finally, an effect of time was observed, such that positive affect increased throughout treatment, accounting for other fixed effects ($\beta = .18$, $SE = .08$, $p = .02$). See Table 10 for model results.

Table 10.

Regression Coefficients for Cognitive Reappraisal Predicting Positive Affect.

Predictor	Coefficient	*SE*	*p*-value	95% CI
Person-Centered CR	.07	.09	.41	[-.10, .25]
Mean CR	.37	.13	.003	[.12, .61]
Condition	-.76	1.68	.65	[-4.06, 2.53]
Time	.18	.08	.02	[.03, .33]
DASS Total	-.12	.06	.04	[-.23, -.01]

Note. *Abbreviations*: SE = Standard Error. CI = Confidence Interval. CR = Cognitive Reappraisal. DASS = Depression, Anxiety, Stress Total Symptoms.

Discussion

The present study assessed whether positive affect and cognitive reappraisal predicted treatment outcomes in Positive Affect Treatment and Negative Affect Treatment. Additionally, this study examined whether change in positive affect predicted change in cognitive reappraisal and vice versa in Positive and Negative Affect Treatment. Results demonstrated that symptoms of depression, anxiety, and stress decreased throughout treatment, and that increases in positive affect predicted decreases in symptoms, although symptom change and effects of positive affect were not specific to conditions. Increases in cognitive reappraisal did not predict symptom outcomes. Nor did increases in positive affect predict increases in cognitive reappraisal, although higher average levels of positive affect predicted higher average levels of reappraisal, and cognitive reappraisal increased throughout treatment. Again, effects were not condition specific. Finally, increases in reappraisal did not predict positive affect, although higher average reappraisal predicted higher average levels of positive affect, and positive affect increased throughout treatment, with each effect non-specific to condition.

The finding that increases in positive affect predicted decreases in transdiagnostic symptoms of depression, anxiety, and stress was somewhat consistent with our hypothesis. We expected increases in positive affect to predict reductions in symptoms in Positive Affect Treatment, given past work that has found Positive Affect Treatment to more robustly increase positive affect and decrease symptoms compared to Negative Affect Treatment (Craske et al., 2019). We also expected that positive affect may predict symptom reduction in Negative Affect Treatment, albeit to a lesser extent because Negative Affect Treatment does not overtly target reward anticipation, motivation, attainment, or learning (processes that relate to positive emotions). Increases in positive affect predicting symptom reduction is consistent with a broader

literature on positive affect states. For example, positive affective states have been found to predict upward spirals, wherein positive emotions promote broadened attention and cognition, which facilitate coping with adversity and in turn, future experiences of positive emotion (Fredrickson & Joiner, 2002). Additionally, positive affect has been associated with lower levels of depressive symptoms (Headey et al., 1993; Lindahl & Archer, 2013). Prospective studies have also found that positive affect buffers against negative affect in predicting depressive symptoms (Riskind et al., 2013). Therefore, the finding that positive affect predicts symptom reduction is aligned with prior evidence for the beneficial effects of positive affect. However, we found that the effect of positive affect on symptoms was not specific to Positive Affect Treatment as opposed to Negative Affect Treatment. Several possible explanations for this finding exist. First, prior work examining positive affect and symptoms in Positive Affect Treatment assessed each as outcomes within conditions or assessed moderating roles of pre-treatment symptom severity on affect outcomes (Craske et al., 2019). This study was the first to examine whether positive affect during treatment predicted symptom outcomes, and the degree to which this relationship might differ between conditions. Given that both Positive and Negative Affect Treatment promote positive affect and symptom reduction, it may be that differences between conditions are too weak to detect. Second, and relatedly, it is likely that the present study was underpowered to detect condition effects. Seminal work on multilevel modeling has suggested that 30 is the smallest acceptable sample size for level 3 groups (Kreft & de Leeuw, 1998). Each condition in this preliminary analysis had fewer than 30 subjects. Replication of findings in a larger sample is essential. Finally, it is possible that the behavioral module of Negative Affect Treatment had unanticipated direct effects on positive affect. For example, exposures for people with depressed mood in Negative Affect Treatment may have functioned similarly to behavioral activation to

some extent (e.g., targeting a fear of failure or loss of control through engagement with tasks), which may have increased positive affect as much or more than it decreased negative affect. Future examination of exposure content and affective change may shed light on this possibility. Despite the lack of condition specific effects, results reinforce the notion that treatments which promote positive affect hold promise as an intervention for transdiagnostic symptoms for depression and anxiety.

