

LOYOLA UNIVERSITY CHICAGO

PAYING MIND TO SAVORING:
NEURAL CORRELATES AND INTERVENTION TARGETS

A DISSERTATION PROPOSAL SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
IN CANDIDACY FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY

PROGRAM IN CLINICAL PSYCHOLOGY

BY
IAN J. KAHRILAS
CHICAGO, IL
MAY 2020

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ACKNOWLEDGEMENTS

This dissertation is dedicated to Dr. Rebecca L. Silton and Dr. Fred B. Bryant. Their extraordinary contributions to this project and my development as a scholar have meant the world to me.

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CHAPTER 1

CHAPTER ONE: INTRODUCTION

1.1 Positive emotion dysregulation in depressive disorders

Major Depressive Disorder (MDD) is one of the most common psychological disorders (Goodwin et al., 2006). In the United States, 17% of adults experience at least one major depressive episode during their life (Kessler et al., 2005). Depression symptoms are associated with life impairments including interpersonal relationship strain, increased likelihood of poor work performance and burnout, and decreased physical wellbeing (Druss et al., 2009; Kessler et al., 2006; Lewinsohn et al., 2003). In the United States, depression-related loss in work productivity has been estimated to exceed \$36 billion (Kessler et al., 2006). Treatment outcomes for depression suggest that even after the completion of therapy, 54% of individuals relapse within two years following treatment (Vittengl et al., 2007). Depression is currently a highly intractable disorder with a high rate of recurrence and relapse. Translational research that strives to develop a better understanding of factors that contribute to ongoing symptoms and relapse is urgently needed to develop effective treatments.

Impaired capability to regulate negative emotions is considered a robust feature of depression. Previous emotion regulation research has predominantly focused on downregulating negative emotions to decrease sadness and negative affect and has largely overlooked the role of positive emotion regulation (Joormann & Stanton, 2016). Yet, above and beyond other depression symptoms, anhedonia (i.e., lack of pleasure) is a hallmark feature of MDD (Association, 2013b), and may be associated with impairments in positive emotion regulation (Joormann & Stanton, 2016). Anhedonia negatively impacts daily function, predicts poor treatment response, indicates risk for future depressive episodes, and shows specificity with regard to depression diagnosis (Khazanov et al., 2019; Watson & Naragon-Gainey, 2010). Anhedonia involves abnormal bi-directional reactivity and regulatory affective processes including 1) positive attenuation, or hyporeactivity to positive stimuli (Bylsma et al., 2008; Forbes & Dahl, 2005) and 2) impaired capability to enhance or upregulate affective responses evoked by positive stimuli (Forbes & Dahl, 2005). Broadly defined, emotion regulation refers to the psychological processes that modulate an initial emotional response (Lewis et al., 2010) and implies that a change has occurred from initial reactivity (i.e., baseline affective response to a stimulus). Emerging research on positive emotion dysregulation in depression indicates

that impaired regulatory mechanisms may diminish the frequency, duration, intensity, and quality of positive emotions, including difficulties anticipating, initiating, sustaining, or upregulating positive stimuli and experiences (Forbes & Dahl, 2005; Joormann & Stanton, 2016; Liu & Thompson, 2017).

Experiencing positive emotions is paramount to deriving vitality from daily lived experiences. Positive emotions are associated with a range of beneficial intertwined psychological and physical outcomes including longevity, reduced incidents of stroke, improved sleep quality, larger social networks, increased prosocial behavior, lower cortisol levels, and increased endogenous opioids and oxytocin (Silton et al., 2020). However, only limited research has focused on understanding positive emotion regulation within the context of depression. Moving forward, a new focus on developing evidence-based strategies to target impairments in positive emotion regulation in depression could be critical to improving the low treatment outcome rate in depression.

1.2 Savoring strategies upregulate positive emotions in depression.

Savoring-based regulatory strategies are the most commonly used strategies implemented to sustain and upregulate positive emotions (Heiy & Cheavens, 2014; Liu & Thompson, 2017). First coined by Bryant (1989), savoring refers to the capacity “to attend to, appreciate, and enhance the positive experience in one’s life” (Bryant & Veroff, 2007). People initiate savoring responses in reaction to a positive event or feeling as a way to maintain, intensify, or prolong the initial positive experience (Bryant & Veroff, 2007). While savoring, one may eagerly anticipate future positive experiences, focus on ongoing positive experiences as they occur in the present moment, or reminisce about past positive experiences. Regardless of the temporal focus, savoring processes upregulate positive emotions in the present moment. Savoring strategies that amplify positive emotions are associated with greater frequency of positive affect (Smith et al., 2014) and the capacity to savor is positively associated with extraversion, self-esteem, happiness, and life satisfaction (Bryant, 2003). Correspondingly, lack of savoring capacity is inversely correlated with anhedonia, depression, hopelessness, and neuroticism (Bryant, 2003), indicating that the capability to upregulate positive emotions likely involves modifiable processes that are vulnerable to change in depression (Silton et al., 2020).

