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A Cross-Methodological Investigation of Emotional Reactivity in Major Depression

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by

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DEDICATION

I dedicate this work to my mother, Maria Panica, who has taught me that no challenge is big enough, no obstacle is large enough. I also dedicate this work to my patients who have taught me about the true struggles of depression and have inspired the highest appreciation for the importance of research in this area.

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ABSTRACT

Major depressive disorder (MDD) is primarily characterized by prevalent sadness and anhedonia. Laboratory studies find that depression is characterized by reduced reactivity across emotional contexts, while a few studies using naturalistic designs find that depressed people show normative reactivity to negative life events and mood brightening in response to positive events. The current study was an investigation of emotional reactivity in depression through the use of experimental and naturalistic designs. This allowed for an investigation of sources of lab-life discrepancies in emotional functioning in depression, including negative affect (NA) regulation. We examined experiential reactivity across contexts and types of stimuli in 41 currently depressed (MDD) and 33 healthy controls. Results showed that overall, our groups were largely indistinguishable in NA and PA reactivity magnitude across contexts and types of stimuli, with some exceptions. When looking at sadness reactivity specifically, despite higher sadness at baseline, MDDs reported in the lab similar decreases in sadness to a humorous film as controls. In daily life, MDDs reported larger decreases in sadness in response to positive daily events, yet indistinguishable reactivity to a structured humorous film relative to controls. Analyses using HLM showed that NA response to the happy film in the acceptance condition was marginally predictive of overall NA in daily life but not of NA reactivity to positive events. Findings suggest group differences in emotional reactivity vary across contexts and stimuli, however these variations are dependent on specificity of emotion. Current results possibly highlight increased flexibility during experience of positive events in daily life in depression.

Acceptance of NA may have implications for the experience of overall negative mood in depression.

CHAPTER ONE:

INTRODUCTION

MDD is a devastating mood disorder, primarily characterized by affective dysfunction, such as prevalent negative mood (i.e., sadness) and decreased positive mood (i.e., anhedonia) (APA, 2000). Depression is highly prevalent, especially among women (10-25%), and is predicted to become the leading cause of disability by 2030 (WHO, 2011). Despite the centrality of affective dysfunction to depression, we continue to have an incomplete understanding of how depression influences emotional functioning.

Emotions are described as short lived, multi-system responses (i.e., experience, physiology, behavior, cognition) to meaningful cues in the environment. From a functionalist perspective, these changes are meaningful in that they regulate an individual's response to the external environment (Keltner & Gross, 1999) in preparation to respond to threats and opportunities (Tooby & Cosmides, 1990). Importantly, emotional inflexibility characterized by behavioral and experiential inflexibility has been repeatedly found in MDD (e.g., Bylsma, Morris, & Rottenberg, 2008), while emotional flexibility is believed to be a cornerstone of psychological health (Kashdan & Rottenberg, 2010).

Over the past forty years, ideas about emotional functioning in depression were often influenced by cognitive theories of depression. For example, Beck's (1976) schema theory postulates that depressed individuals more quickly attend to negative information about self, others, or the world, which leads to exaggerated responses to negative emotional stimuli in the environment. Empirical data, however, suggests otherwise: emotional functioning in depression

is often characterized by limited positive and negative emotion reactivity (PER and NER) to acute positive and negative laboratory stimuli (see Bylsma et al., 2008 for a meta-analysis). Recently, a few studies using naturalistic designs have found that depressed people have normative reactivity to negative life events and mood brightening in response to positive events, although sometimes accompanied by greater variability of NA (Peeters et al., 2006; Thompson, Mata, Jaeggi, et al., 2012). Although these data are limited in extent, they raise several questions: 1) how do we explain and/or reconcile the findings from laboratory and naturalistic studies? and 2) is it possible that state-dependent regulation of negative affect in the laboratory and everyday life impacts reactivity to both positive and negative stimuli?

Laboratory Findings About Emotional Functioning in MDD

Emotional functioning in depression has been largely studied within the context of laboratory designs focused on emotional reactivity to standardized stimuli. This work has generally tested three theoretical perspectives. Namely, the *positive attenuation* view, in line with presence of anhedonia during a depressive episode, posits that depressed individuals will respond less vigorously behaviorally (Berembaum & Oltmanns, 1992), physiologically (Gruber, Harvey,& Purcell, 2011) and experientially (Rottenberg, Kasch, Gross, & Gotlib, 2002) to positive events and stimuli, hypothesis strongly supported by studies that have used various stimuli (pictures: Allen, Trinder, & Brennan, 1999; Dunn, Dalgleish, Lawrence, et al., 2004; films: Rottenberg et al., 2002; Gruber et al., 2011). A complementary view that has been proposed to describe another facet of emotional functioning in depression is the *negative potentiation* view, which proposes that depression strengthens emotional reactivity to negative stimuli. This view stems primarily from cognitive theories of depression (e.g., Beck, 1976) which propose that depressed mood leads to distorted views of the environment, which in turn

lead to increased negative emotion. Robust experimental work (e.g., Allen et al., 1999; Lader & Wing, 1969) contradicts the negative potentiation view. Given that the data do not support negative potentiation and strongly support the positive attenuation makes room for a third view, *emotion context insensitivity* (ECI; Rottenberg, Gross, & Gotlib, 2005) in which depression is characterized by reduced emotional reactivity to various stimuli, independent of valence (see Bylsma et al., 2008 for a meta-analysis of this literature). In support of ECI, the Bylsma et al. (2008) meta-analysis found that when comparing healthy individuals to depressed individuals pooled from 19 laboratory studies, depressed individuals more consistently showed reduced emotional reactivity to both positively (d=−.53) and negatively (d=−.25) valenced stimuli, responses consistent across three major emotion response systems (self-reported experience, expressive behavior, and peripheral physiology).

Emotional Functioning in Everyday Life in Depression

Recently, an interest in emotional functioning in daily life in people with depression has sparked research using ecological momentary assessment (EMA; for a review see Bylsma & Rottenberg, 2011). EMA encompasses a broad range of methodologies that allow repeated assessments of emotional responsivity to life events throughout the day. EMA has also been proposed to have the benefit of increasing ecological validity by looking at emotional experience in response to naturally occurring events (see Wilhelm & Grossman, 2010 for a review). Importantly, EMA methodology has allowed for online investigation of emotional functioning in response to daily life events with the goal of reducing recall bias (i.e., reconstructive self-report) allowing researchers a means to study the dynamics of emotional experience.

Interestingly, naturalistic investigations of emotional functioning in daily life have tended to show that depressed people generally exhibit similar responses to negative events (only

one study using EMA found blunted reactivity to negative events (Peeters, Nicolson, Berkhof, Delespaul, & deVries, 2003) compared to controls, but a larger decrease in NA in response to positive events (Peeters, et al., 2003; Bylsma, Taylor-Clift, & Rottenberg, 2011; Thompson et al., 2012), despite a lower occurrence of positive events in depressed people's lives. This effect has been found in the three naturalistic studies that were done on depressed subjects (Peeters et al., 2003; Bylsma et al., 2011; Thompson et al., 2012) and held despite substantial differences in measurement between the studies. In Bylsma et al. (2011) events were considered positive if the rating of positivity was above 80/100, while in Thompson et al. (2012) ratings above 50/100 would render an event positive; sampling periods were very different as well: data were collected for 3 (Bylsma et al., 2011) to 7 days (Thompson et al., 2012).

Emotions in the Laboratory and Daily Life: Pieces of the Same Affective Puzzle in Depression

To better understand these variations between laboratory and daily life emotional reactivity in depression, certain individual and methodological features may be important to consider.

Appraisal of Setting and Stimuli.

Appraisal is one individual difference that may lead to lab-life discrepancies in emotional reactivity in depression. Scherer (1999) proposed that antecedent appraisal has instrumental value for emotional responses to the environment and that, not surprisingly, durable individual differences in appraisal styles and biases can further impact observed emotional responses. Among depressed individuals, Myin-Germeys and colleagues (Myin-Germeys, Peeters, Havermans, et al., 2003) found that appraisals of stressfulness led to higher reports of NA (i.e., NA intensified more with appraised stressfulness) relative to controls, which indicate that

depressed people are more sensitive than nondepressed people to their own appraisals. This finding is particularly salient when investigating discrepancies in emotional reactivity in the lab and life among depressed individuals given that laboratory valenced stimuli are chosen on the basis of normative data from validity studies, while in naturalistic studies the valence of the events is based on participants' own appraisals. Measurement of appraisal and subsequent emotional reactivity to standardized and naturally occurring stimuli in everyday life would help disentangle this discrepancy between lab and life studies. Additionally, the current study will address how depressed individuals appraise the laboratory environment itself, which has remained an empirical question thus far.

Assessment Interval and Duration.

Differences in assessment interval and duration between lab and life settings can introduce further variability in findings. Laboratory studies are generally time limited to restrict participant fatigue. For this same purpose, most studies on emotional functioning in depression use few and brief stimuli (e.g., several 2-3-minute film clips, Rottenberg et al., 2002). In everyday life, however, the number or duration of stimuli is not rigorously controlled and can fluctuate greatly among participants (e.g., Bylsma et al., 2011) allowing for assessments of the dynamic of emotional reactivity over longer periods of time (see Rottenberg & Bylsma (2014) for a review).

Sampling Mode.

The types of sampling employed have set laboratory and naturalistic studies apart in the literature on emotional functioning in depression. Laboratory studies have generally been concerned with short term emotional responsivity to highly structured, validated stimuli whose valence is predetermined, as noted above. Naturalistic studies, on the other hand, vary in their

sampling mode from structured to random (see Bylsma & Rottenberg (2011) for a review), and often record affect and behavior in response to naturally occurring stimuli whose valence is assessed by participants alone (objective information about the stimuli in question is difficult to acquire). This can create large variations among groups, such as noted above, between clinical and non-clinical participants in the number of events appraised to have positive or negative valences (Bylsma et al., 2011; Thompson et al., 2012). Additionally, the investigation of emotional reactivity to standardized stimuli in everyday life, while intuitively important in elucidating some of the observed lab-life discrepancies, has yet to be done in investigating emotional functioning in depression.

