Harnessing Happiness? Uncontrollable Positive Emotion in Bipolar Disorder, Major Depression, and Healthy Adults

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The ability to adaptively exert control over negative emotions is associated with beneficial mental health outcomes. Less is known about the associated emotional sequelae surrounding controllable versus uncontrollable *positive* emotional experiences. The ability to harness positive emotions is of particular importance in populations involving disrupted positive emotion functioning. In the present study, participants engaged in a relived memory task in which they recalled either a controllable or uncontrollable past positive emotional experience in counterbalanced order, while concurrent experiential and autonomic responses were measured. Participants included adults with bipolar I disorder (BD; $n = 32$), major depression (MDD; $n = 32$), and or nonpsychiatric controls (CTLs; $n = 31$). Across all participants, reliving a controllable positive emotion experience was associated with exhibited increased respiratory sinus arrhythmia, an autonomic marker of regulatory control. Interestingly, only the MDD group reported increased positive emotion and decreased cardiovascular arousal when reliving an event involving uncontrollable positive emotion, compared to the BD and CTL groups. No other group differences emerged. These findings suggest that although controllable positive emotion experiences may be adaptive for most, individuals with a history of restricted affect and depressed mood may actually derive more pleasure from times of unharnessed happiness.

Keywords: positive emotion, emotion regulation, control, bipolar disorder, depression

"To enjoy good health, to bring true happiness to one's family, to bring peace to all, one must first discipline and control one's own mind" (p. 80).

—The Buddha, in Kyonkai, 2004

Daily life inevitably involves events that are beyond our control, such as sudden changes of weather or unexpected good news. An important ingredient of healthy psychological functioning is the ability to exert control over our emotional responses to such events. Empirical research in psychology has recently caught up to the Buddha's prescient observations, indicating that the ability to control or regulate emotion is associated with improved health outcomes, such as greater well-being (e.g., Gross & John, 2003) and improved coping with stress (e.g., Ong, Bergeman, Bisconti, & Wallace, 2006). Although these findings are robust, the focus of this line of research has been almost exclusively on controlling negative emotions with less emphasis on positive emotions.

The current study develops upon the previous literature on emotion control and takes an initial step to examine the emotional sequelae associated with positive experiences perceived as uncontrollable compared to positive experiences perceived as controllable. Specifically, we examined individuals with and without a history of disrupted positive emotional functioning, using two clinical groups both marked by trouble harnessing positive emotions, including relative excesses (i.e., bipolar disorder) or deficits (i.e., major depressive disorder) in positive emotion (Gruber & Keltner, 2007). We also examined positive emotion controllability in a third group of healthy adults characterized by adaptive levels of positive emotion. This recruitment of three selective groups enables examination of positive emotion control along a continuous spectrum of different groups, providing insights into basic human emotion processes, as well as bearing important clinical health implications. Given the growing evidence on the efficacy of interventions that aim at cultivating and adaptively harnessing positive emotions (Sin & Lyubomirsky, 2009), we believe that the ability to control positive emotion may have important health implications.

What Is Emotion Control?

In this article, we define *emotion control* as the ability to generate or modify an existing emotion state by inhibiting, maintaining, and/or enhancing one's emotions. From this definition, *uncontrollable emotions* refer to emotional experience in which perceivers are unable to inhibit, maintain, and/or enhance their emotional state; by contrast, a *controllable emotion* refers to an emotional experience in which perceivers are able to inhibit, maintain, and/or enhance their emotional state. Emotion control in the present study is thus related to but distinct from emotion regulation (e.g., Gross, 1998) and self-control (e.g., Mischel, Cantor, & Feldman, 1996). Whereas emotion regulation is a broad umbrella term referring to a diffuse array of constructs (Lewis, Zinbarg, & Durbin, 2010), *emotion control* refers to a narrower

subset of strategies that specifically focuses on an individuals' ability to harness control over his or her emotions. We note that the concept of emotion control is not new and has been previously discussed in the emotion literature (e.g., Tamir, John, Srivastava, & Gross, 2007).

In general, the ability to adaptively control one's emotions has been associated with beneficial health outcomes.[1] For example, greater self-reported control over emotions is linked to increased well-being and improved social adjustment (Tamir et al., 2007). Furthermore, an ability to control emotions through the process of reappraisal—cognitively construing a situation to alter its emotional impact—is associated with decreased emotion intensity (Gross, 1998; Ochsner & Gross, 2008) as well as improved interpersonal functioning and well-being (e.g., Gross & John, 2003). By contrast, having little or no control over one's emotions is associated with maladaptive mental health outcomes, such as increased symptoms of depression and anxiety. For example, decreased controllability over negative emotional experiences predicts increased depressive symptom severity (Alloy, Kelly, Mineka, & Clements, 1990; Brown & Siegel, 1988; Teasdale, 1983). Similarly, an experience of one's emotions as being uncontrollable is a core feature of anxiety disorders (i.e., feeling "out of control") and can further exacerbate existing anxiety symptomatology (e.g., Moser et al., 2007).

Although important, the majority of work has primarily focused on the relative controllability (or lack thereof) in negative emotion states, as noted above. Less work has examined consequences of positive emotional experiences perceived as uncontrollable versus controllable. Emerging work generally suggests that controllability over positive emotions—measured both as actively generating or increasing positive emotions as well as decreasing or dampening positive emotions—is associated with beneficial mental health outcomes (e.g., Folkman & Moskowitz, 2000; Gruber, Mauss, & Tamir, 2011; Tugade & Fredrickson, 2004). For example, self-reported positive emotion controllability in terms of generating positive emotions is associated with increased resiliency in the face of stressful life experiences (Block & Kremen, 1996), and the self-reported capacity to use strategies that help intensify positive emotions such as savoring is associated with increased optimism, life satisfaction, and self-esteem, and decreased hopelessness and depression (Bryant, 2003; Tugade & Fredrickson, 2004). Furthermore, those who self-report high ability to maintain positive emotional states show less physical illness in the face of stress (Goldman, Kraemer, & Salovey, 1996).

With these initial lines of evidence, there has been growing interest in testing implications of the capacity to control positive emotions among populations characterized with disrupted processing of positive emotions (e.g., Gruber, Mauss, & Tamir, 2011). This includes examining individuals characterized by a relative excess of positive emotions that are difficult to control (i.e., BD, Gruber, 2011) as well as individuals who experience a diminished ability to generate and/or maintain positive emotions (i.e., MDD; Rottenberg, Gross, & Gotlib, 2005; Sloan, Strauss, & Wisner, 2001). Investigating positive emotion control has important implications for isolating processes involved in the onset and maintenance of these disorders as well as ultimately refining therapeutic treatments. We now turn to evidence suggesting that positive emotion, and the ability to successfully harness it, is an important foci point in both BD and MDD.