With specific relevance to depression, studies aimed at enhancing savoring capacity show that enriching any of the three temporal domains of savoring (reminiscing, savoring the moment, or anticipating) is associated with increased frequency and intensity of positive affect, and decreased negative affect (Bryant & Veroff, 1984, 2007). Training on momentary

positive emotion regulation (i.e., memory building, expressing positive emotions) resulted in decreased self-reported depression symptoms when compared to a control group after two weeks (Hurley & Kwon, 2012). A savoring intervention study that was conducted in older adults showed that diminished dampening of positive emotions was related to decreased depression symptoms (J. L. Smith & Hanni, 2017). Savoring may improve the capability to recognize and enjoy positive moments, even during difficult times (J. L. Smith & Hanni, 2017). Positive self-attributions for recent positive events have been associated with attenuated depression symptoms and enhanced positive affect following positive events in a sample of college-aged women (McMakin et al., 2011). Increased attention to positive stimuli is a candidate psychological mechanism through which positive emotion regulation strategies are theorized to mitigate depression symptoms (Carl et al., 2013; Joormann & Stanton, 2016).

1.3 Mindfulness-based interventions may increase capacity for positive emotion regulation in individuals with depression.

While savoring and mindfulness are not analogous, there may be some overlapping conceptual aspects (Bryant & Smith, 2015; Bryant & Veroff, 2007; Hurley & Kwon, 2012). Mindfulness meditation practices and mindfulness-based interventions emphasize the importance of cultivating non-judgmental attention and awareness in the present moment (Gu et al., 2015), which may help enhance the capability to savor the moment. Mindfulness meditation is theorized to enhance the capacity for and experience of positive emotions (Garland et al., 2015; Wielgosz et al., 2019) and ultimately promote wellbeing (Dahl et al., 2015), as well as broaden cognitive scope which in turn bolsters the capacity for savoring (Garland et al., 2015). Mindfulness meditation practices may modify positive valence systems through enhanced emotion awareness, modulations in emotional reactivity, increased use of cognitive reappraisal, and alterations in reward processes (Wielgosz et al., 2019). Along with increasing attention and awareness toward positive experiences as they occur, positive reappraisal may be a key emotion regulation mechanism related to mindfulness meditation practice that reduces stress and depression symptoms (Garland et al., 2015).

Headspace is the top-rated mindfulness app per psyberguide.org. It is also scalable and cost-effective. Additionally, out of 23 commonly used mindfulness-based mental health apps, researchers awarded Headspace with the highest rating on the Mobile Application Rating Scale, which assesses app engagement, functionality, aesthetics, information quality, and subjective satisfaction (Mani et al., 2015). Since the onset of this study, Headspace has provided our study team with free three-month Headspace access codes for study participants and they also share all user-data for study participants. Headspace otherwise provides no

other financial support for this research. The present study aims to advance our understanding of self-report wellbeing and neurophysiological outcomes that index changes in depression and positive emotion regulation following an eight-week trial of Headspace.

1.4 Establishing the neural correlates of positive emotion regulation.

Previous affective neuroscience research rarely focused on reaction and response to positive emotion; thus, we presently have a minimal understanding regarding the neural correlates associated with positive emotion regulation, which remains a critical area of research to attend to moving forward¹⁵. Our research team conducted an electroencephalography (EEG) study to validate and establish the emotion regulation task used in the present study. This research was fundamental to improving our understanding of the temporal course of the neural correlates of positive emotion reactivity and regulation. We pre-registered this previous EEG study, and consistent with open science practices, we will make the data publicly available (OSF link: <https://osf.io/p5ba9>). This research focused on two key event-related potential (ERP) components which provide information about the temporal course of neural activity involved in processing affective stimuli: the early posterior negativity (EPN) and the late positive potential (LPP) in response to positive emotion reactivity and regulation. The EPN represents an early categorization of affective stimuli whereas the LPP is indicative of a later integrated conceptual analysis (Frank & Sabatinelli, 2019). LPP is an established index of emotional arousal in response to visual stimuli (Hajcak et al., 2010; Sabatinelli et al., 2005) and is theorized to index a visual cortical/amygdala pathway that is involved in evaluating the affective salience of a stimuli³⁴. Increased LPP has been associated with increased subjective reports of emotional arousal (Foti & Hajcak, 2008). Therefore, we expected that the capability to flexibly modulate emotional intensity in response to positive stimuli would be indexed by LPP, which would be associated with increased positive emotion regulation capacity (per self-report).

Primary study aim: We will evaluate the hypothesis that an eight-week app-based mindfulness meditation intervention will modify neural correlates of positive emotion regulation for individuals with depression symptoms. Building upon emerging research from my laboratory that characterizes patterns of brain activity associated with positive emotion regulation and savoring the moment (Kahrilas et al., n.d.), the proposed project will evaluate whether an eight-week Headspace mindfulness intervention modifies the neural correlates of positive emotion regulation in individuals with depression symptoms. Specifically, the proposed study will evaluate whether the capability to modulate emotional intensity in response to positive stimuli (as indexed by EPN and LPP) will be increased for emerging adults with depression

following eight weeks of Headspace use. Illustrating proof of concept and feasibility for the proposed research, our preliminary analyses demonstrate that Headspace reduces depression symptoms and increases momentary savoring capacity (Conley et al., 2019; Silton et al., 2018). Significance

Cultivating the capacity to experience positive emotions via upregulating the experience associated with positive stimuli and moments as they occur is critical to psychological and physical health outcomes. The proposed study will examine indices of neural (EEG) function and their association with positive emotion regulation capabilities in order to identify potential mechanisms. This broad aim is consistent with the National Institute of Mental Health (NIMH) Research Domain Criteria (RDoC) initiative which encourages researchers to integrate across units of analysis in order to better characterize dimensional perspectives on human behavior. Identifying modifiable psychological mechanisms associated with positive emotion regulation is critical to advancing evidence-based therapeutic approaches that promote societal health and wellbeing, particularly in the present milieu of rapidly increasing rates of depression and anxiety disorders (World Health Organization, 2014). As such, this research has the potential to inform interventions to enhance physical wellbeing and psychological vitality in individuals with medical and psychological disorders, such as depression, postpartum depression, and pain disorders. Furthermore, this project will provide opportunities to mentor graduate and undergraduate research assistants. Through mentoring in human neuroscience research, students will build a broader skill set involving data science, critical thinking, development of innovative ideas, project management, and communication abilities that will prepare them for successful careers in psychological or health sciences.