Emotion Regulation is Mood State and Context Dependent.

Emotion regulation is defined as the use of cognitive or behavioral strategies in order to modify the circumstances in which an emotion occurs, the experience of an emotional response (including its intensity and duration), or the way in which an emotion is overtly expressed (Gross, 2002). Since the publication of Gross' seminal paper, the context in which emotion regulation is triggered has taken the spotlight and theories have been expanded to integrate the importance of context, including mood state, into observed and normative patterns of emotion regulation implementation (see Aldao, 2013; Gross, 2015 for reviews). This is very much in line with prior propositions for the impact of context in adaptation in depression such as Perrez and Reicherts' (1992) situation-behavior approach to stress and coping which proposes an interplay between maladaptive situation evaluations and coping strategies, which in depressed individuals translate into underestimation of the controllability of situations, often leading to maladaptive emotion regulatory processes, for example avoidance (i.e., unwillingness to experience thoughts, feelings, and physiological sensations in response to events that are negatively appraised) or

rumination (i.e., a repetitive focus on the unwanted thoughts and emotions and their causes and consequences). One context that is of particular importance to the current study is mood state. A recent meta-analysis (Aldao, et al., 2010) showed that the relationship between emotion regulation strategies and psychopathology is a function of clinical severity. It appears that this is particularly true for what are considered adaptive emotion regulation strategies (e.g., acceptance, reappraisal). Specifically, in one study, implementation of adaptive emotion regulation strategies fluctuated with depressed mood state, such that formerly depressed individuals reported higher levels of adaptive emotion regulation implementation relative to currently depressed, while maladaptive emotion regulation remained stable across mood states (D'Avanzato, Joorman, Siemer, Gotlib, 2013). Given that emotion regulation has been shown to impact emotional reactivity in the laboratory context (Gross, 1998; Jackson, Malmstadt, Larson, & Davidson, 2000; Hajcak & Nieuwenhuis, 2006), Rottenberg and Bylsma (2014) suggest that fluctuations in the implementation of emotion regulation strategies may be explanation for the observed lab-life discrepancy in emotional reactivity in depressed individuals. Speaking to this possibility, a recent study found that specific pleasant activities would temporarily interrupt ruminative thinking, which further related to greater reductions in NA during these pleasant activities (Takano, Sakamoto, &Tanno, 2013). Similar findings are reported for neutral distracters (Nolen-Hoeksema & Morrow, 1993); avoidance too can be helpful in decreasing NA in response to episodic events (Davila, 1993). These results indicate that even small, temporary changes in emotion regulation strategies can lead to noticeable changes in NA and over time can possibly lead to fluctuations in reactivity similar to those observed in laboratory and life contexts in depressed individuals.

Positive Events in Depression

Depression is associated with varying affective states from deep sadness to affective numbness and unrelenting anhedonia. It seems counterintuitive to consider positivity and its relationship to depression. Indeed, from a learning theory perspective, Lewinsohn (1974) described depressed individuals as being on a prolonged extinction schedule due to a low rate of response-contingent positive reinforcement. This could be in part due to repeated efforts to avoid harm - the root of depression according to Ferster's (1973) avoidance model - which will also preempt positively reinforced behavior. Indeed, many studies have found that depressed individuals experience fewer events rated as positive in their daily lives relative to healthy individuals (Peeters et al., 2003; Bylsma et al., 2011) and blunted emotional responses to positive stimuli in the laboratory (Bylsma et al., 2008). Even cognitively, deficient hedonic processing of future events in depression (Beck, Rush, Shaw, et al., 1979) translates into deficient motivation for reward or anticipatory pleasure (Sherdell, Waugh, & Gotlib, 2012) and greater automaticity in predicting greater negative events and fewer positive events (Andersen, Spielman, & Bargh, 1992). In short, behaviorally and cognitively, it seems that depressed individuals are shortchanged when it comes to experiencing pleasure.

However, there are studies such as Lewinsohn and Libet's (1972) that show a more optimistic view on depression, in that the relationship between positive events and mood is potentially moderated by the intensity of the depression: less depressed individuals exhibiting stronger relationships between number of pleasant events and mood; similarly, ECI as it relates to positive events was found to be stronger among those with more severe depression (Rottenberg et al., 2005). Furthermore, depressed individuals are characterized by normative levels of desired pleasure (MacPhyllamy & Lawinsohn, 1974) and "liking" of humor (Sherdell,

Waugh, & Gotlib, 2012). Overall, there is some support that depressed individuals have partly intact hedonic capacity, but that likely fluctuates with depression severity. Hence, an integrative investigation of emotional responses to positive events is warranted and could potentially supplement our understanding of strengths people with depression continue to retain even during a depressive episode.

Acceptance of Negative Affect and the Experience of Positive Events in Depression

*A*cceptance of negative affect is a complex emotion regulation strategy that combines cognitive reappraisal of the acceptability of the emotional experience and allowance of the experience as the emotion develops. Acceptance is a component of several therapies that have been shown to have potential utility for individuals with depression: Acceptance and Commitment Therapy (ACT; Hayes et al., 1999) and mindfulness-based therapies (e.g., Teasdale, Segal, Williams, et al., 2000). Practicing acceptance of sadness in the laboratory, for example, resulted in increased reactivity to sad film clips and faster recovery from sadness among depressed individuals (Liverant, Brown, Barlow, & Roemer, 2008). To the extent that affective variation is driven by individuals' reactions to external life events, such as emotional reactivity and subsequent regulation, and given indications that efforts to regulate emotions may affect the intensity and valence of emotional experiences (Gross & John, 2003), it is important to understand the role that regulation of NA plays in the experience of positive opportunities. The patterns observed in Liverant et al (2008) could possibly lead to readiness to engage subsequent positive events and more robust reactivity to these events, leading to an effect akin to the mood brightening effect we see in everyday life among depressed individuals (e.g., Bylsma et al., 2011). Indeed, it seems that acceptance is particularly meaningful to depression under the auspice of high maladaptive emotion regulation in this population. Given previously discussed

impact of context and mood state on implementation of adaptive emotion regulation strategies in particular in MDD, testing the mood brightening effect as a function of the intersection of depressed mood and implementation of acceptance of negative affect.

The Current Study

The current study was a first effort to integrate various perspectives in emotion theory and research design in an attempt to bridge laboratory and naturalistic findings in depression research. Specifically, the study addressed two main aims: 1. Integrate experiential responses to positive and negative events in the laboratory and everyday life; 2. Investigate the impact of NA regulation on the response to positive stimuli.

To achieve these goals, we measured emotional reactivity in the laboratory and everyday life in a sample of individuals with current MDD and controls with no history of depression. Similarly to previous studies, participants' experiential responses to previously validated neutral, sad, and positive stimuli were assessed in the laboratory and responses to naturally occurring events were assessed in everyday life. Despite clear laboratory evidence for less change in emotion in response to same valence stimuli (i.e., change in PA in response to positive stimuli and change in NA to negative stimuli), it should be noted there is little knowledge about how depression impacts fluctuation of the opposite emotion in response to stimuli (i.e., change in NA to positive stimuli or PA to negative stimuli), which was one undertaking of the current study. This addition will put us in a stronger position to compare affect in the lab and life. More importantly, PA and NA have been shown to be relatively independent (Watson & Clark, 1997), hence providing separate pieces of information about emotional reactivity to emotional events in depression.

To allow for direct comparison of emotional experience in these two settings, the current study proposed two basic additions to previous protocols: 1) in the lab, participants will report on both matching and opposite emotions as described above in response to valenced stimuli, and 2) in everyday life, participants will be asked to rate their emotional experience in response to a structured, validated positive film. These two changes to laboratory and naturalistic protocols allowed a direct examination of the specificity of emotional responsiveness across structured and unstructured settings and stimuli. To assess the implications of emotion dysregulation for the differential patterns in emotional reactivity to positive and negative events in the lab and everyday life, the laboratory procedure was enhanced through the introduction of an experimental manipulation of emotion regulation in response to viewing negative stimuli prior to passive viewing a positive film. This manipulation allowed us to model the impact of fluctuations in adaptive emotion regulation implementation during negative mood in depression and to measure its effects on the experience of positive events.

Hypothesis 1: Replication: Current results would replicate previous findings from laboratory and naturalistic studies. We would find that relative to controls, depressed persons exhibit ECI in the lab in response to emotional films and normative responses during EMA in response to negative events and marked decreases in NA in response to positive events.

Hypothesis 2: Comparison of emotional reactivity to structured stimulus and unstructured event during EMA: Based on previous lab findings that depressed individuals show blunted reactivity to structured emotional stimuli, we predicted a similar response to the structured stimuli during the EMA portion of the study compared to everyday life events and relative to controls. These results would help us clarify the importance of type of stimulus for observed reactivity patterns in depression.

***Hypothesis 3: Comparison of lab and EMA emotional reactivity*:** A recent study found that specific everyday pleasant activities temporarily interrupted ruminative thinking, which further related to greater reductions in NA during these pleasant activities (Takano, Sakamoto, &Tanno, 2013). In the current study I proposed that practice of NA acceptance in the laboratory prior to a positive film would:

(a) allow for more drastic reductions in NA in response to the positive film among depressed individuals relative to controls.

(b) laboratory decreases in NA during the positive film after acceptance of NA would be similar to decreases in NA after positive events in everyday life.

Hypothesis 4: The role of emotion regulation in emotional reactivity in the laboratory: Practice of NA acceptance in the laboratory was found to increase emotional reactivity to negative stimuli among depressed individuals (Liverant et al., 2008). I predicted a significant condition (passive viewing, acceptance) by group (controls, MDD) interaction for the sad film; specifically, I expected an increase in NA from the passive to the acceptance condition. Given observed speedier recovery from sadness in the Liverant et al. (2008) study, I also predicted a significant condition (passive viewing, acceptance) by group (controls, MDD) interaction for the positive film; specifically, I expected further decreases in NA from passive condition to the acceptance condition, especially among the depressed individuals. These results would replicate and extend findings from Liverant et al. (2008).

