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The assessment of emotional clarity via response times to emotion items: shedding light on the response process and its relation to emotion regulation strategies

Charlotte Arndt[a], Tanja Lischetzke[a], Claudia Crayen[b] and Michael Eid[b]

[a]Department of Psychology, University of Koblenz-Landau, Landau, Germany; [b]Department of Education and Psychology, Freie Universität Berlin, Berlin, Germany

ABSTRACT

Researchers have begun to use response times (RTs) to emotion items as an indirect measure of emotional clarity. Our first aim was to scrutinise the properties of this RT measure in more detail than previously. To be able to provide recommendations as to whether (and how) emotional intensity – as a possible confound – should be controlled for, we investigated the specific form of the relation between emotional intensity and RTs to emotion items. In particular, we assumed an inverted U-shaped relation at the item level. Moreover, we analysed the RT measure's convergent validity with respect to individuals' confidence in their emotion ratings. As a second aim, we compared the predictive validity of emotional clarity measures (RT measure, self-report) with respect to daily emotion regulation. The results of three experience sampling studies showed that the association between emotional intensity and RT followed an inverted U shape. RT was in part related to confidence. Emotional clarity measures were unrelated to reappraisal. There was some evidence that lower emotional clarity was related to a greater use of suppression. The findings highlight that emotional intensity and squared emotional intensity should be controlled for when using the RT measure of emotional clarity in future research.

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Being able to detect and identify emotions that are experienced in daily life has been considered a crucial component of emotion regulation (e.g. Gross, 2015), and deficits in emotional awareness have been found to be involved in many types of psychopathology (e.g. Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003; Berking & Wupperman, 2012). Emotional clarity is one facet of emotional awareness and represents the extent to which individuals can unambiguously identify and label their emotional experience (e.g. Gohm & Clore, 2002; Salovey, Mayer, Goldman, Turvey, & Palfai, 1995). Higher levels of emotional clarity have been found to be associated with better affect regulation (e.g. Gohm & Clore, 2002; Lischetzke & Eid, 2003, in press; Salovey et al., 1995), higher subjective well-being (e.g. Gohm & Clore, 2002; Lischetzke & Eid, 2003, in press; Salovey et al., 1995), and lower depression (e.g. Berenbaum, Bredemeier, Thompson, & Boden, 2012). Results from longitudinal studies among adolescents suggested that deficits in emotional clarity represent a risk factor for depression (e.g. Flynn & Rudolph, 2014; Hamilton et al., 2016).

Different authors have proposed that a challenge for research on emotional awareness lies in the development of indirect (non-self-report) measures, which do not require individuals to introspect and report where they stand on the dimension of interest (e.g. Kashdan, Feldman Barrett, & McKnight, 2015; Thompson et al., 2015). As an alternative to global self-reports, a response time (RT)-based measure has been proposed as a proxy for emotional clarity. RT scores are calculated by measuring the time taken by individuals to complete ratings of their current affective state (Lischetzke, Angelova, & Eid, 2011; Lischetzke, Cuccodoro, Gauger, Todeschini, & Eid,

CONTACT Charlotte Arndt arndtch@uni-landau.de

2005). The rationale is that at moments when individuals are rather clear about their affective state, they should be able to rate their affective state comparatively quickly. That is, faster ratings are assumed to reflect higher emotional clarity. Similarly, in other research areas, RTs to craving items have been used as an index of craving certainty (Germeroth, Wray, & Tiffany, 2015), and RTs to attitude items have been used as an index of attitude accessibility (Fazio, 1995).

RTs to mood items have been studied as predictors of affect regulation in the laboratory (Lischetzke et al., 2005) and in daily life (Lischetzke et al., 2011), and RTs to positive and negative emotion items (i.e. measuring momentary emotional experience) have been used as outcomes that were predicted by neuroticism and depression status (Thompson et al., 2015). As advice for future research, Thompson et al. (2015) pointed out that it is important "to take into account the levels at which people are endorsing emotion items when using RTs to assess emotional clarity" (p. 622). In their regression models predicting RT to (negative or positive) emotion items, the authors included a linear term for the level of reported (negative or positive) emotions and found that this term was significantly larger than zero. This finding indicates that RTs were longer at moments when emotional experience was more intense. To the extent that RTs to emotion items tap emotional clarity, this finding has theoretical implications when specifying situational conditions that have an impact on emotional clarity. On the basis of this finding, one would conclude that higher emotional intensity involves lower emotional clarity. Moreover, the finding has practical implications in that, as the authors recommended, any model using an RT measure of emotional clarity as a predictor or outcome variable should control for emotional intensity (as a possible confound).