CHAPTER 2

CHAPTER TWO: SAVORING THE MOMENT: A LINK BETWEEN AFFECTIVITY AND DEPRESSION

2.0.1 Introduction

Affective theories of mood and anxiety disorders have posited that low positive affectivity is a specific risk factor for depression (Clark & Watson, 1991; Lewinsohn & Graf, 1973; Watson, Weber, et al., 1995; Watson, Clark, et al., 1995), whereas high negative affectivity may be a more general indicator of distress that is observed across depression and anxiety disorders, as well as other psychopathology types (Watson & Clark, 1984). Positive affectivity reflects a tendency to experience intense and frequent episodes of pleasant moods (Watson, 2009), while negative affectivity refers to a tendency to experience negative moods (Watson & Clark, 1984). Positive and negative affectivity are theorized to represent stable individual differences indicative of an individual's disposition to experience positive and negative affect (i.e., transient emotional experiences) respectively. To this extent, positive affectivity and negative affectivity are closely associated with highly stable personality traits such as extraversion and neuroticism, correspondingly (Costa & McCrae, 1980; Warr et al., 1983). While certain major life events (e.g., unemployment, disability) are associated with long-term changes in subjective well-being, others (e.g., marriage, widowhood, divorce) only have short-term effects with a tendency to revert back to baseline levels of positive affectivity following these major events (Lucas, 2007; Suh et al., 1996; Watson, 2009). With regard to depression, the frequency of positive life events is not fully explanatory of depression symptoms (Needles & Abramson, 1990). Rather, the relationship between positive events and depression symptomatology is likely modulated by individual differences ranging from cognitive style (Needles & Abramson, 1990) to neurobiological factors (Watson, 2009) that influence the interpretation and/or experience of positive events. Related, research has indicated that emotional inertia (i.e., degree to which one's affective state is predicted by a previous affective state) may be a risk factor for future development of mood disorders (Koval et al., 2012; Kuppens et al., 2010). Research has also concurrently indicated that affective instability is related to depression symptoms (Thompson et al., 2012). Seeking to reconcile these findings, research utilizing experience sampling and controlled laboratory methods found that more resistant negative emotion, specifically, was related to depression while positive emotion continues to fluctuate (Koval et al., 2013). While research has explored the role of negative emotion regulation

strategies (e.g., reappraisal, acceptance, problem solving; Aldao et al., 2010) in the context of depression, the same cannot be said about positive emotion regulation (Silton et al., 2020). Characterizing specific positive emotion regulation strategies that mediate the relationship between affectivity and depression could inform treatment and intervention approaches to depression.

2.0.2 Emotion Regulation and Depression

The connection between negative emotion regulation and depression is well established (Gross, 1998; Gross & Muñoz, 1995; Joormann & Gotlib, 2010; Joormann & Vanderlind, 2014; Nolen-Hoeksema et al., 1993). Individuals with depression are more likely to engage in maladaptive regulation strategies such as rumination, expressive suppression, and catastrophizing and less likely to utilize adaptive strategies like reappraisal and self-disclosure compared to individuals without depression (Garnefski & Kraaij, 2007; Gross & John, 2003; Joormann & Gotlib, 2010). More recently, research has begun to examine the influence of positive emotion regulation on depression symptoms (Feldman et al., 2008; Nelis et al., 2015; Raes et al., 2012; Werner-Seidler et al., 2013). Beck (1979) theorized that dampening positive emotions intensifies and perpetuates depression. Accordingly, greater dampening of positive affect is prospectively associated with increased depression symptoms three and five months later (Raes et al., 2012). Other research has shown that those with depression tend to be apprehensive about experiencing positive affect and thus engage in maladaptive emotion regulation strategies, such as dampening positive affect (Werner-Seidler et al., 2013). Furthermore, Werner-Seidler et al. (2013) showed that depression symptoms are inversely related to strategies implemented to amplify positive affect and depression. In sum, although research is beginning to establish that those with depression tend to engage in maladaptive positive emotion regulation strategies that reduce positive emotion (Carl et al., 2013; Garnefski & Kraaij, 2007; Gross, 2013; Silton et al., 2020), there has been less focus on identifying strategies that may successfully enhance positive emotion in individuals who are at risk for depression. As such, the present study evaluates the hypothesis that savoring may ameliorate depression symptoms.