The finding that cognitive reappraisal did not predict symptom reduction was inconsistent with our hypothesis and was unexpected given the broader literature on cognitive reappraisal and psychopathology. For example, prior work has found that cognitive reappraisal is associated with lower depressive and stress-related symptoms as well as lower negative affect (Garnefski & Kraaij, 2006; Moore et al., 2008). Additionally, more frequent use of cognitive reappraisal has been linked with reduced likelihood of depressive diagnoses (Kudinova et al., 2018). Furthermore, the use of reappraisal strategies buffers against effects of stress on depressive symptoms (Shapero et al., 2018; Troy et al., 2010). From a treatment perspective, several studies have demonstrated that interventions aimed at facilitating cognitive reappraisal predict improvements in depressive and anxiety symptoms (e.g., Morris et al., 2015; O'Toole et al., 2019; Rodriguez et al., 2020). It may be that the present study was underpowered to detect effects of reappraisal on symptom outcomes. Cognitive reappraisal was assessed at only five study timepoints, as opposed to positive affect, which was assessed weekly. Additionally, the reappraisal measure was added to the study through an amendment. A delay in processing the amendment contributed to the measure being added to study after data collection had begun, such that at present, only 21 participants have cognitive reappraisal data at follow-up, compared to 44 participants with data at baseline. Beyond a lack of power to detect effects, it may also be

that cognitive reappraisal cannot directly account for symptom change in Positive Affect Treatment and Negative Affect Treatment. Each treatment has a brief (i.e., 3 session) cognitive module. Although both Positive and Negative Affect Treatment tap into aspects of cognitive reappraisal in their respective cognitive modules, neither instructs reappraisal as overtly as the reappraisal-focused interventions mentioned above, which may mean that increases in appraisal are more modest and less likely to directly affect symptoms. Instead, increases or decreases in reappraisal may be more closely associated with affective states, which subsequently predict symptom change in the present study sample.

Effects of positive affect on reappraisal and reappraisal on affect were somewhat consistent with hypotheses. We expected that increases in positive affect would predict increases in cognitive reappraisal and vice versa. We did not find evidence for effects of within-person increases in positive affect on cognitive reappraisal or vice versa. However, we did find that higher average positive affect predicted higher average cognitive reappraisal and vice versa. We also found that both positive affect and cognitive reappraisal increased significantly throughout treatment. Neither effects of affect and reappraisal on one other or increases in affect and reappraisal were condition specific. This was at odds with prior results (e.g., Craske et al., 2019; Craske et al., 2023), which found that Positive Affect Treatment led to greater increases in positive affect than Negative Affect Treatment. Again, small sample size may have precluded the ability to detect significant moderating effects of condition. Additionally, methodological differences between studies may have contributed to disparate findings. For example, Craske et al. (2019) included a dichotomous pre-treatment severity predictor in the model to account for differences which may be attributable to some participants having clinically significant symptomatology prior to treatment. Although our models accounted for pre-treatment symptoms,

specifically assessing the moderating role of pre-treatment severity may alter results.[3] Overall, these findings suggest, as expected, that both Positive and Negative Affect Treatment promote increases positive affect. Results also add to the literature in demonstrating that both conditions predict increases in reappraisal, suggesting that these treatments facilitate the use of adaptive emotion regulation strategies. Given that both Positive and Negative Affect Treatment target biased cognitive processes (e.g., attribution bias in Positive Affect Treatment, catastrophizing in Negative Affect Treatment), it is possible that each treatment promotes flexible thinking, a process tied to both positive affect and reappraisal (Fredrickson, 2004; Garland et al., 2009). However, a lack of significant effects for within person changes in positive affect on reappraisal and vice versa were surprising. It is possible that results are attributable to measurement of cognitive reappraisal in the study. The ERQ measures general tendencies towards selecting an emotion regulation strategy (i.e., reappraisal vs. expressive suppression), and therefore, has generally been considered a measure of trait cognitive reappraisal (Riepenhausen et al., 2022; Silvers & Moreira, 2019). Although the ERQ has been found to be sensitive to change in reappraisal (e.g., Garland et al., 2009), it may be that measures which assess situational reappraisal, or the frequency of spontaneously employed reappraisal in daily life (Riepenhausen et al., 2022) would be more sensitive to within person changes in reappraisal throughout treatment. Such measures might also be more likely to capture the degree to which increases in use of reappraisal strategies promotes changes in affective states and vice versa. Future work examining situational reappraisal, either through ecological momentary assessment or tasks that

[3] To confirm that differences in results were not attributable to Craske et al. (2019, 2023)'s decision to log transform time, we conducted exploratory models with such a transformation in the present study dataset, which did not change results of the present study.

assess success with instructed reappraisal (Riepenhausen et al., 2022), may more effectively capture change in employment and success with reappraisal in daily life.

This study had several strengths. First, the study employed a randomized controlled trial design. Second, this study was the first to examine changes in effective emotion regulation in Positive and Negative Affect Treatment. Finally, the study included a fairly demographically diverse sample. However, this study was not without limitations. The study was limited by reliance on self-report measures, which limit objective assessment of affect and symptomatology. Additionally, lack of comparison to a control condition limited the ability to determine treatment effects compared to an untreated sample. Recruitment from urban populations likely limited generalizability. Lastly, small sample sizes limited both generalizability and power to detect significant effects.

The present study examined effects of positive affect and cognitive reappraisal on symptom outcomes, as well as the effect of positive affect on reappraisal and vice versa in Positive Affect Treatment compared to Negative Affect Treatment. Results demonstrated that positive affect, but not cognitive reappraisal, predicted symptom reduction across conditions. Higher levels of average positive affect predicted higher average reappraisal and higher levels of average reappraisal predicted higher average positive affect. Findings suggest that both Positive and Negative Affect Treatment promote increases in positive affect and reappraisal, and that positive affect predicts treatment response across conditions. Future work examining shifts in situational emotion regulation capabilities may shed light on mechanisms of treatment response in Positive Affect Treatment and Negative Affect Treatment.

