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Emotional Clarity as a Function of Neuroticism and Major Depressive Disorder

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Abstract

Investigators have begun to document links between emotional clarity and forms of negative emotionality, including neuroticism and Major Depressive Disorder (MDD). Research to date has relied almost exclusively on global self-reports of emotional clarity; moreover, no studies have examined emotional clarity as a function of valence, although this may prove to be crucial in understanding the relation of emotional clarity to maladjustment. In two studies, we used experience sampling methodology and multi-level modeling to examine the associations between emotional clarity and two constructs that have been linked theoretically with emotional clarity: neuroticism and depression. In Study 1 we assessed 95 college students who completed a self-report measure of neuroticism. In Study 2 we examined 53 adults diagnosed with MDD and 53 healthy adults. Reaction times to negative and positive emotion ratings during the experience sampling protocols were used as an indirect measure of emotional clarity. Neuroticism was related to lower clarity of negative, but not of positive, emotion. Similarly, compared to the healthy controls, individuals with MDD had lower clarity of negative, but not of positive, emotion. Importantly, findings from both studies held after controlling for baseline reaction times and current levels of negative and positive emotion. These findings highlight the importance of assessing valence when examining emotional clarity and increase our understanding of the nature of the emotional disturbances that characterize neuroticism and MDD.

Keywords: emotional clarity, neuroticism, negative emotionality, Major Depressive Disorder, depression

Emotional Clarity as a Function of Neuroticism and Major Depressive Disorder

Emotions provide individuals with information: They help people navigate their lives and inform them if their goals, needs, and concerns are being met (Carver & Scheier, 1990; Lazarus, 1991; Schwarz & Clore, 2003). In this context, being unclear about how one feels is likely to be maladaptive. For example, how do people decide what actions to take if they are basing decisions on inaccurate information? How well can people successfully regulate emotions about which they are confused? Dizén, Berenbaum, and Kerns (2005) found that people who are less clear about their emotions are also less aware and less clear about their psychological needs.

Emotional clarity refers to the extent to which individuals can unambiguously identify, label, and mentally represent the type (e.g., sadness, nervousness) and source or cause of emotions they feel (Coffey, Berenbaum, & Kerns, 2003; Gohm & Clore, 2000). The extent to which people are clear about their emotional experiences varies continuously and is an individual difference construct (Gohm & Clore, 2000). Lower levels of emotional clarity have been associated with poorer emotion regulation (e.g., Gratz & Roemer, 2008; Salovey, Mayer, Goldman, Turvey, & Palfai, 1995; Tull, Barrett, McMillan, & Roemer, 2007) and diminished psychological well-being (e.g., Saxena & Mehrotra, 2010; Augusto-Landa, Pulido-Martos, & Lopez-Zafra, 2011; Landa, Martos, & Lopez-Zafra, 2010; Montes-Berges & Augusto-Landa, 2014; Saxena, Dubey, & Pandey, 2011). For example, individuals who are diagnosed with Major Depressive Disorder (MDD) report lower levels of emotional clarity than do non-psychiatric controls (Loas et al., 1998). Similarly, college students whose depressive episodes are in remission report lower levels of emotional clarity than do their never depressed peers (Ehring, Fischer, Schnulle, Bosterling, & Tuschen-Caffier, 2008).

The study of emotional clarity has been extended to the domain of personality. In particular, researchers have examined relations between emotional clarity and global or trait measures of neuroticism, or trait negative affect. Neuroticism has been consistently associated with lower levels of emotional clarity in samples of college students (Coffey et al., 2003; Euse & Haney, 1975; Extremera & Fernandez-Berrocal, 2005; Gohm & Clore, 2002; Salovey et al., 1995).

There are two reasons to expect both neuroticism and MDD to be inversely related to emotional clarity. First, if depressed individuals are indeed characterized by diminished levels of emotional clarity, risk factors for the development of MDD, particularly those that have an emotional component, may also be associated with low levels of emotional clarity. In this context, neuroticism, which has been linked to negative affectivity (e.g., Watson, Wiese, Vaidya, & Tellegen, 1999), is posited to serve as a risk factor for MDD (e.g., Barlow, Sauer-Zavala, Carl, Bullis, & Ellard, 2013). Second, it is possible that neuroticism and MDD have in common underlying processes, such as a shared genetic diathesis (e.g., Mineka, Watson, & Clark, 1998; Watson & Clark, 1995).

Researchers examining emotional clarity have almost exclusively used global self-report measures, which have notable limitations. Perhaps most important, the extent to which people can accurately introspect and report on their emotional clarity is unclear. Lischetzke, Angelova, and Eid (2011) used a novel method to assess emotional clarity as part of an experience sampling study. Participants rated how they were feeling in the moment, and their reaction times (RT) to make these ratings were used as a proxy for emotional clarity. Presumably, faster ratings on emotion items reflect greater clarity about emotions. Lischetzke and colleagues (2011) found that although these RTs were not related to global self-reports of emotional clarity, they were related to participants' certainty about their feelings in the moment. Further, faster RTs, but not global measures of emotional clarity, predicted greater subsequent self-reported mood-regulation success during the experience sampling protocol.

Indirect assessments of emotional clarity also reduce possible influences of cognitive biases that have been found to characterize clinical populations, including individuals with MDD (e.g., memory biases; Mathews & MacLeod, 2005). Finally, retrospective self-report measures suffer more generally from the weakness of being far removed from the actual situations and contexts in which people actually experience their emotions. Assessing emotional clarity in the context of people's daily lives provides information with greater ecological validity. Thus, in order to assess level of emotional clarity more reliably, it is important to use methods other than retrospective self-report.

In addition to these methodological issues, investigators examining emotional clarity, including researchers studying neuroticism and MDD, have yet to assess emotional clarity as a function of valence. Although there is evidence that MDD and neuroticism are related to lower levels of emotional clarity, it is unclear whether these results for emotional clarity hold for both positive and negative emotions, or alternatively, whether diminished emotional clarity is unique to negative or positive emotions. There are important clinical implications for understanding whether disturbances in emotional clarity are general or are specific to one valence. For example, if difficulties in emotional clarity are specific to negative emotions, then treatment components targeting emotions need to focus on helping clients learn how to better identify only their negative, and not their positive, emotions.

We hypothesize that neuroticism and MDD will be characterized by decreased clarity of negative, but not positive, emotions. Individuals vulnerable to and diagnosed with MDD exhibit a variety of negative cognitive biases in memory, attention and the interpretation of ambiguous information (e.g., Alloy, Abramson, Walshaw, & Neeren, 2006; Gotlib & Joormann, 2010). For example, people with MDD exhibit difficulty removing negative material from working memory (e.g., Levens & Gotlib, 2010). This strong focus on negative valence may obscure the clarity about the specific negative feelings they may experience. Indeed, people with MDD struggle in their understanding of specific negative emotions. For example, individuals with MDD have less differentiated negative emotions than do healthy controls (Demiralp et al., 2012); importantly, the groups do not differ on differentiation of their positive emotions. Similarly, neuroticism is associated with lower levels of differentiated negative emotions (Erbas, Ceulemans, Pe, Koval, & Kuppers, 2014).