2.0.3 Savoring Responses and Savoring Beliefs

Savoring refers to an awareness of positive experiences and the use of positive emotion regulation strategies to enhance and extend positive feelings that are derived from those experiences (Bryant et al., 2011; Bryant, 1989; Bryant & Veroff, 2007; J. L. Smith & Bryant, 2017). People initiate savoring responses in reaction to a positive event or affect as a way

to maintain, intensify, or prolong positive experience (Bryant & Veroff, 2007). The original conceptual formulation of savoring (Bryant & Veroff, 2007) is predicated on the theory that people typically engage in savoring responses in reaction to positive events or affect, which people regulate through cognitive or behavioral strategies. Chronically low levels of positive affectivity would be expected to reduce savoring responses, which over time would lower self-evaluations of savoring ability. While savoring, one may anticipate the enjoyments of future positive experiences, focus on ongoing positive experiences as they occur, or reminisce about past positive experiences. Regardless of the temporal focus, savoring processes regulate positive emotions in the present moment. In contrast to savoring responses, savoring beliefs are self-perceptions of one's capacity to savor (Bryant, 2003). Although related to ways in which people regulate positive feelings in response to positive events, savoring beliefs are dispositional tendencies that are distinct from specific savoring strategies in which people engage. Stronger savoring beliefs are associated with lower levels of depression symptoms (Bryant, 2003; Eisner et al., 2009; Hou et al., 2016; Ramsey & Gentzler, 2014; Smith & Hollinger-Smith, 2015). Examining the correlations between savoring beliefs and depression in two separate samples, Bryant (2003) found a significant negative correlation between savoring the moment and depression in both samples, a significant negative correlation between positive reminiscence and depression in one of the samples, and no correlation between positive anticipation and depression in either sample. In another study, savoring the moment, but not anticipation, was also identified as a unique predictor of lifetime depression symptoms (Carver & Johnson, 2009). These results suggest that the capacity to savor ongoing positive experiences as they occur may have the strongest relationship with level of depression symptoms. Furthermore, those endorsing higher levels of savoring beliefs report similar experiences as those endorsing high levels of positive affectivity—namely, intense and frequent episodes of positive affect (Bryant & Veroff, 2007; Watson, 2009).

2.0.4 Savoring and Positive Affect

Savoring strategies that amplify positive emotions are associated with greater frequency of positive affect (Gentzler et al., 2013; Quoidbach et al., 2010; Smith et al., 2014). As an example, college students who reminisced for one week using either memorabilia or cognitive imagery reported greater increases in frequency of happy feelings compared to participants in a control condition (Bryant et al., 2005). In addition, a present-focused savoring strategy, mindfully photographing beautiful or meaningful subjects, led to more positive moods compared to photographing neutral subjects (Kurtz, 2015). Research has also found that greater savoring beliefs are associated with higher intensity of positive affect

and less negative affect (Bryant, 2003; Smith & Bryant, 2013). Across two separate samples, people who reported stronger savoring beliefs also tended to report higher levels of personality traits associated with increased positive affect, such as intensity of happy feelings, self-esteem, frequent happy feelings, and less frequent unhappy feelings (Bryant, 2003). Using experience sampling methodology, (2012) found that momentary savoring mediated the relationship between daily positive events and momentary happiness, and this effect was stronger for people with higher trait levels of amplifying (i.e., broad types of savoring strategies) and weaker for people with higher trait levels of dampening. Research has also shown that a combination of low capacity to savor the moment and experiencing less positive events is most strongly associated with lower positive affect and less life satisfaction (Hurley & Kwon, 2013; Jose et al., 2012). Collectively, these studies illustrate that higher savoring capacity results in greater frequency and intensity of positive affect, which is representative of elevated positive affectivity. However, while this research has investigated the relationship between savoring beliefs and trait-like attributes such as intensity and frequency of affect and increased self-esteem, previous research has not explicitly examined the relationship between trait affectivity and savoring beliefs within the context of depression. The present study evaluates savoring as a positive emotion regulation strategy that may modify low positive affectivity and thus reduce depression symptoms.

2.0.5 The Focus of the Present Study

A variety of interventions have been developed that focus on each of the three temporal domains of savoring (i.e., reminiscing, savoring the moment, and anticipating) in an effort to boost happiness (Smith et al., 2014). For example, cultivating the ability to imagine future positive events can enhance anticipating (Quoidbach et al., 2009), taking mindful photographs aids in momentary savoring (Kurtz, 2015), and increasing awareness of recent positive events serves to bolster reminiscing (Seligman et al., 2005). Thus, if savoring mediates the relationship between affectivity and depression, it may be an effective and modifiable target for bolstering positive affectivity and reducing depression symptoms. Common treatments for depression, including cognitive behavioral therapy (CBT) and antidepressant medication (Price & Drevets, 2010), leave considerable room for improvement that may be fulfilled by focusing on enhancing PA. These treatments predominantly focus on ameliorating distorted thought patterns and neurotransmitter systems pertaining to negative emotions (Argyropoulos & Nutt, 2013; Beck, 1979). Approximately 45-65% of those with depression undergoing CBT do not achieve remission (DeRubeis et al., 2005; Dimidjian et al., 2006). The importance of enhancing PA is corroborated by the fact that patient definitions of depression recovery