Shedding light on the response process

Research on processes underlying response choices in the domains of personality assessment (e.g. Akrami, Hedlund, & Ekehammar, 2007; Amelang, Eisenhut, & Rindermann, 1991) and craving assessment (Germeroth et al., 2015) has demonstrated inverted U-shaped relations between response choice (i.e. the degree of agreement to personality items or craving items) and RT. That is, short RTs were found for responses located at the extremes of the response scale, and longer RTs were found for responses in the middle of the response scale. In the domain of personality assessment, an explanation for such inverted U-shaped effects is that the comparison between the content of a specific personality item (e.g. "I am the life of the party") and a relevant self-schema (e.g. degree of extraversion) can be conducted more quickly if the item is either clearly consistent or clearly inconsistent with the self-schema than if the item is moderately self-descriptive (e.g. Akrami et al., 2007). For our example item, this would mean that for a highly extraverted person or for a highly introverted person, the response process should be faster than for a moderately extraverted person.

With respect to the assessment of momentary emotional experience, a similar process might take place: Conceptual knowledge about a specific emotion, for example, anger, may contain (situation-specific) information about what triggers an instance of anger or what it feels like to be angry (Barrett, 2006). More intense sensations may provide a better fit with a stored conceptualisation of an emotion than sensations of moderate intensity. Hence, similar to the self-schema explanation in personality assessment, affective states that are clearly inconsistent or clearly consistent with one's stored conceptual knowledge about an emotion should involve higher confidence and allow a faster response process.

When using RTs to emotion items as an index of momentary emotional clarity, multiple items are assessed at each occasion (e.g. Lischetzke et al., 2005); and for each occasion, the individual RTs are aggregated across items. To find out whether (and how) emotional intensity should be controlled for when applying the RT measure, additional information on the intensity–RT link is needed on the level of aggregated scores. Thompson et al. (2015) analysed the relation between (aggregated) emotional intensity and (aggregated) RT separately for positive vs. negative emotions. They found a positive linear relation between emotional intensity and RT scores – but they did not report whether they had tested for a curvilinear relation. For assessments of craving (Germeroth et al., 2015) and personality (Akrami et al., 2007), an inverted U-shaped relation between response and RT was demonstrated on the level of aggregated scores. However, to the extent that emotional intensity varies across distinct negative emotions, a moderate aggregated negative emotional intensity score does not necessarily have to go along with a longer aggregated RT. For example, in a situation in which high anger, high sadness, no fear and no shame are

all experienced, we would expect relatively short individual RTs for all ratings, resulting in a short average RT. However, if a moderate aggregated negative intensity score results because all negative emotions are moderate in intensity, we would expect a longer RT. Hence, for a measure of emotional experience that consists of multiple discrete emotion items (as compared to individual emotion items), it is theoretically less clear whether an inverted U-shaped relation between emotional intensity and RT can be expected, and the form the relation takes has yet to be empirically determined. Taken together, our first aim was to test for inverted U-shaped relations between emotional intensity and RTs on both the item level (i.e. the level of analysis that is directly related to the response process) and the level of aggregated scores.

As an indication of *convergent validity*, the RT to an emotion item should be related to one's confidence in one's answer to the item. Confidence in momentary emotion ratings can be considered as a direct (self-report) measure of momentary emotional clarity. In line with this idea, Lischetzke et al. (2011) have found that aggregated confidence (certainty) ratings were positively correlated with self-reported dispositional emotional clarity. Research on achievement tests has demonstrated that answers given with low confidence in the correctness of the answer were related to higher RTs than answers given with high confidence (e.g. Koriat & Ackerman, 2010). For emotional experience, participants of an experience sampling method (ESM) study were faster at rating mood items they reported feeling more confident about (Lischetzke et al., 2011). We aimed to replicate this negative relation between confidence in an emotion rating and the RT to this emotion item. Going beyond Lischetzke et al.'s study (2011), we separately analysed this relation for valence-specific clarity (i.e. RTs to positive vs. negative emotion items; Thompson et al., 2015) to test whether the expected negative confidence–RT link would generalise across emotion valence.

If both RT and confidence ratings of emotion items tap momentary emotional clarity, the response process relating emotional intensity to momentary clarity should be similar between the two measures (RT vs. confidence in one's self-report). Hence, the inverted U-shaped relation proposed for the emotional intensity–RT link should translate into a U-shaped emotional intensity–confidence link. Empirical evidence for a corresponding curvilinear relation between emotional intensity and confidence ratings would demonstrate that the curvilinear intensity–RT link is not an RT-specific artefact and thereby help researchers gain a better understanding of the response process.

Predicting emotion regulation

According to Gross (2015), one key point of potential failure in emotion regulation involves deficiencies at the emotion perception step (i.e. a lack of [momentary] emotional clarity). In a similar vein, mood regulation models (e.g. Larsen, 2000) assume that emotional clarity should facilitate effective mood regulation (Lischetzke & Eid, in press). One reason for this is that individuals with higher emotional clarity should need only few cognitive resources to arrive at an understanding of their momentary feelings. Hence, the better individuals know what they feel, the more cognitive resources they should have available to evaluate potential regulation strategies and effectively implement them (Hemenover, Augustine, Shulman, Tran, & Barlett, 2008; Larsen, 2000).