Hypothesis 5: Integration of lab and EMA studies:

(a) Given positive findings that acceptance of NA leads to more robust decreases in NA after a positive stimulus in the lab among depressed individuals, I expected that NA in the lab in response to the positive film after the acceptance condition would be a significant predictor of

NA in response to positive life events during EMA compared to NA in response to the positive film after the passive condition.

(b) Given previous findings that change in emotion regulation leads to more robust changes in NA in response to positive events, I predicted that changes in acceptance of NA in the laboratory from the passive to the acceptance condition would predict changes in NA in response to everyday life positive events. This finding would bring further support that robust changes in NA observed among depressed individuals in response to positive events are in part due to changes in emotion regulation.

(c - exploratory): Given findings that appraisal can impact both emotion regulation and emotional reactivity, I expected that appraisal would be a significant covariate in the above analysis.

(d - exploratory): Given positive findings to parts (a), (b), (c) of this hypothesis, I predicted that changes in emotion regulation in the laboratory would moderate the relationship between decreases in NA in response to positive stimuli during a passive condition in the laboratory and emotional reactivity to positive life events during EMA. Specifically, I expected that lab NA after a positive stimulus would predict life NA after a positive event especially when we see small changes in NA acceptance in the laboratory, after controlling for appraisal. This would indicate that people that are more labile in their emotion regulation would also be more labile in response to positive events, after controlling for appraisal.

CHAPTER TWO:

METHODS

Participant Recruitment and Selection

A total of 74 participants were recruited from the Tampa Bay area through fliers and online advertisements as well as through the University of South Florida participant pool SONA system. The final sample consisted of men and women that were considered psychologically healthy or had a current diagnosis of MDD. An initial phone screen using questions from the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID I; First, Spitzer, Gibbon, et al., 2002) MDD section ensured that participants met primary diagnostic inclusion criteria and reported no current serious brain trauma or other neurological illnesses, alcohol or substance dependence or abuse within the past 6 months, lifetime or current diagnosis of bipolar disorder, and no lifetime history of psychotic ideation. Medication use was monitored; however, it was not one of the exclusionary criteria. Actively suicidal patients were also excluded, although referral information was offered and, to ensure participant safety, the director of the Psychological Services Center, Dr. Jack Darkes, had agreed to be the emergency contact for the current study. Participants were required to have cell phones (as a portion of the study assessed affect using participants' cell phones) and to be able to access the internet. Control and MDD groups were matched on gender, age, and SES.

Power Analysis

The proposed sample size was selected to achieve a power of at least .80 with a two tailed

alpha level of .05, using methods suggested by Cohen (1988). A previous meta-analysis reported an average effect size of the emotional reactivity in depressed individuals in the laboratory and a medium to large effect size was found (d = -.37). The effect size for PER was even larger (d = -.53), while the effect size for NER was d = -.25. As noted in the review, there are no studies that looked at the between group correspondence of experiential reactivity between lab and life. Thus there are no effect sizes in the literature that are directly related to many of the hypotheses. Nevertheless, it should be noted that previous studies using lab measures (i.e., pupillary reactivity, Silk, Dahl, Ryan, et al., 2007; striatal activation, Forbes, Hariri, Martin, et al., 2009) to predict everyday life affect found large effect sizes (ds > .5). Therefore, for a within-between study design, assuming a medium effect size of .35 for the group by condition interactions, a total sample size of 50 participants would have an observed power of .80. This sample is comparable to others used in studies employing both lab and life measurements (i.e., Silk et al., 2007; Forbes et al., 2009). Additionally, Eliason (1993) recommended a minimum sample of 60 for small models utilizing hierarchical linear modeling. Finally, for our moderator analysis run only on the depressed sample, to achieve power of .80 assuming a large effect size an MDD sample of 36 would be adequate. Put together, a final sample of 66 participants (30 healthy controls and 36 MDDs) is recommended for the current study.

Study Design

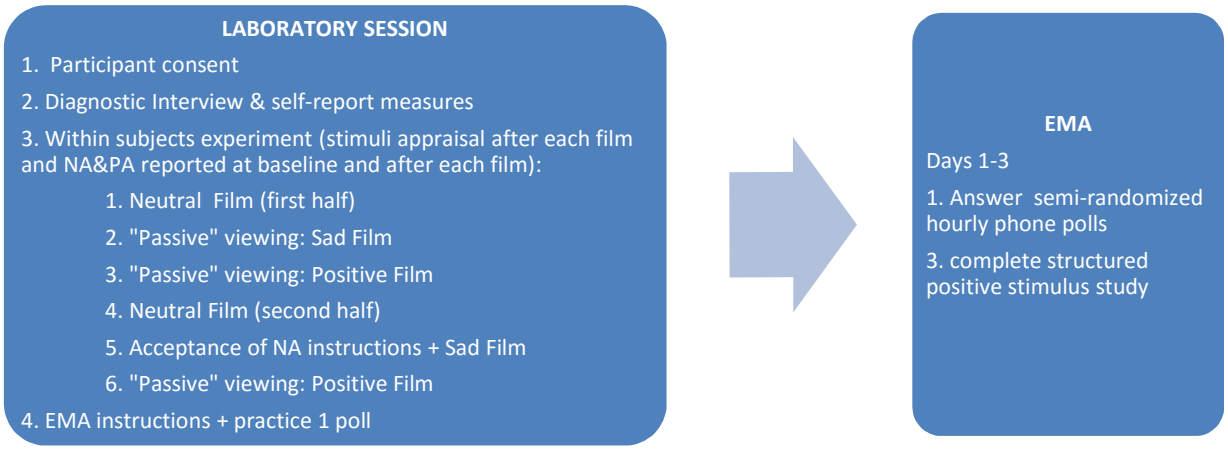

Figure 1. Summary of study design.

The current study used a within-subjects design. During the initial visit, participants completed a diagnostic interview and were asked to answer brief self-report questionnaires. Next, participants were asked to view a series of films and rate the films as well as their affect on various dimensions. Specifically, participants first watched a neutral film during which baseline emotional experience was recorded. Next, all participants were asked to view a series of emotional films in the following order: 1. “Passive” view of a sad film, 2. “Passive” view of a positive film, 3. Listen to instructions on how to respond to NA with acceptance, 4. Instructed view of a sad film during which participants will be asked to apply the strategies they heard in the preceding instructions about responding to NA in response to the film, 5. “Passive” view of a second positive film. At the end of this first session participants received written instructions and were asked to practice how to respond to the EMA portion of the study prior to leaving the lab (see Appendix A for an outline of the laboratory session).

During the EMA portion of the study participants were called 10 times a day between 10 am and 10 pm for three consecutive days (procedure similar to that used in a previous study by

Silk et al., 2007) and were asked to respond to a brief telephone poll asking several questions about the last emotional event including affect in response to this event. During the three days, participants were asked to access an internet link that allowed them to view a positive film similar to that viewed in the lab and rate their affect on similar dimensions to those used in the laboratory session, after appraising the task on a similar scale as that used in the lab.

The fixed order of assessments within the laboratory session and between diagnostic, laboratory, and EMA portions of the study served multiple functions: 1) it was necessary for the diagnostic session to be first to ensure that enrolled participants met all inclusion criteria and none of the exclusion criteria before engagement in further assessments; 2) doing the laboratory session before the EMA study increased chances of participant retention in the study by eliminating an additional visit to the lab; 3) the neutral film was used to accustom participants to the lab environment, collect baseline affect ratings, and to ensure no affective spillover from the previous emotional film; 4) the sad film was used to ensure an opportunity to experience and regulate NA prior to exposure to a positive stimulus given that one of the central aims of the study is to understand effects of regulation of NA on experience of positive stimuli; 5) the "passive" viewing condition prior to the guided emotion regulation condition was important to ensure observation of natural emotion regulation tendencies prior to receiving specific instructions which could be carried over to subsequent sad films if order was counterbalanced, which in turn could decrease observed effects; 6) keeping some portions of the study fixed increases statistical power.

Step 1. Laboratory Session:

Diagnostic Interviews and Procedure

Diagnostic evaluations were based on DSM-IV (APA, 2000) and were conducted by trained doctoral students. Given that all participants invited to the laboratory passed a telephone screen, the diagnostic procedure was intended to confirm currently depressed or healthy control group membership. Inter-rater reliabilities with the SCID-I are higher than those typically reported for diagnostic reliability (i.e., r>.82 for major Axis I diagnostic categories; Skre, Onstad, Torgersen and Kringlen, 1991). The depressed participants were required to meet diagnostic criteria for current Major Depressive Disorder using the Structured Clinical Interview for DSM-IV Axis I Disorders, Research Version, Patient Edition with Psychotic Screen (SCID-I W/ PSY SCREEN; First, Spitzer, Gibbon, et al., 2002). Healthy control participants were required to be free of any lifetime diagnoses of an Axis-I disorder when assessed with the SCID-I/P.

The diagnostic procedure employed for the current study was similar to that used in a previous study in the Mood and Emotion Laboratory at the University of South Florida during which the current investigator was trained on diagnostic interviewing. For the current study, a reliability analysis of 15 cases that contained both eligible and ineligible participants was conducted. Diagnostic agreement with the original decisions was assessed with a second rater who was blind to the diagnostic decisions of the first rater and who independently assessed the SCID-I solely on the basis of the audiotape records. For the classification of current MDD and healthy control subjects, the first and second raters agreed in all 15 cases, k =1.00.

Measures

Demographic and health questionnaire: Participants completed a questionnaire inquiring about demographic information (e.g., age, gender) and health inclusion criteria (e.g., brain trauma).