equally emphasize repair of PA and NA (Demyttenaere et al., 2015). Further, Dunn and colleagues (2019) conducted two separate studies investigating the efficacy of therapeutic and pharmacological approaches to treating depression and mitigating high NA and PA. Results indicated that NA and PA were both uniquely related to depression and that current treatments (CBT, selective serotonin reuptake inhibitors, selective norepinephrine reuptake inhibitors, tricyclic antidepressants, and monoamine oxidase inhibitors) improve NA, but do little to bolster PA (Dunn et al., 2019). This is despite the fact that reductions in PA were more marked than elevated NA in the samples tested, indicating that PA may be a more pressing intervention target (Dunn et al., 2019). Novel treatments have theorized that increased use of dampening appraisals may be a psychological mechanism of reduced PA (Dunn et al., 2018). This implicates positive emotion regulation and savoring, which is underscored by literature illustrating that greater savoring beliefs are correlated with lower levels of depressive symptoms (Bryant, 2003; Eisner et al., 2009; Hou et al., 2016; Ramsey & Gentzler, 2014; Smith & Hollinger-Smith, 2015). A more thorough understanding of the mechanisms of PA and savoring may pave the way for improving depression treatments. The present study characterizes the relationship between affectivity, savoring beliefs, and depression symptomatology. We evaluated the following hypotheses: 1) replicating past research, positive affectivity will be negatively associated with depression symptoms and negative affectivity will be positively associated with depression symptoms, 2) positive affectivity will be positively associated with all three temporal domains of savoring and negative affectivity will be negatively associated with all three temporal domains of savoring, 3) savoring the moment will be distinctly associated with depression, and 4) savoring the moment will distinctly mediate the relationship between affectivity and depression. Despite the present study's focus on PA, mitigating NA remains an important factor to address in depression, with research demonstrating that both are independently related to depression symptoms (Dunn et al., 2019). Additionally, given the negative associations that exist between stable negative traits and savoring (e.g., neuroticism; Bryant, 2003), NA was included as an exogenous variable in the exploratory path analysis. Further, including NA facilitates the analysis of PA and NA's unique relationship with depression via the temporal domains of savoring by statistically controlling for the effects of the other. Because anxiety and depression symptoms frequently co-occur (Association, 2013a; Clark, 1989; Mineka et al., 1998), we accounted for the effects of anxiety by including measures of anxious arousal (somatic) and anxious apprehension (worry) symptoms (Sharp et al., 2015) in our analyses. Additionally, research suggests that worry spans temporal domains and is associated with rumination about past events and hopelessness regarding the future (Andrews & Borkovec, 1988; MacLeod & Byrne, 1996) as well as procrastination (Stöber & Joormann, 2001), each of which may

overlap with the temporal domains of savoring. Further, since research indicates that females tend to report greater savoring capacity than do males (Bryant & Veroff, 2007), gender was included as a covariate. The present study utilized a parallel mediation model with cross-sectional data. Some researchers have advocated against this practice since correlational data do not afford causal interpretation (Maxwell et al., 2011). Alternatively, Hayes (2018) advocated for a more relaxed stance: “We should not let the limitations of our data collection efforts constrain the tools we bring to the task of trying to understand what our data might be telling us about the processes we are studying” (p. 18). Many researchers share this sentiment as indicated by their use of mediation analyses with cross-sectional data (Blashill & Vander Wal, 2010; Gaunt & Scott, 2014; Goodin et al., 2009; Kung et al., 2016; Lee et al., 2014; Li et al., 2011; Osborne et al., 2015; Pollack et al., 2012; Rees & Freeman, 2009; Smith et al., 2016; Thai et al., 2016; Thomas & Bowker, 2015; Torres & Taknint, 2015; Webb et al., 2016). Thus, the present study utilized cross-sectional mediation analyses while recognizing its preclusion of causal inference.

2.1 Method

2.1.1 Participants

Participants ($N = 2,482$) were recruited from introductory psychology courses. Participants received course credit for completion of an online survey. Case wise deletion was used to omit participants ($n = 864$) that had missing responses to any questionnaires used in the present study. The final sample of 1,618 participants ($n = 375$ males, $n = 1,243$ females) ranged in age from 17 - 40 ($M = 18.99$ years, $SD = 1.33$) and was 70.0% Caucasian, 19.1% Asian, 4.5% Black or African American, 0.9% Native Hawaiian or other Pacific Islander, 0.7% American Indian or Alaskan Native, and 4.9% Biracial; 11.4% reported that they were Hispanic/Latinx and 88.6% were not Hispanic/Latinx. The study was approved by the University’s Institutional Review Board, and informed consent was provided to all participants prior to beginning the survey.

2.1.2 Questionnaire Measures

Savoring capacity. We administered the Savoring Beliefs Inventory (Bryant, 2003) to assess participants’ savoring capacity. The SBI measures the perception of one’s ability to feel pleasure through anticipating positive experiences, savoring positive moments as they occur, and reminiscing about past positive events (Bryant & Veroff, 2007). The SBI was analyzed as three eight-item subscales pertaining to temporal forms of savoring: anticipating (e.g., “Before a good thing happens, I look forward to it in ways that give me pleasure in the

present.”), savoring the moment (e.g., “I know how to make the most of a good time.”), and reminiscing (e.g., “I enjoy looking back on happy times from my past.”). Items are rated on a seven-point Likert scale from “1” (strongly disagree) to “7” (strongly agree). The three temporal subscales of the SBI were originally conceived as separate, intercorrelated measures of individuals’ characteristic capacities to savor. Test-retest reliability assessments provide cross-cultural evidence for the stability of the SBI subscales (Bryant, 2003; Kawakubo et al., 2019). Prospective research testing predictive validity found that participants’ SBI scores predicted ability to anticipate, momentarily savor, or reminisce upon winter break three months later (Bryant, 2003). This empirical evidence collectively supports the conclusion that the three SBI subscales reflect stable traits that manifest themselves in predictable forms of behavioral and emotion experience over time. Bryant (2003) found moderate to high internal consistency across all three subscales. The present study replicated these findings (Anticipating, $\omega = .87$; Savoring the Moment, $\omega = .85$; and Reminiscing, $\omega = .86$).