VIII. Summary and Implications

An extensive body of work has examined the impact of significant life events upon mental health, although studies have disproportionately focused on deleterious mental health outcomes resulting from stressful or negative events. Appreciating that there may be positive contextual features of even significant or stressful events, more recent work has explored the role of positive aspects of life events and has found that positive features of significant life events protect against psychopathology. To date, mechanisms by which positive aspects of events confer their beneficial effects have not been comprehensively explored. The current studies examined affective states and cognitive reappraisal, an emotion regulation strategy, as possible explanatory factors in the relationship between positive aspects of life events and psychopathology outcomes.

Study 1 tested longitudinal relationships between positive and negative aspects of life events, affective states, cognitive reappraisal, and transdiagnostic symptoms, and found that positivity of interpersonal, but not non-interpersonal events promoted positive affect, and offered preliminary support for positive affect as a mediator of the relationship between positivity of events and General Distress. Results also demonstrated that General Distress predicted a stress generation pathway, wherein higher levels of General Distress predicted increased negative affect and lower cognitive reappraisal, as well as higher levels of negativity of interpersonal and non-interpersonal events. Study 2 assessed whether experimental manipulation of affective states alters cognitive appraisals, represented by interpretive bias. Results demonstrated that a positive mood induction produced more positive interpretive bias to non-social situations than a negative induction condition, whereas a negative induction condition demonstrated greater negative response bias for social scenarios and higher positive response bias for non-social scenarios.

Contrary to expectation, positive mood did not promote more positive social interpretive bias or positive response bias, and negative mood did not predict negative interpretive biases. Study 3 explored the role of positive affect and cognitive reappraisal as predictors of treatment response within a novel treatment aimed at promoting positive affect, compared to a treatment targeting reductions in negative affect. Findings demonstrated that positive affect predicted symptom reduction across treatment conditions. Additionally, higher average positive affect predicted higher average cognitive reappraisal and vice versa. Contrary to expectation, cognitive reappraisal did not predict symptom reduction and non-significant differences between conditions were observed across all models.

Findings from the current studies have several clinical implications. Study 1 highlights the importance of understanding context surrounding life events, and the potential clinical utility of attending to positive aspects of life events in order to promote positive affect and subsequent reductions in psychopathology. This approach is consistent with theoretical models and empirical work which link broadened attentional capacity to positive mood states (Rowe et al., 2007). Indirect evidence from the mindfulness literature suggests that mindfulness, a type of attentional awareness, promotes emotion regulation and positive mood states (e.g., Garland et al., 2015; Lazarus & Folkman, 1984) by disrupting automatic conditioned reactions and providing an opportunity for perspective taking and cognitive set shifting (Garland et al., 2015). In turn, practicing mindfulness may provide individuals with cognitive capacity to notice pleasant aspects of significant or even stressful events. Furthermore, mindful attention to positive life experiences may promote reward sensitivity through a broadening of the diversity of pleasant sensations and feelings derived from events (Bryant et al., 2011). Results of Study 1 also suggest that positively reappraising negative or stressful events may disrupt a stress generation pathway.

Repeated, successful engagement with positive reappraisal may provide a framework by which individuals can reframe unpleasant events as meaningful (Garland et al., 2015). This framework may then be applied to future stressors, reducing their negative impact. Positive reappraisal may also disrupt stress generation given that the technique has been found to reduce symptoms of psychopathology (Helgeson et al., 2006). Finding positive meaning in adversity, a form of positive reappraisal, has also been associated with a tendency to attend to positive information (Chan et al., 2011), which may function as a form of positive emotion regulation (Wadlinger & Isaacowitz, 2011). Thus, the same reappraisal processes that downregulate negative emotion may ultimately function to increase positive emotion as well.

Study 2 suggests that inducing positive affective states may promote more positive appraisals of ambiguous situations. This work has implications for treatment sequencing. For example, many treatments begin with interventions that challenge cognitive distortions. Although this practice is beneficial, it may also be that foregrounding interventions aimed at increasing positive affect (e.g., Craske et al., 2019; 2023), rather than targeting maladaptive cognitions in the earliest phases of treatment, may ultimately facilitate later efforts towards altering automatic appraisals. Finally, results from Study 3 support a growing literature that suggests that positive affect is associated with cognitive reappraisal (Brockman et al., 2017; Andreotti et al., 2013). Seminal work on cognitive reappraisal has suggested that positive affect results from reappraisal, given that reappraisal was originally conceptualized as an antecedent-focused emotion regulation strategy (Gross & John, 2003). While findings from our study support that effect, we add to the literature by demonstrating that positive affect also predicts higher average reappraisal throughout treatment. As with Study 2, this suggests that affect modulation may ultimately promote success with cognitive techniques in therapy.