In our studies, we focused on two well-studied emotion regulation strategies – cognitive reappraisal (i.e. construing a potentially emotion-eliciting situation in a way that changes its emotional impact) and expressive suppression (i.e. inhibiting ongoing emotion-expressive behaviour; Gross & John, 2003). In previous studies, reappraisal was related to higher positive affect, lower negative affect, fewer depressive symptoms, higher self-esteem and higher well-being (Gross & John, 2003) and can thus be seen as adaptive for psychological functioning. By contrast, suppression was associated with higher negative affect, lower positive affect, more depressive symptoms, lower self-esteem and lower well-being (Gross & John, 2003) and can thus be seen as maladaptive. According to Boden and Thompson (2015), a mental representation of the emotion is needed when using reappraisal. Being clear about one's emotions should facilitate the building of a mental representation and should therefore enable individuals to select an adaptive emotion regulation strategy such as reappraisal (Boden & Thompson, 2015). By contrast, individuals using expressive suppression direct their attention "away from the emotion source and/or response" (Boden & Thompson, 2015, p. 401), which might impair clarity (Gross & John, 2003). In their process model of emotional expression, Kennedy-Moore and Watson (1999) propose that being unclear about one's feelings interferes with emotional expression,

leading individuals to inhibit expressive behaviour (i.e. suppress). Therefore, we expected that higher emotional clarity would be positively associated with the use of reappraisal and negatively associated with the use of suppression.

Previous research on the relation between emotional clarity and the use of reappraisal and suppression is limited, is based on self-reports of trait emotion regulation only, and has yielded mixed findings. A coping measure of positive reinterpretation was positively related to emotional clarity in some studies (Gohm & Clore, 2002; Gohm, Corser, & Dalsky, 2005) but unrelated to emotional clarity in another study (Salovey, Stroud, Woolery, & Epel, 2002, Study 2). When reappraisal was measured with the Emotion Regulation Questionnaire (ERQ) (Gross & John, 2003), emotional clarity was unrelated to reappraisal in three studies (Boden, Bonn-Miller, Kashdan, Alvarez, & Gross, 2012; Boden, Gross, Babson, & Bonn-Miller, 2013; Gross & John, 2003). By contrast, Boden and Thompson (2015) reported a positive regression weight for emotional clarity ("type clarity") in the prediction of reappraisal (with three other emotional awareness facets included as additional predictors). Only two studies have examined the relation between emotional clarity and suppression: Gross and John (2003) found a negative relation, whereas Boden and Thompson (2015) found that emotional clarity and suppression were unrelated (in a multiple regression model with three other emotional awareness facets as additional predictors).

To go beyond previous research, we aimed to assess the use of reappraisal and suppression repeatedly in daily life. Moreover, we utilised a multimethod strategy to compare the associations with emotion regulation across self-reported and indirectly measured emotional clarity.

Overview of the present research

To obtain information about individuals' emotional experience and emotion regulation with greater ecological validity, we used data from three ESM studies to test our hypotheses. Given that Thompson et al.'s (2015) recent results pointed towards the importance of examining emotional clarity separately by valence, we assessed emotional experience and emotional clarity after positive vs. negative events in daily life. Our first aim was to scrutinise the process of responding to emotion items in more detail than has been done previously. On the basis of research in other domains that focused on the relation between the response to questionnaire items and RT, we did not expect a linear relation but instead expected a curvilinear (inverted U-shaped) relation between emotional intensity and RTs to emotion items (on both the item level and the level of aggregated scores). This first hypothesis was tested with data from all three studies. Our second aim was to analyse the convergent validity of RTs to emotions assessed in individuals' daily lives with respect to their subjective confidence ratings of their answers (as a direct measure of momentary emotional clarity). This confidence measure was included in Study 3; it was also used to investigate the U-shaped relation between response and confidence to rule out RT-specific artefacts in the link between emotional intensity and momentary emotional clarity. Our third aim was to investigate the relations between emotional clarity and the use of specific emotion regulation strategies – a research question that has received only limited attention to date. In particular, the relations between emotional clarity and two emotion regulation strategies (reappraisal and suppression) as measured by global self-report were analysed in all three studies. In Study 1, we additionally analysed daily emotion regulation. Because the three studies were similar, we combined their Method and the Results sections. We refer to the samples from the three studies as Samples 1, 2 and 3.

Method

Participants and procedure

Participants were recruited via flyers on campus. Each study consisted of a laboratory session and an ESM part. In the laboratory session, participants completed trait measures and were instructed in the use of mobile devices that were distributed for the ESM part. In Sample 1, participants were requested to report their mood multiple times per day. In week 2, participants additionally completed end-of-day reports on the most important positive event and the most important negative event of the day, including their emotional experience and regulatory behaviour. These end-of-day reports were analysed in the present study. In Samples 2 and 3, participants received signals three times each day at fixed time points with a time lag of 4 h. At each occasion, participants were asked to report a positive and a negative event they had experienced since the last signal and to rate their emotional experience. Table 1 provides

Table 1. Detailed information on procedure and participants (Samples 1–3).