Symptom severity measure: *Beck Depression Inventory (BDI-II; Beck, Steer & Brown, 1996).* The BDI-II is a well-validated 21-item self-administered scale of depression symptom severity during the past two weeks. Scores range from 0 to 63 with higher scores representing more severity. Psychometric characteristics of the BDI-II are well established (Cronbach's alpha = .91; Beck, Steer, Ball, & Ranieri, 1996; test-retest reliability r = .93; Beck, Steer, & Brown, 1996). The Beck Anxiety Inventory (BAI; Beck, Epstein, Brown and Steer, 1988) will also be administered given high comorbidity rates for anxiety and depressive disorders (Hasin, Goodwin, Stinson & Grant, 2005) (Appendix B).

Positive and Negative Affect Schedule-State (PANAS-S; Watson, Clark, & Tellegen, 1988). The PANAS consists of a 22-item mood scale designed to measure positive affect (PA) and negative affect (NA). Participants rated experienced feelings (e.g., interested, distressed, excited) on a 5-point Likert scale, ranging from very slightly or not at all (1) to extremely (5). The scale has demonstrated high internal consistency for both PA (Cronbach's alpha = .89) and NA (Cronbach's alpha = .85) and has been found to be a valid and reliable measure (Crawford & Henry, 2004) (Appendix C).

Trait acceptance: The Acceptance and Action Questionnaire-II (AAQ-II; Hayes et al., 2003) is a ten-item self-report measure of experiential avoidance/acceptance. At the beginning of the study, respondents rated the degree to which each statement applies to them using a seven-point Likert-type scale (1, never true; 7, always true), with half of the items requiring reverse scoring. The internal consistency (Cronbach's alpha) of the AAQ-II was found to be 0.70 (Hayes et al., 2003) (Appendix D).

State acceptance: Post-Task Questionnaire II. After each sad film, participants were asked to rate the degree to which they used different emotion regulation strategies on a

questionnaire developed by Campbell-Sills, Barlow, and Brown (2006a). The questionnaire consists of four items pertaining to different ways of changing emotions (suppression, distraction, reappraisal, and redirecting attention) and four items pertaining to letting emotions run their natural course. Participants used a 0 to 8 scale (0 = not at all to 8 = all the time) to rate how much each statement described their approach to emotions experienced during the film (see Appendix E).

Manipulation checks: Post-Task Questionnaire III. The first manipulation check (Part A) (adapted from Campbell-Sills, Barlow, Brown, et al., 2006b) was a 4-item, true/false questionnaire that tests participants' understanding of the instructions that are presented *before* the second film (e.g., ''During the film, I should try to inhibit my emotions as much as possible;'' the correct answer was ''false''). The second manipulation check (Part B) tested whether the instructions were difficult to enact. This check consists of one item presented *after* the second sad film: ''How able were you to follow the audiotaped instructions during the film?'' Participants rated their ability to follow the instructions on a 0–8 scale (0 = not at all able to 8 = completely able). This information was used to control for any observed confounding effects (Appendix F).

Post-laboratory session questionnaire. This questionnaire asked participants at the beginning and end of the laboratory session to appraise the session on five characteristics on a scale from 0 meaning "Not at all" to 6 meaning "Very". How IMPORTANT would you rate this session? How PLEASANT would you rate this session? How UNPLEASANT would you rate this session? How STRESSFUL would you rate this session? How EXPECTED would you rate this session? This information will be used to assess appraisal of the laboratory session (Appendix G).

Experimental Laboratory Procedure

Overview

At the start of the experimental session (see Appendix A), participants were positioned in a comfortable chair facing a video monitor in a quiet, well-furnished room. After an introduction of the overall session, eligible participants were asked to view a series of short films (each about 3 minutes long; see Rottenberg, Ray, & Gross, 2007 for a review) carefully. First, participants were asked to watch the first half of a neutral film, a sad film, and a happy film. Next, participants were asked to watch the second half of the neutral film and then listen to instructions on acceptance of NA prior to watching a second sad film. Subsequent to watching the second sad film, participants were asked to watch a positive film. A current emotional state questionnaire was administered before the baseline neutral film and after each emotional film. At the end of the laboratory session participants were introduced to the EMA portion of the study, asked to practice as described below, and paid for their participation in the laboratory portion of the study.

Stimuli.

Films have been shown to elicit emotions ethically and reliably (Rottenberg et al., 2007) and are stimuli most people are often exposed to in everyday life. The film selection for the current study was based on recommendations by Rottenberg et al. (2007). The neutral film which will be split into two parts lasts 5 min and depicts nature scenery, animals, and uplifting music. Two 2-3 minute sad films were chosen to induce sadness and their order will be counterbalanced to control for any film effects. The two sad films are Lion King and Return to Me matched on self-reported sadness in a validation study (Rottenberg et al., 2007). Finally, three 2-3 minute positive films were chosen for this study, two for the laboratory session and one for the EMA portion of the study: When Sally Met Harry, Cosby, Whose Line. The three movies were chosen

for matching on self-reported amusement and happiness (see Rottenberg et al., 2007 for validation study of these movies).

Emotion experience. PANAS_Short. After each task and during EMA, participants were asked to report on their current mood by rating a shorter list of adjectives from the PANAS (Appendix H).

Appraisal of task valence. Post-Task Questionnaire I. After each film, participants were asked to rate whether tasks were viewed as positive or negative, stressful and expected, independent of how the tasks made the participants feel (see Appendix I).

NA emotion regulation instructions. Prior to watching the second sad film, all participants listened to six-minute audiotaped instructions on the use of emotion acceptance for modulating NA (see Appendix J for the instructions). These were based on instructions developed with input from an expert panel put together and piloted by Campbell-Sills et al. (2006a, 2006b) and used in a previous study on depressed individuals (Liverant et al., 2008). The instructions consist of a series of metaphors and stories designed to convey key elements of acceptance of NA and facilitate processing of didactic material (Otto, 2000). After listening to these instructions participants completed a questionnaire designed to assess comprehension of the instructions (see Appendix F for this questionnaire).

Step 2. EMA procedure

The EMA procedure was employed using Precision Polling which is a SurveyMonkey product that makes automated telephone surveys. Participants were asked to carry their phone while engaging in their daily activities over 3 days (week and weekend days). Participants completed one phone survey on the day of the Lab session for practice. On each of the 3 days, participants were instructed to respond to polls when alerted to do so at semi-random times

between 10:00am and 8:00pm. Participants were allowed 15 minutes to complete the survey from the initial alert. Surveys completed outside this time range were flagged and discarded.

At each call, participants were asked to report on: 1. their current mood by rating 14 mood adjectives (7 for PA and 7 for NA) by using their phone key pad pressing from 0 "not at all" to 6 "very". The mood adjectives chosen were similar to those used in other day sampling studies (e.g., Peeters et al., 2003) and were the same items used for the laboratory measure of PA and NA (see PANAS_Short); 2. the context of the most important emotional event since their last report by responding to a list of choices about who they were interacting with; and 3. how important, stressful, pleasant, unpleasant and expected the event was by using the same scale as the mood adjectives (see Appendix K for the Poll).

Computation of Affect and Events

PA and NA. For each episode recorded during the 3-day telephone poll, a PA score will be computed by averaging the 7 positive mood adjectives (talkative, enthusiastic, confident, cheerful, energetic, satisfied, and happy) and an NA score will be computed by averaging the 7 negative mood adjectives (tense, anxious, distracted, restless, irritated, depressed, guilty). Multilevel reliability accounting for within person changes over time resulted in estimates larger than .90 for NA and PA (estimates similar to those reported by Bylsma et al, 2011; Thompson et al, ,2012). Two averages across all episodes were computed to determine the overall daily PA and NA.

Event appraisals and derivation of pleasant, unpleasant, and neutral events. Pleasant, unpleasant, and neutral events were defined on the basis of the participants' appraisals of the pleasantness and unpleasantness of each event. Following prior empirical work (Peeters et al., 2003; Bylsma, et al., 2011) and theory (Watson, Wiese, Vaidya, & Tellegen, 1999) that focuses on reactions to relatively intense emotional stimuli, we coded pleasant events as events

that were rated high on pleasantness (5,6) and low on unpleasantness (0,1). Similarly, we coded unpleasant events as events rated high on unpleasantness and low on pleasantness. Events that were not rated high on pleasantness or unpleasantness were coded as neutral events. An event could be categorized as only pleasant, unpleasant, or neutral. Pleasant and unpleasant events were dummy coded with 0 depicting a neutral event.

Hypotheses and Hypotheses Testing

Hypothesis 1: Replication: Current results would replicate previous findings from laboratory and naturalistic studies. We would find that relative to controls, depressed persons exhibit ECI in the lab in response to emotional films and normative responses during EMA in response to negative events and marked decreases in NA in response to positive events.

Hypothesis testing (HT):

(a) To test affective responses to laboratory stimuli, 2 repeated measures ANOVAs were used to test a 2 group (controls, MDD) by 2 conditions (neutral, positive film) interaction for PA and a 2 group (controls, MDD) by 2 conditions (neutral, negative film) interaction for NA. Group, condition, and group by condition interaction were the independent variables and NA and PA were separate dependent variables.

(b) To estimate group differences in NA and PA in response to daily events, we implemented hierarchical linear modeling and separate models were estimated, similarly to those employed in previous studies (e.g., Bylsma et al., 2011), for NA and PA using SPSS. Initial models estimated overall group differences in NA and PA (dependent variables) with group (MDD vs. control) as a predictor. These were followed by the primary models of interest, which estimated group differences in PA and NA following both positively and negatively valenced events. Variables were entered in the models in the following manner: NA or PA as the dependent variable,

pleasant event (0/1) or unpleasant event (0/1) are the Level 1 predictors and group status is the Level 2 predictor. Finally, group by event was tested as predictor.