The present studies had several strengths. Study 1 afforded a longitudinal examination of contextual features associated with life events, symptom outcomes, and possible mechanisms of protection via affect and emotion regulation. The study also used an objective measure of life events, reducing the likelihood that symptomatology impacted reporting of the effects of life events. Study 2 demonstrated the effectiveness of a novel mood induction procedure that utilized autobiographical memory, although future work comparing this methodology for mood induction to others is essential. Study 2 also used a well-validated measure of interpretive bias, which allowed for the separation of interpretive bias from response bias. Study 3 employed a randomized controlled trial design and was the first to examine changes in emotion regulation in Positive and Negative Affect Treatment. Together, these studies provide longitudinal, experimental, and interventional support for beneficial effects of positive affect as it relates to life events and to appraisal and symptom outcomes.

However, several limitations exist which may explain unexpected or null results. First, Study 1 was likely underpowered to detect significant effects given the number of parameters retained in models. Future work should replicate results in a larger sample. Relatedly, due to attempts to limit the number of parameters in each model, we did not assess buffering effects across positivity and negativity of life events. Exploring longitudinal moderating effects of positivity of events is an important future direction. Studies 1 and 2 relied on young adult samples from rigorous undergraduate institutions. In the case of Study 1, the sample was also comprised of individuals from higher socioeconomic status backgrounds. Regarding Study 1, it may be that this demographic group experienced fewer significant life events given benefits conferred by privileged backgrounds and due to younger age, ultimately reducing the breadth of positive or negative outcomes resulting from contextual features of life events. Across both

studies, a narrow demographic group limits generalizability to the broader population, and especially to lower income, less educated, and older demographic groups. Studies 1 and 3 each relied on a measure of tendencies toward cognitive reappraisal, likely capturing some proportion of both trait and state engagement with cognitive reappraisal. A measure of spontaneous reappraisal may more directly relate both to emotional responses to life events and to symptom change during treatment. Study 2 relied on a measure of interpretive bias as a proxy for appraisals. Assessing real-time engagement and effectiveness in reappraisal of self-relevant situations after a mood induction may more readily capture the impact of affect-induced change on appraisal. More broadly, two studies focused on one aspect of emotion regulation, cognitive reappraisal, as it relates to life events, affective states, or symptomatology. Other models of emotion regulation suggest that a broader repertoire of emotion regulation techniques may be relevant (e.g., awareness, acceptance, and understanding of emotions; Gratz & Roemer, 2004). Particularly as it relates to significant life events, principles of acceptance as a regulatory strategy may be important to explore. Furthermore, Study 1 and 2 focused on state affect, while Study 3 captured mood through past week ratings. Future work should examine the role of mood, which may be a more stable indicator of affect. Finally, Study 3 used a subsample from an ongoing treatment study. Reassessing findings upon completion of the overall randomized controlled trial may increase power to detect condition differences and effects of reappraisal on symptom outcomes.

The current studies examined affective states and emotion regulation as possible mechanisms of protection against psychopathology originating from positive aspects of life events. Findings highlight a need for future work examining longitudinal moderating effects of positivity of events upon negativity of events in predicting affective, emotion regulation, and

symptom outcomes, studies that examine spontaneous appraisals, rather than trait measures, and a broader array of emotion regulation techniques, and work conducted in demographically diverse samples. The current studies highlight the promise of interventions which upregulate positive emotional states, as they may facilitate emotion regulation and reduce risk for or severity of psychopathology.

IX. Appendices

Measures

Acceptance and Action Questionnaire-II (AAQ-II)

Below you will find a list of statements. Please rate how true each statement is for you by using the scale below to fill in your choice.

1	2	3	4	5	6	7
never true	**very seldom true**	**seldom true**	**sometimes true**	**frequently true**	**almost always true**	**always true**

1. My painful experiences and memories make it difficult for me to live a life that I would value.

2. I'm afraid of my feelings.

3. I worry about not being able to control my worries and feelings.

4. My painful memories prevent me from having a fulfilling life.

5. Emotions cause problems in my life.

6. It seems like most people are handling their lives better than I am.

7. Worries get in the way of my success.

Depression Anxiety Stress Scale (DASS)-21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement.

The rating scale is as follows:

0 Did not apply to me at all
1 Applied to me to some degree, or some of the time
2 Applied to me to a considerable degree or a good part of time
3 Applied to me very much or most of the time

1 (s) I found it hard to wind down	0 1 2 3
2 (a) I was aware of dryness of my mouth	0 1 2 3
3 (d) I couldn't seem to experience any positive feeling at all	0 1 2 3
4 (a) I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	0 1 2 3
5 (d) I found it difficult to work up the initiative to do things	0 1 2 3
6 (s) I tended to over-react to situations	0 1 2 3
7 (a) I experienced trembling (e.g. in the hands)	0 1 2 3
8 (s) I felt that I was using a lot of nervous energy	0 1 2 3
9 (a) I was worried about situations in which I might panic and make a fool of myself	0 1 2 3
10 (d) I felt that I had nothing to look forward to	0 1 2 3
11 (s) I found myself getting agitated	0 1 2 3
12 (s) I found it difficult to relax	0 1 2 3
13 (d) I felt down-hearted and blue	0 1 2 3
14 (s) I was intolerant of anything that kept me from getting on with what I was doing	0 1 2 3
15 (a) I felt I was close to panic	0 1 2 3
16 (d) I was unable to become enthusiastic about anything	0 1 2 3
17 (d) I felt I wasn't worth much as a person	0 1 2 3
18 (s) I felt that I was rather touchy	0 1 2 3
19 (a) I was aware of the action of my heart in the absence of physical exertion (e.g. sense of heart rate increase, heart missing a beat)	0 1 2 3
20 (a) I felt scared without any good reason	0 1 2 3
21 (d) I felt that life was meaningless	0 1 2 3