In addition, there are also two lines of research that provide at least indirect support for our central hypothesis that neuroticism and MDD will be associated with reductions in the clarity of negative, but not positive, emotions. First, both neuroticism (Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008) and MDD (Aldao, Nolen-Hoeksema, & Schweizer, 2010) have been found to be associated with poor regulation of negative emotions. We posit that these problems with emotion regulation are due in part to these individuals being unclear about their negative emotions. In other words, we think that the

diminished clarity of negative emotion is one factor that leads to subsequent difficulties in regulating negative emotions. Consistent with this formulation, investigators have shown that participants with lower clarity of emotion have greater difficulty repairing experimentally induced negative moods (Salovey et al., 1995).

Although we conceptualize emotional clarity as being central to understanding why people experience aberrations in negative emotions, emotional clarity may play less of a key role in understanding the relations between positive emotions and neuroticism or MDD. First, neuroticism is generally unrelated to positive emotions; even though MDD is associated with diminished positive emotions, the particular issue is that people do not experience enough positive emotion (Watson, Clark, & Carey, 1988). We think that the main issues involved in understanding aberrations in positive emotions related to neuroticism and MDD will be linked to factors and processes that clarify the elicitation, maintenance, and up-regulation of positive emotions, and emotional clarity may not be central to these processes. Indeed, in a related line of research, Barrett, Gross, Christensen, and Benvenuto (2001) found that emotion regulation was related to the extent to which people differentiated negative, but not positive, emotions.

The second line of research that provides indirect support for our central hypothesis involves the construct of emotional instability. Higher levels of emotional variability have been found to be associated with less emotional clarity (Thompson, Berenbaum, & Bredemeier, 2011). In this context, compared with healthy controls, individuals diagnosed with MDD experience greater variability of negative, but not of positive, emotions (e.g., Houben, Van den Noortgate, & Kuppens, in press; Peeters, Berkhof, Delespaul, Rottenberg, & Nicolson, 2006; Thompson et al., 2012). Thus, we predict that depressed individuals will experience lower clarity of negative, but not of positive, emotions.

Before examining the specific mechanisms that may underlie possible lower levels of clarity of negative emotions in individuals with high levels of neuroticism or MDD, it is important that we elucidate the relations between emotional clarity and both neuroticism and MDD. Therefore, in the first study, which involves the reanalysis of existing data (e.g., Kuppens, Allen, & Sheeber, 2010), we examined the

strength of the relation between emotional clarity and trait neuroticism in a sample composed largely of college students. In the second study, we examined the relation between emotional clarity and MDD in a community sample of adults who were in a current depressive episode or who had no history of any mental health disorders. Importantly, in both studies participants completed experience-sampling protocols that included items assessing their current levels of positive and negative emotion. This allowed us to measure negative and positive emotional clarity using participants' RTs to endorse negative and positive emotions, respectively. This is the first study to use RTs to examine clarity of positive and negative emotions as a function of neuroticism and MDD.

Method

Participants and Procedure

Study 1: An initial sample of 80 participants took part in the study, of which 77 were university students and 3 were university personnel.[1] They were recruited by responding to ads that were placed around the university campus. One participant withdrew after the first day of data collection, resulting in a final sample of 79 participants (63% female). They ranged in age from 18 to 67 years (M = 24; SD = 7.82). All participants had Belgian nationality and are from European ethnicity. Participants came from a variety of disciplines, including, the humanities (42%), science and technology (22%), and biomedical sciences (22%). Participants provided informed consent and were compensated for their participation.

In the first session, each participant received a Tungsten E2 palmtop computer along with instructions for how to use it to respond to the questions at each prompt. Each palmtop was programmed to beep 10 times a day for 14 consecutive days during the participant's waking hours using the Experience Sampling Program 4.0 (D. J. Barrett & Feldman Barrett, 2000) on the basis of a stratified random interval scheme (dividing each participant's waking hours into ten equal periods and randomly assigning one prompt in each interval). At each prompt, the palmtop presented a number of questions in randomized order, including items about the experience of specific emotions and questions about the circumstances that led to them. For the next two weeks, participants carried the palmtop during their normal daily activities and responded to the questions when signaled. Compliance was good: overall,

participants responded to 82% of the prompts. After two weeks, participants attended a second session in which they were debriefed and paid for participation. All participants also completed a battery of self-report measures either before or after the sampling procedure, as determined by random assignment. These measures included questionnaires assessing self-esteem, emotion, emotion-regulation, self-esteem (which are not relevant to the current research question) and a personality scale (see below).

Study 2: Adults from the surrounding communities of Ann Arbor, Michigan, and Stanford, California, were recruited using postings at local businesses and online (e.g., Craigslist). To be eligible for participation, people needed to be between 18 and 40 years old (M = 26.8, SD = 6.5) and be native English speakers. The sample was largely women (69.8%) and ethnically/racially diverse: 67.9% white, 7.5% African American, 10.4% Asian American, 2.8% Latino/a, 9.4% multi-racial and 1.9% indicated "other." Participants were highly educated with approximately 51.9% having a bachelor's degree or higher. People were required to either have no history of any mental health disorder (CTL; n = 53) or be in a current depressive episode (MDD; n = 53). Mental health status was assessed using the Structured Clinical Interview for DSM-IV (SCID-I; First, Spitzer, Gibbon, & Williams, 2001). Additional eligibility requirements for the control group included a Beck Depression Inventory–II (BDI-II; Beck, Steer, & Brown, 1996) score of 9 or less. Additional eligibility for the depressed group included a BDI-II score of 14 or higher, and no alcohol/drug dependence in past six months, Bipolar I or II diagnoses, or psychotic disorders. The final sample of 106 participants excluded 15 participants because of equipment failure (n = 12; 7 CTLs, 5 MDDs) or noncompliance (n = 3; all MDDs). The MDD and control groups did not differ significantly in gender ($\chi^2(1) = 0.18$, $p = .83$), race–ethnic composition ($\chi^2(5) = 7.79$, $p = .17$), or educational attainment ($\chi^2(3) = 6.67$, $p = .08$). Individuals with MDD, however, were significantly older than control participants ($t(104) = 2.19$, $p < .05$).[2]

At their first session, participants completed the lifetime SCID, which was administered by graduate and post-baccalaureate students who had received extensive training. Diagnostic reliability was assessed by randomly selecting and re-rating recorded interviews. Our team has achieved excellent inter-

rater reliability for a major depressive episode (k = .93) and for classifying participants as non-psychiatric controls (k = .92; Levens & Gotlib, 2010). Participants returned to the laboratory for a second session to complete a series of self-report measures, including the one described below. At this session, they were instructed on the experience sampling method (ESM) protocol, including completing a full practice trial.

