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Examining emotional reactivity to daily events in major and minor depression

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Examining Emotional Reactivity to Daily Events in Major and Minor Depression

by

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A thesis submitted in partial fulfillment
of the requirements for the degree of
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Lauren M. Bylsma

ABSTRACT

Major depressive disorder (MDD) is a debilitating disorder characterized by significant mood disturbance. In laboratory studies, MDD has been characterized by both blunted positive (PER) and negative emotional reactivity (NER). However, mood disordered persons' emotional reactivity has rarely been studied in naturalistic settings, and it is unknown how less severe forms of depression relate to emotional reactivity. To address these issues, the current study utilized two naturalistic sampling methods (the Day Reconstruction Method and the Experience Sampling Method) to examine PER and NER to daily life events in 35 individuals currently experiencing a major depressive episode (MDD), 26 individuals currently experiencing a minor depressive episode (mD), and 38 healthy controls. Both methods demonstrated that individuals with major and minor depression exhibited blunted PER relative to controls. In surprising contrast to previous laboratory findings, both individuals with MDD and mD showed increased NER relative to controls. Correlational analyses with severity measures indicated that depression and anxiety severity were positively related to NER and negatively related to PER. Findings suggest that NER in mood disorders may diverge as a function of assessment context and may be heightened in naturalistic environments. Despite the fact that mD is a milder mood disorder, findings suggest that mD results in similar emotional impairments as found in MDD.

Introduction

Major Depressive Disorder (MDD) is a debilitating disorder that affects as many

as 10-25% of women and 9-12% of men at some point in their lifetime (DSM-IV; APA,

2000) and is a leading cause of disability worldwide (Murray & Lopez, 1997). The point

prevalence in adult community samples varies from 5-9% for women and 2-3% for men

(DSM-IV; APA, 2000). MDD is characterized by extremely high recurrence rates – over

70% of depressed patients have more than one episode and may spend only 22% of the

12 years following a major depressive episode symptom-free (Judd et al., 1998).

Furthermore, approximately 40% of individuals with 3 or more episodes of major

depression relapse within 12-15 weeks of recovery (Keller et al., 1992; Mueller et al.,

1996). The high burden of MDD has motivated considerable research designed to

uncover risk factors and characteristics that are associated with MDD.

One strand of research on MDD has sought to clarify how this disorder influences

different aspects of affective functioning such as moods and emotions. Reflecting the

profound disturbance of affective functioning in MDD, it is classified as a Mood Disorder

by The Diagnostic and Statistical Manual of Mental Disorders (DSM-IV; APA, 2000).

DSM–IV diagnostic criteria specify symptoms of at least 2 weeks duration that implicate

deficient positive affect and loss of interest in pleasurable activities (e.g., anhedonia),

excessive negative affect (e.g., sadness), or both. When queried, patients who have been

diagnosed with depression reliably report low positive affect and elevated negative affect

on a variety of questionnaire and interview measures (Clark, Watson, & Mineka, 1994).

Durable disturbance of mood is thus one of the most salient features of MDD. MDD symptoms also include several associated somatic and cognitive symptoms which include loss or increase in appetite, weight gain or loss, sleep disturbance, psychomotor agitation or retardation, fatigue, feelings of worthlessness or guilt, concentration or decision-making difficulties, and suicidal ideation or behavior (DSM-IV; APA, 2000).

Based in part upon the prevalent assumption that moods facilitates emotions when the mood and emotion are matching in valence (Rosenberg, 1998), researchers have suggested that negative mood in MDD may potentiate negative emotional reactions (e.g., Golin, Hartman, Klatt, Munz, & Wolfgang, 1977; Lewinsohn, Lobitz, & Wilson, 1973), and the absence of positive mood may attenuate positive emotional reactions (Berenbaum & Oltmanns, 1992; Sloan, Strauss, Quirk, & Sajatovic, 1997; Sloan, Strauss, & Wisner, 2001). However, accumulating evidence from laboratory studies indicates that MDD may actually involve blunted emotional reactivity independent of valence (Bylsma, Morris & Rottenberg, 2008), a pattern that has been labeled emotion context insensitivity (ECI; Rottenberg, 2005; Rottenberg, Gross, & Gotlib, 2005). Given that laboratory results with diagnosed MDD samples do not appear to uphold the assumptions that the mood states in MDD facilitate negative emotions, two important questions become: (1) whether less severe depressive mood states (e.g., minor depressive disorder) facilitate negative emotional reactivity and (2) whether the findings of ECI are also obtained when data is collected outside of the laboratory, in naturalistic settings. In the following sections we review the body of theory and data relevant to these issues, and then describe a naturalistic study designed to address them.

Depression and the Continuity Debate

In recent years, there has been disagreement in the literature regarding whether many DSM disorders are truly categorical, as the current DSM defines them, or whether they are best conceptualized along a continuum of varying symptom severity (Widiger & Samuel, 2005). In regard to depression, MDD may have unique characteristics that distinguish it categorically from minor depression (mD), and dysphoria (Fechner-Bates, Coyne & Schwenk, 1994). However, recent research suggests that depression may be better conceptualized as a continuum of depressive symptoms (e.g., Geiselmann & Bauer, 2000). The possibility of a latent qualitative difference between MDD and subclinical forms of depressions has not been ruled out (Solomon, Haaga & Arnow, 2001). Recent taxometric investigations of epidemiological samples of depression have provided evidence that depression occurs along a continuum of symptom severity (Prisciandaro & Roberts, 2005). However, research in this debate has yet to consider many central features of MDD, such as changes in emotional reactivity.

Many researchers use dysphoric populations (individuals who indicate low mood and score high on symptom checklists), operating under the assumption that findings from this population will generalize to individuals with a clinical diagnosis of MDD (Vredenburg, Flett, & Krames, 1993). This practice assumes that ordinary dysphoria can be placed along the depression continuum and shares the same symptoms, mood states, and emotion regulation difficulties as MDD (Coyne, 1993; Cassano et al, 2004; Prisciandaro & Roberts, 2005; Hankin, Fraley & Lahey, 2005). According to this view, the diagnostic threshold presents an arbitrary cutpoint, which does not recognize that distress and impairment are a monotonic function of increasing symptoms. By contrast,

the disease state model suggests that the individuals with MDD suffer from mood and physical symptoms that are qualitatively different than those symptoms of an individual with ordinary sad mood (e.g., Fechner-Bates et al. 1994, Rottenberg, Gross, & Gotlib, 2005).

One means to examine the question of continuity is to study well-defined mood disorders that are less severe than MDD and to contrast them with MDD itself. The DSM-IV currently lists one form of less severe depression, minor depressive disorder (mD), in the appendix as a diagnosis that merits further research (DSM-IV; APA, 2000). Minor depression is defined as a period of 2 or more weeks during which at least 2-4 of the 9 symptoms for a major depressive episode are present. As in MDD, one symptom must be either depressed mood or anhedonia (DSM-IV; APA, 2000). Minor depression may differ from MDD by its general lack of neurovegetative symptoms (Rapaport et al., 2002). Because of the lack of research on mD, prevalence rates are largely unknown. Estimates vary depending on the degree of adherence to DSM-IV diagnostic criteria. Data from the nationally representative population of the National Comorbidity Survey found lifetime prevalence rates for mD with no prior history of MDD of 10% (Kessler, Zhao, Blazer, & Swartz, 1997). Those studies which utilize the DSM-IV criteria for mD found lower prevalence rates than those studies that defined mD based on dimensional depression scales, indicating that even mD may differ from non-clinical dysphoric states (Hermens, et al., 2004).

Research indicates that mD results in similar, but less severe impairments than those observed in MDD. As in MDD, research suggests that individuals with mD experience significant incomplete resolution of episodes (Kessler et al., 1997). mD

results in significant functional disability and interferes with employment attendance to a similar degree as mild MDD (Cuijpers, de Graaf, & van Dorsselaer, 2004; Kessler et al., 1997). Furthermore, individuals with mD are at an increased risk for developing MDD compared to individuals with no depressive symptoms (Cuijpers et al., 2004; Fogel, Eaton, & Ford, 2006). It is possible that mD may represent a transient mood state preceding or following a major depressive episode rather than a discrete disorder. Alternatively, mD may consist of a period of maladaptive functioning that is precipitated by distress, but is not biologically, physiologically, or functionally equivalent to MDD. Surprisingly, there has been no prior research on emotional characteristics of mD that may differentiate it from MDD, an important means to determine whether the emotional characteristics of depressive mood states are best conceived of as a continuum or a discrete disease state.

Theories of Emotional Reactivity in MDD

Although theories of emotional functioning in mood disorders have thus far centered on MDD, it is useful to generate a theoretical framework that could also be potentially applied to mD. Given that MDD is quintessentially a disorder of mood, one way to conceptualize the problem of emotion in MDD (and potentially to mD) is to ask how a pervasive mood disturbance will influence ongoing emotional reactivity to positive and negative stimuli in the environment. Addressing this problem requires a distinction between the constructs mood and emotion (e.g., Rottenberg & Gross, 2003). Moods have been defined as diffuse, slow-moving feeling states that are weakly tied to specific stimuli in the environment (e.g., Watson, 2000). By contrast, emotions have been defined as quick-moving reactions that occur when an individual processes a meaningful

stimulus, and these reactions typically involve coordinated changes in subjective feelings, behavior, and physiology (Ekman, 1992; Keltner & Gross, 1999). When mood and emotion are so distinguished, it becomes apparent that the various diagnostic criteria for depression, such as pervasive sadness or anhedonia, indicate alterations in mood, but do *not* indicate alterations in emotion with corresponding specificity.

Although the constructs are distinguishable, moods and emotions are generally seen as interconnected, with moods altering the probability of having specific emotions (e.g., Rosenberg, 1998). Although there have been surprisingly few empirical demonstrations of explicit links between moods and emotions, moods are widely believed to potentiate like-valenced or matching emotions (e.g., irritable mood facilitates angry reactions, an anxious mood facilitates panic, etc; Rottenberg, 2005). By extension, excessive negative mood in MDD would *potentiate* negative emotional reactivity. Furthermore, a lack of positive mood in depression would *attenuate* positive emotional reactivity. Indeed, the idea of mood facilitation is one source of guidance for the major viewpoints regarding emotional reactivity in MDD that appear in the literature: (1) negative potentiation (2) positive attenuation and (3) emotion context insensitivity.