Emotion Regulation Questionnaire

We would like to ask you some questions about your emotional life, in particular, how you control (that is, regulate and manage) your emotions. The questions below involve two distinct aspects of your emotional life. One is your emotional experience, or what you feel like inside. The other is your emotional expression, or how you show your emotions in the way you talk, gesture, or behave. Although some of the following questions may seem similar to one another, they differ in important ways. For each item, please answer using the following scale:

1	2	3	4	5	6	7
strongly disagree			**neutral**			**strongly agree**

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

Scoring:
Items 1, 3, 5, 7, 8, 10 make up the Cognitive Reappraisal facet.
Items 2, 4, 6, 9 make up the Expressive Suppression facet.
Scoring is kept continuous.
Each facet's scoring is kept separate.

Generalized Anxiety Disorder-7

Over the last two weeks, how often have you been bothered by the following problems?

	Not at all	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it is hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid, as if something awful might happen	0	1	2	3

Positive and Negative Affect Schedule (I-PANAS-SF-10)

Indicate the extent you have felt this way over the past week.	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Active	1	2	3	4	5
2. Afraid	1	2	3	4	5
3. Inspired	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Alert	1	2	3	4	5
6. Ashamed	1	2	3	4	5
7. Determined	1	2	3	4	5
8. Nervous	1	2	3	4	5
9. Attentive	1	2	3	4	5
10. Hostile	1	2	3	4	5

Positive and Negative Affect Schedules (PANAS)

Indicate the extent you have felt this way over the past week.	Very slightly or not at all	A little	Moderately	Quite a bit	Extremely
1. Interested	1	2	3	4	5
2. Distressed	1	2	3	4	5
3. Excited	1	2	3	4	5
4. Upset	1	2	3	4	5
5. Strong	1	2	3	4	5
6. Guilty	1	2	3	4	5
7. Scared	1	2	3	4	5
8. Hostile	1	2	3	4	5
9. Enthusiastic	1	2	3	4	5
10. Proud	1	2	3	4	5
11. Irritable	1	2	3	4	5
12. Alert	1	2	3	4	5
13. Ashamed	1	2	3	4	5
14. Inspired	1	2	3	4	5
15. Nervous	1	2	3	4	5
16. Determined	1	2	3	4	5
17. Attentive	1	2	3	4	5
18. Jittery	1	2	3	4	5
19. Active	1	2	3	4	5
20. Afraid	1	2	3	4	5

PANAS-X

This scale consists of a number of words and phrases that describe different feelings and emotions. Read each item and then mark the appropriate answer in the space next to that word. Indicate to what extent you feel this way right now. Use the following scale to record your answers:

1. _____ cheerful
2. _____ disgusted
3. _____ attentive
4. _____ bashful
5. _____ sluggish
6. _____ daring
7. _____ surprised
8. _____ strong
9. _____ scornful
10. _____ relaxed
11. _____ irritable
12. _____ delighted
13. _____ inspired
14. _____ fearless
15. _____ disgusted with self
16. _____ sad
17. _____ calm
18. _____ afraid
19. _____ tired
20. _____ amazed
21. _____ shaky
22. _____ happy
23. _____ timid
24. _____ alone
25. _____ alert
26. _____ upset
27. _____ angry
28. _____ bold
29. _____ blue
30. _____ shy
31. _____ active
32. _____ guilty
33. _____ joyful
34. _____ nervous
35. _____ lonely
36. _____ sleepy
37. _____ excited
38. _____ hostile
39. _____ proud

40. _____ jittery
41. _____ lively
42. _____ ashamed
43. _____ at ease
44. _____ scared
45. _____ drowsy
46. _____ angry at self
47. _____ enthusiastic
48. _____ downhearted
49. _____ sheepish
50. _____ distressed
51. _____ blameworthy
52. _____ determined
53. _____ frightened
54. _____ astonished
55. _____ interested
56. _____ loathing
57. _____ confident
58. _____ energetic
59. _____ concentrating
60. _____ dissatisfied with self