Participants carried a hand-held electronic device (Palm Pilot Z22) that was programmed using the Experience Sampling Program 4.0 (D. J. Barrett & Feldman Barrett, 2000). They were prompted (via a tone signal) eight times per day between 10 a.m. and 10 p.m. The majority of participants carried the device for 7 to 8 days to be prompted 56 times. Prompts occurred at random times within eight 90-min windows per day; thus, prompts could occur between 2 and almost 180 min apart (M = 93 min, SD = 38 min). After a prompt, participants had 3 min to respond to the initial question. For each ESM item, an RT was recorded. MDD and CTL groups did not differ in the percentage of completed prompts (MDD = 77.9%, CTL = 81.0%, $t(104) = 1.24$, $p = .22$). Participants provided informed consent and were compensated for their participation, with an extra incentive for responding to more than 90% of the prompts. The protocol was approved by the Institutional Review Boards of University of Michigan and Stanford University.

Neuroticism. In Study 1, the Dutch translation of the NEO-Five Factor Inventory (FFI) personality questionnaire (Hoekstra, Ormel, & de Fruyt, 1996) was used to measure neuroticism. The questionnaire consists of 60 items, with 12 items measuring each of the Big Five personality dimensions. Respondents are asked to indicate the degree to which they agree or disagree with each of the statements using a five-point Likert-type scale (ranging from 0 = *strongly disagree*, 4 = *strongly agree*; Cronbach α = .88).

Emotion ratings. Finally, to rule out the possibility that people take longer to respond to emotion items that they endorse strongly, we controlled for within-person mean levels of current emotion. At each prompt, participants reported their current levels of negative and positive emotions. Each study administered a different list of emotion words. To maximize comparison of results from each study, we limited the analyses to emotions that were administered in both studies. For negative emotion, we used

ratings for angry, sad, and anxious. For positive emotion, we used ratings for happy and excited.[3] In Study 1, participants indicated the extent to which they were currently feeling each emotion using a continuous slider scale that ranged from 0 (*not at all*) to 100 (*very much*). For Study 2, participants used a 4-point scale (1 = *not at all*, 4 = *a great deal*) to report the extent to which they were currently feeling each emotion at each prompt. We calculated the between and within-person reliability values for negative and positive emotions using MIXED methods (see Shrout & Lane, 2011, for detailed information, including syntax). For Study 1 for negative emotion, the between-person reliability was .995 and the within-person reliability was .657, and for positive emotion the between-person reliability was .994 and the within-person reliability was .715. For Study 2 for negative emotion, the between-person reliability was .994 and the within-person reliability was .570, and for positive emotion the between-person reliability was .997 and the within-person reliability was .751. Across studies, the between-person reliabilities were excellent and the within-person reliability values are in the moderate range (Shrout, 1998).

Emotional clarity. As described above, based on previous work (e.g., Lischetzke et al., 2011), we operationalized emotional clarity as the speed with which participants responded to emotion items during the experience-sampling period. Because of the non-normal distribution of the data in our analyses and to avoid excessive influence of outliers (which occur given the nature of collecting experience sampling data), RTs were log transformed before computing averages or conducting analyses. For clarity of negative and positive emotions, mean scores for the log-transformed RTs to negative and positive emotion items, respectively, were calculated at the prompt-level (i.e., for each participant for each prompt). Study 2 also assessed global emotional clarity. Participants were administered the emotional clarity subscale of the Trait Meta Mood Scale (TMMS; Salovey et al., 1995).

Baseline reaction time. We included baseline RTs as a covariate in our analyses at the within-person level.[4] It is important to control for baseline RTs when examining RTs to valenced stimuli. However, it was particularly important to do so for Study 2 because some people with MDD exhibit psychomotor retardation (American Psychiatric Association, 2013). To assess baseline RT, log-transformed RTs across all non-emotion items were averaged for each prompt to provide a general RT

variable. RTs to any item that included an emotion term were excluded. More specifically, for Study 1, this included items asking participants to provide information about their ongoing situation and how they appraised the situation. For Study 2, this included items assessing physical activity (Mata et al., 2012), significant events (Thompson et al., 2012), as well as mind wandering and rumination.

Analytic overview

Because of the nested data structure (prompts nested within individuals), we tested our hypotheses using multilevel modeling. Multilevel modeling simultaneously estimates within- and between-person effects (Krull & MacKinnon, 2001) while handling varying time intervals between prompts and missing data (Snijders & Bosker, 1999). Importantly, multilevel modeling does not assume independence of data points. We used hierarchical linear modeling (HLM 6.08; Raudenbush, Bryk, & Congdon, 2008) and report parameter estimates with robust standard errors. Full models, all of which were random effects models (i.e., intercepts and slopes were allowed to vary), are described in each respective section.

For both studies, we conducted a series of multilevel models. First, we examined whether negative emotional clarity varied as a function of the Level 2 variables, neuroticism (Study 1) and depression status (Study 2), after controlling for the Level 1 variables: mean log-transformed RT on non-emotion items at that prompt (i.e., baseline RT), and the level of negative emotion at that prompt (all Level-1 predictors person-mean centered). Then, we conducted the same multilevel analyses for positive emotional clarity. For Study 1, in the equations below, $_i$ represents beeps or prompts and $_j$ represents participants. In all models that included neuroticism as a Level 2 (between-person) variable, neuroticism was grand-mean centered.

Level 1 Model (prompt level)[5]:

$$\text{RT to emotion items}_{ij} = \beta_{0j} + \beta_{1j}* \text{mean emotion} + \beta_{2j}* \text{baseline RT} + r_{ij} \quad 1a$$

Level 2 Model (person level):

$$\beta_{0j} = \gamma_{00} + \gamma_{01}*(\text{neuroticism}) + u_{0j} \quad 1b$$

$\beta_{1j} = \gamma_{10} + \gamma_{11}$*(neuroticism) + u_{1j} 1c

$\beta_{2j} = \gamma_{20} + \gamma_{21}$*(neuroticism)+ u_{2j} 1d

For Study 2, all models were identical to those presented in Study 1, with the exception that depression status instead of neuroticism was included as a Level 2 (between person) variable (dummy-coded as 0 = CTL group; 1 = MDD group). The equations below represent the series of multilevel models we conducted on the participants in Study 2.