	Sample 1	Sample 2	Sample3
Procedure			
Length of ESM part	2 weeks	1 week	3 weeks
Mobile devices	Handheld PC HP iPAQ rx 1950	Handheld PC HP iPAQ rx 1950	Smartphones HTC One V
Software	Izybuilder, IzyData Ltd, Fribourg, Switzerland	Izybuilder, IzyData Ltd, Fribourg, Switzerland	movisensXS, Version 0.5.2600, movisens GmbH, Karlsruhe, Germany
Financial compensation	up to 100€	20€	up to 60€
Participants			
N (final sample)	140 students[a]	51 students	84 students
Age	*M* = 23.71 years (*SD* = 3.37)	*M* = 22.96 years (*SD* = 2.40)	*M* = 22.80 years (*SD* = 2.40)
Sex	56% female	84% female	67% female
Compliance (number of responded signals out of number of possible signals)	*M* = 6.05 (*SD* = 1.26) out of 7	*M* = 19.12 (*SD* = 2.78) out of 21	*M* = 57.63 (*SD* = 5.30) out of 63
Number of reported events			
Positive	*M* = 4.04 (*SD* = 2.10)	*M* = 15.71 (*SD* = 3.74)	*M* = 25.60 (*SD* = 14.21)
Negative	*M* = 2.37 (*SD* = 2.00)	*M* = 10.82 (*SD* = 4.51)	*M* = 14.29 (*SD* = 9.89)
Total number of events			
Positive	580	797	2111
Negative	333	552	1126

[a]165 participants were recruited in Sample 1 but 25 participants reported no event. Hence, their data were excluded from the analyses. Therefore, the sample was reduced from 165 to 140 participants.

further details on the procedure (top part) and on the final samples (bottom part).

Measures

Emotional intensity

To measure emotional experience during a positive event, five positive emotions (joy, affection, relief, pride and gratitude) were assessed in Samples 1 and 2, and six positive emotions (joy, affection, relief, pride, gratitude and hope) were assessed in Sample 3. To measure emotional experience during a negative event, five negative emotions (fear, anger, frustration, sadness and shame) were assessed in Samples 1 and 2, and six negative emotions (fear, anger, frustration, sadness, embarrassment and boredom) were assessed in Sample 3. Emotional intensity was rated on a 5-point response scale (0 = *not at all*; 1 = *very weak*; 2 = *rather weak*; 3 = *rather intense*; *4* = *very intense*) in Samples 1 and 2. The response format in Sample 3 was branched: first, participants had to indicate whether they experienced the specific emotion (yes vs. no). If yes, they were subsequently requested to rate the intensity of the emotion (1 = *very weak*; 2 = *rather weak*; 3 = *rather intense*; 4 = *very intense*). For the analyses that focused on the item level, (emotion-specific) intensity ratings were used as predictors of item-specific RTs. For the analyses that focused on the event level, the intensity ratings of positive (negative) emotion items were aggregated to form an indicator of positive (negative) emotional intensity.

RTs to emotion items

Only one emotion item was presented per screen. For each item, the time between item presentation and choice of an answer was measured unobtrusively. In Samples 1 and 2, we measured the RT for an emotional intensity rating given on a scale from 0 (*not at all*) to 4 (*very intense*). In Sample 3, due to item branching, the RTs corresponded to the time needed to rate the intensity of those emotions that were at least very weakly experienced (but not totally absent).[1] To deal with outliers, we excluded individual RTs that were higher than a specific cut-off value.[2]

For the item-level analyses, individual RTs to emotion items were used as dependent variables. For the event-level analyses, the median of the RTs to the positive (negative) emotion items was computed to form an index of the clarity of positive (negative) emotions. We used the median instead of the mean because RTs were skewed. In general, the median is a robust measure of central tendency and more adequate than the conventional mean when data are skewed (e.g. Whelan, 2008). For analyses on the between-persons level, these RT medians were averaged per person, and baseline speed (i.e. individual differences in the speed with which participants generally rated questionnaire items) was partialled out of the RT measure. A participant's baseline

speed was computed by calculating the median of the RTs to items that referred to features of the situation (e.g. presence of other people, type of activity) across all events.[3]

Confidence

Confidence was measured by a single item ("How certain are you about your last answer?", Lischetzke et al., 2011) using a 4-point response scale (0 = *not at all*, 1 = *somewhat*, 2 = *quite*, 3 = *very much*). Confidence was assessed in the first ESM week in Sample 3. To reduce burden, the item was displayed on only one occasion per day after each positive emotion item and on another occasion per day after each negative emotion item (balanced order between days). On average, participants provided 9.85 ($SD = 7.08$) confidence ratings of positive emotion items and 3.77 ($SD = 3.45$) confidence ratings of negative emotion items.