Scales General Positive Emotion:= (p31 + p25 + p3 + p52 + p47 + p37 + p13 + p55 + p39 + p8)
General Negative Emotion:= (p18 + p44 + p34 + p40 + p11 + p38 + p32 + p42 + p26 + p50)
Fear:= (p18 + p44 + p53 + p34 + p40 + p21)
Hostility:= (p37 + p38 + p11 + p9 + p2 + p56)
Guilt:= (p32 + p42 + p51 + p46 + p15 + p60)
Sadness:= (p16 + p29 + p48 + p24 + p35)
Joviality:= (p22 + p33 + p12 + p1 + p37 + p47 + p41 + p58)
Self-Assurance:= (p39 + p3 + p57 + p28 + p6 + p14)
Attentiveness:= (p25 + p3 + p59 + p52)
Shyness:= (p30 + p4 + p49 + p23)
Fatigue:= (p36 + p19 + p5 + p45)
Serenity:= (p17 + p10 + p43)
Surprise:= (p20 + p7 + p54)
Basic Positive Affect:= (joviality+self_assurance+attentiveness)/3
Basic Negative Affect:= (sadness+guilt+hostility+fear)/4

Patient Health Questionnaire-9

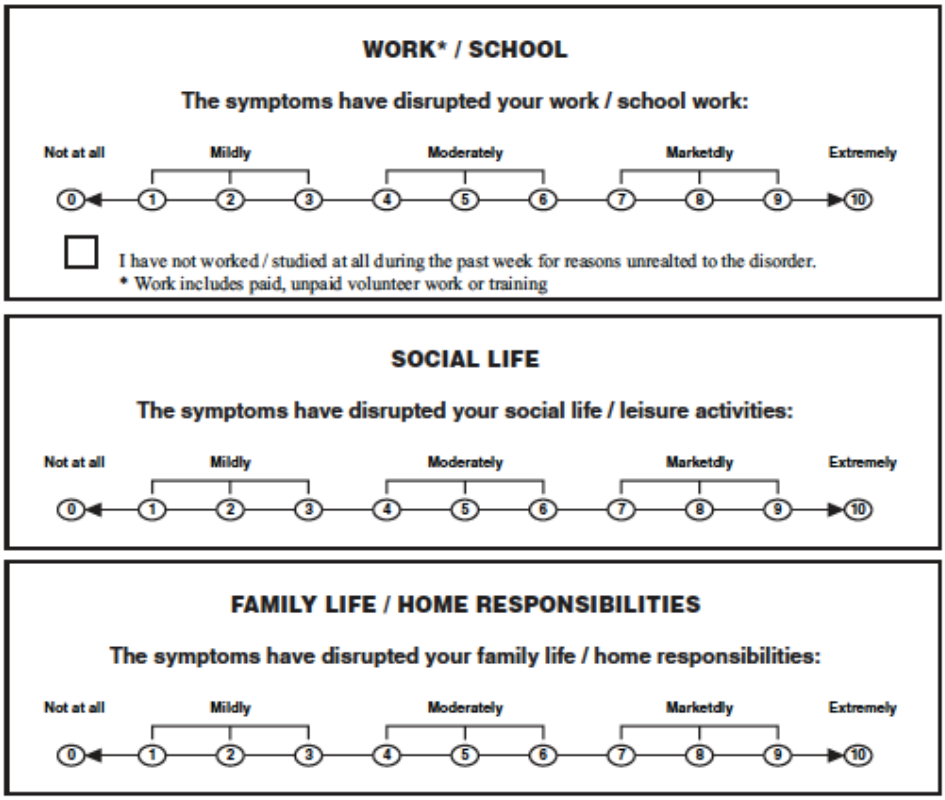
Over the last 2 weeks, how often have you been bothered by any of the following problems?

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

Sheehan Disability Scale (SDS)

A brief, patient rated, measure of disability and impairment.

Please mark ONE circle for each scale.



Days Lost

On how many days in the last week did your symptoms cause you to miss school or work or leave you unable to carry out your normal daily responsibilities? _____

Days Unproductive

On how many days in the last week did you feel so impaired by your symptoms, that even though you went to school or work, your productivity was reduced? _____

Interpretive Bias Task Scenarios

The Wedding
Your friend asks you to give a speech at her wedding reception. You prepare some remarks and when the time comes, get to your feet. As you speak, you notice some people in the audience start to
L _ _ G H
LAUGH
Did you stand up to speak? Enter Y or N.

The Local Group
You are invited to a party hosted by a local group, although you don't know any of the group members very well. As you approach the door you can hear conversation and loud music, but as you enter the room it stops for a
M O _ _ _ T
MOMENT
Do you know most of the group members? Enter Y or N.

The Bus Ride
You get on a bus and find an empty seat, next to one that has a small rip in it. At the next stop several people get on who know you, but all of them go and sit somewhere else, so the seat next to you remains
V A _ _ _ T
VACANT
Were the people who got on strangers to you? Enter Y or N.

The Job Interview
You see a job advertised that you would really like. You apply and are invited to an interview, where you answer the questions as well as you can. Reflecting later, you think that the quality of your answers decided the
O U _ _ O M _
OUTCOME
Did you think about your answers later? Enter Y or N.

Meeting a Friend
In the street you bump into an old friend you haven't seen for a long time. She is too busy to stop, so you arrange to meet later in a bar. You arrive a little late but the bar is empty, and a few minutes later she is still not
T H _ _ E
THERE
Was anyone else in the bar? Enter Y or N.