Level 1 Model (prompt level)[2]:

RT to emotion items$_{ij}$ = β_{0j} + β_{1j}* mean emotion + β_{2j}* baseline RT + r_{ij} 2a

Level 2 Model (person level):

$\beta_{0j} = \gamma_{00} + \gamma_{01}$*(depression status) + u_{0j} 2b

$\beta_{1j} = \gamma_{10} + \gamma_{11}$*(depression status) + u_{1j} 2c

$\beta_{2j} = \gamma_{20} + \gamma_{21}$*(depression status)+ u_{2j} 2d

Results

Study 1

In Table 1, we present the average scores and within- and between-person standard deviations for RT to negative and positive emotion items as well as levels of negative and positive emotion. Next, we examined the correlations between RTs to negative versus positive emotion items at the within-person level (Nezlek, 2012) and at the between person level, using aggregated values across the ESM period. At the within-person level correlation, RT to negative emotion items was moderately correlated with RT to positive emotion items, $r = .47$, $p < .001$. At the between-person level, they were correlated at $r = .63$, $p < .001$; when controlling for baseline RT, RT to negative emotion items was moderately correlated with RT to positive emotion items, $r = .48$, $p < .001$. These correlations suggest that clarity of negative and positive emotions (i.e., RT to negative and positive emotion items) overlap but are not redundant.

Negative emotional clarity. The top half of Table 2 presents results from the negative emotional clarity model (see Figure 1A for a graphical representation of the findings). People with higher levels of

neuroticism had longer RTs to endorse negative emotion items (see γ_{01}). This suggests that higher levels of neuroticism were related to lower levels of negative emotional clarity. Importantly, the model controlled for the level of current negative emotion and participants' current baseline RT. Findings also show that RTs increased with the level of reported negative emotion (see γ_{10}); further, this relation was moderated by levels of neuroticism (see γ_{11}). Although on average it took participants longer to report negative emotions as their levels of negative emotions increase, this effect was weaker for participants with high levels of neuroticism. Baseline RT was positively related to RT to negative emotion items (see γ_{20}), but this relation was not moderated by levels of neuroticism (see γ_{21}).

Positive emotional clarity. The bottom half of Table 2 presents results from the positive emotional clarity model (see Figure 1A). After controlling for average level of current positive emotion and participants' current baseline RT, neuroticism was not significantly related to participants' RT to positive emotion items (see γ_{01}). Thus, positive emotional clarity was not related to levels of neuroticism. In addition, RTs increased with higher levels of reported positive emotions (see γ_{10}), but this relation did not vary as a function of neuroticism (see γ_{11}). Baseline RT was also positively related to RT to positive emotion items (see γ_{20}), but the relation between baseline RT and RT to positive emotion items did not vary as a function of levels of neuroticism (see γ_{21}).

Study 2

Next, we examined our hypotheses in an adult community sample, half of whom were in a major depressive episode (MDD group) and half of whom had no current or past history of any mental health disorders (CTL group). See Table 1 for the average values and within- and between-person standard deviations for RT to negative and positive emotion items as well as of negative and positive emotion as a function of MDD status. Next, we examined the validity of using RTs to in-the-moment ESM ratings of negative and positive emotion ratings to assess emotional clarity. Study 2 included an assessment of emotional clarity using a global self-report measure. Controlling for baseline RT, scores on the global emotional clarity scale were not significantly associated with aggregated RTs to negative emotion items (MDD: $r = .15$, $p = .31$; CTL: $r = .05$, $p = .75$) or with aggregated RTs to positive emotion items for the

MDD group (r = -0.12, p = .42). On the other hand, global emotional clarity was significantly associated with RTs to positive emotion items for the CTL group, controlling for baseline RT (r = .29, p = .04). As in Study 1, we examined the correlation coefficients between RT to negative and positive emotion items at the within- and between-person level. At the within-person level, RTs to negative and positive emotion items were weakly associated, r = .14. At the between-person level, however, they were strongly correlated, r = .77, p < .001; when controlling for baseline RT, RTs to negative and positive emotion items were moderately related, r = .55, p < .001. As in Study 1, these correlations suggest that RTs to negative and positive emotion items are not redundant.

Negative emotional clarity. The top half of Table 3 presents results from the negative emotional clarity model (see Figure 1B for a graphical representation of the findings). Compared to the healthy control group, the MDD group had longer RTs to negative emotion items (see MDD (γ_{01}) row for the intercept (β_0)). Thus, the MDD group had lower levels of negative emotional clarity than did the CTL group. Importantly, the model controlled for average level of negative emotion and participants' baseline RTs to non-emotion items at each prompt. In addition, RTs increased (i.e., emotional clarity decreased) as the level of reported negative emotions increased for the CTL group (see γ_{10}). This relation, however, was moderated by group status (see γ_{11}): As the level of reported negative emotions increased, the MDD group exhibited a smaller increase in RTs to negative emotion items than did the CTL group. Baseline RT was positively related to RT to negative emotion items, and the relation between baseline RT and RT to negative emotion items did not vary as a function of depression status (see γ_{20} and γ_{21}, respectively).

Positive emotional clarity. The bottom half of Table 3 presents results from the positive emotional clarity model (see Figure 1B for a graphical representation of the findings). After controlling for the level of positive emotion and participants' baseline RT to non-emotion items at each prompt, the MDD group did not demonstrate significantly higher RTs to positive emotion items (see γ_{01}) than did the CTL group (γ_{00}). In other words, there was no moderation based on MDD status. Higher levels of positive emotion were related to higher RTs for the CTL group (γ_{10}), this relation was not moderated by group status (γ_{11}). In other words, higher levels of positive emotion were related to longer RTs for all

participants independent of their depression status. Finally, baseline RT was also positively related to RT to positive emotion items (γ_{20}), but this relation was also not moderated by group status (γ_{21}).

Discussion

We hypothesized that neuroticism and MDD are characterized by a similar emotional deficit—experiencing lower clarity of negative but not of positive emotions. We posited that individuals with higher neuroticism and MDD have deficits in their knowledge of negative emotions. This theorizing is consistent with research on a conceptually related but distinct construct (Boden, Thompson, Dizen, Berenbaum, & Baker, 2012) of emotional differentiation. Less differentiation of negative emotions is related to higher neuroticism (Erbas et al., 2014) and characterizes people with MDD compared to healthy controls (Demiralp et al., 2012).

We were able to test our hypothesis in two studies examining emotional clarity in people's day-to-day lives in terms of how quickly they respond to items assessing their momentary experience. We found that participants' longer RTs to make ratings of their negative, but not positive, feelings in-the-moment were related both to higher levels of neuroticism (Study 1) and to a diagnosis of MDD (Study 2). Given that slower responses to emotion items reflect lower emotional clarity, our results suggest that individuals high in neuroticism or with MDD are less clear about their negative emotions in daily life. This lower clarity may have important intrapersonal and interpersonal consequences. Intra-personally, for example, it may give individuals less accurate information about how a specific event impinges on their concerns (Dizen et al., 2005), and how they can deal emotionally with the event (Butler & Randall, 2013). Interpersonally, diminished emotional clarity may hinder adequate emotion regulation or social support (Butler, 2011).