Emotional clarity (global self-report)

A six-item scale was used to assess dispositional emotional clarity (Lischetzke, Eid, Wittig, & Trierweiler, 2001). It included items such as "I know what I feel" (see Lischetzke & Eid, 2003, for the full item list) that were rated on a 4-point response scale (1 = *almost never*, 4 = *almost always*). In two studies (Lischetzke et al., 2001), the scale demonstrated high correlations with the TAS–20 Difficulty Identifying Feelings subscale (Bagby, Taylor, & Parker, 1994). Moreover, self-reports of emotional clarity showed moderate to high correlations with friend reports (Eid, Lischetzke, Nussbeck, & Trierweiler, 2003). Cronbach's alpha was .88 in Sample 1, .84 in Sample 2 and .86 in Sample 3.

Emotion regulation (global self-report)

Cognitive reappraisal and expressive suppression were assessed with the ERQ (Abler & Kessler, 2009; Gross & John, 2003). Participants responded to the six-item reappraisal and the four-item suppression subscales using a 7-point response scale (1 = *strongly disagree*, 7 = *strongly agree*). Cronbach's alphas were .79, .59 and .71 in the three samples, respectively, for reappraisal and .69, .78 and .73 for suppression.

Daily emotion regulation (ESM)

Daily emotion regulation was assessed separately for positive and negative events (analysed in Sample 1). Suppression of positive (negative) emotions was measured with two items ("When I was feeling positive [negative] emotions, I was careful not to express them" from Kashdan & Steger, 2006; "When I felt positive [negative] emotions, people could easily see exactly what I was feeling" from Gross & John, 1995). To estimate local (within-persons) reliability (Buse & Pawlik, 1996), we calculated the polychoric correlation between the two items for each occasion and summarised them with the median. For suppression of positive emotions, the median polychoric correlation was .45, and for suppression of negative emotions, the median polychoric correlation was .55. To estimate aggregate (between-persons) reliability, we calculated the Pearson correlation between the two items, aggregated across occasions. For suppression of positive emotions, the correlation was .44, and for suppression of negative emotions, the correlation was .52. These inter-item correlations are in a range that is recommended for correlations between questionnaire items measuring the same construct (e.g. Clark & Watson, 1995). Reappraisal was assessed only after negative events and was measured with two items ("I changed the way I thought about the situation I was in" from Kashdan & Steger, 2006; "I looked at things differently" from Totterdell & Parkinson, 1999). The median polychoric correlation was .69, and the Pearson correlation between aggregated items was .68. All items were answered on a 4-point response scale (1 = *strongly disagree*, 4 = *strongly agree*).

Data analytic models

The hypotheses were tested separately for positive events (positive emotions) and negative events (negative emotions). For the first set of analyses that focused directly on the response process, three-level cross-classified multilevel models were specified (items nested in events nested in persons, with type of emotion as a crossed random factor). Type of emotion was treated as a random effect that was crossed with events and persons because the same emotion items were presented to all participants at each event. To test the hypothesised curvilinear relation between emotional intensity and RT, the equation for predicting the RT of person i to item m corresponding to emotion type j at event t was

$$\begin{aligned}\mathrm{RT}_{mtij} = {} & \gamma_{000} + r_{0ti} + u_{00i} + \nu_{00j} + (\gamma_{100} + u_{10i} + \nu_{10j}) \\ & \times \mathrm{Intensity}_{mtij} + (\gamma_{200} + u_{20i} + \nu_{20j}) \cdot \mathrm{Intensity}^2_{mtij} + e_{mtij},\end{aligned} \tag{1}$$

where the fixed effects γ_{100} and γ_{200} characterised the form of the average relation between emotional

intensity and RT. Emotional intensity was grand-mean centred (and not person-mean centred) so that centred scores could be easily related to the original metric of the intensity variable and represented the same intensity levels for each participant.[4] Thus, the mean intercept γ_{000} represented the expected RT for mean emotional intensity, and the random intercept terms represented event-specific deviations (r_{0ti}), person-specific deviations (u_{00i}) and emotion type-specific deviations (v_{00j}) from the mean intercept. Random slopes across persons (u_{10i}, u_{20i}) and across type of emotion (v_{10j}, v_{20j}) were specified. They were tested for significance using a backward procedure, and only significant random slopes were retained in the model (Snijders & Bosker, 2012).[5] As an effect size measure for the strength of the relation between emotional intensity and RT, we calculated a quasi-R^2 at Level 1, which represented the proportional reduction in the residual variance at Level 1 due to the linear and the squared emotional intensity terms (Raudenbush & Bryk, 2002).