Positive Emotion Control in BD

For many individuals the experience of heightened positive feelings is associated with beneficial mental, physical, and social health outcomes. However, individuals suffering from BD experience unusually heightened and intense positive feelings that are uncontrollable and associated with severe functional impairment, morbidity, and even mortality (e.g., American Psychiatric Association, 2000; Dilsaver, 2011). Indeed, a cardinal symptom of BD includes difficulties controlling intense and impairing positive emotions (e.g., Gruber, 2011; Johnson, Gruber & Eisner, 2007; Phillips, Ladoceur, & Drevets, 2008). For example, both BD patients and young adults at risk for developing BD reported sustained elevations in positive emotion following a happy mood induction compared to a healthy control group (Farmer et al., 2006) and continued to experience positive emotion across negative and even neutral contexts (Gruber, Johnson, Oveis, & Keltner, 2008; Gruber, Harvey, & Purcell, 2011). Furthermore, BD patients exhibit a tendency to passively dwell on, rather than actively exert control over, positive feelings compared to healthy controls (Gruber, Eidelman, Johnson, Smith, & Harvey, 2011; Johnson, McKenzie, & McMurrich, 2008). Even when using cognitive reframing strategies such as reappraisal, BD patients continued to exhibit elevations in positive affect (PA), positive thoughts, and heightened physiological responses (Gruber, Harvey, & Johnson, 2009). Neuroimaging data suggest mechanisms that may underlie this purported difficulty controlling positive emotion, including reduced gray matter volume in prefrontal cortex regions in BD (López-Larson, DelBello, Zimmerman, Schwiers, & Strakowski, 2002) and functional abnormalities within the ventromedial prefrontal cortical regions (e.g., Phillips et al., 2008). Both of these regions have been strongly implicated in cognitive control of emotion (Ochsner & Gross, 2008). Given a deficit in the ability to harness control over positive emotions in BD, cultivating the ability to control positive emotions is likely an important treatment target (e.g., Johnson, 2005; Robb, Cooke, Devins, Young, & Joffe, 1997).

Positive Emotion Control in MDD

A core symptom of MDD includes persistent experience of negative emotions (e.g., sadness) as well as trouble generating and/or maintaining positive emotions (e.g., anhedonia; American Psychiatric Association, 2000). With respect to negative emotions, a robust line of work indicates that those with MDD have difficulties controlling negative emotions. For example, concurrent and prospective depression severity is strongly associated with rumination, which involves uncontrollable negative thoughts and feelings (e.g., Nolen-Hoeksema, 1991). Depressed individuals also show disrupted negative emotion processing, such that they report flattened, less variable, and context-insensitive emotional reactiv-

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[1] We note that emotion controllability is not always adaptive. Specifically, suppression involves inhibiting or exerting control over outward displays of emotional behavior (Gross, 1998). Findings collectively indicate that controlling one's negative emotions by means of suppression can lead to diverse dysfunctional consequences. For example, Gross and John (2003) reported that suppression was associated with lesser positive emotion, greater negative emotion, worse interpersonal functioning, and lower well-being.

ity in response to films intended to induce sadness, fear, and amusement (Rottenberg, Kasch, Gross, & Gotlib, 2002). Neuro-imaging findings provide further evidence that those with MDD experience difficulty controlling negative emotions, indexed by sustained amygdala activity associated with processing emotion salience (Siegle, Thompson, Carter, Steinhauer, & Thase, 2007).

Although evidence points more clearly toward deficits in negative emotion control in MDD, less is known about the positive emotion control among MDD patients. This is important as current models of MDD specify core deficits in positive emotion that differentiate it from other forms of psychopathology, including anxiety (e.g., Kring & Bachorowski, 1999; Watson, Clark & Carey, 1998). Specifically, MDD patients tend to experience difficulty in generating, maintaining, and enhancing positive emotions over time (Garber, Braafladt, & Weiss, 1995; McMakin, Santiago, & Shirk, 2009) and report less happiness to positive film stimuli compared to a healthy control group (Rottenberg et al., 2005). In support of this view, neuroimaging data suggest that those with MDD failed to sustain activity within the nucleus accumbens, a region implicated in control of positive emotion, even when attempting to increase positive feelings (Heller et al., 2009). Depressed individuals also have impaired ability to enhance and sustain positive emotion through the process of savoring (e.g., Sloan et al., 2001). In sum, a converging line of evidence suggests that those with MDD may exhibit trouble controlling—generating, maintaining, or enhancing—positive emotions. However, no study to date has yet experimentally examined this thesis.

The Present Investigation

The present study experimentally investigated positive emotional experiences perceived as uncontrollable versus controllable across three groups: those with relative excesses of positive emotion (remitted BD), deficits in positive emotion (remitted MDD), and healthy adults (CTLs). We examined participants' emotional responses to memory recalls that involved emotion control. Using a within-subjects design, participants reflected on and described an autobiographical positive event across two counterbalanced conditions occurring at separate experimental sessions, referred to as the *Positive-Controllability* and *Positive-Uncontrollability* conditions. We chose this recall procedure given that it has been shown to be a reliable elicitor of feelings of personal control versus no control in prior studies that were successful in experimentally inducing a perceived sense of psychological controllability (Kay, Gaucher, Napier, Callan, & Laurin, 2008). We thus adapted this task to elicit feelings of emotion control (vs. no control) in the context of positive emotions. In the Positive-Controllability condition, participants recalled a positive autobiographical event in which they had control over their positive emotions. In the Positive-Uncontrollability condition, they recalled a positive autobiographical event in which they had no control over their positive emotions. After each memory recall, participants described the event in short sentences and reported their current emotional experience. Physiological responses were concurrently monitored during the experiment.