In contrast to negative emotional clarity, positive emotional clarity did not vary as a function of participants' levels of neuroticism (Study 1) or depression status (Study 2). These findings are important because past research examining relations between emotional clarity and both neuroticism and MDD has conceptualized emotional clarity as a general disturbance in emotion, rather than a disruption that may vary by valence. The present studies are the first to examine emotional clarity as a function of valence,

and the findings from both studies highlight the importance of this distinction. Using a set of common items assessing negative and positive emotion in the two studies, we documented that emotional clarity is related only to levels of negative emotion. It is possible, of course, that different mechanisms underlie emotional clarity for positive and negative emotions, and this issue should be examined more explicitly in future research.

Given that neuroticism is a risk factor for MDD (Barlow et al., 2013**)**, another direction for future research is to examine whether reduced clarity of negative emotion predicts the onset of this disorder. We cannot examine this question in Study 1 because we do not know which, if any, of the participants had experienced a major depressive episode of in their past, were in a depressive episode at the time of the study, or may experience an episode in the future. Future research should also examine longitudinally whether clarity of negative emotion diminishes after the onset of a major depressive episode and/or increases after individuals experience remission from depression. If predictive, RTs to negative emotion items could be an easy way to assess future risk for mood disorder such as MDD. Such RTs can easily be collected online and could be used as a diagnostic indicator for possible mood dysregulation. Further research is needed to examine the diagnostic utility of such RTs however.

Only Lischetzke and colleagues (2011) used methods other than global self-reports to assess emotional clarity. Our paper extends Lischetzke et al.'s findings in two important ways. First, these investigators administered emotion items with bipolar scales (e.g., relaxed--nervous); in contrast, we administered emotion items with unipolar scales. Our use of unipolar items is important because it lays bare the valence-specificity of emotional clarity. Indeed, the findings from Study 1 illustrate that emotional clarity is not always diminished across all emotions, but can be specific to an emotional valence. Second, Lischetzke et al. found that people's RTs to emotion items were related to how certain they felt about their emotions in the moment, but not to global emotional clarity scores; RTs to emotion items were also correlated with people's self-reported success of subsequent emotion regulation. Consistent with Lischetzke et al.'s findings, we found in Study 2 that RTs were generally not related to self-reports of global emotional clarity.

Using an indirect assessment of emotional clarity is particularly important when assessing clinical samples, such as individuals diagnosed with MDD. RTs should be less influenced by cognitive biases than are more volitional self-reports of emotional clarity. Although we were able to minimize biases in self-report, some individuals with MDD can exhibit psychomotor retardation. In our main analyses we controlled for varying baseline RTs at the within-person level. However, our pattern of findings did not differ when baseline RT was also included at the between-person level. Although the MDD participants were slower than the CTL participants to respond to all experience sampling items, they were even slower to respond to the emotion items.

In addition to including baseline RT in our multilevel models, we controlled for the levels at which people endorsed emotions in our analyses. This is important because increased levels of negative emotion are a defining feature of neuroticism. Moreover, increased negative emotion and decreased positive emotion are diagnostic criteria for MDD (American Psychiatric Association, 2013), with a large body of evidence documenting this pattern of affective functioning in individuals diagnosed with MDD (e.g., Peeters et al., 2006). People who are experiencing higher levels of negative or positive emotion may take longer to evaluate the specific level at which they are feeling the emotions than do people who are not experiencing any negative or positive emotion. Our results suggest that as levels of negative emotion increase, adults with average levels of neuroticism (Study 1) and without mental health problems (Study 2) take longer to rate the specific levels at which they are experiencing negative emotion (i.e., have less clarity about negative emotion). RTs also increase as levels of negative emotion increase for people with higher levels of neuroticism and for those with MDD, but significantly less than is the case for healthier individuals. This was an unexpected pattern of results, and future research is needed to better understand how the relations between levels of emotion and clarity of emotion vary based on the levels of current emotion. For positive emotion, our results suggest that all people (independent of their levels of neuroticism or their MDD status), take longer to rate the levels at which they are experiencing positive emotion as their actual levels of positive emotion increase (as happens for negative emotion). That is, people's clarity of positive emotions decreases with increasing positive emotion. Although the relation

between level of positive emotion and RT to positive emotion items is significant, the magnitude of this association is lower than that of the relation between negative emotion and RTs to negative emotion items, underscoring the importance in future research of taking into account the levels at which people are endorsing emotion items when using RTs to assess emotional clarity.

Despite the methodological strengths and the importance of findings from these studies, there are four limitations of this research. First, the sample in Study 1 comprised largely students and, in Study 2, adults up to 40 years of age. Therefore, investigators should examine whether neuroticism and MDD are associated with decreased clarity of negative emotions in older adults. Second, despite consistent findings concerning the clarity of negative emotions across two studies with diverse samples, it is not clear whether the lower clarity of negative emotions in participants with neuroticism or MDD reflects a labeling issue or whether their actual emotional experience is amorphous, which should be examined in future research. Third, the three negative emotions (angry, sad, anxious) varied across arousal and approach/avoidance domains, whereas the two positive emotions (happy, excited) were both fairly high-arousal and more approach-oriented emotions. Consequently, participants may have had to make more distinctions for the negative than for the positive items, which may have made it more difficult to rate negative than positive emotions. Future research should examine whether the present findings are replicated if the arousal and approach/avoidance domains are better represented among positive emotions. Finally, in Study 2, as noted above, RTs to emotion items were largely unrelated to the global emotional clarity (with one exception: for the CTL group, RTs to positive emotion items were positively related to global emotional clarity, which was in the opposite direction as expected.) On the one hand, these findings question the validity of using RTs as a measure of emotional clarity. On the other hand, Lischeske and colleagues (2011) conducted a rigorous assessment validating this indirect method to assess emotional clarity. Further, although it is reasonable to expect that different measures of emotion to converge, correlations between measures of emotions are "moderate at best, small in typical studies and inconsistent across studies" (Mauss & Robinson, 2009, p. 227). Regardless, it will be important for future researchers to attend to issues of validity when examining emotional clarity.

In sum, across two independent naturalistic studies, we found consistent evidence that negative emotionality, conceptualized as both a disposition (neuroticism) and a state (MDD) is related to decreased clarity of negative, but not of positive, emotions in daily life. These results highlight the importance of examining emotional clarity separately by valence. In these studies, we used a validated assessment method and utilized statistical techniques appropriate to the research questions and to analyses of experience sampling data. Negative emotions often communicate whether people's goals, needs and concerns are not being met. In this context, the results of these studies contribute to a growing understanding of the emotional disturbances that characterize neuroticism and MDD, and implicate difficulties in clarity of negative emotions in both of these disruptive forms of distress.