Hypothesis 2: Comparison of emotional reactivity to structured stimulus and unstructured event during EMA: Based on previous lab findings that depressed individuals show blunted reactivity to structured emotional stimuli, we predicted a similar response to the structured stimuli during the EMA portion of the study compared to everyday life events and relative to controls. These results would help us clarify the importance of type of stimulus for observed reactivity patterns in depression.

HT: To test responses to structured and everyday life stimuli, repeated measures ANOVA were used to test a 2 group (controls, MDD) by 2 events (structured, natural event) interaction. Group, type of stimulus, and the interaction of the two were the independent variables and PA and NA were separate dependent variables.

***Hypothesis 3: Comparison of lab and EMA emotional reactivity*:** A recent study found that specific everyday pleasant activities temporarily interrupted ruminative thinking, which further related to greater reductions in NA during these pleasant activities (Takano, Sakamoto, &Tanno, in press). In the current study I proposed that practice of NA acceptance in the laboratory prior to a positive film would:

(a) allow for more drastic reductions in NA in response to the positive film among depressed individuals relative to controls.

HT: To test NA responses one repeated measures ANOVA was used to test a 2 group (controls, MDD) by 2 conditions (negative film acceptance, positive film after acceptance) interaction. Group, emotion regulation condition, and the interaction term were independent variables and NA was the dependent variable.

(b) laboratory decreases in NA during the positive film after acceptance of NA would be similar to decreases in NA after positive events in everyday life.

HT: To test NA responses a repeated measures ANCOVA was used to test a 2 group (controls, MDD) by 2 conditions (positive film after acceptance condition, positive everyday life event). Group and emotion regulation condition were independent variables and change in NA was the dependent variable. Context type (lab vs. everyday life) was investigated as a potential covariate for this analysis.

Hypothesis 4: The role of emotion regulation in emotional reactivity in the laboratory: Practice of NA acceptance in the laboratory was found to increase emotional reactivity to negative stimuli among depressed individuals (Liverant et al., 2008). I predicted a significant condition (passive viewing, acceptance) by group (controls, MDD) interaction for the sad film; specifically, I expected an increase in NA from the passive to the acceptance condition. Given observed speedier recovery from sadness in the Liverant et al. (2008) study, I also predicted a significant condition (passive viewing, acceptance) by group (controls, MDD) interaction for the positive film; specifically, I expected further decreases in NA from passive condition to the acceptance condition, especially among the depressed individuals. These results would replicate and extend findings from Liverant et al. (2008).

HT: To test NA responses two repeated measures ANCOVAs were used to test a 2 group (controls, MDD) by 2 conditions (passive viewing, acceptance). Group, emotion regulation condition, and the interaction term were independent variables and NA was the dependent variable.

Hypothesis 5: Integration of lab and EMA studies:

(a) Given positive findings that acceptance of NA would lead to more robust decreases in NA after a positive stimulus in the lab among depressed individuals, I expected that NA in the lab in response to the positive film after the acceptance condition would be a significant predictor of NA in response to positive life events during EMA compared to NA in response to the positive film after the passive condition.

HT: A multiple linear regression analysis was used to investigate the relationship between NA in response to the positive film after passive viewing and in response to the positive film after acceptance of NA during the sad film, which were the independent variables, and NA in response to positive life events in everyday life which was the dependent variable.

(b) Given previous findings that change in emotion regulation leads to more robust changes in NA in response to positive events, I predicted that changes in acceptance of NA in the laboratory from the passive to the acceptance condition would predict changes in NA in response to everyday life positive events. This finding would bring further support that robust changes in NA observed among depressed individuals in response to positive events were in part due to changes in emotion regulation.

HT: To test this hypothesis a linear regression was used to investigate the predictive value of the independent variable - change in state acceptance as emotion regulation from uninstructed condition to instructed condition in the laboratory - and the dependent variable: change in NA in response to a positive everyday life event.

(c - exploratory): Given findings that appraisal can impact both emotion regulation and emotional reactivity, I expected that appraisal would be a significant covariate in the above analysis.

HT: Appraisal was tested as a possible covariate and above analyses re-run with appraisal as a covariate.

(d - exploratory): Given positive findings to parts (a), (b), (c) of this hypothesis, I predicted that changes in emotion regulation in the laboratory would moderate the relationship between decreases in NA in response to positive stimuli during a passive condition in the laboratory and emotional reactivity to positive life events during EMA. Specifically, I expected that lab NA after a positive stimulus would predict life NA after a positive event especially when we would see small changes in NA acceptance in the laboratory, after controlling for appraisal. This would indicate that people that are more labile in their emotion regulation would also be more labile in response to positive events, after controlling for appraisal.

HT: To examine the moderation, a series of three regression analyses were performed. First, a linear regression was performed to investigate the predictive value of lab NA and change in emotion regulation (acceptance) as independent variables for life NA as the dependent variable. After both independent variables were mean centered and I computed the interaction term of lab NA and change in emotion regulation, a second linear regression was performed with the two centered variables and interaction term as the independent variables and life NA as the dependent variable. Finally, a change in emotion regulation group (low vs. high) was computed and a final linear regression was run with lab NA as the independent variable and live NA as the dependent variable, after splitting the file by group of level of change in emotion regulation.

CHAPTER THREE:

RESULTS

Participants

Demographic Characteristics

For the current study, out of a total of 817 individuals who were screened, 583 did not pass the screen: 388 individuals screened did not meet primary diagnostic criteria (i.e., current MDD episode or healthy control free of lifetime depression and anxiety symptoms), 35 reported being in active treatment for alcohol or substance use or having had problems due to substance use, 47 reported mania, 105 reported at least one psychotic symptom, 4 reported a seizure or neurological disorder, and 4 reported bad vision or had fluency deficits.

The 234 persons who passed initial screening were invited to the laboratory to complete a clinical diagnostic interview (i.e., SCID). Of those invited, 104 completed a SCID, of which 28 individuals did not meet study entry criteria, 2 were excluded due to discontinuation of study participation, leaving74 participants met both the screening and diagnostic criteria for either MDD (N = 41) or healthy controls (N = 33). A series of t-tests showed that participants in the two groups did not differ on age, gender, race, education, income, or marital status. Both groups were on average about 20 years old; two thirds were Caucasian; both groups had some college education, on average, and reported an average income range of $35,000 to $45,000. Most sample was female and not married (see Table 1).

Clinical Characteristics of the Sample

Clinical characteristics, such as depression severity and level of functioning, are presented in Table 1. The groups exhibited expected differences on several variables: relative to controls, MDDs, on average, scored in the severe depression range on the BDI-II (group mean = 31, SD = 8.3; t (73) = -18.17, p<.001), moderate anxiety on the BAI (group mean = 21, SD = 8.3; t (73) = -10.61, p<.001), and moderate symptoms and difficulty in functioning on the GAF scale (group mean = 57, SD = 6.6; t (73) = 22.87, p<.001). Finally, both groups showed minimal levels of trauma history.

Of the 41 included MDD participants, nearly half were taking an antidepressant and nearly two thirds were receiving some kind of psychotherapy for depression.[1] Two thirds of MDDs met criteria for a comorbid anxiety diagnosis. In terms of depression characteristics, most individuals in the MDD group experienced depression onset early in life, during childhood or adolescence and 66% had recurrent depression. Current MDD episode was often moderate to severe with an average length of 3 years (SD = 5 years; range = 1-288 months), although two thirds of the sample had a current episode length of up to 18 months.

Preliminary Analyses

State Emotion Regulation

First, prior to testing response to an acceptance of negative affect exercise, preliminary analyses of state emotion regulation strategies were performed. Results show that after watching a sad film, MDDs more often endorsed using suppression, distraction, and attention refocusing and less often acceptance of negative emotions than did controls (all ps < .01; Table 2).

[1]Psychotherapy and Medications were tested as possible confounds and neither was a significant control when investigating laboratory and daily NA and PA. These variables were not included in the main hypothesis testing analyses.

Mean Daily Affect by Group and Assessment Context

Before testing our primary hypotheses, we first examined whether group status predicted PA and NA in the lab and daily life to establish a context for interpreting reactivity to pleasant and unpleasant stimuli and events. Descriptive statistics for NA and PA lab and daily means, as well as sadness and happiness means by group and context are shown in Table 3. In the laboratory, MDD's reported higher NA (M = 15.9, SD = 5.8) and lower PA (M = 13.3, SD = 6.0) relative to controls (NA: M = 7.9, SD = 5.8, t (73) = 5.63, p < 001; PA: M = 23.1, SD = 8.2, t (73) = -5.62, p < 001). Similar patterns were observed for happiness and sadness.

For the EMA data, PA and NA were analyzed (separately) using multilevel models, which were unconditional at Level 1, with group status entered at Level 2. In daily life, MDDs reported greater overall NA (B = 7.77, t(73) = 5.93, p < .001) and reduced PA (B = -10.08, t(73) = -6.34, p < .001) relative to healthy controls. Similarly, in daily life MDDs reported higher overall sadness (B = 1.28, t(73) = 6.30, p < .001) and lower happiness (B = -1.53, t(73) = -6.30, p < .001) than healthy controls.

Manipulation Checks

First, to ensure that the emotional films elicited the expected changes in sadness and happiness across groups, we conducted manipulation checks. Consistent with a successful manipulation, paired-sample t-tests revealed significant increases in reported sadness in response to both the first ($M_{change1}$ = 1.51, SD = 1.13, t(73) = 11.57, p<.001) and second sad films ($M_{change2}$ = 2.03, SD = 1.30, t(73) = 13.38, p<.001) and significant increases in reported happiness in response to the happy films ($M_{change1}$ = 0.36, SD = 1.15, t(73) = 2.72, p<.01; $M_{change2}$ = 0.35, SD = 1.04, t(73) = 2.91, p<.01).

Second, we expected increases in acceptance of NA in response to the acceptance exercise. Indeed we found that reports of state emotional acceptance increased during the sad film from pre to post acceptance exercise (M_{change} = 4.68, SD = 6.47, $t(72) = 6.19$, $p<.001$).