Manipulation Check

Given the novelty of investigating positive emotion controllability, we examined additional emotion-relevant variables that might uniquely differentiate the Positive-Controllability from the Positive-Uncontrollability condition beyond state-level differences in emotion responding during the experiment. Specifically, we examined three measures previously associated with positive emotion and differing degrees of emotion control. This included (a) cognitive reappraisal associated with high PA and high emotion control that involves the tendency to cognitively reconstrue a situation to alter its emotional impact using the reappraisal subscale of the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) with reappraisal subscale scores ranging from 6 to 42 ($\alpha = .84$); (b) suppression associated with low PA and high emotion control defined as the inhibition of outward displays of emotion using the suppression subscale of the ERQ with suppression subscale scores ranging from 4 to 28 ($\alpha = .79$); and (c) mindfulness associated with high PA and low emotion control defined as a state of nonjudgmental awareness of present moment stimuli (Jain et al., 2000; Kang, Gruber, & Gray, in press) using the total score from Five Facets of Mindfulness Scale (FFMQ; Baer, Smith, Hopkins, Krietemeyer, & Toney, 2006) with scores ranging from 86 to 225 ($\alpha = .83$). We examined the extent to which these three variables predicted differential subjective and physiological responses as a function of positive emotion controllability across the two experimental conditions.

Aim 1: Condition Differences in Controllable Versus Uncontrollable Positive Emotion

The first aim was to examine general differences in emotion response between the controllable versus uncontrollable positive emotion experiences. Across all participants, we predicted that the Positive-Controllability condition would be associated with increased PA and decreased negative affect (NA) as compared to the Positive-Uncontrollability condition, based on the premise that having little control over one's emotions is experienced as distressing (e.g., Moser et al., 2007; Teasdale, 1983). We also predicted that participants in the Positive-Controllability condition would exhibit greater reactivity in RSA ($RSA_{reactivity}$) reflecting increased efforts to exert regulatory control over their emotions, relative to the Positive-Uncontrollability condition. This hypothesis is based on findings that increased $RSA_{reactivity}$ is associated with within-person changes of regulatory efforts (e.g., Beauchaine, Gatzke-Kopp, & Mead, 2007; Butler, Wilhelm, & Gross, 2006; Thayer & Lane, 2000).

Aim 2: Group Differences in Emotion Response

The second aim was to examine group-related differences in emotion response across the two conditions. For the BD group, we predicted greater increases in emotion reactivity (i.e., increased PA and $RSA_{reactivity}$) across both conditions compared to the MDD and CTL groups. This is grounded in prior work indicating that BD patients show greater increases in PA in response to positive autobiographical memories (Gruber et al., 2009) and increases in RSA across different stimuli contexts (Gruber, 2011). For the MDD group, we predicted lower positive emotion and related physiological responses across both conditions relative to the BD and CTL groups. This was grounded in previous work that reported no increase in PA after a positive memory recall among remitted MDD individuals (Joormann, Siemer, & Gotlib, 2007).

Methods

Participants

Participants were recruited using online advertisement and fly-ers posted in mental health centers and surrounding communities. Participants were 32 individuals diagnosed with BD Type I, cur-rently remitted (neither manic nor depressed), 32 persons diag-nosed with MDD who were also remitted, and 31 healthy adults (CTLs) who did not meet current or past criteria for any *DSM–IV–TR* Axis I disorder. Remitted BD and MDD participants were selected to examine more trait-like patterns of emotion control independent of current mood phase. Exclusion criteria included history of severe head trauma, stroke, neurological disease, auto-immune disorder, or alcohol or substance abuse in the past 6 months. Demographic and clinical characteristics are listed in Table 1.

The average age at onset of illness for the BD group was 18.40 years ($SD = 6.31$) and average illness duration was 14.23 years ($SD = 9.87$). The average age at onset of illness for the MDD group was 16.09 years ($SD = 7.26$) and average illness duration was 15.34 years ($SD = 10.37$). The lifetime average of manic/hypomanic episodes for BD participants was 9.50 ($SD = 17.19$). The lifetime average of major depressive episodes was 12.39 ($SD = 17.48$) for the BD group and 5.47 ($SD = 7.35$) for the MDD group. The frequency of mania (lifetime manic episodes/illness duration) was 1.20 ($SD = 1.22$) for the BD group. The frequency of depression (lifetime depressive episodes/illness duration) was 1.11 ($SD = 1.14$) for the BD group and 0.42 ($SD = 0.43$) for the MDD group. For the BD group, the average number of psycho-tropic medications was 2.0 ($SD = 1.52$) and included anticonvul-sants ($n = 13$), lithium ($n = 11$), neuroleptics ($n = 11$), anxiolytics ($n = 8$), stimulant ($n = 4$), antidepressants ($n = 3$), and sedative-hypnotics ($n = 2$). For the MDD group, the average number of psychotropic medications was 0.53 ($SD = 0.84$) and included antidepressants ($n = 10$), anxiolytics ($n = 3$), anticonvulsants ($n = 2$), and neuroleptics ($n = 1$).

Neither BD nor MDD groups were excluded on the basis of comorbid disorders (aside from substance or alcohol abuse disor-ders) given that both BD and MDD are commonly comorbid with other disorders. BD participants had an average of 0.53 ($SD = 0.84$) current comorbidities including specific phobia ($n = 5$), generalized anxiety disorder ($n = 3$), obsessive–compulsive dis-order ($n = 3$), social phobia ($n = 3$), agoraphobia ($n = 1$), hypochondriasis ($n = 1$), and panic disorder ($n = 1$). MDD participants had an average of 0.66 ($SD = 0.97$) current comor-bidities including social phobia ($n = 7$), generalized anxiety dis-order ($n = 5$), specific phobia ($n = 4$), panic disorder ($n = 2$), agoraphobia ($n = 1$), binge eating disorder ($n = 1$), and obsessive–compulsive disorder ($n = 1$). The CTL group did not meet criteria for any current or lifetime Axis I disorders.

Measures of Clinical Functioning

Diagnostic evaluation. Diagnoses of BD, MDD, and CTL were confirmed using the Structured Clinical Interview for *DSM–IV* (SCID-IV; First, Spitzer, Gibbon, & Williams, 2007). Trained clinical psychology faculty, psychology doctoral candi-dates, or postbaccalaureate research fellows administered the SCID-IV. One-third ($n = 29$; 30.53%) of videotaped interviews were rated by another reviewer, and ratings matched 100% ($\kappa = 1.0$) of primary diagnoses.