Negative potentiation, the first view, holds that the pervasive negative mood states that are prevalent in MDD contribute to potentiated emotional reactivity to negative emotional cues. Perhaps most relevant to this view, cognitive theorists have advanced a view of MDD in which negative moods and negative emotions are mutually reinforcing (e.g., Beck, 1967; Beck, Rush, Shaw, & Emery, 1979). Beck's schema model and related theories of MDD (e.g., Bower, 1981) conceptualize the disorder in terms of cognitive structures, or schemas, that serve to negatively distort the processing of emotional stimuli.

Importantly, according to these theories, negative mood states prime, or activate, these cognitive structures (Scher, Ingram & Segal, 2005). Once activated, these structures precipitate depressotypic emotional responses (e.g., crying spells) whenever schema-matching negative emotion stimuli are encountered, presumably potentiating reactivity to negative emotional stimuli in MDD.

Positive attenuation, the second view, holds that individuals with MDD will have reduced reactivity in response to positive emotional stimuli. Because this hypothesis applies primarily to positive emotional stimuli, positive attentuation is compatible with negative potentiation (individuals with MDD can exhibit both patterns simultaneously). The starting point for this hypothesis is depressed persons' strong tendency to exhibit low positive mood. Indeed, anhedonia (the reduced ability to experience pleasure) is one of the cardinal symptoms of MDD, and depressed individuals exhibit several other signs that are also indicative of deficient appetitive motivation (e.g., psychomotor retardation, fatigue, anorexia, apathy). Not surprisingly, several theorists have centered their accounts of emotion dysregulation in MDD on this constellation of motivational deficits (e.g., Clark, et al., 1994; Depue & Iacono, 1989; Henriques & Davidson, 1991).

Emotion context insensitivity (ECI), the third view, holds that depressed individuals will exhibit reduced reactivity to all emotion cues, regardless of valence (Rottenberg, 2005). By this account, individuals with MDD should exhibit less reactivity to *both* positive and negative stimuli and events compared to healthy individuals. ECI is derived from evolutionary accounts that describe depression as characterized by disengagement with the environment (Nesse, 2000). According to this view, depressed mood states evolved as an internal signal to bias organisms against action. Depressed

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mood may have evolved as a defensive mechanism to prevent a response in adverse situations where continued activity could potentially be dangerous or wasteful (e.g. famine, loss of a status conflict, etc.). Thus, according to ECI, severe depressed mood states in MDD are postulated to inhibit emotional reactivity across a broad range of stimuli. In sum, ECI makes similar predictions as the positive attenuation view for positive stimuli; however, ECI opposes the negative potentiation view for negative stimuli.

Laboratory Studies of Emotional Reactivity in MDD

Laboratory studies have attempted to clarify the effects of MDD on emotional reactivity. Empirical research that supports negative potentiation in diagnosed samples is scarce; interestingly, however, there appears to be some support for negative potentiation in dysphoric (non-diagnosed) samples (Golin, Hartman, Klatt, Munz, & Wolfgang, 1977; Lewinsohn, Lobitz, & Wilson, 1973). There is fairly consistent empirical support for the positive attenuation theory. For example, depressed individuals have shown diminished emotion response to pleasant film stimuli compared to healthy controls (Berenbaum & Oltmanns, 1992). Similarly, depressed individuals also report reduced emotional responses to positive picture stimuli (Sloan, Strauss, Quirk, & Sajatovic, 1997; Sloan, Strauss & Wisner, 2001). Furthermore, there has been empirical research in support of ECI across different emotional response systems. For example, depressed patients have shown less electromyography (EMG) modulation to affective stimuli (Gehricke & Shapiro, 2000) and less facial reactivity to expressive faces (Wexler, Levenson, Warrenburg, & Price, 1994). In addition, a lack of physiological reactivity to affective film stimuli has been found to predict a worse clinical outcome for patients with MDD (Rottenberg, Kasch, Gross, &

Gotlib, 2002). In fact, a recent meta-analytic review of 19 laboratory studies of MDD found blunting of emotional reactivity, consistent with ECI view, with reasonable generalization of findings across emotion response systems (Bylsma et al., 2008).

Do the Emotional Characteristics of MDD Differ From Less Severe Forms of Depressive Symptomatology?

A critical question related to mood-emotion interaction concerns whether the changes in emotional reactivity that are seen in MDD (i.e., ECI) are similar to or are different from those evidenced in less severe forms of depressive symptomatology. Again, very little research has been conducted that examines emotional reactivity across the full range of depressive symptoms. In fact, to our knowledge no prior research has been conducted examining emotional reactivity for minor depression (mD), as defined by DSM criteria. Some research has examined emotional reactivity in dysphoric college student samples; however, these studies have not found consistent differences in emotional reactivity when comparing dysphoric samples and health controls (e.g., Persad, 1993; Gehricke & Shapiro, 2001; Hughes & Stoney, 2000). Further, the personality trait neuroticism has been associated with increased vulnerability to developing depression, and individuals with clinical and subclinical levels of depression tend to score higher on measures of neuroticism (Kendler, Gatz, Gardner, & Pederson, 2006). Some research in nonclinical samples suggests that higher levels of neuroticism are correlated with greater emotional reactivity to stressful or negative events (Suls, Green, & Hilis, 1998; Berenbaum & Williams, 1995), and in turn, reduced reactivity to positive stimuli (Berenbaum & Williams, 1995), both findings that are broadly consistent with the idea of mood facilitation. However, not all studies have found a relationship between

neuroticism and emotional reactivity (Affleck, Tennen, Urros & Higgins, 1994; David, Green, Martin & Suls, 1997) and it is unclear how these findings might relate to depression severity.

In sum, it still remains unclear how emotional reactivity relates to diagnostic status or depression severity. Previous laboratory research suggests that negative mood facilitation may hold for lower levels of negative mood (Gross, Sutton & Ketelaar, 1998), while other research demonstrates that emotional reactivity may be blunted in more severe forms of mood disturbance, such as that present in MDD (see Bylsma et al., 2008 for review). As important, it is not clear whether results obtained from depressed persons in laboratory contexts are a faithful representation of their emotional functioning, as it might be ascertained in every day life settings.

Does MDD Emotional Functioning in the Laboratory Generalize to Everyday Life?

Laboratory assessments of emotional reactivity have been criticized as lacking ecological and external validity (Cacioppo & Gardner, 1999). Fortunately, several day sampling methods have been developed to assess emotional reactivity in naturalistic settings across one's daily life. One advantage of day sampling methods is that a relatively large sample of behavior can be obtained relative to a single-point laboratory sessions, potentially providing a more reliable estimate of emotional reactivity. Furthermore, a wide variety of eliciting stimuli that are ecologically valid can be sampled over the course of the day. Two commonly used day sampling methods, the Day Reconstruction Method and the Experience Sampling Method, are described below.

The Day Reconstruction Method (DRM) is a self-report survey instrument designed to collect data describing the experience a person has on a given day, through a

systematic reconstruction conducted on the following day (Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004; Stone, Schwartz, Schwarz, Schkade, Krueger, & Kahneman, 2006). The DRM builds on the strengths of ESM with the added advantage that it is less time consuming and expensive. Empirical findings indicated a close correspondence between the DRM and established results from ESM methods in healthy populations, including examination of factors that are previously known correlates of well-being and positive affect (e.g., Kahneman, Krueger, Schkade, Schwarz, & Stone, 2004). Key advantages of the DRM method over ESM methods include joint assessment of activities and subjective experiences, information about the duration of each experience, lower respondent burden, and more complete coverage of the day (Kahneman et al. 2004). Furthermore, since the DRM method does not interrupt individuals during their daily life, it does not disturb the natural flow of daily life events, an effect that other day sampling methods, such as ESM, might potentially have. Other advantages of in comparison to other self-report measures include potentially lower susceptibility to retrospective reporting biases typical for global reports of daily experience compared to questionnaires that ask about events or emotions that occur in the more distant past, and the DRM has high flexibility in adapting the content of the survey based on the needs of the study (Kahneman et al. 2004).

The DRM has been used in previous research to examine emotion and diurnal mood variation (Stone et al., 2006); however, this method has not been extended to clinical populations. To validate the use of the DRM with depressed populations, the DRM was utilized in conjunction with ESM (described in the next section), which has been used successfully in previous research with MDD participants (e.g., Peeters et al.,

2003; Barge-Schaapveld, Nicolson, Gerritsen van der Hoop & DeVriew, 1995; Barge-Schaapveld, Nicolson, Befkhof & DeVries, 1999). For example, potential threats to the validity of the DRM are the retrospective memory impairments (Burt, Zembar & Niederehe, 1995) as well as negative memory biases (Matt, Vasquez & Campbell, 1992) often found in depressed populations. Since the DRM asks participants about events that happened the previous day, memory impairments or systematic memory biases could affect the depressed groups, making their reports less accurate and/or more negatively biased than those of the nondepressed group, which could make group differences in emotional reactivity less interpretable. However, since the ESM uses momentary reports that inquire about participants' current moods and most recent activities, memory impairments or memory biases should be minimized.

The Experience Sampling Method (ESM) is another powerful method for understanding a range of psychological phenomena as they occur in the daily lives of individuals (Christensen, Barrett, Bliss-Moreau, Lebo & Kaschub (2003). This method is designed to allow respondents to document their thoughts, feelings, and actions in a naturalistic setting within the context of daily life. The advantage of ESM methods is that they capture the representation of experience as it occurs, which minimizes any retrospective memory bias, which might be of concern when testing depressed populations. However, ESM methods are time and resource consuming to both the researchers and participants. Furthermore, because the ESM method interrupts individuals at various moments throughout the day, it can be intrusive and potentially disturb the natural flow of daily life events. For these reasons, the DRM may hold advantages over the ESM method. ESM can be implemented with either paper-and-pencil

or computerized methods (Christensen et al., 2003). One advantage of using a computerized data collection protocol is that compliance can be carefully monitored and the time an individual responds can be validated; by contrast, in paper-and-pencil methods it is possible that individuals will wait until the end of the day to fill out their responses. Some studies have demonstrated poor rates of compliance with the paper and pencil methods compared to the computerized methods (e.g., Stone, Shiffman, Schwartz, Broderick & Hufford 2002); however, others found similar rates of compliance (Green, Fafaeli, Bolger, Shrout & Reis, 2006). A further advantage with the computerized method is that branching questions adapted to the individual's responses are easier to implement in a computer program. Because of its multiple advantages, computerized ESM was used in the present study.