Assumptions

The sphericity assumption (that the dependence between conditions is relatively equal among groups) was checked for repeated measures ANOVAs. Where this assumption was violated the Greenhouse-Geiser correction was used.

For the HLM analyses I checked normality, homoscedasticity, and linearity by investigating residual plots for level-1 and level-2 predictors. The QQ plots testing normality and the residual scatter plots (homoscedasticity) showed no specific pattern, indicating assumptions were met.

Replication of Prior Findings

Hypothesis 1.1: Replication of Emotion Context Insensitivity in the Laboratory

At the outset, we predicted that MDDs would report smaller changes in both PA and NA in response to the happy and sad films, respectively, compared to controls. Inconsistent with this prediction, 2 repeated measures ANOVAs indicated that the two groups were indistinguishable in magnitude of change in NA or PA,[2] with both groups showing increases in NA in response to the sad film and increases in PA in response to the happy film.[3]

[2] Given that MDDs appraised the sad film as being more stressful, when controlling for stressfulness and tenseness, MDDs showed decreased NA reactivity to the sad film relative to controls (F (1,71) = 14.02, $p < .001$)

[3] When investigating discrete emotions, MDDs showed lower fluctuations in both sadness and happiness relative to controls, although it was only the changes in happiness that reached significant levels (both linear and quadratic effects were significant; F (1,71) = 6.40, $p = .014$; F (1,71) = 10.47, $p = .002$). MDDs showed decreased sadness reactivity relative to controls after controlling for stressfulness of the sad film (F (1,71) = 6.26, $p = .015$).

Hypothesis 1.2: Replication of Mood Brightening Effect in Everyday Life

To estimate group differences in NA and PA in response to daily events, we implemented hierarchical linear modeling. Investigation of the daily reports of PA and NA in response to positive and negative events revealed no significant group differences on these variables (ps > .05). Results, therefore, did not replicate the mood-brightening effect of positive events among depressed individuals (e.g., a greater decrease in NA in response to positive events among MDDs relative to controls, see Table 4). [4]

Extension of Prior Knowledge

Hypothesis 2: Comparison of Emotional Reactivity to a Structured Stimulus and Unstructured Event During EMA

The results of two repeated measures ANOVA analyses investigating the interaction effects of group and type of event in daily life on mean PA and NA reactivity revealed that, on average, MDDs and controls showed relatively similar changes in positive and negative affect in response to structured and unstructured daily positive events relative to neutral events. After controlling for PA and NA during neutral daily events, both groups reported overall decreased NA and increased PA in response to both structured and unstructured positive events in daily life. In other words, both groups benefited to a similar extent from experiencing positive events (either in the form of an unstructured life event or a happy film).

[4] Notably, our findings support a "mood brightening effect" when specifically looking at changes in sadness in response to positive events, with MDDs showing a more robust decrease in sadness in response to positive daily events relative to controls (B = -.36, p = .014).

Hypothesis 3: Comparison of Lab and EMA Emotional Reactivity

3.a. Does acceptance of NA in the lab lead to subsequent mood brightening?

Acceptance of NA has been shown to have acute influence on experience of sadness in response to a sad film (Liverant et al, 2008). In the current study I proposed that influence would extend to changes in NA during a subsequent happy film. Given prior findings, current predictions were that after experiencing a higher increase in NA during the sad film after exercising acceptance, MDDs would also experience a larger decrease in NA during a subsequent happy film. However, our analysis investigating a 2 group by 3 condition (neutral, sad, and happy films) interactions showed no group differences in changes in NA after the neutral film in response to acceptance of NA during the sad and subsequent happy film. Both groups reported an increase in NA after the sad film and a decrease in NA after the subsequent happy film. Although MDDs reported a slightly larger decrease in NA at the end of the happy film relative to controls consistent with our hypothesis, the difference did not reach conventional thresholds of statistical significance (p = .067).

3.b. NA reactivity to a happy film and to positive daily events.

A recent study found that specific everyday pleasant activities temporarily interrupted one type of maladaptive emotion regulatory style (ruminative thinking), which further related to greater reductions in NA during these pleasant activities (Takano, Sakamoto, &Tanno, 2013). Given my prior prediction that subsequent to exercising acceptance of NA MDDs would experience larger decreases in NA during a happy film, I hypothesized that NA levels after the lab happy film after acceptance of NA will be similar to level of NA in response to positive life events. Our analysis looking at a 2 group (controls, MDD) by 2 condition (positive film after acceptance condition, positive everyday life event) interaction showed that laboratory decreases

in NA during the positive film after acceptance of NA was similar to decreases in NA after positive events in everyday life ($p > .05$). However, current findings show that both controls and MDDs benefited equally, in that magnitude of reactivity was similar between the two groups, rather than finding a mood brightening effect among MDDs both in the lab and life.

Hypothesis 4: The Role of Emotion Regulation in Emotional Reactivity in the Laboratory

Hypothesis four predicted that practice of acceptance in the lab would have a more impactful effect on NA in response to a sad film among MDDs relative to controls. Two ANOVAs were run to test changes in NA reactivity to the sad and happy films from the passive to the acceptance condition. Findings did not support the hypothesis: exercising acceptance of NA during the sad film did not lead to MDDs reporting higher levels of NA during the sad film ($F(1,72) = 2.93$, $p = .091$) or higher decreases in NA during the subsequent happy film ($F(1,72) = 3.22$, $p = .077$). Additionally, it is important to note that despite the changes in state acceptance of NA seen in our manipulation checks, we did not find significant expected changes in NA reactivity after exercising acceptance of NA independent of group.

When looking at sadness specifically, our results replicated Liverant et al. (2008) findings that MDDs reported an increase in sadness in response to a sad film from pre to post exercising acceptance of NA ($F(1,72) = 103.01$, $p < .001$). Similar changes were seen among controls as well, leading to non-significant group differences in this effect ($F(1,72) = 2.16$, $p = .146$). However, groups differed in their sadness changes in response to the subsequent happy film ($F(1,71) = 5.75$, $p = .019$).

Hypothesis 5: Lab-Life Correspondence - Integration of Lab and EMA Studies Among Depressed Individuals:

5.a. Does emotional reactivity in the lab predict emotional reactivity to everyday life among depressed individuals?

I hypothesized that NA in response to the happy film in the acceptance condition but not in the passive viewing condition would predict NA in response to daily positive events. Analyses using HLM showed that NA to the happy film in the acceptance condition was a predictor of overall NA in daily life (B = .49, p = .045) but not of NA reactivity to positive events (B = -.19, p > .05). These results indicated that those depressed individuals that benefited more from the acceptance exercise by reporting larger decreases in NA in response to the happy film also reported lower levels of NA in daily life.

5.b. Does change in state emotional acceptance of NA in the lab predict reactivity to positive life events?

The prediction that acute changes in state acceptance of NA will be a significant predictor of reactivity to positive life events was tested with HLM. Findings did not support our prediction: State acceptance measured in the lab was not a significant predictor of overall NA in daily life (B = -.15, p > .05) nor of NA in response to positive life events (B = -.03, p > .05).[5]

5.c. Role of appraisal in integration of lab-life emotional reactivity

Prior to exploring the significance of event appraisals as possible covariates in the analyses investigating lab-life integration, a series of analyses tested the role of event appraisals on overall NA and PA in daily life. Our analyses showed that when events were appraised as

[5] The mood brightening effect observed above as a larger decrease in sadness in response to positive events among MDDs relative to controls was significantly reduced when controlling for overall emotion regulation after the acceptance exercise in the lab. This indicates that a significant portion of the mood brightening effect is a function of flexibility in emotion regulation of NA.

more important (B = .87, $p < .001$), more pleasant (B = 1.54, $p < .001$), and less unpleasant (B = -.55, $p < .001$) MDDs reported higher overall PA. When events were appraised as less pleasant (B = -.48, $p < .001$), more unpleasant (B = .30, $p < .001$), and more stressful (B = 1.41, $p < .001$) MDDs reported higher overall daily NA. However, using pleasantness, unpleasantness, and stressfulness as covariates in analyses testing Hypotheses 5.a. and 5.b. did not impact prior results.

5.d. Do changes in state emotional acceptance moderate the relationship between changes in NA in response to a happy film in the lab and changes in NA in response to positive life events?

Our prediction that changes in state acceptance of NA will moderate the relationship between NA reactivity to a happy film in the lab and daily life positive events was not supported. Model 2 investigating the added benefit of including the interaction effect of state NA acceptance and NA reactivity to a happy film in predicting NA changes to positive life events did not account for more variance than a preliminary model investigating main effects (R^2 change = .009, $p = .272$).

CHAPTER FOUR:

DISCUSSION

Our current understanding of emotional functioning in depression is split between laboratory data, which suggests that depression is often characterized by limited positive and negative emotional reactivity to acute positive and negative laboratory stimuli (e.g., Bylsma et al., 2008), and a few naturalistic studies that have found normative reactivity to negative life events and mood brightening in response to positive events among depressed individuals (Peeters et al., 2003; Bylsma et al., 2011; Thompson et al., 2012). Little has been done to integrate these findings and identify sources of variability in emotional functioning in depression. The current study was designed to integrate experiential responses to positive and negative events in the laboratory and everyday life and to investigate the impact of acceptance of negative affect on response to positive events. Our results largely did not support our a priori predictions and hence did not provide a robust platform to test explanatory factors. In the following sections, alternative hypotheses are discussed.

In contrast to our prediction to replicate prior ECI findings, our results showed that despite higher overall NA and lower overall PA among depressed individuals relative to controls, the two groups were indistinguishable in their magnitude of reactivity to sad and happy films, respectively. These results are in contrast to robust empirical support for the ECI theory elsewhere (Bylsma et al, 2008). On the one hand, these results are curious given findings that, consistent with ECI, depressed individuals appraised the neutral film as more unpleasant but the sad film equally unpleasant relative to controls. On the other hand, this discrepancy may be due

to findings that depressed individuals in the current sample also appraised the sad film as more stressful than controls. This propensity to react more strongly to stress, also referred to as stress sensitivity, has been linked both to the development of depression and increases in depression symptomatology (see e.g., Wichers, Geschwind, et al., 2009; Wichers et al., 2007b).