Mood symptoms. Current symptoms of mania were measured using the Young Mania Rating Scale (YMRS; Young, Biggs, Ziegler, & Meyer, 1978), an 11-item, clinician-rated measure of current manic symptoms with scores ranging from 0 to 60, with scores ≥ 7 represent clinically significant symptoms. Current symptoms of depression were measured using the Inventory of Depressive Symptomatology (IDS-C; Rush, Gullion, Basco, Jar-rett, & Trivedi, 1996). The IDS-C is a 30-item, clinician-rated measure of current depressive symptoms with scores ranging from 0 to 84, with scores ≥ 11 represent clinically significant symptoms. Intraclass correlations (ICCs) for absolute agreement for a subset of participants ($n = 23$; 24.21%) were strong for the YMRS (0.98) and IDS-C (0.98).

Current remitted mood status (i.e., neither manic, depressed, nor mixed mood state) for all groups was verified according to SCID-IV criteria and cutoff scores on the YMRS (≤ 7), and IDS-C (≤ 11). The CTL group also scored below these cutoffs.

Table 1

Demographic and Clinical Characteristics

Characteristic	BD ($n = 32$)	MDD ($n = 32$)	CTL ($n = 31$)	Statistic
Demographic				
Age (years)	30.81 (9.61)	31.47 (11.05)	32.10 (9.25)	$F = 0.12$
Female (%)	65.6%	65.6%	64.5%	$\chi^2 = 0.01$
Caucasian (%)	90.6%	90.6%	90.3%	$\chi^2 = 6.47$
Education (years)	15.08 (2.21)	15.16 (2.23)	15.95 (2.37)	$F = 1.39$
Employed (%)	46.9%	50.1%	64.5%	$\chi^2 = 12.39$
Living alone (%)	21.9%	12.5%	16.1%	$\chi^2 = 7.60$
Clinical				
YMRS	1.85 (1.73)	1.63 (1.38)	1.17 (1.17)	$F = 1.73$
IDS-C	4.98 (3.05)	5.43 (2.43)	2.18 (1.85)	$F = 15.41$[a,b]
GAF	75.78 (5.91)	79.03 (6.82)	87.74 (3.40)	$F = 38.44$[a,b]

Note. BD = bipolar disorder group; MDD = major depressive disorder group; CTL = healthy control group; YMRS = Young Mania Rating Scale; IDS-C = Inventory to Diagnose Depression; GAF = Global Assessment of Functioning. Mean values are displayed with standard deviations in parentheses where applicable.
[a] $p < .05$ for BD and CTL. [b] $p < .05$ for MDD and CTL.

Global functioning. The Global Assessment of Functioning Scale (GAF; Luborsky, 1962) was used to assess general functioning in the past week. The GAF assesses overall psychological, social, and occupational functioning on a scale from 1 (*lowest level of functioning*) to 100 (*highest level of functioning*). ICCs for a subset of study participants ($n = 11$; 11.56%) was high (= 0.94).

Multi-Method Measurement of Emotion Response

A multimethod approach was used to measure emotion at experiential and physiological levels of analysis. These data were assessed across four periods: two baseline periods (60 s each, one preceding each separate experimental condition) and an experimental condition for the Positive-Controllability and Positive-Uncontrollability conditions.

PA and NA. Self-reported PA and NA during the experiment were assessed using the modified Differential Emotion Scale (mDES; Cohn, Fredrickson, Brown, Mikels, & Conway, 2009) consisting of 18 individual positive (amusement, awe, compassion, contentment, gratitude, hope, interest, joy, love, pride) and negative (anger, contempt, disgust, embarrassment, fear, guilt, sadness, shame) emotion terms rated on a 1 (*not at all*) to 5 (*extremely*). From this mean PA and NA composites were created. Internal consistency scores across the experiment for PA ($\alpha_{mean} = 0.91$; $\alpha_{range} = 0.90–0.92$) and NA ($\alpha_{mean} = 0.86$; $\alpha_{range} = 0.84–0.87$) were high.

Physiology. Physiological data were recorded continuously at 100 kz using a MindWare multichannel chassis device (BioNex 50–3711-08 MindWare Technologies, Gahanna, OH). Physiological data were acquired and analyzed with MindWare v3.0 software. A transistor–transistor logic digital signal automatically enabled the synchronization of physiological data with the onset of the different experimental periods. Artifacts and recording errors were corrected offline and values more or less than 3.0 standard deviations were deemed outliers and Winsorized (reassigned a value at the next highest or lowest value that was not an outlier: <2% of data).

Cardiovascular arousal. Any single physiology channel can contain ample individual errors making it either difficult to interpret in isolation or detect subtle physiological system changes (e.g., Fredrickson & Levenson, 1998). To avoid this issue, we computed a general cardiovascular arousal composite to measure arousal levels, which may reflect general degrees of physiological tension. Following standard convention (e.g., Gross & Levenson, 1997), five channels were selected to provide a broad index of the activity in cardiovascular and electrodermal systems important to emotional responding. A composite was computed using these five channels separately for each experimental period by averaging the standardized (*z*-scored) values across each of the five channels noted below with signs changed as appropriate so that larger *z*-scores reflect greater cardiovascular arousal.

Interbeat interval (IBI). Heart rate is influenced by both sympathetic and parasympathetic branches of the autonomic nervous system and was assessed as a general index of cardiovascular activity. Electrocardiograph (ECG) recordings were obtained with two prejelled Ag-AgCl snap disposable vinyl electrodes placed in a modified Lead II configuration. A MindWare ECG amplifier, using a bandpass filter of 0.5 Hz to 100 Hz (high cutoff with a 60 Hz notch filter), was used and the ECG signal was converted to R-wave intervals to the nearest millisecond. IBI was calculated as the time between successive R-peaks of the ECG in milliseconds. Lower IBI values reflect a faster heart rate.

Skin Conductance Level (SCL). Absolute SCL was assessed using a MindWare GSC100C amplifier maintaining a constant voltage of 0.5v between two 38.1 × 25.4 mm Ag-AgCl pregelled isotonic (1% NaCl) electrodes placed on the thenar and hypothenar eminence of the nondominant palm. Greater sympathetic activation is associated with higher SCL values (e.g., Dawson, Schell, & Filion, 2000).

Skin Temperature (SKT). Participants' SKT was measured by a thermistor attached using tape to the distal phalanx of the pinky finger of the nondominant hand. The voltage was automatically translated into continuous degrees in Fahrenheit. Greater sympathetic activation leads to decrease in diameter of blood vessels at the fingertip, and lower SKT values.