ESM methods have been validated with a variety of research questions and clinical and healthy populations. Specifically, ESM has been used to examine emotional and mood reactivity in various populations, such as those with a history of psychosis (Myin-Germeys, Krabbendam, Delespaul & van Os, 2004), adolescents at risk for developing psychopathology (Schneiders, Nicolson, Berkhof, Feron, van Os & deVries, 2006), and major depression (Peeters et al., 2003). ESM techniques have also been used with participants diagnosed with MDD to evaluate response to antidepressant treatment and its relationship to daily life activities (Barge-Schaapveld, Nicolson, Gerritsen van der Hoop & DeVriew, 1995) and to assess quality of life (Barge-Schaapveld, Nicolson, Befkhof & DeVries, 1999), and to examine diurnal mood variation (Peeters et al., 2006).

Despite the development of these instruments, to our knowledge, there has been only one naturalistic study of emotional reactivity in a diagnosed MDD sample and no

studies of diagnosed mD samples. Peeters, Nicolson, Berkof, Delespaul, and deVries (2003), examined emotional reactivity to daily life events among MDD participants and healthy controls using paper-and-pencil ESM. They found that both the MDD and control groups reported a similar number of negative events, but the MDD group reported fewer positive events. MDD participants experienced blunted NA and PA responses to negative life events, and NA responses persisted longer in MDD individuals. In contrast to previous laboratory findings of positive attenuation in MDD, MDD individuals in this sample reported greater reductions in NA and *larger increases* in PA when responding to positive events relative to controls. The authors also tested the relationship between depression severity and emotional reactivity to positive and negative events and found no significant relationship, though their sample only included individuals meeting criteria for MDD, so less severe forms of depression were not examined. Reporting on the same sample, Peeters, Berkhof, Delespaul, and Rottenberg (2006) examined diurnal mood variation patterns and found distinct patterns of positive and negative affect over the course of the day and found that depressed individuals exhibited a more pronounced NA diurnal rhythm that was more variable moment-to-moment compared to healthy individuals. In sum, these findings suggest that there may be important differences in emotional functioning in the laboratory in comparison to emotional situations that occur in an individual's daily life. However, there are no known studies that examine emotional reactivity in MDD using the computerized Experience Sampling Method (ESM) or the Day Reconstruction Method (DRM), and there have been no naturalistic studies of emotional reactivity in minor depression (mD).

Overview of the Present Study

The present study examined positive and negative emotional reactivity to daily life events in a mood disordered sample of individuals diagnosed with MDD, mD, and healthy controls with no history of depression. The Day Reconstruction Method (DRM) was the primary means to examine emotional reactivity in a naturalistic setting. The DRM is a relatively new survey instrument which inquires about daily events and emotional responses to these events from the previous day. However, since the DRM has not yet been validated in clinical populations, the computerized Experience Sampling Method (ESM) was also used with Palm Pilots over a 3 day period, with the last ESM sample day corresponding to the day being sampled with the DRM.

Specific Aims

Existing research on emotional reactivity in depression has focused on the high end of depressive symptomatology (i.e. individuals who meet full criteria for MDD) in laboratory settings. Therefore, ECI may only explain emotional reactivity at the high end of the depressive continuum and may be specific to laboratory studies. The idea of negative mood facilitation (i.e., that negative mood potentiates negative emotional reactivity) may be relevant to low levels of depressed mood, but not to more severe levels of depressed mood. To provide clear cut-off points for low and high depression severity, the current study examined individuals with MDD and mD, as diagnosed according to DSM-IV-TR criteria (APA, 2000). These groupings afforded us both categorical (based on the SCID diagnoses) and dimensional analyses of severity (e.g., based on BDI severity measures). Finally because it is unclear how well previous laboratory findings generalize

to real life situations, emotional reactivity was examined using two naturalistic day sampling methods.

The general aim of this study was to investigate emotional reactivity across varying levels of depression severity in a naturalistic setting. This study can help to elucidate whether the symptoms of depression are best conceived as occurring along a continuum (i.e., minor dysphoria to severe depression) or a discrete disease state defined by the diagnostic threshold of MDD. Furthermore, this study can inform our understanding of emotion in regard to whether milder levels of negative affect influence ongoing emotional reactivity differently from the more severe negative affect present in MDD. In addition, this study will elucidate whether emotional responding in daily life follows the same pattern found in laboratory studies. The specific aims and hypotheses for the research project are as follows:

Specific Aim 1. To examine whether emotional reactivity differs between DSM-IV diagnostic variants of depression and to assess the continuous relationship between depression severity and emotional reactivity in a naturalistic setting.

Hypothesis 1. Emotional reactivity of MDD individuals to positive and negative daily events will be significantly different from the emotional reactivity patterns of control subjects and subjects with mD. Specifically, individuals with MDD will have blunted positive and negative reactivity to daily life events (as measured by the DRM and ESM) compared to controls and individuals with mD will have increased negative reactivity to daily life events. In other words, as depression severity increases from controls to mD, emotional reactivity will increase, and as depression severity increases from mD to MDD, emotion reactivity will decrease creating an inverted U pattern. For

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positive reactivity, positive reactivity will decrease as depression severity increases. Therefore, those with MDD will have the least positive reactivity, followed by the mD, followed by controls who will have the greatest positive reactivity.

Specific Aim 2. A secondary aim is to validate the use of the DRM method in depressed populations by examining the correspondence between ESM and DRM methods for capturing emotion experience in depressed populations.

Hypothesis 2. Results derived from the DRM and will produce comparable data to ESM sampling, as manifested by a similar pattern group of differences and similar emotional reactivity effect sizes when both methods are examined for the same day.

Method

Participants

　　Recruitment and Screening.　Participants were recruited from fliers and online

forum postings in and around the Tampa Bay community. A total of 474 potential

participants were initially screened by telephone. Of those individuals, 271 were invited

into the lab to complete the Structured Clinical Interview based on the Diagnostic and

Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV-TR) Axis I Disorders,

Research Version, Patient Edition with Psychotic Screen (SCID-I/P W/ PSY SCREEN;

First et al., 2002). A total of 164 participants completed the SCID (107 did not show up

for their first appointment and were not able to be rescheduled), and of those participants

who completed a SCID, approximately 57 were excluded for failing to meet inclusion or

exclusion criteria, leaving 107 eligible participants who were invited to come back to

participate in the ESM and DRM protocols. In addition, 7 individuals failed to complete

the ESM and DRM due to scheduling difficulties. Two participants were not able to

complete ESM and DRM within 3 weeks of the initial SCID and had to be re-screened

for the mood disorders module of the SCID, and one person no longer met the criteria for

an mD diagnosis and was excluded.　Participants in all groups were excluded from the

study for the following reasons: history of a major head injury, hearing impairment,

diagnosis of bipolar disorder, substance abuse occurring within 6 months prior to entry

into the study, or any history of primary psychotic symptoms, as assessed by the

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telephone screen and SCID. Included participants met criteria for Major Depressive

Disorder with a current episode ($n = 35$), Minor Depressive Disorder with a current

episode ($n = 26$), or had no past or present psychopathology (i.e., no history of any Axis I

disorder as assessed by the SCID; $n = 38$). Provisional DSM-IV-TR criteria recommend

an absence of past episodes of MDD for an mD diagnosis. To improve study feasibility,

we loosened this criterion, and 32% of mD participants experienced at least one major

depressive episode (MDE). In these included subjects we required a period of at least

eight weeks with no residual depressive symptoms between the major depressive episode

and the minor depressive episode.

   Demographics. Final participants were primarily females (77.8%) and all were

fluent in English and between the ages of 18 and 55 (mean age = 28.3). The final sample

approximated the ethnic distribution of the Tampa Bay area: 60.6% Caucasian, 17.2%

African American, 10.1% Latino/ Hispanic, 6.1% Asian, 1.0% Native American, 1.0%

Native Hawaiian/Pacific Islander, 1% Middle Eastern, 3% Other. Table 1 contains

demographic information of the sample according to diagnostic group. Groups were

matched on age, ethnicity, gender, education level, income, and marital status (all ps >

.05 for Cramer V tests).

Table 1.

Demographic Characteristics of the Sample

	Group		
	MDD	mD	Control
Variable	(*n* = 34)	(*n* = 26)	(*n* = 32)
Age, M (SD)	28.85 (9.42)	27.00 (7.58)	28.78 (8.55)
% Caucasian	62.9%	73.1%	50.0%
% Female	88.6%	65.4%	76.3%
Education (SD)	5.30 (1.73)	5.28 (1.67)	5.94 (2.06)
Income (SD)	5.30 (3.37)	4.39 (3.18)	6.41 (3.64)
% Married	25.7%	19.2%	28.9%
Number of Children (SD)	.48 (.94)	.44 (.86)	.47 (.92)

Education was assessed on an 8-point scale with higher numbers representing more
education—a score of 5-6 reflects graduation from a 2-year or a technical
college.
Income was assessed on a 12-point scale—a score of 5-6 represents an income of
between $25,000 and $34,999.

Procedure Overview

Individuals responding to research ads via email and phone were initially

screened over the phone to determine potential eligibility. Screening questions were

based on key diagnostic questions from the Structured Clinical Interview based on the

Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition (DSM-IV-TR)

Axis I Disorders, Research Version, Patient Edition with Psychotic Screen (SCID-I/P W/

PSY SCREEN; First et al., 2002). Based on this initial screening, potential participants

were invited to complete a complete SCID with a doctoral student in clinical psychology.

Final diagnoses for study inclusion were made based on the SCID administration.

Participants also completed a Beck Depression Inventory-II (BDI-II; Beck, Steer, &

Brown, 1996) and demographics questionnaire at this session.

Participants deemed eligible based on the initial SCID interview were invited to

begin the ESM protocol or to return to the lab within 2-3 weeks to complete the ESM and

DRM protocol (2 appointments). The ESM protocol began on a Monday and ended on a

Friday, with data collection Tuesday-Thursday. Participants completed the DRM the

Friday of the ESM week, so that the questions would correspond to Thursday, the last

day of the ESM data collection. At the time of the DRM, participants also completed a

current mood rating (using the same mood ratings of the DRM and ESM), and measures

of depression and anxiety severity. Three participants were not able to come back for

their scheduled appointments on Friday and had to come on Thursday instead, so their

DRM data covered Wednesday instead of Thursday. One additional participant was not

able to come back until Monday to return the Palm Pilot and did not complete the DRM.