Depression severity. To evaluate depression severity, the nine-item Patient Health Questionnaire (PHQ-9; Kroenke et al., 2001) was administered. PHQ-9 items are scored from “0” (not at all) to “3” (nearly every day) and are based on the depression criteria from the Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition. Internal consistency of the PHQ-9 in the present study ($\omega = .87$) was consistent with past research (Kroenke et al., 2001).

Affectivity and anxiety symptoms. To assess for positive and negative affectivity as well as anxiety, the 39-item Mood and Anxiety Symptoms Questionnaire (Watson, Weber, et al., 1995; Watson, Clark, et al., 1995) was administered. The MASQ was analyzed as three separate subscales: the eight-item negative affectivity (NA) Scale (MASQ-NA8; e.g., “Felt withdrawn from other people”), the 14-item positive affectivity (PA) Scale (MASQ-PA14; e.g., “Felt cheerful”), and the 17-item Anxious Arousal Scale (MASQ-AA; e.g., “Startled easily”). Previous literature has supported these oblique factors in two independent samples of individuals at-risk for depression and anxiety (Kendall et al., 2015; Nitschke et al., 2001). Participants rated their affectivity and anxiety symptoms using a five-point Likert scale from “1” (not at all) to “5” (extremely). Consistent with previous research (Bredemeier et al., 2010), the MASQ scales demonstrated good to excellent internal consistency (MASQ-NA8, $\omega = .80$; MASQ-PA14, $\omega = .94$; and MASQ-AA, $\omega = .88$).

Worry. The 16-item Penn State Worry Questionnaire (Meyer et al., 1990) was used to assess for the trait of worrying. PSWQ items are rated on a five-point Likert scale from “1” (not at all typical) to “5” (very typical). Meyer and colleagues (1990) found a high degree of internal consistency in the PSWQ, and the present study found good consistency ($\omega = .87$).

2.2 Results

2.2.1 Depression Severity

To provide clinically relevant descriptive information regarding depression severity in the sample, participants were categorized into five depression severity groups based on established PHQ-9 cutoff scores: minimal (1-4), mild (5-9), moderate (10-14), moderately severe (15-19), and severe (20-27; Kroenke et al., 2001). Group means, standard deviations, and reliability coefficients of primary variables of interest (PA, NA, and savoring the moment) were calculated for each of the depression severity groups (see Table 1). Pairwise t-test comparisons with Holm correction were conducted to assess mean differences between each depression group for PA, NA, and savoring the moment. Analyses indicated significant differences between all groups for all variables except for the difference in mean PA between moderately severe and severe depression groups.

Depression Group	n	%	Positive Affectivity			Negative Affectivity			Savoring the Moment		
			Mean	<i>SD</i>	ω	Mean	<i>SD</i>	ω	Mean	<i>SD</i>	ω
Minimal	613	37.9	47.9	10.8	.93	14.8	4.2	.70	43.9	7.8	.81
Mild	561	34.7	43.2	10.2	.92	18.4	4.5	.65	40.3	8.3	.83
Moderate	269	16.6	38.9	10.3	.91	23.0	4.2	.50	35.9	8.0	.78
Moderately Severe	125	7.7	34.5	11.3	.93	26.3	4.3	.49	31.5	8.7	.82
Severe	50	3.1	33.0	14.6	.96	29.3	4.8	.55	27.9	9.4	.83

2.2.2 Correlations Among Study Variables

Pearson correlations were computed among the primary study variables (see Table 2). As expected, PA was positively associated with all temporal domains of savoring. NA, depression, and anxious arousal were negatively associated with all temporal savoring domains. All correlations were statistically significant.

2.2.3 Positive Affectivity, Negative Affectivity, and Anxious Arousal as Predictors of Depression

The tripartite model posits that depression and anxiety have specific relations with three affective dimensions: PA, NA, and anxious arousal (Clark et al., 1995; Watson, Clark, et al., 1995). Given the present study's focus on PA and depression, we wanted to confirm the unique relation between each of these dimensions and depression symptoms in the present sample. Per the tripartite model, we anticipated that low levels of PA and high levels of NA would be positively associated with depression symptoms, and that anxious arousal would be unrelated

to depression symptoms. Multiple regression analyses were conducted with PA, NA, and anxious arousal as predictors and depressions with no covariates. Diverging from the specific association between PA and depression proposed by Clark and Watson (1991, 1995a, 1995b), results from the test sample indicated that each of the predictors were uniquely associated with depression. NA [$b = .52$, $\beta = .55$, $t(1614) = 25.47$, $p < .001$] was the strongest predictor of depression, followed by anxious arousal [$b = .11$, $\beta = .21$, $t(1614) = 10.38$, $p < .001$], and lastly PA [$b = -.09$, $\beta = -.19$, $t(1614) = -10.55$, $p < .001$].