Finger Pulse Transit Time (FPTT) and Finger Pulse Amplitude (FPA). FPTT and FPA are influenced by the contractile force of the heart in conjunction with the distensibility of the blood vessels that are mediated by the sympathetic nervous system (Fredrickson & Levenson, 1998; Mauss, Levenson, McCater, Wilhelm, & Gross, 2005). An infrared photoelectric pulse plethysmograph was attached to the participant's distal phalanx of the index finger of the nondominant hand. FPTT was derived as the time interval, in milliseconds, elapsed between the closest previous R-wave on the ECG and the upstroke of the pulse pressure wave at the fingertip. FPA indexes the blood volume in the fingertip, measured as the trough-to-peak amplitude of each finger pulse. Smaller FPTT and FPA values reflect greater sympathetic activation.

Respiratory Sinus Arrhythmia Reactivity (RSA$_{reactivity}$). In addition to a gross cardiovascular arousal composite, we examined RSA$_{reactivity}$ individually as a noninvasive index of cardiac vagal tone, or parasympathetic nervous activity (e.g., Grossman & Taylor, 2007). This was particularly important given the emerging link between RSA$_{reactivity}$ and emotion regulation or control (e.g., Butler et al., 2006; Thayer & Lane, 2000). RSA was derived from a power spectral analysis of the high frequency band of heart rate (0.12–0.40 Hz; Berntson et al., 1997). Specifically, the ECG signal was digitized (1,000 Hz), an IBI series was derived, and artifacts were identified and edited (Berntson, Quigley, Jang, & Boysen, 1990). A 4-Hz (250 ms) time series was then derived by interpolation, and the series was detrended by the second-order polynomial to minimize nonstationaries in the data. The residual series was then tapered with a Hamming window, and a Fast-Fourier Transform was applied to the resampled R-R intervals.

Manipulation Checks

We examined five manipulation check items. First, we checked whether participants underwent qualitatively different emotional states during the Positive-Controllability versus Positive-Uncontrollability conditions by assessing how their trait emotion control strategies are associated with their self-report PA in each condition, separately. Two baseline self-report measures of trait emotion regulation were used, including ERQ and FFMQ. ERQ measures participants' trait emotion regulation tendency, assessing the typical use of emotion suppression (four items, e.g., "I keep my emotions to myself") versus reappraisal (six items, e.g.,

"I control my emotions by changing the way I think about the situation I'm in") on a 1 (*strongly disagree*) to 7 (*strongly agree*) scale. FFMQ measures five factors of mindfulness: observing (eight items), describing (eight items), acting with awareness (eight items), nonjudging (eight items), and nonreacting (seven items), on a 1 (*never or very rarely true*) to 5 (*very often or always true*) scale. The five factors form a global mindfulness score.

Third, to ensure no group difference in recency of the event recalled participants rated the recency of the recalled positive event at the end of both conditions (1 = *1 day ago;* 2 = *in the past week;* 3 = *in the past 2 weeks;* 4 = *in the past month;* 5 = *in the past 2 months;* 6 = *in the past 3 months;* and 7 = *more than 3 months ago*). Fourth, to ensure no group differences in the intensity of memory recall, participants rated the intensity of the recalled event on a 1 (*not at all*) to 7 (*extremely*) scale. Fifth, participants provided a brief description of the event in no more than 100 words used to examine whether there were group differences in memory content. Two coders blind to diagnostic status coded the essays along four dimensions including (adapted from Gruber, Harvey, & Purcell, 2011): (a) two items for positive and negative valence, rated on a 1 (*not at all*) to 5 (*extremely*) scale; (b) six items coded for themes in the descriptions rated dichotomously (yes or no) including social interaction (family and friends), job or money-related, romantic or sexual interaction, outdoors or recreation, accomplishment, or good news about another person; (c) three memory characteristics relevant to mood disorders were coded on a 1 (*not at all*) to 5 (*extremely*) scale, including the degree to which the memory was goal-oriented, self-focused, or other(s)-focused.

Potential Confounds

We examined the role of three potential confounds on our observed results, including trait emotion controllability, state emotion controllability, and current symptom levels. For trait emotion controllability, we examined responses from the Implicit Theory of Emotion Scale (ITES; Tamir et al., 2007) and examined how ITES scores influenced emotion response during the experiment. The ITES has four items assessing control ("If they want to, people can change the emotions") versus no control ("The truth is, people have very little control over their emotions") beliefs about emotion on a 1 (*strongly disagree*) to 5 (*strongly agree*) scale to create a single composite score ($\alpha = .79$ in present study).

For state emotion controllability, two question items were used to measure the degree to which participants believed they had control over their current positive emotions ("Right now, I have complete control over my positive feelings") and negative emotions ("Right now, I have complete control over my negative feelings") during the experiment on a 1 (*strongly disagree*) to 7 (*strongly agree*) scale.

For the descriptions of current symptoms assessment, we assessed current symptoms of depression and mania, described above.

Procedure

After obtaining informed consents, trained clinical psychology faculty, graduate students, or postbaccalaureate researchers administered the SCID-IV, YMRS, and IDS-C. Physiological sensors were first attached in a private room, and participants were then escorted to a 6′ × 7′ copper-shielded individual testing room where they were seated in front of a 26–in. monitor. Participants were oriented to the task verbally by the experimenter and were self-guided through the experiment using computerized software (MediaLab v2008, MediaLab, Inc., Atlanta, GA). Using a within-subjects design, participants completed both the Positive-Controllability and Positive-Uncontrollability conditions. The two conditions were completed at separate experimental sessions in a counterbalanced order. The two visits were spaced approximately 1 week apart ($M = 8.17$ days, $SD = 3.52$) to avoid potential carryover effects. At the beginning of each condition, a resting baseline recording (60 s) was acquired, and participants read the following message on the computer screen: "Please sit still and relax for the next 60 seconds." Next, participants completed either the Positive-Controllability or Positive-Uncontrollability induction task (adapted from Kay et al., 2008). For the Positive-Controllability condition, participants were asked to recall a recent positive event during which they had control over their emotions following instructions on a computer screen: "Please try and think of a positive event in which you had absolute control over your emotions that happened to you in the past couple months." For the Positive-Uncontrollability condition, participants were asked to recall a recent positive event during which they had no control over their positive emotions again following instructions on a computer screen: "Please try and think of a positive event in which you had absolutely no control over your emotions that happened to you in the past couple months." Participants were first told to identify the event, and then were asked to remain seated for 60 s and vividly recall the event while concurrent physiological measurements were obtained. After the 60 s ended, participants provided a brief description of the event in no more than 100 words using the keyboard, reported current PA and NA, and completed several manipulation check items. Once finished, participants were debriefed and paid for their participation.