Diagnostic Procedure

The Structured Clinical Interview for DSM-IV-TR Axis I Disorders, Research

Version, Patient Edition with Psychotic Screen (SCID-I/P W/ PSY SCREEN; First et al.,

2002) is a semi-structured interview designed to diagnose individuals based on the

Diagnostic Statistical Manual-IV (DSM-IV). Reliability and validity measures for the

SCID differ according to population and diagnosis, but reliability for diagnosing MDD is

relatively high with inter-rater reliability kappas ranging from .80 -.93 (Zanarini &

Frankenburg, 2001; Zanarini et al., 2000; Skre, Onstad & Torgersen, 1991). Using the

SCID, screening was conducted for the following diagnoses: bipolar I and II disorder,

major depressive disorder, dysthymic disorder, psychotic symptoms, substance

dependence, social phobia, specific phobia, obsessive compulsive disorder, generalized

anxiety disorder, and post-traumatic stress disorder. This session generally lasted

between 1-2 hours.

Severity Measures

The Beck Depression Inventory-II (BDI-II; Beck, Steer & Brown, 1996) was administered to obtain a depression severity score. The BDI-II is a well-validated 21-item self-administered scale of depression symptom severity. Scores range from 0 to 63 with higher scores representing higher severity. Coefficient alphas for the BDI-II are high (alpha = .91; Beck, Steer, Ball, & Ranieri, 1996). The test-retest reliability is also high at r = .93 (Beck, Steer, & Brown, 1996).

To assess the severity of anxiety symptoms, the Beck Anxiety Inventory (BAI) was administered (Beck, Epstein, Brown, & Steer, 1988). The BAI is a 21-item self-administered questionnaire of anxiety symptoms. Symptoms are rated on a 4-point scale, with higher scores indicating more severe anxiety symptoms. The internal consistency of the BAI is high (alpha = .92), and the BAI correlates highly with the SCL-90-R Anxiety Subscale (r = .81) (Steer, Ranieri, Beck, & Clark, 1993).

Positive and negative affect (PA and NA) were also measured in the lab at the beginning of the DRM session. For PA, 7 positive mood items rated on a 7-point Likert scale from "not at all" to "very" were summed (talkative, enthusiastic, confident, cheerful, energetic, satisfied, and happy). For NA, 7 negative mood items rated on the same scale were summed (tense, anxious, distracted, restless, irritable, depressed, and guilty). Internal consistency for all severity measures used was high in all cases for this sample (alphas >.90).

ESM Procedure

The computerized ESM procedure was employed using Palm Pilots (Zire22) and the ESP software (Barrett & Feldman-Barrett, 2004). Participants carried a Palm Pilot

around with them as they engaged in their daily activities over 3 weekdays (weekends

were not used, in order to have a more homogenous sampling of days). Participants

completed at least 4 practice beeps on the evening prior to the first ESM sampling day.

On each of the 3 days, the Palm Pilots were programmed to alarm 10 times a day semi-

randomly between 8:00am and 10:00pm. Participants were given 15 minutes to respond

after they were beeped. If they did not respond in 15 minutes, the questionnaire would

disappear and be marked as a missed questionnaire.

On each beep, participants were first asked to report on their current mood by

rating 14 mood adjectives (7 for positive affect and 7 for negative affect) by sliding a bar

from "not at all" to "very", which is coded by the computer as a continuous value

between 1 and 100. The mood adjectives chosen are similar to those used in other day

sampling studies (e.g., Peeters et al., 2003) and are the same items used for the laboratory

measure of PA and NA described earlier. Following this, participants were asked about

the context and nature of the most important emotional event since their last report by

responding to a list of choices about what they were doing, the nature of the event, the

location of the event, and who they were interacting with. Participants selected options

from a list of choices for each question, and they could select more than one answer

choice if more than one was applicable to the situation (e.g., eating while watching TV

would involve selecting two types of activities from the list). Further, they were asked to

rate how important, stressful, pleasant, and unpleasant the event was by using the same

sliding bar scale as the mood adjectives. The entire questionnaire generally takes less

than 5 minutes to complete after practice. See Appendix for a complete list of questions

and response choices. After the 3 ESM sampling days were completed, participants

returned to the lab to complete the DRM (which inquired about the previous day, the last day of the ESM sampling) and to return the Palm Pilots.

DRM Procedure

Participant came back to the lab the day after their 3rd ESM day to complete the DRM survey packet. The DRM asks about the previous day, which corresponded to the 3rd ESM day, to allow us to compare the data from the two sampling procedures. The DRM survey packet (Kahneman et al., 2004) was tailored to the needs of this study, including insuring the questions correspond as closely as possible to those used in the ESM method (see Appendix for a copy of the DRM survey packet).

The DRM asked participants to reconstruct the previous day, by thinking of their day as a continuous series of episodes. For each episode, participants were asked to give details such as what they were doing, time of episode, duration or episode, and what their thoughts and feelings were during the episode. As in the ESM, they were also asked to respond to the same questions regarding what they were doing, the nature the event, the location of the event, and who they were interacting with. Furthermore, they were also asked to rate the importance, stressfulness, pleasantness, and unpleasantness of the event, but on a 7-point Likert scale (0 being "not at all" and 6 being "very"). Participants were also asked to rate their mood during the episode on the same 7-point Likert scale, using the same mood adjectives in the ESM.

Computation of Affect and Emotional Reactivity

Positive Affect (PA). A PA scale score was computed for each episode in the DRM and ESM data by adding together 7 positive mood adjectives (talkative, enthusiastic, confident, cheerful, energetic, satisfied, and happy). The internal

consistency of this scale was very high (alpha=.97). For the DRM data, each item was coded on a 7-point Likert scale from 0 (not at all) to 6 (very). For the ESM data, the palm pilots stored responses on a continuous scale from 1-100 based on responses participants gave by sliding a bar from "not at all" to "very." These ESM ratings were rescaled to be on the same scale as the DRM mood ratings so that scores on the two measures could be compared. To compute overall PA for the day, for both the ESM and DRM data, the composite PA scores for each episode across the day were averaged to compute an overall average PA rating for the day.

Negative Affect (NA). An NA scale score was computed for each episode in the DRM and ESM data by adding together 7 negative mood adjectives (tense, anxious, distracted, restless, irritated, depressed, guilty). The internal consistency for this scale was also very high (alpha=.94). Similar to the computations for PA, the ESM scores were first rescaled, then composite NA scores were computed for each episode, and these were averaged over the day to compute an overall NA average.

Positive Emotional Reactivity (PER). In order to obtain a measure of PER, defined as a positive emotional response to a positively valenced event, first positive events were identified based on participant's ratings. Participants rated each episode on overall "Pleasantness" using a 0 to 6 Likert scale for the DRM data and a 1-100 sliding bar scale for the ESM data. The ESM scores were rescaled to be on the same scale as the DRM data. Episodes rating 4 to 6 on Pleasantness as well as 0 to 3 on Unpleasantness were considered to be positive episodes. Then, average PA ratings for these positively rated episodes were computed to obtain a measure of PER. In order to better isolate the effects of reactivity to events, PER responses to neutral episodes were also computed and

used as a covariate in the statistical analyses. This practice is consistent with past work that has used a neutral comparison point to distinguish reactivity differences from differences in dispositional mood (e.g., Bylsma et al., 2008). Neutral episodes were defined as those which were rated low (<4) on both Pleasantness and Unpleasantness. PA responses to neutral episodes were then averaged to obtain a measure of PER to neutral episodes.

Negative Emotional Reactivity (NER). Similarly, in order to obtain a measure of NER, defined as a negative emotional response to a negatively valenced event, first negative events were identified based on participant's overall rating of the "Unpleasantness" of the event, which was coded in the same way as "Pleasantness". Episodes rating 4 to 6 on Unpleasantness as well as 0 to 3 on Pleasantness were considered to be negative episodes. Then, average NA ratings for these positively rated episodes were computed to obtain a measure of NER. As in the PER analyses, in order to account for baseline differences in reactivity, NER responses to neutral episodes were computed and used as a covariate. NA responses to neutral episodes were then averaged to obtain a measure of PER to neutral episodes.

Hypothesis Testing

Two Repeated Measures ANCOVA's were computed with measure (DRM or ESM) as the within subjects factor and group as the between subjects factor. The first ANCOVA examined PER to positively rated events as the dependent variable with PER to neutrally rated events as a covariate and the second ANCOVA examined NER to negatively rated events as the dependent variable with NER to neutrally rated events as a covariate.

In order to address Hypothesis 1a for PER and NER, the group effects of the two Repeated Measures ANCOVA's were examined and post-hoc t-tests were computed to examine specific group differences. Based on positive attenuation and ECI theory, as well as previous laboratory findings, it was expected that there would be a significant group effect and that post-hoc tests comparing groups would reveal that MDD individuals have the lowest PER, mD individuals would have the second lowest PER, and healthy control individuals would have the greatest PER, with all groups differing from one another. Based on ECI and previous laboratory findings, it was predicted that mD participants would have significantly higher NER compared to controls, but that MDD participants would have significantly lower NER compared to both mD and control participants. In order to test whether measures of symptom severity would be related to emotional responding (Hypothesis 1b), correlations were computed between the severity measures (BDI and BAI) and the reactivity variables (NER and PER).

In order to assess whether data obtained from the DRM and ESM were comparable (Hypothesis 2), the effect of measure in the two Repeated Measures ANCOVA's described above was examined as well as the group by measure interactions. A significant measure effect would indicate that the data obtained from the two methods are significantly different. A group by measure interaction would show that the effect of measure differs by group. Further, to examine the strength of the reliability between the affect reports in the DRM and ESM data, correlations were computed between the overall daily NA and PA reported by individuals as well as for NER and PER.

Results

Overview

A total of 38 healthy controls, 35 MDD, and 26 mD participants completed the DRM. Of these participants, a total of 31controls, 30 MDD, and 21 mD participants completed the ESM protocol on the third day of data collection (the day corresponding to the DRM). Of the participants who completed ESM, 7 were excluded from analyses for having completed less than 3 questionnaires on Day 3. ESM results for Day 1 and Day 2 are not presented here.

Clinical Characteristics of the Sample

In the MDD sample, 76.5% were recurrent (i.e., had experienced at least one previous MDE) and 3% also met criteria for dysthymia (i.e., double depression). Concerning MDD subtypes, 39.4% were melancholic and 36.4% were atypical. In the mD sample, 32% experienced at least one MDE in the past. Clinical characteristics of each group on the severity measures are in Table 2.

Analyses comparing group differences in depression severity scores were in line with the diagnostic categorizations. A one-way ANOVA confirmed that BDI scores varied significantly among all three groups [$F(2, 94) = 123.79$, $p < .001$], such that MDD individuals had the highest depression severity scores, followed by mD individuals and then control individuals (p<.001 for all comparisons). Similarly, Beck Anxiety Inventory (BAI) scores also differed significantly between groups [$F(2, 95) = 46.50$, $p < .001$].