Your Birthday
It is your birthday and you wake up looking forward to your day. You wonder how many friends will send you a birthday card. However, you have an appointment in the afternoon, and by the time you leave, no cards have

A R R _ _ _ D
ARRIVED
Do you receive any cards before you leave? Enter Y or N.

Your First Painting
You have taken up painting as a hobby, and have just finished your first picture. You hang it up on the wall for your friends to see. Later you overhear your friends making remarks that make clear their opinion of your
P I _ T _ R _
PICTURE
Did you leave your painting on an easel? Enter Y or N.

The House-Warming Party
Your neighbor has a house warming party and you are invited. You arrive to find many other guests whom you do not know. You try talking to some of them, and get an impression of how much they are interested in your
C _ _ V E R _ _ T I _ N
CONVERSATION
Was the party thrown by a relative of yours? Enter Y or N.

The Evening Class
You have just started going to an evening class. The instructor asks a question and no one in the group volunteers an answer, so he looks directly at you. You answer the question, aware of how your voice must sound to the
O T H _ _ S
OTHERS
Have you been going to the class a long time? Enter Y or N.

The Local Bar
You are with a group of new friends at a local bar. You decide to tell a joke you heard recently. Everyone looks at you as you start telling the joke, and you see their expressions change when you get to the punch
L _ _ E
LINE
Did you recently hear the joke you told? Enter Y or N.

Visiting the Doctor
You have been feeling dizzy occasionally and decide to get a checkup. You make an appointment right away. Your doctor takes your blood pressure and listens to your chest, and then tells you to relax while giving you his
O P _ N _ O N
OPINION
Did you delay going to the doctor? Enter Y or N.

At Home One Night

You are at home alone late one night. You have just finished reading and turn out the light to go to sleep. While lying in the dark you hear a soft rustling sound coming from just outside your
W _ _ D _ W
WINDOW
Were you listening to the radio before bed? Enter Y or N.

The Flight
You are going on a trip. You have been in the air for an hour when you hear a change in the sound of the engine next to you. The fasten seat belt light flashes, and you hear the captain begin to make an
A N N _ _ N C _ _ E N T
ANNOUNCEMENT
Did the engine sound different than before? Enter Y or N.

The Screening Clinic
You have been offered a routine cancer screening appointment at your local health center. You have an X-ray and some samples are taken for tests. While waiting, you see the Doctor point out something on the X-ray to the
N _ R S _
NURSE
Were you being screened for cancer? Enter Y or N.

Walking Home
You have been visiting friends in the center of town, when you realize it is getting late. They offer you a ride, but you decide to walk. Walking down a street that you don't know very well, you can hear someone running up from
B E _ _ N D
BEHIND
Did your friends offer you a ride? Enter Y or N.

Your Eye Operation
You are finding that your sight is worse than it used to be and decide to try the laser surgery you have read about. After the operation your eyes are still bandaged, and you realize that your life will be affected radically by the
R _ S U _ T
RESULT
Did you read about the laser surgery? Enter Y or N.

Moving Day
You are preparing for the moving men and packing your things in boxes. You finish a large box and try lifting it to one side. As you lift it, you feel a pain in your chest and down your arm and let the box drop onto the
F L O _ _
FLOOR
Did you move the box to where you wanted it? Enter Y or N.

The Evening Walk
You are taking a walk on a quiet street near where you live. As you round the corner you see someone coming towards you on the same side of the street. As you meet, he stares straight at you and moves closer while raising his
H _ _ D
HAND
Were you walking on a busy street? Enter Y or N.

The Exercise Program
You decide that you must start to exercise more. For the next week you exercise a bit more each day. After several weeks, you are running further and decide to see how far you can push yourself, when you notice your breathing is
H _ _ V Y
HEAVY
Have you been exercising for several weeks? Enter Y or N.

A Late Return Home
Your partner is working late this evening, but now it is well past the time that you were expecting them home. You are thinking about a crash you saw on the route your partner drives when the phone rings. You pick it up and find out what has
H A _ _ E N _ D
HAPPENED
Did you expect your partner to be late? Enter Y or N.

Interpretive Bias Responses

The Wedding
As you speak, people in the audience laugh appreciatively (positive)
As you speak, some people in the audience find your efforts laughable (negative)
As you speak, everyone in the audience bursts into applause (positive foil)
As you speak, you notice somebody in the audience start to yawn (negative foil)

The Local Group
As you enter the room the music stops for a moment (positive)
As you enter the room someone asks why you are there (negative foil)
As you enter the room someone greets you warmly (positive foil)
As you enter the room everyone stops and stares at you (negative)

The Bus Ride
The person in the seat next to you talks to you in a friendly way (positive foil)
No one chooses to sit with you so the seat next to you stays empty (negative)
No one can sit next to you because the seat has a rip in it (positive)
The person in the seat next to you makes a rip in the fabric (negative foil)

The Job Interview
Reflecting later, you think the quality of your answers lost you the job (negative)
You think that your appearance may have made a bad impression (negative foil)
You think it must have been your clear answers that got you the job (positive)
Reflecting later, you think it was a good thing you did not take the job (positive foil)