Similarly, at face value, controls and MDDs exhibited comparable reactivity to the happy film. However, we cannot say the two groups benefitted equally from watching a positively valenced film given much lower levels of PA among depressed individuals during the neutral film relative to controls. One possible explanation for the equal magnitude in reactivity to the happy film may be the stimulus itself. For this study we used a humorous film rather than a happy film that induces general happy feelings. Prior studies have found similar levels of "liking" of humorous material when comparing depressed and healthy individuals (Sherdell, Waugh, & Gotlib, 2012) suggesting that humor may be a more potent activator triggering a response among depressed individuals comparative to controls. Taken together, these findings only in part support a deficient hedonic functioning but not reward processing among depressed individuals (Beck, Rush, Shaw, et al., 1979).

Another major goal was to replicate prior findings describing emotional reactivity in daily life. While we too found normative reactivity to negative life events in MDD, current results did not replicate the mood brightening effect in response to positive events in daily life (which would anticipate larger decreases in negative affect in response to positive events in MDD). One possible explanation could be our slight shift from previous protocols (Peeters et al., 2003; Bylsma et al., 2011; Thompson et al., 2012) in that our negative adjective list included "sadness". Given centrality of sadness to depression and the fact that sadness was one of the most often endorsed emotion in daily life in our depressed sample (after depressed and guilty)

relative to controls, we tested sadness reactivity in isolation. Indeed, our findings support a "mood brightening effect" when specifically looking at changes in sadness in response to positive events, with MDDs showing a more substantial decrease in sadness in response to positive daily events relative to controls. Although we did not investigate mechanisms of change in daily life, one previous study found that exposure to positive events in daily life led to decrease in one maladaptive emotion regulation (rumination) among depressed individuals which further decreased NA (Takano, Sakamoto, &Tanno, 2013). Our results point to sadness, rather than general NA, as particularly salient to depression.

Ours was a first attempt at investigating the differential effect of context and stimulus type on reactivity in daily life by directly comparing a structured stimulus to a life event and reactivity to films in lab versus life. We expected differences between lab and life and between structured and unstructured stimuli to be especially notable among depressed individuals. We found the expected overall group differences in NA and PA in daily life, but not the expected differences in reactivity. Curiously, the two groups did not differ in their appraisal of the film in the lab or life, however both groups found the film in daily life more pleasant and less unpleasant than that in the lab. These results could be a function of at least two latent characteristics that may set the two contexts apart: one, the laboratory study followed an intense diagnostic interview, which may have been stressful for both groups given the expectation that eligibility was dependent on results to the interview; two, participants had the freedom to choose the time and place of the viewing at home which likely aided in appraising the task itself more pleasant and less unpleasant. In sum, these findings support our original suggestions that context could potentially lead to variations in emotional experiences, although in this case such differences were observed again in appraisals but not reactivity levels. This is especially true given that we

found these clips to perform similarly in our pilot in a similar group or in a previous validation study (Rottenberg et al, 2007).

Next, based on empirical findings (Liverant et al 2008) and theory (Hayes et al., 1999; Teasdale, Segal, Williams, et al., 2000) we predicted that one form of emotion regulation, acceptance of NA, will lead to the "mood brightening" effect in the lab. Our null finding here could be a direct result of the MDDs not reporting an increased reactivity to the sad film after practicing acceptance of NA. This was in disaccord with the self-reported acceptance of NA among MDDs relative to controls. Consequently, to try to better understand this pattern of results, we again tested the possibility of sadness specificity in depression. When looking at sadness specifically, we indeed replicated prior findings (Liverand et al 2008) that depressed individuals experienced an increase in sadness after practicing acceptance of NA during the sad film relative to their reported sadness in response to the prior sad film. However, this difference was parallel that seen among controls which had not been tested by Liverand and colleagues (2008). However, the expected group differences were observed in reactivity to the happy film. MDDs showed some decreases in sadness in response to the happy film, while the controls continued to experience some sadness during the happy film, moderately in line with our predictions of a mood brightening effect in response to an acceptance of NA exercise.

Given that most discrepancies were expected among MDDs, our final set of hypotheses attempted to integrate lab and daily life data and focused on the group of depressed individuals. Our first hypothesis was that reactivity to a happy film after practicing acceptance of NA would be a stronger predictor of reactivity to positive events in daily life. Prior studies (Takano, Sakamoto, & Tanno, 2013) found that exposure to positive events decreased rumination, which led to decreases in NA. Rumination is conceptualized as repetitive focus on symptoms of distress

and the causes and consequences of these symptoms (Nolen-Hoeksema, 1991). Acceptance is an equally complex emotion regulation strategy, although opposite rumination, it combines cognitive reappraisal of the acceptability of the emotional experience and allowance of the experience as the emotion develops, rather than attempts at explaining and "fixing" the emotion. We found a complementary set of results to that in Takano et al (2013) when increasing acceptance of NA among depressed individuals in the lab. While our lab data was marginally predictive of overall NA in daily life, it was not specifically predictive of NA reactivity to positive events. It is possible that NA reactivity to the happy film in the lab after practicing acceptance of NA during a sad film may be speaking more broadly to capacity to regulate negative mood or NA independent of context, rather than acute emotional responses. In one recent study, for example, acceptance during highly stressful life events predicted lower levels of depressive symptoms (Shallcross, Troy, Boland, Mauss, 2010).

To build on prior hypotheses, I predicted that change in acceptance of NA from pre to post exercising acceptance in the lab would reflect capacity to flexibly adapt to changing environments, which, in turn, would predict fluctuations in reactivity to positive life events. First, we thought this flexibility may, again, be more evident when looking across events that would assume larger fluctuations in NA to both positive and negative events. However, when we looked at acceptance of NA as a predictor of overall daily NA, it was the overall emotion regulation score after practicing acceptance of NA compared to pre exercise that was a strong predictor of overall NA among depressed individuals. Our results actually suggest that as people are more ineffective at using an emotion regulation style in a specific context (i.e., acceptance of NA in a sad context), and indiscriminately use all emotion regulation strategies (by rating all possible strategies as being highly used) are more likely to experience higher NA. It is likely that

an indiscriminate use or endorsement of strategies shows lack of success in regulating emotion and decreased flexibility (Kovacs et al, 2009). Ineffective emotion regulation implementation likely leads to increased NA. Notably, showing the opposite effect, we found that the overall emotion regulation score *after* practicing acceptance of NA (but not the uninstructed emotion regulation score) during a sad film explained the "mood brightening effect" seen specifically in sadness reactivity in response to positive daily events. These findings are in support of the idea that the capacity to flexibly respond to an acceptance exercise was linked to a more flexible response to positive events by showing higher decreases in NA during these events. This pattern of findings suggests that the mood brightening effect is possibly in part a reflection of some variability and possibly retained flexibility in regulating sadness among depressed individuals.

Overall our results show a curious pattern of findings; despite observed group differences in appraisal of neutral lab stimuli and life events, with depressed individuals appraising both more negatively relative to controls, the two groups were indistinguishable in reactivity to negative or positive events in both lab and life. It is possible that for both lab and life negative events the group differences in stressfulness appraisal of these events may have led to an increased reactivity hence bringing the groups closer in observed magnitude of reactivity. Indeed, once we controlled for stressfulness appraisal and how tense participants reported feeling during the sad film, a drastic difference in reactivity was observed between MDDs and controls, with MDDs showing a significantly lower reactivity level. Interestingly, the happy film was appraised as positively as the neutral film, although this may have been a function of the films following in succession and therefore affect during the happy film showing mood repair and returns to baseline after the sad film. This pattern of results showed the impact of negative affect on the appraisal of subsequent positive stimuli. Unfortunately, our data is limited in providing

evidence to test this hypothesis at home given that we did not collect information about the exact context in which the positive film was viewed at home. Finally, it is possible that what is observed is the byproduct of appraising the films prior to reporting on the emotional experience, a link which is possibly disturbed among MDDs.

Current results are limited in the extent to which they replicate prior results. The current study was based on the premise that depression is characterized by emotion context insensitivity, a state in which people exhibited less motivated behavior in adverse environments (Rottenberg, 2007). A select set of results suggest that depressed individuals are characterized by sensitivity to the stressfulness of laboratory stimuli and that level of reactivity is actually partly dependent on this characteristic; specifically, while unpleasant stimuli may trigger blunted reactivity among depressed individuals, unpleasant *and* stressful appraisals would lead to increased reactivity. For example, our findings that the sad film was more often appraised as stressful by depressed relative to controls, which likely led to indistinguishable reactivity levels despite smaller changes in appraisal of unpleasantness from neutral to the sad film, is in line with previous findings by Myin-Germeys and colleagues (2003) that negative affect intensified more with appraised stressfulness. Given the importance of appraisal for level of reactivity only reinforces the importance of therapeutic work to reappraise the characteristics of events in everyday life, which is in line with current cognitive behavioral therapeutic practices (e.g., Beck et al., 1979; also see Rottenberg and Bylsma (2014) for a discussion).

By testing the role of practicing acceptance of negative affect on emotional reactivity in the lab and daily life we made two unexpected discoveries that are of consequence. One, by asking depressed individuals to engage in a brief acceptance exercise, a variety of emotion regulation strategies were implicated, such as suppression, reappraisal, distraction, and attention

refocusing. Second, these changes were noted to impact sadness reactivity to both positive stimuli in the lab and positive events in daily life. In the lab, changes in emotion regulation during the sad film subsequently led to differential group reactivity to a humorous film, with the depressed individuals tending to benefit a bit more than controls by reporting a decrease in sadness at a trend level. The emotion regulation in response to the acceptance exercise in the lab was also found to explain a significant portion of the mood brightening effect in daily life, when this was tested with sadness specifically. Our results add to previous findings that when depressed individuals respond with acceptance to negative affect they experience more sadness in the moment (e.g., Liverant et al, 2008) which we find to be similar to responses of healthy controls, but they also experience a mood brightening-effect during positive stimuli similarly to that observed in naturalistic studies (Peeters et al., 2003; Bylsma et al., 2011; Thompson et al., 2012). Such results would provide further evidence for the importance of fluctuation of emotion regulation for emotional reactivity in depression (also see Takano, Sakamoto, & Tanno, 2013). This is particularly important in light of new findings that adaptive emotion regulation strategies are predictive of psychopathology especially at high levels of maladaptive strategies (Aldao & Nolen-Hoeksema, 2012), such as in depression.