Follow-up tests indicated that MDD individuals and mD individuals endorsed significantly higher symptoms of anxiety than did healthy individuals ($p < .001$), and MDD individuals endorsed significantly higher anxiety severity than mD individuals ($p<.01$).

Expected group differences in reported positive and negative affect at the time of the diagnostic assessment were also obtained. For PA an overall effect was observed [F (2, 98) = 42.61, $p < .001$], with MDD and mD individuals both showing significantly lower levels of PA than control individuals ($p < .001$), but not differing from one another. Similarly, NA differed significantly between groups [F (2, 98) = 40.64, $p <. 001$], such that MDD and mD individuals had significantly higher NA compared to controls ($p < .01$). However, MDD and mD individuals did not differ significantly on reported NA.

Table 2

Clinical and Treatment Characteristics of the Sample

	Group		
	MDD	mD	Controls
	($n = 35$)	($n = 26$)	($n = 38$)
Variable	Mean (SD)	Mean (SD)	Mean (SD)
BDI	28.96 (9.71)	19.78 (8.52)	2.41 (3.42)
BAI	18.07 (10.24)	11.94 (9.19)	1.78 (2.01)
PA (Lab)	11.11 (6.76)	14.39 (9.44)	26.94 (7.98)
NA (Lab)	21.74 (10.06)	18.56 (6.35)	5.56 (6.17)
% Antidepressants	20.0%	7.7%	0.0%
% Psychotherapy	11.4%	3.8%	0.0%

Note:
BDI = Beck Depression Inventory
BAI = Beck Anxiety Inventory
PA = Positive Affect
NA = Negative Affect

Overall Daily Affect by Group

To set a context for understanding emotional responses to positive and negative events, overall reported positive and negative affect across all episodes were first examined. Overall positive (PA) and negative affect (NA) were computed by averaging reported affect for each episode over the day for each individual for both the DRM and ESM data. The means are reported in Table 3.

To examine group and measurement differences in PA, a Repeated Measures ANOVA was computed with measure (DRM or ESM) as the within subjects factor, group as the between subjects factor, and PA Average as the dependent variable. As expected, the analyses revealed a significant group effect [$F(2, 81) = 31.98, p < .001$]. However, there was also a significant effect of measure type [$F(1, 81) = 8.87, p < .01$], with ESM mean PA values being slightly higher than mean PA values for the DRM across groups. There was no group by measure interaction. Follow-up t-tests revealed that the control group reported more average PA compared to both the MDD and mD groups (p<.001). However, the mD and MDD groups did not significantly differ on average PA.

Similarly, to examine group and measurement differences in NA, a Repeated Measures ANOVA was computed with NA Average as the dependent variable. Again, as expected, the analyses revealed a significant group effect [$F(2, 81) = 55.16, p < .001$]. However, there was also a significant effect of measure type [$F(1, 81) = 50.27, p < .001$], with ESM mean NA values being higher than mean NA values for the DRM. There was also no group by measure interaction for NA. Follow-up t-tests revealed that the control

group reported significantly less NA overall compared to both the MDD and mD groups (p<.001); however, the mD and MDD groups did not differ on average NA.

In order to examine the concurrent relation between the DRM and ESM data, pairwise Pearson's correlations were computed between average daily PA and NA. For these analyses the three participants who completed the DRM on a non-corresponding day were excluded. All correlations were significant and large in magnitude (all ps<.001; see Table 4). These results were also highly correlated with the assessment of PA and NA during the participants laboratory visit (See also Table 4). In sum, the expected differences in average NA and PA were found between MDD and control participants. Interestingly, although MDD and mD participant differed in their depression severity, they did not significantly differ on their overall PA and NA, suggesting that individuals with mD had a similar level of affective disturbance as those with MDD. Furthermore, although there was a significant measurement effect, the NA and PA averages obtained by the DRM and ESM data were strongly correlated and ANOVAs computed separately for ESM and DRM revealed the same pattern of group effects. It appears that ratings on the ESM tended to be slightly higher across groups for both NA and PA, perhaps due to differences in the response format.

Table 3

Averaged Daily Affect

Method	Valence	Group		
		MDD	mD	Controls
		(n = 35)	*(n = 26)*	*(n = 38)*
DRM		Mean (SD)	Mean (SD)	Mean (SD)
	PA	12.93 (6.27)	13.05 (6.66)	22.99 (7.60)
	NA	17.65 (7.78)	16.95 (7.24)	5.52 (5.14)
ESM		*(n = 30)*	*(n = 31)*	*(n = 21)*
	PA	16.55 (6.73)	15.03 (6.06)	25.37 (6.15)
	NA	22.02 (6.50)	21.86 (6.24)	7.74 (5.91)

[*]Ratings are based on the sum of seven positive and seven negative mood ratings, each on a 0-6 point scale, averaged over the day. The possible range is 0 to 42.

Table 4

Correlations between Measures of PA and NA

Variable	PA (Lab)	PA (DRM)	PA (ESM)	NA (Lab)	NA (DRM)	NA (ESM)-
PA (Lab)	-	.72*	.62*	-.67*	-.59*	-.64*
PA (DRM)		-	.75*	-.45*	-.54*	-.62*
PA (ESM)				-.50*	-.57*	-.65*
NA (Lab)				-	.78*	.85*
NA (DRM)					-	.84*
NA (ESM)						-

Note:
*$p < .001$

Event Characteristics

Before reporting on PER and NER to everyday life events in the sample, we first report contextual information about the events that were recorded in the DRM in order to provide more information about what it was that participants were reacting to. Information about the type of activity, the nature of the event, location of the event, and interactions with others were recorded for each event. Average proportions of each type of context are presented by group in Tables 5a, 5b, and 5c by group. These are computed

by calculating the proportions of each contextual feature within individual then averaging across groups, so that all participants are weighted equally regardless of the number of events they reported. A wide variety of contextual features were endorsed by participants for all three groups. Exploratory ANOVAs were used to test for group differences on each of the contextual variables, and were all non-significant ($p > .01$), with the exception of the experience of "personal failure." This type of event had a significant group effect [$F(2, 98) = 4.96$, $p < .01$]. Follow-up t-tests revealed that the control group reported significantly fewer events rated as personal failures compared to both the mD ($p = .01$) and MDD ($p < .01$) groups. However, the mD and MDD groups did not significantly differ from one another in the number of personal failure events. Overall the groups were very similar in the activity types, nature of the events, location of the events, and interactions with others as reported in the DRM, with the exception of personal failures.

Table 5-A

Characteristics of Events Recorded in the DRM: Activity Type

Activity Type	Control	mD	MDD
Praying, Meditating	0.00	0.00	0.01
Exercising	0.01	0.02	0.02
Errands	0.02	0.03	0.02
Reading	0.02	0.04	0.02
Housework, Chores	0.03	0.05	0.03
Shopping	0.04	0.02	0.02
Taking Care of Children	0.04	0.04	0.04
On Computer	0.06	0.08	0.07
Other	0.06	0.06	0.05
Napping, Resting	0.06	0.06	0.09
Grooming, Self-care	0.06	0.05	0.06
Watching TV	0.07	0.09	0.08
Studying, Schoolwork	0.07	0.06	0.05
Paid Work	0.08	0.08	0.08
Commuting	0.12	0.11	0.13
Socializing	0.12	0.10	0.10
Eating, Cooking	0.15	0.12	0.13
Nature of the Event	**Control**	**mD**	**MDD**
Personal Failure	0.00	0.04	0.04
Goal Blocked	0.01	0.04	0.04
Negative Social	0.03	0.06	0.05
Thought, Idea, Realization	0.04	0.10	0.06
Neutral Social	0.05	0.09	0.08
Caught up in the Moment	0.07	0.08	0.10
Free from Thought	0.09	0.08	0.15
Reaction to Something	0.10	0.06	0.06
Personal Success	0.13	0.08	0.06
Other	0.14	0.11	0.12
Goal Accomplished	0.16	0.12	0.09
Positive Social	0.17	0.14	0.15

Table 5-B

Characteristics of Events Recorded in the DRM: Event Location

Location of Event	Control	mD	MDD
Family Member's Home	0.00	0.00	0.02
Place of Entertainment	0.01	0.01	0.00
Friend's Home	0.02	0.02	0.03
Outside	0.02	0.07	0.03
Restaurant	0.03	0.04	0.04
Other	0.03	0.06	0.03
Store, Shopping	0.05	0.04	0.04
School	0.09	0.06	0.05
Work	0.10	0.08	0.10
Car, Bus	0.14	0.10	0.13
Home	0.52	0.52	0.53

Table 5-C

Characteristics of Events Recorded in the DRM: Social Interactions

Interacting	Control	mD	MDD
Proportion Interacting with others	0.53	0.51	0.55
Interacting With			
Pets	0.03	0.01	0.06
Boss, Supervisor	0.06	0.06	0.06
Other	0.07	0.07	0.03
Own Children	0.08	0.09	0.12
Strangers	0.08	0.11	0.07
Co-workers	0.09	0.06	0.09
Parents, Relatives	0.10	0.09	0.10
Clients, Customers, Students, Patients	0.12	0.08	0.09
Spouse, Significant Other	0.13	0.22	0.20
Friends	0.23	0.19	0.18

Participants' ratings on subjective characteristics of the events were also

computed.   Mean ratings are presented in Table 6 for ratings of how "Pleasant,"

"Unpleasant," "Important," or "In Control" they considered the events to be. ANOVAs

were used to explore group differences for each of the ratings. There was a significant

group effect for both ratings of "Pleasant" [$F(2, 98) = 8.80$, $p < .001$] and "Unpleasant" [$F(2, 98) = 8.21$, $p < .01$]. Follow-up t-tests revealed that control participants rated events as significantly more pleasant compared to both the MDD (p<.01) and the mD groups (p<.001), though the mD and MDD groups did not differ. Similarly, the control participants rated events as significantly less unpleasant compared to both the MDD (p<.01) and the mD groups (p<.001). The overall group effects were also significant for the average number of reported positive $F(2, 98) = 5.52$, $p < .01$] and negative [$F(2, 98) = 5.00$, $p < .01$] events (which are based on the pleasantness and unpleasantness ratings), and the groups showed a similar pattern with control group experiencing significantly more events rated as positive when compared to both the MDD (p<.01) and mD groups (p<.05). Control participants also experienced less events rated as negative when compared to the mD group (p<.05) and the MDD group, though this comparison was only marginally significant (p=.08). The groups did not differ on the number of events rated as neutral (low on pleasantness and unpleasantness). Overall, there were consistent differences in the subjective event ratings between the control and depressed groups; though no differences between the mD and MDD groups emerged.