2.2.4 Mediation Analyses

Path analyses were run in R `citation()` using the lavaan package (Rosseel, 2011) to assess the indirect effects of PA and NA on depression via three temporal domains of savoring capacity while accounting for the variance associated with gender, worry, and anxious arousal (see Figure 1). Exogenous variables (PA and NA) were allowed to correlate with one another, as were the residual variances of each of the temporal domains of savoring. Maximum likelihood estimation was used to estimate path coefficients, and bias-corrected bootstrap confidence intervals based on 10,000 bootstrap samples were used to estimate indirect effects of temporal domains of savoring between affectivity and depression. The fully saturated model contained 45 free parameters with zero degrees of freedom, resulting in perfect goodness of fit indices. Results (see Figure 1 and Table 3) showed that PA was associated with anticipating (standardized: $a_1 = .41$, unstandardized: $a_1 = .30$, $p < .001$), savoring the moment (standardized: $a_2 = .46$, unstandardized: $a_2 = .36$, $p < .001$), and reminiscing (standardized: $a_3 = .39$, unstandardized: $a_3 = .28$, $p < .001$). There were significant associations between NA and anticipating (standardized: $a_i = -.11$, unstandardized: $a_i = -.16$, $p < .001$), savoring the moment (standardized: $a_{ii} = -.29$, unstandardized: $a_{ii} = -.44$, $p < .001$), and reminiscing (standardized: $a_{iii} = -.16$, unstandardized: $a_{iii} = -.23$, $p < .001$). Further, savoring the moment was related to lower depression severity (standardized: $b_2 = -.07$, unstandardized: $b_2 = -.04$, $p = .024$), while anticipating and reminiscing were not. Bias-corrected bootstrap confidence intervals (based on 10,000 bootstrap samples; see Table 3) for the indirect effects of temporal domains of savoring between PA and depression did not include zero for savoring the moment (95% CI $[-.028, -.002]$, $a_2b_2 = -.01$) but did include zero for anticipating (95% CI $[-.009, .012]$, $a_1b_1 = .00$) and reminiscing (95% CI $[-.009, .013]$, $a_3b_3 = .00$). Similarly, bias-corrected bootstrap confidence intervals for the indirect effects of temporal domains of savoring between NA and depression did not include zero for savoring the moment (95% CI $[.003, .035]$, $a_{ii}b_2 = .02$) but did include zero for anticipating (95% CI $[-.007, .005]$, $a_ib_1 = .00$) and reminiscing (95% CI $[-.011, .007]$, $a_{iii}b_3 = .00$). Notably, there is

a negative indirect effect between PA and depression via savoring the moment with a positive relationship between PA and savoring the moment. This signifies that the positive association between PA and momentary savoring results in reduced depression scores that accounts for a portion of the significant negative relationship between PA and depression (standardized: $c'_{PA} = -.16$, unstandardized: $c'_{PA} = -.08$, $p < .001$). The direct effect of NA on depression was also significant (standardized: $c'_{NA} = .49$, unstandardized: $c'_{NA} = .02$, $p < .001$).

2.3 Discussion

The present study examined the relationship between affectivity (PA and NA) and depression symptoms via the future-, present-, and past-focused temporal domains of savoring beliefs (i.e., self-reported capacity to savor by anticipating, savor the moment, and savor by reminiscing, respectively). As predicted, results showed that PA and NA were associated with all three temporal domains of savoring. Savoring the moment distinctly mediated the relationship between affectivity and depression; whereas, the other temporal domains did not mediate this relationship. Replicating past research, we also found a relationship between affectivity and depression symptoms (Chorpita, 2002; Clark & Watson, 1991; Dunn et al., 2019; Khazanov & Ruscio, 2016; Watson, Weber, et al., 1995; Watson, Clark, et al., 1995). Of note, we found that the effect size for the bivariate relationship between NA and depression (i.e., 55% shared variance) was roughly three times larger than the effect size for the relationship between PA and depression (i.e., 18% shared variance); but given that NA is theorized to be a common factor shared among depression and anxiety (Watson, Weber, et al., 1995; Watson, Clark, et al., 1995), higher NA may also be increased due to co-occurring anxiety symptoms. These findings are similar to results from a meta-analysis suggesting that low positive emotionality creates an inherent vulnerability to depression, but perhaps to a lesser degree than previously surmised (Khazanov & Ruscio, 2016). While findings from the present study imply that structured interventions aimed at enhancing any of the three temporal domains of savoring may serve to attenuate levels of NA and bolster levels of PA and well-being, only savoring the moment is likely to reduce depression symptoms. This latter finding is consistent with previous research showing that momentary savoring capacity has a stronger negative association with depressive symptoms than do reminiscing and anticipating (Bryant, 2003; Carver & Johnson, 2009). Together, these findings indicate that developing interventions to promote savoring the moment may be effective in reducing depression. When partitioned by pre-established depression severity cutoff-scores (Kroenke et al., 2001), the majority of the sample fell into minimal and mild depression groups, with significantly fewer participants in the moderate to severe groups. This result is consistent with a previous

study conducted by Kroenke and colleagues (2001) that categorized a sample of 580 adult participants into groups based on PHQ-9 depression cut-off scores. It is also critical to note that 444 participants (27.5%) of the total present sample likely meet clinical criteria for a depression diagnosis as indicated by scoring 10 or higher on the PHQ-9 (Kroenke et al., 2001). Additionally, pairwise comparisons indicate that as participants increase in depression severity, levels of PA and capacity to savor the moment decrease while NA increases. This supports a dimensional conceptualization of the relationship between depression symptoms and individual difference factors, the present study indicates that a gradual decrease in PA/savoring the moment and increase in NA accompany a rise in depression severity. The present study expands on previous research that has investigated the relationship between positive emotion regulation and depression by assessing beliefs about positive emotion regulation, specifically savoring, across past, present, and future temporal domains. As such, these findings suggest that savoring the moment, as opposed to reminiscing or anticipating, may be instrumental in bolstering PA and reducing NA to ameliorate depression symptoms. This conclusion is further supported by positive psychological interventions that include training in momentary savoring strategies to reduce depression (Hurley & Kwon, 2013; McMakin et al., 2011; Smith & Hanni, 2019). In particular, a savoring-based intervention that instructed female college students with symptoms of dysphoria to make positive self-attributions for recent positive events was effective in reducing depression symptoms and sustaining positive affect following positive events (McMakin et al., 2011). In another study, participants who received training in the use of strategies for savoring the moment, such as memory building and expressing positive emotions, displayed lower depression and lower negative affect after two weeks compared to a control group (Hurley & Kwon, 2013). While interventions targeting reminiscing and anticipating may serve to increase PA and decrease NA, patients presenting with depression may require more specific treatment focused on savoring the present moment compared to a non-clinical sample. Supporting this notion, increased attention to positive stimuli is likely one mechanism through which savoring influences depression symptoms (Carl et al., 2013). Although it should be noted that savoring and mindfulness are not analogous (Bryant & Veroff, 2007), the importance of moment-to-moment awareness in treating depression is corroborated by mindfulness-based interventions (Gu et al., 2015).