To test whether the proposed inverted U-shaped relation between emotional intensity and RT would hold for the intensity and RT measures that were aggregated across individual items, we specified two-level models (events nested in persons). Again, positive and negative emotions were analysed separately, and emotional intensity was centred on the grand mean. The equation for predicting the average RT to the emotion items of person i at event t was

$$\mathrm{RT}_{ti} = \gamma_{00} + u_{0i} + (\gamma_{10} + u_{1i}) \cdot \mathrm{Intensity}_{ti} + (\gamma_{20} + u_{2i}) \cdot \mathrm{Intensity}_{ti}^2 + r_{ti}. \quad (2)$$

To investigate whether RT was related to confidence, three-level cross-classified models were specified. The equation for predicting the RT of person i to item m and emotion type j at event t was

$$\mathrm{RT}_{mtij} = \gamma_{000} + r_{0ti} + u_{00i} + v_{00j} + (\gamma_{100} + u_{10i} + v_{10j}) \cdot \mathrm{Confidence}_{mtij} + e_{mtij}. \quad (3)$$

To model the pure within-persons relation (Enders & Tofighi, 2007), confidence was centred on the person mean. Only significant random slopes (across persons, u_{10i}, and across type of emotion, v_{10j},) were retained. The U-shaped relation between intensity and confidence was analysed as described in Equation (1) (with confidence instead of RT).

To analyse the relations between RTs to emotions and daily emotion regulation at the within-persons level, we specified separate two-level models (events nested in persons) for each type of regulation strategy. The equation for predicting the daily emotion regulation of person i at event t by (person-mean centred) RT was

$$\mathrm{Regulation}_{ti} = \gamma_{00} + u_{0i} + (\gamma_{10} + u_{1i}) \cdot \mathrm{RT}_{ti} + r_{ti}. \quad (4)$$

Again, only significant random slopes were retained in the models. In addition, we included linear and squared emotional intensity on Level 1 to test whether the relations between RT and regulation would hold when (grand-mean centred) intensity was controlled for.

All multilevel models were created with the R package lme4 (Bates, Mächler, Bolker, & Walker, 2015), and p-values were determined with the R package lmerTest (Kuznetsova, Brockhoff, & Christensen, 2015).

Results

Relation between emotional intensity and RT

The means and standard deviations for all variables can be found in Table 2. First, we tested for an inverted U-shaped relation between emotional intensity and RT on the item level. Distributions of RTs for each response category of emotional intensity are depicted in Figure 1. Table 3 (top part) shows the results for the three-level cross-classified models predicting item-specific RTs by emotional intensity. In all six analyses (positive and negative emotions in three samples), the quadratic term for emotional intensity was negative (indicating an inverted U shape) and statistically significant.[6] Figure 2 shows the estimated inverted U-shaped associations between emotional intensity and the RTs to the positive (Panels A, C, E) and the negative emotion items (Panels B, D, F). As expected, individuals needed more time to rate their emotional experience for items for which emotional intensity was at the midpoint of the scale. Responses were faster for the emotion items that were characterised by very low or very high intensity. The size of quasi-R^2 values can be interpreted similar to R^2 values in regression models (Kwok et al., 2008) with .02 as a small, .13 as a medium, and .26 as a large effect (Cohen, 1977). That is, the relations between intensity and RT were small to moderate. Next, we tested the inverted U-shaped relation on the event level (i.e.