Similar to the differences for ratings of the unpleasantness of an event, the groups also significantly differed in their ratings of the events as "Stressful" [$F(2, 98) = 15.54$, $p < .001$], with control participants rating events as significantly less stressful when compared to both the MDD and mD groups (p<.001). There was also a significant group effect for "In Control" [$F(2, 98) = 4.35$, $p < .05$], with control participants rating events as significantly more in control than mD participants, which reflects how in control

participants felt about their situation. Groups did not significantly differ in their ratings of how "Expected" or "Important" an event was (p>.05).

Table 6

DRM Event Appraisals

Event Rating	Control Mean (SD)	mD Mean (SD)	MDD Mean (SD)
Pleasant	4.07 (.83)	3.17 (1.06)	3.34 (.97)
Unpleasant	1.33 (.92)	2.34 (1.19)	2.16 (1.18)
Stressful	1.49 (1.00)	2.91 (1.29)	2.77 (1.25)
Important	4.13 (1.02)	3.38 (1.27)	3.71 (1.56)
In Control	4.39 (.85)	3.57 (1.36)	4.09 (1.10)
Expected	4.25 (.91)	3.73 (1.25)	3.94 (1.43)
Number Rated Positive	8.37 (4.91)	5.65 (4.08)	5.11 (4.17)
Number Rated Negative	1.55 (1.59)	3.19 (2.62)	2.40 (2.03)
Number Rated Neutral	2.79 (2.66)	3.00 (3.24)	3.66 (3.44)

Positive and Negative Emotional Reactivity to Everyday Life Events

To examine positive and negative emotional reactivity (PER and NER), a Repeated Measures ANCOVA was computed with measure (DRM or ESM) as the within subjects factor, group as the between subjects factor, PER average (average PA rating to positively rated events) as the dependent variables, and PA ratings to neutral events as a covariate. Participants that did not have any positively rated events (n=5) or who did not have any neutrally rated events (n=18) in both the DRM and ESM data were dropped from the analyses. As expected, the analyses revealed a significant group effect [$F(2, 51) = 8.21, p < .001$]. There was no effect of measure, or any group by measure interaction. Follow-up tests revealed that the control group experienced more average PER compared to both the MDD and mD groups (p<.001). However, the mD and MDD groups did not significantly differ from one another. Although the neutral covariate was a significant

Discussion

Although major depressive disorder (MDD) involves affective disturbance, it still remains unclear how chronic mood disturbance effects emotional responding. While there is a growing laboratory evidence of blunted emotional reactivity (ECI) in MDD (Bylsma et al., 2008), it still remains unclear how the severity of depression influences emotional reactivity. Specifically, it is unknown whether less severe forms of depression, such as minor depression (mD), involve similar or distinct patterns of emotional responding as observed in MDD. No previous studies have examined emotional reactivity in mD as defined by DRM criteria. Furthermore, naturalistic studies of emotion in depression have been rare, so it is not yet known how well emotional responding in the laboratory generalizes to daily life.

This study was the first to examine the relationship between emotional reactivity to pleasant (PER) and unpleasant (NER) daily life events in a sample of diagnosed MDD individuals, mD individuals, and healthy controls in a naturalistic assessment. This study utilized the DRM and ESM day sampling methods to provide convergent evidence on emotional reactivity in this sample. The general aim of the current study was to examine the differences in emotion reactivity between healthy individuals and individuals with mD and MDD in two naturalistic settings. Further, to clarify the role of symptom severity in emotional reactivity, we examined the relationship between emotional reactivity (NER and PER) with depression and anxiety severity, as measured by the BDI and BAI. A secondary aim was to evaluate the correspondence between two day

sampling methods, the computerized Experience Sampling Method (ESM), and the Day Reconstruction Method (DRM) in order to evaluate whether these two methods obtain similar findings.

Emotional Reactivity and Diagnostic Status

The primary hypothesis for PER predicted that controls would experience the greatest PER, and that mD individuals would experience more PER relative to MDD individuals. Group differences in PER were as predicted: healthy controls reported significantly more positive emotional reactivity to positively rated events compared to both mD and MDD individuals. These findings are in line with both positive attenuation and ECI. However, contrary to expectations, mD and MDD individuals did not differ in PER, suggesting that they experience a similar level of impairment in PER despite their different diagnostic status.

For NER, the primary hypothesis predicted that MDD individuals would show blunted reactivity compared to controls and mD individuals, and that mD individuals would show increased emotional reactivity relative to controls. When examining group differences in NER, contrary to expectations, healthy controls reported significantly less NER in comparison to both the mD and MDD individuals, which supports negative potentiation. Again, surprisingly, the mD and MDD individuals did not differ, suggesting a similar level of impairment in PER despite differences in diagnostic status. These findings are in contrast to the predictions of ECI (Rottenberg, 2005) and recent meta-analyses of laboratory findings that MDD individuals report reliable blunting of NER in comparison to healthy controls (Bylsma et al., 2008).

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The findings of this study of enhanced NER and blunted PER for MDD are in contradiction to the findings of Peeters et al. (2003) which demonstrated blunted NER responses and enhanced PER responses in MDD individuals. This difference in findings is quite puzzling given that Peeters et al. (2003) also used a similar ESM procedure to measure emotional reactivity in MDD. It is possible that differences in their data collection or analyses may have produced different findings. While their ESM procedure was very similar, important differences were that the procedure was not computerized (leaving the possibility that participants did not always complete their questionnaires on time), and instead of asking participants to report on their most emotional event since their last beep, participants were asked whether they had any positive or negative events to report on. Because of the way the question was asked, in some cases there were no positive or negative events reported, and internal events such as thinking about a painful memory were not included in the analyses. Therefore, the multi-level regression analyses they used may not have taken into account all important emotional events from the day. Further notable differences are that the population under study in the Peeters et al. (2003) sample was Dutch, unmedicated, and history of mania or bipolar disorder was not part of their exclusion criteria.

Emotional Reactivity and Symptom Severity

Regression analyses were used to better understand the relationship between depression and co-morbid anxiety severity with emotional reactivity. For PER, as predicted, BDI and BAI scores both exhibited negative linear relationships with PER, such that as depression and anxiety severity increased, positive emotional reactivity decreased. These findings correspond to the predictions of positive attenuation and ECI

and laboratory findings demonstrating positive attenuation in MDD individuals (Bylsma et al., 2008).

For NER, it was predicted that NER would show a non-linear relationship with severity measures, such that as severity increased NER would initially increase but then decrease in the more severe range of severity. However, contrary to predictions, both BDI and BAI scores showed a significant positive linear relationship, such that as depression and anxiety severity increased, negative emotional reactivity increased. Since a non-linear relationship was predicted for the relationship of NER with severity, the fit of the linear and quadratic models were compared. For the relationship of NER with BDI scores, it was clear that a linear model was the best fit of the data, contrary to expectations and the predictions of ECI. It is possible that a quadratic trend was not observed because our MDD sample was not as representative of the severe end of depressive symptomatology (mean BDI of the MDD group was 29), however, our sample is comparable to samples used in laboratory findings that have found blunted NER in MDD individuals (e.g., Rottenberg et al., 2005). For the relationship of NER and BAI findings were more ambiguous, with some suggestion that the quadratic model may be a better fit of the data. However, the quadratic fit was driven by a few subjects on the high end of BAI severity, and it is unclear how well the model would be maintained if there were more individuals on the high end of anxiety severity in the sample. That emotional reactivity was largely a linear function of symptom severity across a wide range of severity provides support for the conceptualization of depression as a continuum rather than representing a distinct disease state.

Event Characteristics

Examination of the context of the daily life events revealed a wide variety of situations with different contextual features reported in the data across groups, suggesting that the findings for PER and NER may generalize to a wide variety of stimuli in a naturalistic environment. Reported event characteristics were very similar for controls, MDD, and mD individuals. This is somewhat surprising given that previous research has found that individuals with depression report less positive social interactions, more interpersonal stress, more daily stressors, etc (e.g., Nezlek, Imbrie & Shean, 1994; O'Neill, Cohen, Tolpin, & Gunthert, 2004). The only significant group difference found was that MDD and mD individuals reported significantly more personal failures than healthy controls. It is possible that this finding may be due to the negative attributions found in depressed individuals, in that depressed individuals are more likely to see themselves or their actions as a failure even if that attribution is not supported by objective evidence (e.g., Beck et al., 1979). The similar reports of events and event contexts across the groups suggest that group differences in emotional reactivity are unlikely to be completely driven by differences in the types of events experienced, though it is possible that there are subtle differences in the event contexts that are not captured by the data.

However, in terms of the subjective ratings of the events, there were group differences, with healthy controls rated events as significantly more pleasant and less unpleasant in comparison to both MDD and mD individuals. These findings suggest the potential importance of event appraisal for the experience of emotional reactivity. Previous research has found that depressed individuals tend to appraise events as more negative (e.g., Beck et al., 1979). It may be that appraisal of daily life events and

laboratory emotional stimuli is critical to understanding group differences in emotional

reactivity and the relationship between severity and emotional reactivity. Specifically,

the negative appraisal of particular events may predict negative emotional reactivity.

Indeed, some theorists have argued that appraisals (i.e., cognitive evaluations of events

and situations) are critical for eliciting emotion and can explain emotion differentiation

(see Roseman & Smith, 2001).

Correspondence between the ESM and DRM Sampling Techniques

Analyses of ESM and DRM intended to examine their correspondence showed

remarkably high correspondence between these sampling procedures. No effect of

measurement was found in the analyses of PER and NER, nor were there group by

measure interactions. There was some concern that in a retrospective measure such as

the DRM, depressed individuals might show more negative memory bias; however, there

was no evidence that the DRM report of negative emotion was higher for depressed

persons. Overall, results suggest that the DRM may valid and reliable measure of

emotional reactivity in depressed samples. Further, correspondence between the

measures was quite high in correlational analyses of emotional reactivity, which is

impressive in light of clear differences in the measurement techniques. Specifically, the

times of the measurements differ, since in the DRM individuals choose how they break

up their day into events, but for the ESM data they are questioned at random times. The

close correspondence in findings between these two measures give further validity to the

findings for NER and PER and give confidence that these findings are likely to also

generalize to other naturalistic sampling techniques.

Why Might Naturalistic and Laboratory Findings Diverge?

Findings for NER demonstrated a surprising divergence from a growing body of laboratory findings that MDD may be characterized by blunted NER. This study revealed the opposite pattern, in which NER was found to be potentiated in MDD. This suggests that previous laboratory findings of emotional reactivity in the laboratory may not generalize well to real life, and that the specific contextual features of emotional stimuli may be critical for understanding emotional reactivity.