References

Aldao, A., Nolen-Hoeksema, S., & Schweizer, S. (2010). Emotion-regulation strategies across psychopathology: A meta-analytic review. *Clinical Psychology Review, 30,* 217-237. doi: 10.1016/j.cpr.2009.11.004

Alloy, L. B., Abramson, L. Y., Walshaw, P. D., & Neeren, A. M. (2006). Cognitive vulnerability to unipolar and bipolar mood disorders. *Journal of Social and Clinical Psychology, 25*, 726-754. doi: 10.1521/jscp.2006.25.7.726

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders* (5th ed.). Washington, DC: American Psychiatric Association.

Augusto-Landa, J. M., Pulido-Martos, M., & Lopez-Zafra, E. (2011). Does perceived emotional intelligence and optimism/pessimism predict psychological well-being? *Journal of Happiness Studies, 12*, 463-474. doi: 10.1007/s10902-010-9209-7

Barlow, D. H., Sauer-Zavala, S. E., Carl, J. R., Bullis, J., & Ellard, K. K. (2013). The nature, diagnosis, and treatment of neuroticism: Back to the future. *Clinical Psychological Science, 2*, 344-365. doi: 10.1177/2167702613505532

Barrett, D. J., & Feldman Barrett, L. (2000). The Experience Sampling Program (ESP): Available at: http://www.experience-sampling.org/.

Barrett, L. F., Gross, J., Christensen, T. C., & Benvenuto, M. (2001). Knowing what you're feeling and knowing what to do about it: Mapping the relation between emotion differentiation and emotion regulation. *Cognition & Emotion, 15*, 713-724. doi: 10.1080/02699930143000239

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Beck Depression Inventory-II (BDI-II)* (2nd ed.). San Antonio, TX: Psychological Corporation.

Boden, M. T., Thompson, R. J., Dizen, M., Berenbaum, H., & Baker, J. P. (2012). Are emotional clarity and emotion differentiation related? *Cognition & Emotion*. doi: 10.1080/02699931.2012.751899

Butler, E. A. (2011). Temporal interpersonal emotion systems: The "TIES" that form relationships. *Personality and Social Psychology Review, 15*, 367-393. doi: 10.1177/1088868311411164

Butler, E. A., & Randall, A. K. (2013). Emotional coregulation in close relationships. *Emotion Review, 5,* 202-210. doi: 10.1177/1754073912451630

Carver, C. S., & Scheier, M. F. (1990). Origins and functions of positive and negative affect: A control-process view. *Psychological Review, 97,* 19-35. doi: 10.1037/0033-295X.97.1.19

Coffey, E., Berenbaum, H., & Kerns, J. K. (2003). The dimensions of emotional intelligence, alexithymia, and mood awareness: Associations with personality and performance on an emotional stroop task. *Cognition & Emotion, 17*, 671-679. doi: 10.1080/02699930302304

Demiralp, E., Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Barrett, L. F., . . . Jonides, J. (2012). Feeling blue or turquoise? Emotional differentiation in major depressive disorder. *Psychological Science, 23*, 1410-1416. doi: 10.1177/0956797612444903

Dizen, M., Berenbaum, H., & Kerns, J. G. (2005). Emotional awareness and psychological needs. *Cognition & Emotion, 19*, 1140-1157. doi: 10.1080/02699930500260468

Ehring, T., Fischer, S., Schnulle, J., Bosterling, A., & Tuschen-Caffier, B. (2008). Characteristics of emotion regulation in recovered depressed versus never depressed individuals. *Personality and Individual Differences, 44*, 1574-1584. doi: 10.1016/j.paid.2008.01.013

Erbas, Y., Ceulemans, E., Pe, M. L., Koval, P., & Kuppers, P. (2014). Negative emotion differentiation: Its personality and well-being correlates and a comparison of different assessment methods. *Cognition and Emotion, 28*. doi: 0.1080/02699931.2013.875890

Euse, F. J., & Haney, J. N. (1975). Clarity, controllability, and emotional intensity of image - Correlations with introversion, neuroticism, and subjective anxiety. *Perceptual and Motor Skills, 40*, 443-447. doi: 10.2466/pms.1975.40.2.443

Extremera, N., & Fernandez-Berrocal, P. (2005). Perceived emotional intelligence and life satisfaction: Predictive and incremental validity using the trait meta-mood scale. *Personality and Individual Differences, 39*, 937-948. doi: 10.1016/j.paid.2005.03.012

First, M. B., Spitzer, R. L., Gibbon, M., & Williams, J. B. W. (2001). *The structured clinical interview for DSM-IV-TR axis I disorders*. New York, NY: NY State Psychiatric Institute, Biometrics Research.

Gohm, C. L., & Clore, G. L. (2000). Individual differences in emotional experience: Mapping available scales to processes. *Personality and Social Psychology Bulletin, 26*, 679-697. doi: 10.1177/0146167200268004

Gohm, C. L., & Clore, G. L. (2002). Four latent traits of emotional experience and their involvement in well-being, coping, and attributional style. *Cognition & Emotion, 16*, 495-518. doi: 10.1080/02699930143000374

Gotlib, I. H., & Joormann, J. (2010). Cognition and depression: Current status and future directions. *Annual Review of Clinical Psychology, Vol 6, 6*, 285-312. doi: 10.1146/annurev.clinpsy.121208.131305

Gratz, K. L., & Roemer, L. (2008). The relationship between emotion dysregulation and deliberate self-harm among female undergraduate students at an urban commuter university. *Cognitive Behaviour Therapy, 37*, 14-25. doi: 10.1080/16506070701819524

Hoekstra, H. A., Ormel, J., & de Fruyt, F. (1996). *Handleiding NEO persoonlijkheidsvragenlijsten NEO-PI-R and NEO-FFI [Manual of the NEO personality inventories NEO-PI-R and NEO-FFI]*. Lisse, The Netherlands: Swets Test Services.

Houben, M., Van den Noortgate, W., & Kuppens, P. (in press). The relation between short term emotion dynamics and psychological well-being: A meta-analysis. *Psychological Bulletin*.

Krull, J. L., & MacKinnon, D. P. (2001). Multilevel modeling of individual and group level mediated effects. *Multivariate Behavioral Research, 36*, 249-277. doi: 10.1207/S15327906MBR3602_06

Kuppens, P., Allen, N. B., & Sheeber, L. B. (2010). Emotional inertia and psychological maladjustment. *Psychological Science, 21*, 984-991. doi: 10.1177/0956797610372634

Landa, J. M. A., Martos, M. P., & Lopez-Zafra, E. (2010). Emotional intelligence and personality traits as predictors of psychological well-being in Spanish undergraduates. *Social Behavior and Personality, 38,* 783-793. doi: 10.2224/sbp.2010.38.6.783

Lazarus, R. S. (1991). *Emotion and adaptation*. New York: Oxford University Press.