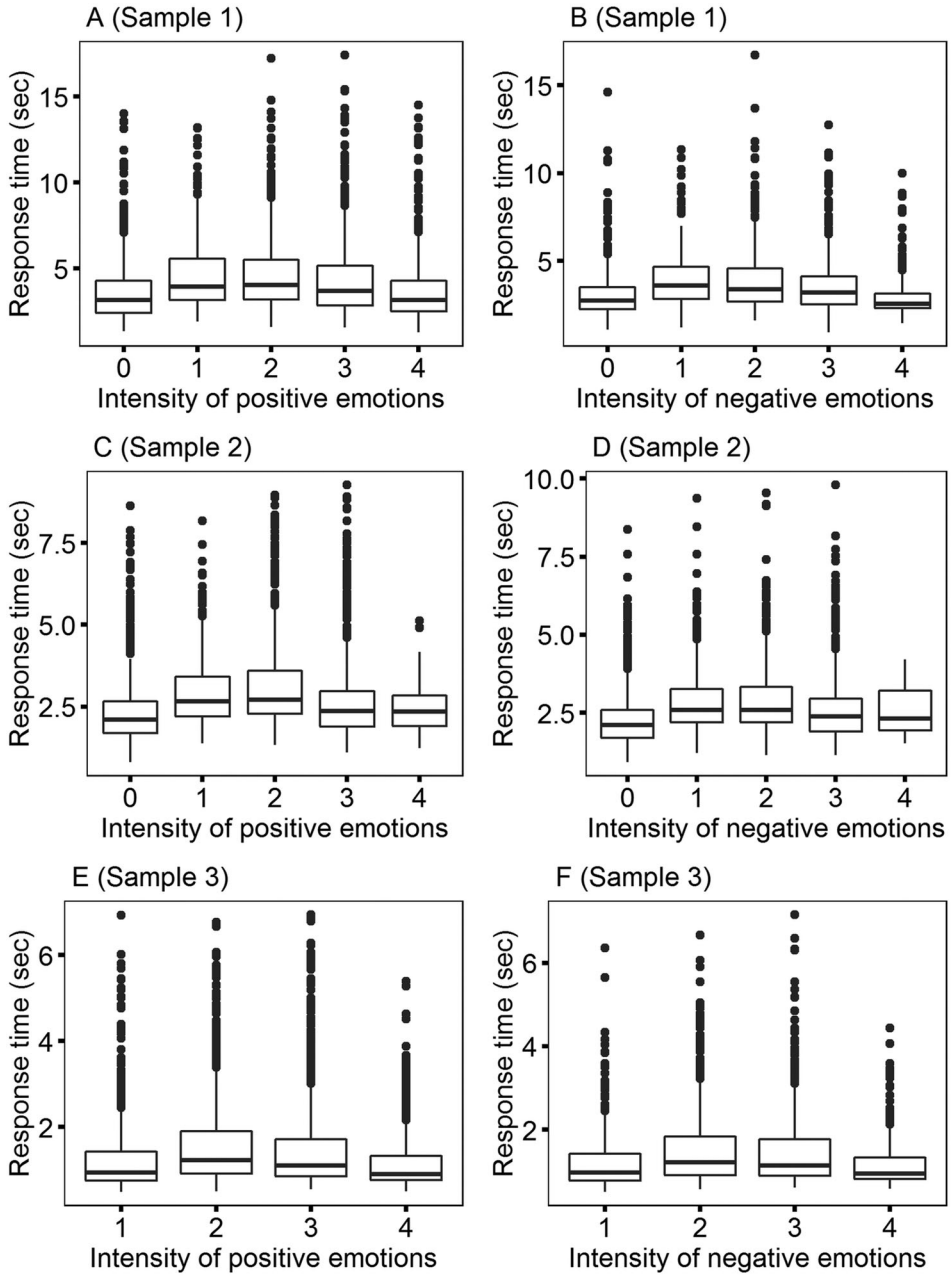

Figure 1. Distributions of RTs separately for each response category. The response format in Samples 1 and 2 was 0 = *not at all*, 1 = *very weak*, 2 = *rather weak*, 3 = *rather intense*, 4 = *very intense*. The response format in Sample 3 was 1 = *very weak*, 2 = *rather weak*, 3 = *rather intense*, 4 = *very intense*.

when emotional intensity and RT were aggregated across individual items). Two-level models for events nested in persons largely confirmed the inverted U-shaped relation between emotional intensity and RT for both positive and negative emotions (see Table 3, bottom part). The only exception emerged in the model predicting the RTs to positive emotions in Sample 3 where the intensity–RT link was linear and negative (i.e. shorter RTs for higher intensity ratings).

Relation between confidence and RT

To test for convergent validity, we used data from Sample 3 and investigated whether the confidence

Table 2. Means (and standard deviations) of study variables (Samples 1–3).

	Sample 1		Sample 2		Sample 3	
Variable	Pos. emotions	Neg. emotions	Pos. emotions	Neg. emotions	Pos. emotions	Neg. emotions
Momentary measures (ESM)						
RT	4.17 (2.17)	3.51 (1.72)	2.67 (1.15)	2.59 (1.06)	1.38 (0.85)	1.37 (0.82)
Emotional intensity	2.19 (1.44)	1.79 (1.46)	1.82 (1.29)	1.47 (1.28)	2.69 (0.93)	2.45 (1.03)
Suppression	1.91 (0.66)	2.44 (0.82)	–	–	–	–
Reappraisal	–	2.13 (0.79)	–	–	–	–
Confidence	–	–	–	–	2.47 (0.59)	2.42 (0.64)
Trait measures						
Emotional clarity	3.04 (0.60)		3.20 (0.47)		3.10 (0.54)	
Suppression	3.27 (1.14)		3.04 (1.15)		3.37 (1.23)	
Reappraisal	4.71 (0.93)		4.98 (0.80)		4.49 (0.86)	

Note: ESM: experience sampling part; RT: response time in seconds.

with which individuals gave an emotion rating and the corresponding RT were negatively related. On the within-persons level, three-level cross-classified models confirmed the expected negative relation between confidence and the RT to positive emotion items ($b = -0.19$, $SE = 0.05$, $t = -3.43$, $p < .001$, quasi-$R^2 = .01$) but not to negative emotions items ($b = -0.09$, $SE = 0.08$, $t = -1.21$, $p = .227$, quasi-$R^2 = .00$). On the between-persons level (see Table 4), confidence and RT were negatively correlated for negative emotions ($r = -.39$, $p < .001$), whereas the corresponding relation for positive emotions was also negative but was not significant ($r = -.17$, $p = .140$). Thus, the hypothesis that higher confidence would be related to a shorter RT was partially supported.