Examination of event characteristics revealed that a large diversity of types of events were sampled. Although a wide range of emotion-eliciting procedures are used in the laboratory, these assessments are restricted in the types of stimuli that are generally used and are criticized for lacking ecological validity. It may be that an important difference is that events in an individual's daily life are more personally important and relevant. Stimuli in a laboratory setting may not elicit potentiated NER because the stimuli are not particularly salient to depressed individuals who are showing increased NER in their daily lives to more personally meaningful stimuli. A previous laboratory study has used idiographic stimuli (videotapes of participants describing peak happy and sad events from their lives) and still found blunted NER in MDD individuals (e.g., Rottenberg et al., 2005). However, this study only used one type of emotional stimuli (videos) and participants were describing events that they had already previously reacted to in their daily lives.

The use of idiographic stimuli in the laboratory to elicit emotional reactivity has been rare, and stimuli or contexts that more closely resemble naturalistic situations (e.g., interpersonal conflicts, social support, failing an important task, etc.) have not been used to study emotional reactivity in MDD in a controlled laboratory setting. The possibility

remains that types of events and the context surrounding them is particularly important

for understanding differences in emotional reactivity. For example, there may be specific

types of common daily events, such as interpersonal stressors, that relate to increased

NER in depressed individuals but have not been used in laboratory studies of emotional

reactivity in MDD. Further, since positive and negative events were identified by

participants' appraisals of their daily life events, only events appraised as highly positive

or negative were included in the analyses. In laboratory studies, participants may not

necessarily appraise the stimuli as strongly positive or negative. As discussed earlier,

appraisal may be particularly important for understanding emotional reactivity in

depression.

Conclusions and Future Directions

In conclusion, this study found clear relationships between emotional reactivity,

diagnostic status, and symptom severity. Specifically it was found that both MDD and

mD individuals reported more NER and less PER in comparison to healthy controls and

correlation analyses with symptom severity revealed a linear relationship for both.

Surprisingly there were no differences in emotional reactivity found when comparing the

MDD and mD groups, suggesting that both groups experience a similar degree of

impairment in affective functioning. These findings suggest that depression may be

better conceptualized as a continuum of symptom severity rather than a categorical

disease state. Findings for NER diverged from laboratory findings, suggesting that

emotional functioning from daily life may have important differences from emotional

responses to stimuli in the lab. Further, a close correspondence was found between the

two naturalistic methods used, suggesting that these results are a good measure of emotional reactivity in daily life.

Because the findings for NER diverge from laboratory findings, it will be important to examine how specific event characteristics relate to emotional reactivity. In addition, because PER and NER were defined by participants' subjective ratings of their events and the depressed groups reported experiencing more negative and fewer positive events, it would be important to examine whether their ratings of these events are biased and to examine the importance of appraisal in understanding emotional reactivity, which would also apply to laboratory studies. It would also be useful for laboratory studies to use more idiographic stimuli or stimuli more like situations experienced in daily life in order to examine these factors in a controlled setting. Further, since depression severity and co-morbid anxiety demonstrated a similar relationship to emotional reactivity, it will be important for future research to examine the specific influence of depression and anxiety on emotional reactivity. Although this study is cross-sectional, emotional reactivity to everyday life events could potentially serve as a relatively inexpensive and noninvasive predictor of the course of mood disorders. Thus, another important future direction of the current study would be to conduct a longitudinal follow-up of this sample in order to examine whether PER and NER predict the course of mD and MDD.

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Appendices

First we have some general questions about your life. Please answer these
questions by placing a check mark next to the answer that best describes your
opinion.

1.　　Taking all things together, how satisfied are you with your life as a whole these
　　　days? Are you:

　　　__ very satisfied, __ satisfied, __ not very satisfied, __ not at all satisfied?

2.　　Next, let's turn to your life at home. Overall, how satisfied are you with your life at
　　　home? Are you:

　　　__ very satisfied, __ satisfied, __ not very satisfied, __ not at all satisfied?

3.　　And how about your job? Overall, how satisfied are you with your present job?
　　　Are you:

　　　__ very satisfied, __ satisfied, __ not very satisfied, __ not at all satisfied?

4.　　Now we would like to know how you feel and what mood you are in when you are
　　　at home. When you are at home, what percentage of the time are you:

in a bad mood	____%
a little low or irritable	____%
in a mildly pleasant mood	____%
in a very good mood	____%
Sum	100%

5.　　Now we also like to know how you feel and what mood you are in when you are
　　　at work When you are at work, what percentage of the time are you:

in a bad mood	____%
a little low or irritable	____%
in a mildly pleasant mood	____%
in a very good mood	____%
Sum	100%

Yesterday

We would like to learn what you did and how you felt yesterday. Not all days are the same – some are better, some are worse and others are pretty typical. Here we are only asking you about yesterday.

Because many people find it difficult to remember what exactly they did and experienced, we will do this in three steps:

1.   On the next page, we will ask you when you woke up and when you went to sleep yesterday.

2.   We'd like you to reconstruct what your day was like, as if you were writing in your diary. Where were you? What did you do and experience? How did you feel? Answering the questions on the next page will help you to reconstruct your day.

3.   After you have finished reconstructing your day in your diary, we will ask you specific questions about this time. In answering these questions, we'd like you to consult your diary page and the notes you made to remind you of what you did and how you felt.

To begin, please circle the day of the week that YESTERDAY was:

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday

Diary Pages

About what time did you wake up yesterday?   _____

And when did you go to sleep?   _____

On the next three pages, please describe your day. Think of your day as a continuous series of scenes or episodes in a film. Give each episode a brief name that will help you remember it (for example, "commuting to work", or "at lunch with B", where B is a person or a group of people). Write down the approximate times at which each episode began and ended. The episodes people identify usually last between 15 minutes and 2 hours. Indications of the end of an episode might be going to a different location, ending one activity and starting another, or a change in the people you are interacting with.

There is one page for each part of the day – Morning (from waking up until noon), Afternoon (from noon to 6:00 pm) and Evening (from 6:00 pm until you went to bed). There is room to list 10 episodes for each part of the day, although you may not need that many, depending on your day. It is not necessary to fill up all of the spaces – use the breakdown of your day that makes the most sense to you and best captures what you did and how you felt.

Try to remember each episode in detail, and write a few words that will remind you of exactly what was going on. Also, try to remember how you felt, and what your mood was like during each episode. What you write only has to make sense to you, and to help you remember what happened when you are answering the questions about the specific episodes in your day.

	What happened?	Time Began	Time Ended	What did you feel?	What were you thinking?
Morning (from waking up until just before lunch)					
01A	Lunchtime				
02A					
03A					
04A					
05A					
06A					
07A					
08A					
09A					
10A					

	Afternoon (from lunch until just before)

	What happened?	**Time Began**	**Time Ended**	**What did you feel?**	**What were you thinking?**
01A	Lunchtime				
02A					
03A					
04A					
05A					
06A					
07A					
08A					
09A					
10A					

	Evening (from dinnertime until just before you went to sleep)				
	What happened?	**Time Began**	**Time Ended**	**What did you feel?**	**What were you thinking?**
01E	Dinnertime				
02E					
03E					
04E					
05E					
06E					
07E					
08E					
09E					
10E					

Please look over your diary once more. Are there any other episodes that you'd like to revise or add more notes to? Is there an episode that you would want to break up into two parts? If so, please go back and make the necessary adjustments on your diary pages. If not, you may go on to the next section.

Thank You
You may now start on the next section.

How Did You Feel Yesterday?

Before we proceed, please look back at your diary pages.

How many episodes did you record for the Morning?   _____

How many episodes did you record for the Afternoon?   _____

How many episodes did you record for the Evening?   _____

Now, we would like to learn in more detail about how you felt during those episodes. For each episode, there are several questions about what happened and how you felt. Please use the notes on your diary pages as often as you need to.

Please answer the questions for every episode you recorded, beginning with the first episode in the Morning. To make it easier to keep track, we will ask you to write down the number of the episode that is at the end of the line where you wrote about it in your diary. For example, the first episode of the Morning was number 1M, the third episode of the Afternoon was number 3A, the second episode of the Evening was number 2E, and so forth.

It is very important that we get to hear about all of the episodes you experienced yesterday, so please be sure to answer the questions for each episode you recorded. After you have answered the questions for all of your episodes, including the last episode of the day (just before you went to bed), you can go on to the next section.

| **First Morning Episode** |
| **Please look at your Diary and select the <u>earliest</u> episode you noted in the Morning.** |

When did this first episode begin and end (e.g., 7:30am)? Please try to remember the times as precisely as you can.

This is episode number _____, which began at _____ and ended at _____.

What were you doing? (please check all that apply):

__ paid work
__ studying, schoolwork
__ commuting
__ shopping
__ housework, chores
__ eating or cooking
__ watching TV
__ reading
__ socializing
__ napping/resting
__ exercising
__ on computer
__ taking care of children
__ praying or meditating
__ grooming/self-care
__ errands
__ other (please specify:_____)

What was the nature of this episode?

__ A personal success
__ A personal failure
__ A positive social interaction
__ A negative social interaction
__ A neutral social interaction
__ A thought, idea, or realization
__ A goal was accomplished
__ A goal was blocked
__ Being free from thought
__ Caught up in the moment
__ A reaction to something I saw or heard
__ Other (please specify: _____)

Where were you?
    __ At home
    __ At work
    __ At school
    __ At a friend's home
    __ At a family member's home
    __ At a store/shopping
    __ At a restaurant
    __ At a place of entertainment
    __ In the car/bus
    __ Outside
    __ Somewhere else (please specify: _____)

Were you interacting with anyone (including on the phone, in a teleconference, etc)?
    __ yes
    __ no one   *skip next question.*

If you were interacting with someone (please check all that apply)
    __ spouse, significant other
    __ friends
    __ co-workers
    __ boss, supervisor
    __ clients,customers,students, patients
    __ my children
    __ parents,relatives
    __ strangers
    __ pets
    __ other (please specify: _____)

How <u>IMPORTANT</u> would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How <u>PLEASANT</u> would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How <u>UNPLEASANT</u> would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How <u>STRESSFUL</u> would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How <u>EXPECTED</u> would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How <u>IN CONTROL</u> of this episode were you?

Not at all						Very
0	1	2	3	4	5	6

First Morning Episode

How did you <u>feel</u> during this episode?