Results

Demographic and Clinical Characteristics

As seen in Table 1, BD, MDD, and CTL participants did not significantly differ with respect to age, gender, ethnicity, or education ($ps > 0.25$). All groups scored well below standardized cutoffs on the YMRS (≤ 7) and IDS-C (≤ 11) and did not differ in YMRS scores ($ps > 0.07$). The BD and MDD groups did score significantly higher on the IDS-C than the CTL group ($ps < 0.01$). As expected, the CTL group scored higher on general functioning (GAF) than both the BD and MDD groups ($ps < 0.01$).

Preliminary Analyses

First, we examined skewness and kurtosis indices of all four dependent variables (PA, NA, physiological composite, and $RSA_{reactivity}$). One variable (i.e., NA) was leptokurtic and positively skewed, and attempts were made to normalize the data using a square root transformation (nontransformed data are presented for ease of interpretation). Second, repeated-measures analyses of variance (ANOVAs) revealed no significant effect of Group, Condition, or Group × Condition interaction in the recency and

intensity ratings of the positive event recalled ($ps > 0.05$). Third, we examined differences in the content of the event descriptions provided by participants. To do this, we computed interrater reliability for the content of essays coded by two independent coders. Interrater reliability estimates were strong ($\kappa_{mean} = 0.90$, $\kappa_{range} = 0.75$–1.00; $ICC_{mean} = 0.94$, $ICC_{range} = 0.88$–0.97), and average scores between both coders were used in the final analyses. An example of an Uncontrollable positive event includes "I was recording my band's new CD and a wave of positive emotion came over me. This was last Thursday and I have been on top of the world since," and an example essay of a Controllable positive event from the same participant was "I got a 100 on an important exam. I was so happy but not so happy that I wasn't out of control." Results indicated no group or condition differences for any of these event type codes and the positive valence of the content of the essay across the conditions ($ps > 0.05$). Lastly, no main effects emerged for order ($ps > .20$) or gender ($ps > 0.05$).

Manipulation Check

We computed bivariate correlations between the three individual difference measures (reappraisal, suppression, mindfulness) and our four emotion response variables (PA, NA, cardiovascular arousal, and RSA) separately for the Positive-Controllability and Positive-Uncontrollability conditions. Reappraisal was associated with increased PA during the Positive-Controllability ($r = .31$) and Positive-Uncontrollability ($r = .31$) conditions ($ps < .01$). Suppression was significantly associated with decreased PA for the Positive-Controllability ($r = -0.33$, $p < .01$) but not the Positive-Uncontrollability ($r = -0.13$, $p = .20$) condition. Mindfulness was associated with increased PA for the Positive-Controllability ($r = .49$, $p < .001$) but not the Positive-Uncontrollability ($r = .17$, $p = .10$) condition. No associations emerged for NA, cardiovascular arousal, or RSA, pointing to unique specificity between these measures and PA especially for during the Positive-Controllability condition.

Overview of Main Analyses

Four separate 2 (Condition: Positive-Controllability, Positive-Uncontrollability) × 3 (Group: BD, MDD, CTL) repeated-measures analyses of co)ariance (ANCOVAs) were conducted for each of the two behavioral and two physiological dependent variables. All physiology data were controlled for baseline by entering the mean of two 60-s resting period recordings that preceded each Positive-Controllability and Positive-Uncontrollability condition as a covariate. A Greenhouse-Geisser correction was used when assumptions for sphericity were not met and adjusted F and p values are reported. Effect sizes for significant results are reported as partial eta squared (η_p^2). All reported p values are two-tailed. Means and standard deviations are presented in Table 2.

Aims 1–2: Condition and Group Differences

PA. For PA, there was no significant main effect of Condition, $F(1, 88) = 0.01$, $p = .93$, $\eta_p^2 = 0.00$; and Group, $F(2, 88) = 0.95$, $p = .39$, $\eta_p^2 = 0.02$. However, the Group × Condition interaction was significant, $F(2, 88) = 5.70$, $p < .01$, $\eta_p^2 = 0.12$. To identify the source of the Condition × Group interaction, three separate one-way ANOVAs were run for each group to compare the Positive-Controllability versus Positive-Uncontrollability conditions. Results indicated that the MDD group reported decreased PA in the Positive-Controllability ($M = 2.80$, $SD = 0.90$) compared to the Positive-Uncontrollability ($M = 3.20$, $SD = 0.87$) condition, $F(1, 29) = 8.16$, $p < .01$, $\eta_p^2 = 0.22$. The BD and CTL group did not significantly differ in PA across the two conditions ($ps > 0.05$).

NA. For NA, there was no significant main effect of Condition, $F(1, 88) = 0.02$, $p = .89$, $\eta_p^2 = 0.00$; Group, $F(2, 88) = 1.07$, $p = .35$, $\eta_p^2 = 0.02$; or a significant Condition × Group interaction, $F(2, 88) = 2.10$, $p = .13$, $\eta_p^2 = 0.05$.

Cardiovascular Arousal. For the cardiovascular arousal, there was no significant main effect of Condition, $F(1, 85) = 0.06$, $p = .81$, $\eta_p^2 = 0.00$; or Group, $F(2, 85) = 1.70$, $p = .19$, $\eta_p^2 = 0.04$. There was, however, a higher-order Condition × Group interaction, $F(2, 85) = 3.53$, $p < .05$, $\eta_p^2 = 0.08$. To identify the source of this interaction, three separate one-way ANCOVAs were run for each group. Results indicated that the MDD group exhibited greater cardiovascular arousal in the Positive-Controllability ($M = 0.14$, $SD = 0.58$) compared to the Positive-Uncontrollability ($M = $

Table 2

Mean and Standard Deviation for Emotion Response and Emotion Control Variables Across All Participants

	Group	Positive-Controllability	Positive-Uncontrollability	Statistic
PA	BD	2.89 (0.86)	2.75 (0.75)	$F = 0.91$
	MDD	2.80 (0.90)	3.20 (0.87)	$F = 8.16^*$
	CTL	3.23 (0.93)	2.95 (0.93)	$F = 3.13$
NA	BD	1.26 (0.39)	1.16 (0.25)	$F = 2.13$
	MDD	1.31 (0.51)	1.24 (0.52)	$F = 0.27$
	CTL	1.09 (0.23)	1.23 (0.50)	$F = 3.00$
Cardiovascular arousal	BD	−0.02 (0.46)	0.05 (0.42)	$F = 0.62$
	MDD	0.14 (0.58)	−0.07 (0.46)	$F = 5.28^*$
	CTL	−0.09 (0.44)	0.01 (0.40)	$F = 1.09$
RSA	BD	6.00 (1.80)	5.80 (1.91)	$F = 0.00$
	MDD	6.23 (1.04)	6.02 (1.04)	$F = 4.63^*$
	CTL	6.09 (1.27)	5.85 (1.46)	$F = 6.36^*$

Note. BD = bipolar disorder group; MDD = major depressive disorder group; CTL = healthy control group; PA = positive affect; NA = negative affect; Cardiovascular Arousal = Computed using mean of z-scores across the following channels: interbeat-interval, skin conductance level, skin temperature, finger pulse transit time, and finger pulse amplitude; RSA = respiratory sinus arrhythmia. Mean values are displayed with standard deviations in parentheses where applicable, and all scores were controlled for the baseline.
* $p < .05$.