Although limited, our results buttress the idea that emotional flexibility is one cornerstone of mental health (Kashdan & Rottenberg, 2010). Additionally, results suggest that perhaps merely correcting how people interpret external events (i.e., appraisal bias) may not be sufficient to correct emotional dysfunction in depression, but that teaching specific emotion regulation strategies (i.e., acceptance) that are not the typical emotion regulation tools used by depressed people (i.e., avoidance, rumination) may help to increase flexibility in emotional reactivity and emotion regulation implementation, and in turn to increase resilience and well-

being (Coifman &Bonanno, 2009, 2010). Our findings also provide data that support recent therapeutic efforts, such as the development of Emotion Activation Therapy (EAT), that target emotional mastery through relearning of emotional experiences and their meaning, as well as development of emotion regulation strategies to support the experience of emotion (Hauke & Dall'Occhio, 2013).

This study is a first to look at discrete emotions in daily life in depression. To build on this initial attempt to understand the dynamics of emotions in daily life, further work will investigate the role of sadness dynamics in short-term changes in daily depression symptoms and longitudinal course of depression. This would be a natural next step, given the established use of ESM as a predictor of depression development (Wichers et al., 2007a); depression course (Wichers, Geschwind, et al., 2009; Wichers, Peeters, et al., 2009), and short-term changes in daily symptoms (Hankin et al., 2005). Next, the current findings showing a link between acceptance of negative affect and the mood brightening effect on sadness, a future study should use a feedforward paradigm to understand the dynamic links between practice of acceptance of sadness during sad events and subsequent changes in sadness in response to positive daily events. Again, such endeavors are reinforced by prior uses of ESM to investigate response to treatment (Gunthert, Cohen, Butler, & Beck, 2005).

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TABLES

Table 1. Demographic and clinical characteristics

Characteristics	MDD (n = 41)	Control (n= 33)
Age in years (SD)	23.44 (7.4)	22.48 (7.1)
Caucasian (%)	65.9	66.7
Female (%)	82.9	66.7
Education[a] (SD)	2.97 (1.5)	2.86 (1.2)
Income[b] (SD)	6.10 (3.8)	6.39 (4.4)
Married (%)	7.3	15.2
BDI-II (SD)***	30.76 (8.3)	2.42 (4.9)
BAI (SD)***	21.02 (10.9)	2.15 (3.1)
GAF (SD)***	57.12 (6.6)	91.79 (6.4)
Trait acceptance***	48.85 (10.7)	18.33 (6.6)
Experienced trauma[c] (SD)	2.29 (1.9)	1.88 (2.4)
Antidepressants (%)	43.9	-
Psychotherapy (%)	61.0	-
Comorbid anxiety diagnosis (%)	61.0	-
MDD age of onset[d] (SD)	1.88 (0.6)	-
MDD recurrent (%)	65.9	-
Current MDD severity[e] (SD)	2.24 (0.5)	-
Current MDD length (SD)	37.29 (64.6)	-

***p<.001

Note. MDD = major depressive disorder; BDI-II = Beck Depression Inventory–II; BAI = Beck Anxiety Inventory; GAF = Global Assessment of Functioning. [a]Education represents years in college. [b]Income was assessed on a 12-point scale, with a score of 6-7 representing an annual income of between $35,000-$44,999 (Note: this item was optional and response rate was 69% for controls and 75% for MDDs). [c]Trauma was categorized on X point scale. [d]MDD age of onset was categorized on a 3 point scale with a score of 1-2 representing childhood and adolescent onset. [e]Current MDD severity was assessed on a 3-point scale, with a score of 2-3 representing moderate to severe (without psychosis) MDD.

Table 2. State emotion regulation strategies in response to a sad film pre and post an acceptance exercise

	Pre-acceptance		Post-acceptance	
Characteristics	MDD	Control	MDD	Control
Suppression	3.46 (2.42)**	2.06 (2.00)	1.41 (1.67)*	0.52 (1.23)
Reappraisal	2.80 (2.74)	1.85 (1.91)	1.80 (2.15)*	0.73 (1.65)
Distraction	2.34 (1.93)***	0.64 (1.03)	1.15 (1.85)*	0.33 (1.11)
Attention refocusing	2.93 (2.23)***	0.91 (1.10)	1.29 (1.81)	0.58 (1.48)
State acceptance	16.22 (6.86)**	21.67 (7.99)	22.05 (6.06)	24.79 (6.99)

*p<.05; **p<.01; ***p<.001

Note. MDD = major depressive disorder; Emotion regulation characteristics are rated on a 0-8 scale, with lower scores indicative of lower frequency of use (4 = occasionally). State acceptance is the sum of 4 items with scores ranging from 0-32; higher scores indicate higher acceptance of negative affect.

Table 3. Mean daily affect and mean daily sadness and happiness emotion ratings by group and assessment context

Context and valence	MDD	Control
Laboratory		
NA***	16.65 (4.4)	8.70 (2.5)
PA***	11.33 (3.7)	24.00 (6.1)
SAD***	2.78 (1.3)	1.15 (0.4)
HAPPY***	1.50 (0.6)	3.70 (1.0)
EMA		
NA***	15.89 (5.8)	7.86 (5.8)
PA***	13.31 (6.0)	23.12 (8.2)
SAD***	1.87 (1.7)	0.54 (1.1)
HAPPY***	2.28 (1.6)	3.85 (1.7)

Note. Standard deviations are given in parentheses. Ratings of mean daily affect are based on the sum of seven positive and seven negative mood ratings, each on a scale ranging from 0 to 6 points, with a total range of 0 – 42. For EMA, PA and NA values were averaged over all reports within individuals before calculating overall group means. MDD = major depressive disorder; PA = positive affect; NA = negative affect; EMA = ecological momentary assessment.

***p<.001

Table 4. Summary of parameter estimates for multilevel models of NA and PA

	NA			PA		
	B	SE	p	B	SE	p
For Intercept						
Intercept	7.93	0.97	<.001	23.06	1.18	<.001
MDD	7.78	1.31	<.001	-10.07	1.59	<.001
For positive event slope						
Intercept	-6.57	1.49	<.001	9.99	1.81	<.001
MDD	-0.07	0.90	.938	-0.46	1.10	.679
For negative event slope						
Intercept	5.14	1.61	.002	-9.52	1.53	<.001
MDD	1.09	0.96	.263	0.15	0.91	.872

MDD = major depressive disorder; PA = positive affect; NA = negative affect.

Table 5. Aggregated mean event ratings by group and assessment context

	1. Laboratory		2. EMA		3. Home activity	
	MDD	Control	MDD	Control	MDD	Control
Event rating	Neutral film		Neutral events		-	
Pleasant	3.85* (1.8)	4.79 (1.5)	2.30* (0.8)	2.71 (0.8)	-	-
Unpleasant	1.07* (1.4)	0.27 (0.8)	1.73 (0.6)	1.54 (0.8)	-	-
Stressful	0.20** (0.5)	0.03 (0.2)	2.00 (0.6)	1.85 (1.2)	-	-
Expected	2.41 (2.2)	2.15 (1.9)	3.24 (1.1)	3.50 (1.2)	-	-
Important	1.49 (1.4)	2.33 (1.5)	2.12* (1.0)	2.64 (1.0)	-	-
Event rating	Sad film		Negative events		-	
Pleasant	1.51 (1.3)	1.79 (1.4)	0.68 (0.6)	0.71 (0.7)	-	-
Unpleasant	3.90 (1.6)	4.18 (1.5)	5.34 (0.4)	5.50 (0.4)	-	-
Stressful	3.54* (1.7)	2.61 (1.6)	4.50 (1.3)	4.47 (1.3)	-	-
Expected	1.54 (1.6)	1.15 (1.8)	2.44 (1.5)	2.54 (1.9)	-	-
Important	2.24 (2.0)	2.30 (1.8)	2.93* (1.9)	3.77 (1.7)	-	-
Event rating	Happy film		Positive events		Happy film	
Pleasant	3.68 (1.9)	4.00 (1.5)	5.37 (0.4)	5.43 (0.4)	4.76 (1.3)	5.03 (1.2)
Unpleasant	1.32 (1.6)	1.21 (1.6)	0.49 (0.6)	0.38 (0.5)	0.45 (0.8)	0.31 (1.0)
Stressful	1.15 (1.7)	0.76 (1.4)	0.96 (0.7)	0.72 (0.6)	0.37 (0.7)	0.25 (1.1)
Expected	2.29 (2.1)	1.70 (1.8)	3.35 (1.4)	3.80 (1.3)	2.16 (1.6)	2.09 (1.4)
Important	2.02 (2.0)	2.09 (1.9)	3.08 (1.6)	3.68 (0.9)	1.74 (1.7)	1.59 (1.5)
% rated neutral	-	-	67.1***	56.4	-	-
% rated negative	-	-	10.7***	6.0	-	-
% rated positive	-	-	22.2***	37.6	-	-

Note. Standard deviations are given in parentheses. Data were calculated within individuals, then averaged across individuals. EMA = ecological momentary assessment (i.e., telephone polling); MDD= major depressive disorder.

*p< .05; **p< .01; ***p<.001 in comparison with controls.

APPENDICES

Measures used are copyrighted. Please contact original author for each of the measures.