Levens, S. M., & Gotlib, I. H. (2010). Updating Positive and Negative Stimuli in Working Memory in Depression. *Journal of Experimental Psychology-General, 139,* 654-664. doi: 10.1037/A0020283

Lischetzke, T., Angelova, R., & Eid, M. (2011). Validating an indirect measure of clarity of feelings: Evidence from laboratory and naturalistic settings. *Psychological Assessment, 23,* 447-455. doi: 10.1037/A0022211

Loas, G., Dhee-Perot, P., Chaperot, C., Fremaux, D., Gayant, C., & Boyer, P. (1998). Anhedonia, alexithymia and locus of control in unipolar major depressive disorders. *Psychopathology, 31,* 206-212. doi: 10.1159/000029041

Mata, J., Thompson, R. J., Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Gotlib, I. H. (2012). Walk on the bright side: Physical activity and affect in major depressive disorder. *Journal of Abnormal Psychology, 121,* 297-308. doi: 10.1037/a0023533

Mathews, A., & MacLeod, C. (2005). Cognitive vulnerability to emotional disorders. *Annual Review of Clinical Psychology, 1,* 167-195. doi: 10.1146/annurev.clinpsy.1.102803.143916

Mauss, I. B., & Robinson, M. D. (2009). Measures of emotion: A review. *Cognition and Emotion, 23,* 209-237. doi: 10.1080/02699930802204677

Mineka, S., Watson, D., & Clark, L. A. (1998). Comorbidity of anxiety and unipolar mood disorders. *Annual Review of Psychology, 49,* 377-412. doi: 10.1146/annurev.psych.49.1.377

Montes-Berges, B., & Augusto-Landa, J. M. (2014). Emotional intelligence and affective intensity as life satisfaction and psychological well-being predictors on nursing professionals. *Journal of Professional Nursing, 30,* 80-88. doi: 10.1016/j.profnurs.2012.12.012

Nezlek, J. B. (2012). Multilevel modeling of diary-style data. In M. R. Mehl & T. S. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 357-383). New York, NY: Guilford Press.

Nolen-Hoeksema, S., Wisco, B. E., & Lyubomirsky, S. (2008). Rethinking rumination. *Perspectives on Psychological Science, 3*, 400-424.

Peeters, F., Berkhof, J., Delespaul, P., Rottenberg, J., & Nicolson, N. A. (2006). Diurnal mood variation in major depressive disorder. *Emotion, 6*, 383-391. doi: 10.1037/1528-3542.6.3.383

Raudenbush, S., Bryk, A., & Congdon, R. (2008). Hierarchical Linear and Nonlinear Modeling (HLM) 6 (Version 6.06). Chicago: Scientific Software International.

Salovey, P., Mayer, J. D., Goldman, S. L., Turvey, C., & Palfai, T. P. (1995). Emotional attention, clarity and repair: Exporing emotional intelligence using the Trait Meta-Mood Scale. In J. W. Pennebaker (Ed.), *Emotion, disclosure and health* (pp. 125-154). Washington, D.C.: American Psychological Association.

Saxena, P., Dubey, A., & Pandey, R. (2011). Role of emotion regulation difficulties in predicting mental health and well-being. *Journal Of Projective Psychology & Mental Health, 18*, 147-155.

Saxena, P., & Mehrotra, S. (2010). Emotional disclosure in day-to-day living and subjective well being. *Psychological Studies, 55*, 208-218. doi: 10.1007/s12646-010-0034-1

Schwarz, N., & Clore, G. L. (2003). Mood as information: 20 years later. *Psychological Inquiry, 14*, 296-303. doi: 10.1207/S15327965pli1403&4_20

Shrout, P. E. (1998). Measurement reliability and agreement in psychiatry. *Statistical Methods in Medical Research, 7*, 301-317. doi: 10.1191/096228098672090967

Shrout, P. E., & Lane, S. P. (2011). Psychometrics. In M. R. Mehl & T. A. Conner (Eds.), *Handbook of research methods for studying daily life* (pp. 302-320). New York, NY: Guilford Press.

Snijders, T. A. B., & Bosker, R. J. (1999). *Multilevel analysis: An introduction to basic and advance multilevel modeling*. Thousand Oaks, CA: Sage Publications.

Thompson, R. J., Berenbaum, H., & Bredemeier, K. (2011). Cross-sectional and longitudinal relations between affective instability and depression. *Journal of Affective Disorders, 130*, 53-59. doi: 10.1016/j.jad.2010.09.021

Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Gotlib, I. H. (2012). The everyday emotional experience of adults with major depressive disorder: Examining emotional instability, inertia, and reactivity. *Journal of Abnormal Psychology, 121*, 819-829. doi: 10.1037/a0027978

Tull, M. T., Barrett, H. M., McMillan, E. S., & Roemer, L. (2007). A preliminary investigation of the relationship between emotion regulation difficulties and posttraumatic stress symptoms. *Behavior Therapy, 38,* 303-313. doi: 10.1016/j.beth.2006.10.001

Watson, D., & Clark, L. A. (1995). Depression and the melancholic temperament. *European Journal of Personality, 9*, 351-366. doi: 10.1002/per.2410090505

Watson, D., Clark, L. A., & Carey, G. (1988). Positive and negative affectivity and their relation to anxiety and depressive-disorders. *Journal of Abnormal Psychology, 97*, 346-353. doi: 10.1037/0021-843X.97.3.346

Watson, D., Wiese, D., Vaidya, J., & Tellegen, A. (1999). The two general activation systems of affect: Structural findings, evolutionary considerations, and psychobiological evidence. *Journal of Personality and Social Psychology, 76*, 820-838. doi: 10.1037/0022-3514.76.5.820

Footnotes

[1] Excluding the non-student participants did not change the conclusions for either study.

[2] Age was not significant when it was included as a covariate in any of the models examining negative or positive emotional clarity. Further, the significance levels were not different from those in the analyses in which we did not include age as a covariate.

[3] Results of models that included all available negative and positive emotions (and not only the common emotions) that were administered for Study 1 and 2 were similar to those presented in this paper; that is, the significance levels did not change for the models for positive and negative emotional clarity for either study.

[4] When we include baseline RT as a between-person variable in our models (i.e., in equations 1b-1d and 2b-2e), the conclusions do not differ for either study.

[5] The model can also be written as follows:

Emotional clarity = γ_{00} + γ_{01}(depression status)+ γ_{10}baseline RT + γ_{11}depression status*baseline RT + γ_{20} mean affect + γ_{21}depression status * emotion level+ u_0 +u_{1*}baseline RT + u_2*mean affect + r

Table 1

Means and Within- and Between Person Standard Deviations of Major Variables

	Study 1			Study 2					
	Mean	Within SD	Between SD	Mean CTL	Mean MDD	Within SD CTL	Within SD MDD	Between SD CTL	Between SD MDD
RT to negative emotion items[a]	268.29	166.02	86.23	171.95	223.72	239.85	218.29	61.95	79.16
RT to positive emotion items[a]	337.07	201.58	92.95	202.18	225.74	272.87	390.94	73.35	110.39
Negative emotion mean	7.53	8.24	7.25	1.15	1.95	0.32	0.78	0.17	0.50
Positive emotion mean	56.72	16.42	13.86	2.17	1.59	0.83	0.74	0.53	0.41

[a] These values are for hundredths of seconds and represent the raw RT means. For analyses, log-transformed values were used to minimize effects of outliers. CTL = healthy control group; MDD = group with major depressive disorder.