−0.07, $SD = 0.46$) condition, $F(1, 28) = 5.28$, $p < .05$, $\eta_p^2 = 0.16$. The BD and CTL group did not significantly differ in cardiovascular arousal across the two conditions ($ps > 0.30$).

RSA. For RSA, there was a main effect of Condition, $F(1, 80) = 5.26$, $p < .05$, $\eta_p^2 = 0.06$. There was no significant main effect of Group, $F(2, 80) = 0.08$, $p = .92$, $\eta_p^2 = 0.00$, or a Condition × Group interaction, $F(2, 80) = 0.02$, $p = .98$, $\eta_p^2 = 0.00$. For the Condition main effect, pairwise-comparisons indicated that all participants exhibited increased $RSA_{reactivity}$ during the Positive-Controllability ($M = 6.11$, $SD = 1.38$) compared to the Positive-Uncontrollability ($M = 5.89$, $SD = 1.67$) condition.

Secondary Analyses: Potential Confounds

We reran all analyses covarying for the three potential confounds described earlier: trait emotion controllability, state emotion controllability, and current symptoms. First, for trait emotion controllability, we reran all analyses controlling for the ITES score and no results changed. Second, for state emotion controllability, scores and all results remained significant with the exception of one result that became marginally significant: for the RSA measure, the Condition main effect was no longer significant, $F(1, 79) = 3.70$, $p = .06$, $\eta_p^2 = 0.05$. Finally, given observed group differences in subsyndromal levels of depression symptoms (see Table 1), we explored the possibility of rerunning analyses controlling for current symptoms of depression (IDS-C). We note that results largely remained parallel with the exception of one result, which remained trending in the same direction; that is, for the cardiovascular arousal, the Condition × Group interaction, $F(2, 83) = 1.69$, $p = .19$, $\eta_p^2 = 0.04$.

Discussion

Having control over emotions is generally desirable and is associated with greater well-being and adaptive coping. However, most work on this topic has been on negative emotion control, with little focus on positive emotion control. Given the potentially important implications associated with the ability to rein in positive emotions (Gruber, Mauss, & Tamir, 2011), the present study examined the effect of perceived recollection of having control over one's emotions in a positive event on subsequent emotional experience among three different groups, including individuals characterized by relative excesses (BD), relative deficits (MDD), and normative degrees (CTL) of positive emotion. To our knowledge, the current study is the first to experimentally examine positive emotion control along a range of positive emotional backgrounds using both healthy and specialized psychiatric groups.

Manipulation Checks: Distinctiveness of Positive Emotion Un/Controllability

Consistent with previous findings, in the Positive-Controllability condition, trait suppression and mindfulness predicted decreased and increased PA, respectively. However in the Positive-Uncontrollability condition, such association disappeared. We suggest that usual emotion control strategies and associated emotional outcomes may not be applicable in positive emotional states that are uncontrollable. This result suggests that our manip-

ulation was successful, and participants underwent distinctive experiential states during the two experimental conditions.

Aim 1: Condition Differences in Controllable Versus Uncontrollable Positive Emotion

The first hypothesis focused on the general differences in emotion response as a function of positive emotion control across all participants. We predicted that across all groups, recalling a positive event that involved control over one's emotions would result in increased PA, decreased NA, and increased $RSA_{reactivity}$. Inconsistent with this prediction, we did not find any condition-related differences in subjective reports of either PA or NA. Recalling positive events, regardless of whether they are controllable or not, did not seem to differentially affect the magnitude to which the positive emotions were consciously experienced.

Consistent with this prediction, we did find that participants exhibited increased $RSA_{reactivity}$ during the Positive-Controllability compared to the Positive-Uncontrollability condition. We interpreted these results to suggest that our manipulation was successful in eliciting predicted physiological responses; namely, that increased $RSA_{reactivity}$ may reflect increased psychological effort associated with recalling an event that in itself involved exerting control over one's positive emotions.[2] This potential interpretation is consistent with prior work in young adults associating greater $RSA_{reactivity}$ with increased emotion control/regulation effort (Butler et al., 2006). Our findings extend this literature by suggesting that perhaps even merely recalling—and not directly experiencing—an event that involved exerting control over one's emotions may evoke concurrent physiological responses innervated by the vagus nerve system. We suggest that, responding to an event in which you exert a degree of control may involve more regulated and constrained affective processes whereas responding to a positive event without emotion control may involve more reactive and unconstrained patterns of affective processes. These findings shed important insights alongside parallel work associating resting or tonic RSA with increased positive emotion, by contrast (e.g., Kok & Fredrickson, 2010; Oveis et al., 2009). Taken together, the present study contributes to a growing literature suggesting distinct but complementary functions of tonic versus phasic RSA (e.g., Beauchaine et al., 2007; Thayer & Lane, 2000). Specifically, it is feasible that resting RSA may index more baseline affective dispositions, whereas more stimuli-sensitive shifts in $RSA_{reactivity}$ may instead reflect the ability to adaptively regulate and respond to emotional events in the environment. Therefore, an interesting future avenue would be to test the association between baseline RSA and emotion controllability.