2.3.1 Limitations

The present study has several limitations. First, the present results are based solely on self-report measures. Although self-report data are often inordinately criticized (Chan, 2009), such measures are not without problems. Self-report methods are prone to exaggeration

or underreporting, both of which may be caused by social desirability bias, or a tendency to present oneself favorably (Fisher, 1993). While the PHQ-9 is frequently used to screen for depression and track treatment outcomes in research studies and clinical settings, the present study did not implement clinical interviews to validate the self-report data. Future research in this area might consider using a clinical interview to confirm depression diagnoses. However, the PHQ-9 allows for a dimensional conceptualization of depression symptoms, which is likely to be more consistent with the range of affective and cognitive experiences that co-vary with depression symptoms (Levin et al., 2007). Second, the present study is limited by its cross-sectional design, which precludes unequivocal conclusions about cause and effect. To overcome this limitation, future research should aim to extend the present findings using a longitudinal, randomized control trial (RCT) design to evaluate the impact of various savoring interventions designed to specifically target each of the three temporal domains in a sample of participants with low levels of PA and depression. In addition, more research is needed to understand the extent to which mindfulness-based interventions that focus on developing moment-to-moment awareness also indirectly enhance positive emotion regulation and savoring the moment, or whether interventions specifically designed to enhance savoring of positive events in the moment effectively reduce depression. Additionally, all subscales (anticipating, savoring the moment, reminiscing) measure one's capacity to generate positive feelings in the moment while focusing on either past, present, or future positive experiences (Bryant & Veroff, 2007). Studies utilizing experience sampling methods (e.g., Koval et al., 2013) offer stronger conclusions regarding temporal fluctuations of emotion and depression symptoms. The presence of multicollinearity, or tautological logic, can be argued due to the high correlation between NA and depression in the present sample and the fact that depressed mood (NA) forms a central construct of depression. Other researchers analyzing the association between affectivity (measured with the MASQ) and depression concluded that tautological logic did not compromise their analyses (Dunn et al., 2019). Additionally, the constructs of NA and depression are theoretically distinct despite being related. NA is conceptualized as a general indicator of distress observed across depression, anxiety, and other psychopathology types (Watson & Clark, 1984). It is conceptually disparate from positive emotions; one with high NA does not necessarily also lack joy, excitement, or enthusiasm, which are hallmarks of depression (Watson & Clark, 1984). Nitschke and colleagues (2001) corroborated this conceptualization via factor analysis, illustrating that the MASQ-NA subscale overlaps with anxiety and depression factors. Other research indicates that the MASQ-PA scale is a superior means of screening for depression compared to the MASQ-NA scale, further suggesting that NA is conceptually distinct from depression (Bredemeier et al., 2010). The PHQ-9, on the other hand, was designed to map onto criteria for major depressive

disorder diagnosis in the Diagnostic and Statistical Manual of Mental Disorders (Kroenke & Spitzer, 2002). As such, the PHQ-9 was formulated for use in clinical settings with robust diagnostic sensitivity (Kroenke & Spitzer, 2001, 2002). Nonetheless, further clarification on the overlap between affectivity and depression are grounds for future research. Finally, a post-hoc power analysis—using the `bmem` package (Zhang, 2014), specifying 1,000 Monte Carlo simulations, each with 1,000 bootstrap samples—indicated that the present sample provided less than optimal statistical power. In particular, our present sample ($N = 1,618$) yielded 60.5% power to detect a significant indirect effect of savoring the moment between PA/NA and depression via bootstrapping. Further analyses indicated that a sample size of 2,700 is required in order to reach 80% power for these indirect effects. This latter finding underscores the fact that researchers need to recruit large sample sizes to detect significant effects in complex mediation models.

2.3.2 Conclusion

This is one of the first studies to examine the degree to which the three temporal domains of savoring mediate the relationship between affectivity and depression symptoms. Interventions that focus on bolstering any of the temporal domains of savoring may benefit those with low PA or high NA. However, enhancing momentary savoring may be the critical temporal domain to consider adapting as an intervention to ameliorate depression. Overall, our results suggest that interventions targeting positive emotion regulation may have considerable benefit for clinical and non-clinical populations. In advancing this research, RCT methodology should be implemented to confirm causality and benefit among individuals with depression disorders.

2.3.3 Acknowledgments

The authors thank the anonymous reviewers whose thoughtful feedback was instrumental in improving the quality of this manuscript.

CHAPTER 3

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