Table 2

Multilevel Analyses Predicting Negative and Positive Emotional Clarity in Study 1

Fixed Effect	Unstandardized Coefficient	*Standard Error*	*t*-ratio	*Degrees of Freedom*	*p*-value
Outcome: Negative Emotional Clarity					
For Intercept, β_0					
Intercept, γ_{00}	5.180	0.029	177.114	77	< 0.001
Neuroticism, γ_{01}	0.120	0.040	2.932	77	0.004
For negative emotion average slope, β_1					
Intercept, γ_{10}	0.017	0.001	15.863	77	< 0.001
Neuroticism, γ_{11}	-0.004	0.001	-2.703	77	0.008
For baseline RT slope, β_2					
Intercept, γ_{20}	0.540	0.013	40.573	77	< 0.001
Neuroticism, γ_{21}	0.001	0.018	0.028	77	0.978
Outcome: Positive Emotional Clarity					
For Intercept, β_0					
Intercept, γ_{00}	5.585	0.024	236.137	77	< 0.001
Neuroticism, γ_{01}	0.036	0.034	1.044	77	0.300
For positive emotion average slope, β_1					
Intercept, γ_{10}	0.002	< 0.001	4.361	77	< 0.001
Neuroticism, γ_{11}	< 0.001	< 0.001	0.311	77	0.757
For baseline RT slope, β_2					
Intercept, γ_{20}	0.609	0.011	54.080	77	<0.001
Neuroticism, γ_{21}	0.007	0.015	0.505	77	0.615

Note. Neuroticism represents the contrast between the average level of neuroticism and a one-unit increase in neuroticism.

Table 3

Multilevel Analyses Predicting Negative and Positive Emotional Clarity in Study 2

Fixed Effect	Unstandardized Coefficient	Standard Error	*t*-ratio	*Degrees of Freedom*	*p*-value
Outcome: Negative emotional clarity					
For Intercept, β_0					
CTL, γ_{00}	2.083	0.016	126.563	104	<0.001
MDD, γ_{01}	0.136	0.024	5.573	104	<0.001
For negative emotion slope, β_1					
CTL, γ_{10}	0.184	0.029	6.394	104	<0.001
MDD, γ_{11}	-0.147	0.032	-4.645	104	<0.001
For baseline RT slope, β_2					
CTL, γ_{20}	0.278	0.027	10.112	104	<0.001
MDD, γ_{21}	0.013	0.045	0.289	104	0.773
Outcome: Positive emotional clarity					
For Intercept, β_0					
CTL, γ_{00}	2.180	0.018	123.618	104	<0.001
MDD, γ_{01}	0.023	0.026	0.883	104	0.379
For positive emotion slope, β_1					
CTL, γ_{10}	0.055	0.016	3.499	104	<0.001
MDD, γ_{11}	0.007	0.021	0.333	104	0.739
For baseline RT slope, β_2					
CTL, γ_{20}	0.264	0.028	9.294	104	<0.001
MDD, γ_{21}	0.046	0.048	0.977	104	0.331

Note. MDD represents the contrast between the healthy control group (CTL) and group with Major Depressive Disorder (MDD).

Figure 1A

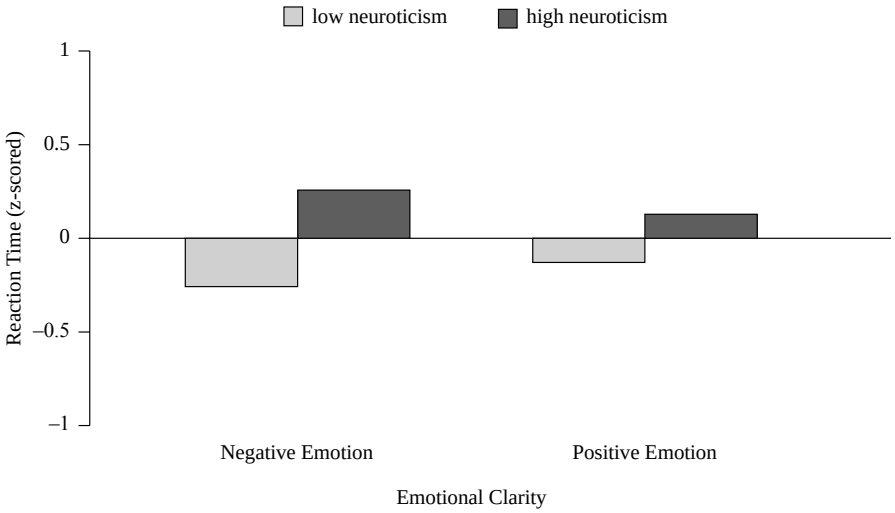

Figure 1B

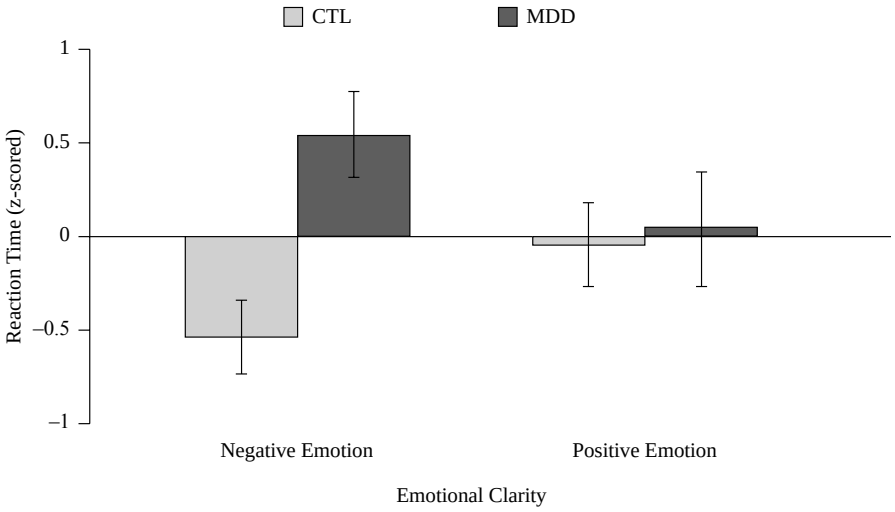

Figure 1. Aggregated within-person reaction times (prompt level, z-scored). Panel A presents results from Study 1, separately for low (-1 SD below mean) versus high (+1 SD above the mean) levels of neuroticism. Panel B presents results from Study 2 by depression group (CTL = healthy control group; MDD = Major Depressive Disorder group), with error bars representing 95% confidence intervals.