Aim 2: Group Differences in Emotion Response

The second hypothesis examined more specific group-related differences in emotion response as a function of positive emotion control. We predicted that the BD group would show greater

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[2] Previous work also associates resting RSA with positive emotion (e.g., Kok & Fredrickson, 2010; Oveis et al., 2009). However, it is unlikely that increased $RSA_{reactivity}$ in the Positive-Controllability condition reflects subjective PA alone, given a lack of significant associations between PA with $RSA_{reactivity}$ in either of the two conditions ($ps > .05$)."

increases in PA and RSA_reactivity across both conditions compared to the MDD and CTL groups. Contrary to this prediction, the BD group did not differ in PA or RSA_reactivity compared to both MDD and CTL groups. This is in contrast with prior work that has reported greater self-reported positive emotion in BD in response to autobiographical positive memories compared to a healthy adult group (Gruber et al., 2009) and across stimuli contexts more generally in interepisode BD (Gruber, 2011; Gruber, Harvey, & Purcell, 2011). We suggest that for BD patients with a history of uncontrollably heightened positive emotions that led to damaging consequences, recalling a positive event, specifically in the context of whether they had control or no control, may invoke complex sets of mixed emotions, including feelings of remorse or guilt (especially in the context of manic episodes) that may have dampened the general positive emotions, compared to prior work involving simply recalling a positive memory or watching a pleasant film.

For the MDD group, we predicted that this group would report lower PA relative to the BD and CTL groups across conditions. Surprisingly however, a unique pattern of findings emerged, such that only the MDD group reported greater PA in the Positive-Uncontrollability condition compared to the Positive-Controllability condition. Interestingly, the MDD group also exhibited decreased cardiovascular arousal during the Positive-Uncontrollability condition as well. This suggests that times of unbridled positive emotions may actually be a source of pleasure—and decreased arousal or even relaxation—for the MDD group that is otherwise characterized by an anhedonic emotional landscape (American Psychiatric Association, 2000). This result is particularly compelling given prior work demonstrating that positive memory recall did not increase positive mood among remitted depressed individuals (Joormann et al., 2007). Our work suggests, by contrast, that autobiographical recall procedures can increase positive feelings in a depressed sample, but that it may be only under conditions when specifically recalling more unrestrained positive experiences. Those with MDD show a general dearth of positive emotional experiences (Pizzagalli, Iosifescu, Hallett, Ratner, & Fava, 2008; Sloan et al., 2001), and the experience of a positive event—especially an uncontrolled one—may present novel and hence pleasurable experience for MDD patients who exhibit an otherwise restricted affective landscape (e.g., Rottenberg et al., 2005).

This finding has potential implications for psychosocial interventions in MDD, especially given that interventions that aim at cultivating positive emotions tend to be more effective for individuals with greater depressive symptomatology than for nondepressed populations (Sin & Lyubomirsky, 2009). For example, cognitive–behavioral therapy often uses techniques that typically train depressed individuals to schedule positive activities, such as doing homework to improve mood (e.g., Lewinsohn, Sullivan, & Grosscup, 1980). Training the ability to control positive emotions, however, may not be beneficial for depression, and the increased focus on attaining positive emotion may lead to the paradoxical effect of decreasing or preventing increases in positive emotion (Mauss, Tamir, Anderson, & Savino, 2011). In sum, this suggests that although most individuals may prefer events—even positive—that they experience control over, for those with MDD this may actually impede the ability to experience positive feelings.

Limitations and Future Directions

Findings from the present study should be interpreted within the confines of several limitations. First, emotion control was self-defined by the participants in this study, so we cannot know precisely how successful people actually were in controlling their emotions in the recalled events. It is possible that emotion control may be anchored differently in healthy groups versus those with a history of severe psychiatric disability, so future work should aim to more carefully isolate and quantify the construct of emotion control. Future work using narrative methodologies would be helpful to better understand the different meanings ascribed to emotion control among different types of individuals or groups. Second, we did not assess specific types of emotion control, such as savoring versus reappraisal, as well as how motivated participants were to increase or decrease these emotions. Third, although the recall task was based on a previously validated paradigm by Kay and colleagues (2008), it is still possible that participants may have engaged partially in unrelated mental activities during this period. Future autobiographical imagery studies should also assess unrelated mental activities, such as mind wandering, that might influence obtained results. Fourth, different degrees of difficulty might have been associated with recalling controllable versus uncontrollable events, which could confound the RSA_reactivity findings that are associated with regulatory effort. Future studies using RSA_reactivity in the context of emotion control should also assess the difficulty associated with each recall task. Fifth, the present study included a relatively brief laboratory induction of emotional states and associated physiological parameters. Future work examining whether such findings extent to longer-lasting mood states is important as well as inclusion of longer time durations for physiological measures such as RSA (Berntson et al., 1997). Sixth, although we note that respiration and depth, which might affect RSA_reactivity, were not measured using traditional respiration transducer methodologies. As such, it is possible that additional error variance may be present in the obtained data (e.g., Grossman & Taylor, 2007; Oveis et al., 2009; though see Houtveen, Rietveld, & De Geus, 2002). Therefore, future studies are warranted to carefully assess respiration parameters when examining RSA_reactivity. Seventh, we note that one of the study results no longer reached conventional levels of significance when current subsyndromal symptoms of depression were controlled for. We suggest these secondary results be interpreted with caution given that controlling for current symptoms to minimize between-groups variability violates important statistical assumptions (e.g., Miller & Chapman, 2001). Instead, we suggest future studies compare participants who score high and low on symptom measures to examine the relative influence of symptoms on emotional reactivity. Eighth, BD and MDD participants were not excluded on the basis of comorbidities to obtain ecologically valid populations, so future studies are warranted to examine how the presence of specific comorbidities interacts with BD and MDD to predict emotion response. Finally, given the possible confound of psychotropic medication, future studies with random assignment to different medication classes are warranted.

Conclusion and Implications

In the field of emotion literature, the ability to have control over negative emotions has been extensively studied. However, less is

known about the ability to control positive emotions. The present study is the first to examine the implications of positive emotion control among healthy and emotion disordered individuals. Consistent with the previous work, recalling affective experiences perceived as uncontrollable—even pleasant ones—were associated with lower physiological indices of regulatory effort (i.e., RSA$_{reactivity}$). Such unrestrained affective regulatory processes resulted in differential emotional experiences in individuals with depression. Unlike for those with BD or healthy CTLs, positive events without control appeared to be a source of pleasure for the MDD group. These findings suggest that harnessing positive emotion—or experiencing it as controllable—may be beneficial for most and correlate with physiological indicators of regulatory control. However, for those with a history of depression the most pleasure may be reaped from experiences that are uncontrollable and spontaneous, which may mark a departure from an otherwise blunted affective landscape. Indeed, emotion controllability is a complex construct, and individual difference factors including emotional history should be carefully considered.

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