Please rate each feeling on the scale given. A rating of 0 means that you did not experience that feeling at all. A rating of 6 means that this feeling was a very important part of the experience. Please circle the number between 0 and 6 that best describes how you felt.

	Not at all						Very
	0	1	2	3	4	5	6
Talkative							
Enthusiastic							
Tense							
Confident							
Cheerful							
Anxious							
Energetic							
Satisfied							
Happy							
Distracted							
Restless							
Irritated							
Depressed							
Guilty							
Snobbish							
Ashamed							
Regretful							
Successful							
Embarrassed							
Self-Conscious							
Accomplished							
Stuck-up							
Humiliated							

> **Next Episode**
> **Now look at your Diary and select the episode that <u>immediately followed</u> the one you just rated.**

When did this first episode begin and end (e.g., 7:30am)? Please try to remember the times as precisely as you can.

This is episode number _____, which began at _____ and ended at _____.

What were you doing? (please check all that apply):

    __ paid work
    __ studying, schoolwork
    __ commuting
    __ shopping
    __ housework, chores
    __ eating or cooking
    __ watching TV
    __ reading
    __ socializing
    __ napping/resting
    __ exercising
    __ on computer
    __ taking care of children
    __ praying or meditating
    __ grooming/self-care
    __ errands
    __ other (please specify:_____)

What was the nature of this episode?

    __ A personal success
    __ A personal failure
    __ A positive social interaction
    __ A negative social interaction
    __ A neutral social interaction
    __ A thought, idea, or realization
    __ A goal was accomplished
    __ A goal was blocked
    __ Being free from thought
    __ Caught up in the moment
    __ A reaction to something I saw or heard
    __ Other (please specify: _____)

Where were you?
    __ At home
    __ At work
    __ At school
    __ At a friend's home
    __ At a family member's home
    __ At a store/shopping
    __ At a restaurant
    __ At a place of entertainment
    __ In the car/bus
    __ Outside
    __ Somewhere else (please specify: _____)

Were you interacting with anyone (including on the phone, in a teleconference, etc)?
    __ yes
    __ no one *skip next question.*

If you were interacting with someone (please check all that apply)
    __ spouse, significant other
    __ friends
    __ co-workers
    __ boss, supervisor
    __ clients,customers,students, patients
    __ my children
    __ parents,relatives
    __ strangers
    __ pets
    __ other (please specify: _____)

How IMPORTANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How PLEASANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How UNPLEASANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How STRESSFUL would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How EXPECTED was this episode?

Not at all						Very
0	1	2	3	4	5	6

How IN CONTROL of this episode were you?

Not at all						Very
0	1	2	3	4	5	6

Next Episode

How did you <u>feel</u> during this episode?

Please rate each feeling on the scale given. A rating of 0 means that you did not experience that feeling at all. A rating of 6 means that this feeling was a very important part of the experience. Please circle the number between 0 and 6 that best describes how you felt.

	Not at all						Very
	0	**1**	**2**	**3**	**4**	**5**	**6**
Talkative							
Enthusiastic							
Tense							
Confident							
Cheerful							
Anxious							
Energetic							
Satisfied							
Happy							
Distracted							
Restless							
Irritated							
Depressed							
Guilty							
Snobbish							
Ashamed							
Regretful							
Successful							
Embarrassed							
Self-Conscious							
Accomplished							
Stuck-up							
Humiliated							

Next Episode
**Now look at your Diary and select the episode that <u>immediately followed</u>
the one you just rated.**

When did this first episode begin and end (e.g., 7:30am)? Please try to remember the times as precisely as you can.

This is episode number _____, which began at _____ and ended at _____.

What were you doing? (please check all that apply):

__ paid work
__ studying, schoolwork
__ commuting
__ shopping
__ housework, chores
__ eating or cooking
__ watching TV
__ reading
__ socializing
__ napping/resting
__ exercising
__ on computer
__ taking care of children
__ praying or meditating
__ grooming/self-care
__ errands
__ other (please specify:_____)

What was the nature of this episode?

__ A personal success
__ A personal failure
__ A positive social interaction
__ A negative social interaction
__ A neutral social interaction
__ A thought, idea, or realization
__ A goal was accomplished
__ A goal was blocked
__ Being free from thought
__ Caught up in the moment
__ A reaction to something I saw or heard
__ Other (please specify: _____)

Where were you?
- __ At home
- __ At work
- __ At school
- __ At a friend's home
- __ At a family member's home
- __ At a store/shopping
- __ At a restaurant
- __ At a place of entertainment
- __ In the car/bus
- __ Outside
- __ Somewhere else (please specify: _____)

Were you interacting with anyone (including on the phone, in a teleconference, etc)?
- __ yes
- __ no one   *skip next question.*

If you were interacting with someone (please check all that apply)
- __ spouse, significant other
- __ friends
- __ co-workers
- __ boss, supervisor
- __ clients,customers,students, patients
- __ my children
- __ parents,relatives
- __ strangers
- __ pets
- __ other (please specify: _____)

How IMPORTANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How PLEASANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How UNPLEASANT would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How STRESSFUL would you rate this episode?

Not at all						Very
0	1	2	3	4	5	6

How EXPECTED was this episode?

Not at all						Very
0	1	2	3	4	5	6

How IN CONTROL of this episode were you?

Not at all						Very
0	1	2	3	4	5	6

Next Episode

How did you <u>feel</u> during this episode?

Please rate each feeling on the scale given. A rating of 0 means that you did not experience that feeling at all. A rating of 6 means that this feeling was a very important part of the experience. Please circle the number between 0 and 6 that best describes how you felt.

	Not at all						**Very**
	0	**1**	**2**	**3**	**4**	**5**	**6**
Talkative							
Enthusiastic							
Tense							
Confident							
Cheerful							
Anxious							
Energetic							
Satisfied							
Happy							
Distracted							
Restless							
Irritated							
Depressed							
Guilty							
Snobbish							
Ashamed							
Regretful							
Successful							
Embarrassed							
Self-Conscious							
Accomplished							
Stuck-up							
Humiliated							

If you have more episodes to rate, please ask the researcher for additional forms.

Have you rated all of your episodes, including the last episode of the day, just before you went to bed?

If so, you may go on to the next section.

A Few More Questions about Yesterday

Now that you have told us about your day in detail, we have a few more general questions.

Now we would like to know <u>overall</u> how you felt and what your mood was like yesterday. <u>Thinking only about yesterday</u>, what percentage of the time were you:

in a bad mood	_____%
a little low or irritable	_____%
in a mildly pleasant mood	_____%
in a very good mood	_____%
Sum	100%

Now we'd like to know how <u>typical</u> yesterday was for that day of the week (i.e.,for a Monday, for a Tuesday, or so on). <u>Compared to what that day of the week usually is like</u>, yesterday was (please circle one):

Much Worse	Somewhat Worse	Pretty Typical	Somewhat Better	Much Better
1	2	3	4	5

Appendix B: The ESM Questions

Questions about sleep patterns, only asked at first report of the day:

What time did you wake up this morning?

> 4am or earlier
> 5am
> 6am
> 7am
> 8am
> 9am
> 10am
> 11am
> noon or later

What time did you go to sleep last night?

> 4pm or earlier
> 5pm
> 6pm
> 7pm
> 8pm
> 9pm
> 10pm
> 11pm
> 12am
> 1am
> 2am
> 3am or later

Current Mood ratings, asked at each beep
(responses given on a sliding Likert scale from "Not at all" to "Very"):

How TALKATIVE do you feel?
How ENTHUSIASTIC do you feel?
How TENSE do you feel?
How CONFIDENT do you feel?
How CHEERFUL do you feel?
How ANXIOUS do you feel?
How ENERGETIC do you feel?
How SATISFIED do you feel?
How HAPPY do you feel?
How DISTRACTED do you feel?
How RESTLESS do you feel?
How IRRITATED do you feel?
How DEPRESSED do you feel?
How GUILTY do you feel?
How SNOBBISH do you feel?
How ASHAMED do you feel?
How REGRETFUL do you feel?
How SUCCESSFUL do you feel?
How EMBARRASSED do you feel?
How SELF-CONSCIOUS do you feel?
How ACCOMPLISHED do you feel?
How STUCK-UP do you feel?
How HUMILIATED do you feel?

Questions about current activity, asked at each beep:
What are you doing RIGHT NOW?

paid work
studying, schoolwork
commuting
shopping
housework, chores
eating or cooking
watching TV
reading
socializing
napping/resting
exercising
on computer
taking care of children
praying or meditating
grooming/self-care
errands
other

WHERE are you RIGHT NOW?

At home
At work
At school
At a friend's home
At a family member's home
At a store/shopping
At a restaurant
At a place of entertainment
In the car/bus
Outside
Somewhere else

Are you INTERACTING with someone RIGHT NOW?

Yes
No

WHO are you interacting with? Check all that apply:

spouse, significant other
friends
co-workers
boss, supervisor
clients,customers,students
my children
parents,relatives
strangers
pets

Questions about the event, asked at each beep:
Think about the MOST IMPORTANT EMOTIONAL EVENT that happened SINCE YOUR LAST REPORT, in what CONTEXT did this event occur?

> paid work
> studying, schoolwork
> commuting
> shopping
> housework, chores
> eating or cooking
> watching TV
> reading
> socializing
> napping/resting
> exercising
> on computer
> taking care of children
> praying or meditating
> grooming/self-care
> errands
> other

What was the NATURE OF THIS EVENT?

> A personal success
> A personal failure
> A positive social interaction
> A negative social interaction
> A neutral social interaction
> A thought, idea, or realization
> A goal was accomplished
> A goal was blocked
> Being free from thought
> Caught up in the moment
> A reaction to something I saw or heard

WHERE were you during the event?

> At home
> At work
> At school
> At a friend's home
> At a family member's home
> At a store/shopping
> At a restaurant
> At a place of entertainment
> In the car/bus
> Outside
> Somewhere else

Were you INTERACTING with someone during the event?

      Yes
      No

WHO were you interacting with? Check all that apply:

      spouse, significant other
      friends
      co-workers
      boss, supervisor
      clients,customers,students, patients
      my children
      parents,relatives
      strangers
      pets

Ratings about the event (responses given on a sliding Likert scale from "Not at all" to "Very"):

How IMPORTANT would you rate this event?

How PLEASANT would you rate this event?

How UNPLEASANT would you rate this event?

How STRESSFUL would you rate this event?

How EXPECTED was the event?

How IN CONTROL of the event were you?

Questions about crying:

Did you cry during this event?

      If Yes: How did you feel after crying? (sliding scale from worse then before to better than before)