Meeting a Friend
Your friend tells you that she does not want to meet you (negative foil)
Your friend wants to meet again but you don't have time (positive foil)
You arrange to meet in a bar but your friend doesn't turn up (negative)
You arrange to meet in a bar and your friend arrives late (positive)

Your Birthday
You leave for an appointment knowing that it is going to be a stressful day (negative foil)
You leave for an appointment before the mailman brings all your cards (positive)
You leave for an appointment feeling pleased with the presents you received (positive foil)
You leave for an appointment thinking that no one has sent you a card (negative)

Your First Painting
You overhear your friends saying how much they loved your painting (positive)
You overhear some complimentary remarks about your furniture (positive foil)
You overhear your friends making fun of your taste in furniture (negative foil)
You overhear some friends making critical remarks about your picture (negative)

The House-Warming Party
You don't know any guests and they all ignore you completely (negative foil)

You meet a lot of guests whom you know and arrange to meet again (positive foil)
You talk to some guests but see they find your conversation uninteresting (negative)
You meet some guests and they find your comments very entertaining (positive)

The Evening Class
You answer the question and then realize what a good answer it is (positive foil)
You answer the question, but realize that you have made a mistake (negative foil)
You answer the question, aware of how unsteady your voice sounds (negative)
You answer the question, noting that the others listen very attentively (positive)

The Local Bar
When you get to the punch line everyone looks confused (negative)
When you leave you receive many enthusiastic compliments (positive foil)
When you get to the end you see everyone starting to laugh (positive)
When you start telling your joke someone interrupts you (negative foil)

Visiting the Doctor
The doctor tells you to relax and gives you an opinion on your disease (negative)
The doctor tells you that there is absolutely nothing to worry about (positive)
The doctor tells you that you will need another course of treatment (negative foil)
The doctor tells you that you have made a complete recovery (positive foil)

At Home One Night
Lying in bed you hear the wind blowing something outside your window (positive)
Lying in the dark you hear soft footsteps from just outside your window (negative)
Lying in bed you hear the sound of birds singing outside your window (positive foil)
Lying in bed you hear a car accident in the street outside your window (negative foil)

The Flight
The seat belt light is on and the cabin crew say beverages will be served soon (positive foil)
The seat belt light comes on and the captain reports mechanical difficulties (negative)
The seat belt light comes on and the captain says you will be landing soon (positive)
The seat belt light is on and the cabin crew say you are diverted due to weather (negative foil)

The Screening Clinic
You notice the Doctor pointing out a tumor on your X-ray to the nurse (negative)
You watch the nurse taking the X-ray of your tumor to the Doctor (negative foil)
You see the Doctor pointing out to the nurse that your X-ray is normal (positive)
You hear the Doctor telling the nurse to inform you everything is fine (positive foil)

Walking Home
In an unfamiliar street someone steps out and threatens you with a knife (negative foil)
In an unfamiliar street you hear a jogger running up and past you (positive)
In a street you don't know well you hear a mugger running up behind you (negative)
In a street you don't know you meet an old friend who walks home with you (positive foil)

Your Eye Operation
You realize that this operation is likely to improve your life a great deal (positive)
You realize how awful your life will be if the operation is a failure (negative)
You think that you had not realized how painful the surgery would be (negative foil)
You think how pleased you will be with the improvement in your looks (positive foil)

Moving Day
You feel a pain and decide that you are not strong enough to lift the box (positive)
Your damaged back gives out and you let go of the box right away (negative foil)
You feel a pain that could mean you are straining your heart (negative)
You feel a pain and decide to let the moving men take over (positive foil)

The Evening Walk
As you meet he looks straight at you and makes a threatening remark (negative foil)
As you meet he waves at you and gives you a friendly greeting (positive)
As you meet he stares straight at you and calls good evening (positive foil)
As you meet he moves closer and raises his hand threateningly (negative)

The Exercise Program
Pushing yourself too hard you cannot get enough air and feel dizzy (negative)
Pushing yourself more than usual you feel your running is much easier (positive foil)
Running further than usual you have to breathe harder and deeper (positive)
You push yourself so hard you strain a muscle and hurt yourself (negative foil)

A Late Return Home
The phone rings and a friend invites you and your partner out to dinner (positive foil)
The phone rings and your partner tells you that they are held up at work (positive)
The phone rings and a friend tells you about gossip being spread about you (negative foil)
The phone rings and you hear that your partner has been in an accident (negative)

Distractor Task

Participants are asked to respond to a series of true or false questions.

1. Rats have teeth.
T

2. Desks wear clothes.
F

3. Dogs have tails.
T

4. Snow is white.
T

5. Oceans have fish.
T

6. Cats have feathers.
F

7. Ice is hot.
F

8. Mice are small.
T

9. Light is dark.
F

10. Kids are old.
F

11. Dirt is pink.
F

12. Cacti have thorns.
T

13. Sun is cold.
F

14. Birds have beaks.
T

15. People have brains.
T

16. Tomatoes are vegetables.
F

17. Water is liquid.
T

18. Cows have stripes.
F

19. Metal is plastic.
F

20. Horses have hooves.
T

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