Relation between emotional intensity and confidence

Next, we tested whether emotional intensity and confidence were related in a U-shaped fashion (i.e. mirroring the results found for RT). Three-level cross-classified multilevel models (applied to the data from Sample 3) demonstrated that the linear and quadratic terms for emotional intensity were positive and statistically significant, and this held for both positive and negative emotions (Table 5). Figure 3 shows the estimated associations between emotional intensity and confidence for positive (Panel A) and negative emotions (Panel B). Despite significant quadratic terms, the curvature was low, especially for positive emotions. However, this finding is in line with the results from the models predicting RT by emotional intensity in Sample 3 (see Figure 2, Panels E and F) where the curvature for positive emotions was also lower than in Samples 1 and 2. This might be due to the different response format in Sample 3.[7]

Relation between RT and emotion regulation

Before testing our final hypothesis that higher emotional clarity would be related to more adaptive emotion regulation (i.e. less suppression, more reappraisal), we examined the pattern of between-persons relations of global self-reports to aggregated variables from the ESM period (see Table 4). Note that the correlations between aggregated RT and other measures represent semipartial correlations, with baseline speed partialled out of the RT measure. As in previous research (Lischetzke et al., 2005, 2011; Thompson et al., 2015), the global self-report of emotional clarity was unrelated to aggregated RT to emotion items. RT to positive and RT to negative emotion items demonstrated moderate to strong positive relations on the between-persons level (as confirmed by within-persons analyses; $t \geq 6.00$, $p < .001$, quasi-$R^2 \geq .07$), showing that there was considerable overlap between the valence-specific RT measures. Trait measures of suppression and reappraisal were positively related to aggregated ESM measures of these regulation strategies (indicating convergent validity).

Next, we tested our hypotheses on the relation between emotional clarity and emotion regulation strategies on the between-persons level. Global self-reports of emotional clarity were unrelated to reappraisal measures (both global self-reports and aggregated values from the ESM period) in all samples (see Table 4). As expected, in two out of the three samples, global self-reports of clarity were negatively related to global self-reports of suppression and negatively related to aggregated positive (but not negative) suppression values from the ESM period (Sample 1). For the RT measure of emotional clarity, a similar picture emerged: aggregated RT to emotion items was largely unrelated

Table 3. Results (fixed effects) of the multilevel models predicting RTs to emotion items by emotional intensity (Samples 1–3).

Outcome		Sample 1				Sample 2				Sample 3			
Predictor	Coef.	Est. (*SE*)	*t*	*df*	R^2	Est. (*SE*)	*t*	*df*	R^2	Est. (*SE*)	*t*	*df*	R^2
Analyses for item-specific RTs (three-level models)													
RT pos.					.13				.13				.05
Intercept	γ_{000}	4.96 (0.35)				3.18 (0.11)				1.52 (0.09)			
Intensity	γ_{100}	−0.32 (0.08)	−3.80*	3.62		−0.10 (0.03)	−2.92**	48.33		−0.12 (0.02)	−5.35***	22.84	
Intensity^2	γ_{200}	−0.26 (0.03)	−9.83***	102.68		−0.26 (0.03)	−9.91***	39.73		−0.07 (0.02)	−3.94**	13.89	
RT neg.					.10				.11				.05
Intercept	γ_{000}	4.27 (0.16)				3.01 (0.09)				1.65 (0.08)			
Intensity	γ_{100}	0.06 (0.03)	1.96	716.00		0.12 (0.05)	2.57	3.85		−0.03 (0.02)	−1.78	51.31	
Intensity^2	γ_{200}	−0.30 (0.03)	−9.57***	90.30		−0.19 (0.04)	−5.49***	7.63		−0.15 (0.02)	−7.55***	73.19	
Analyses for aggregated RTs across items (two-level models)													
RT pos.					.01				.03				.07
Intercept	γ_{00}	4.13 (0.10)				2.61 (0.05)				1.51 (0.05)			
Intensity	γ_{10}	0.09 (0.09)	0.94	569.90		0.12 (0.04)	2.93**	727.00		−0.18 (0.04)	−4.33***	42.73	
Intensity^2	γ_{20}	−0.22 (0.09)	−2.51*	567.50		−0.20 (0.05)	−4.22***	778.10		−0.05 (0.04)	−1.36	46.18	
RT neg.					.06				.03				.03
Intercept	γ_{00}	3.46 (0.09)				2.57 (0.06)				1.61 (0.06)			
Intensity	γ_{10}	0.05 (0.07)	0.70	196.72		0.10 (0.04)	2.52*	541.10		−0.06 (0.03)	−2.15*	316.50	
Intensity^2	γ_{20}	−0.22 (0.06)	−3.90***	296.41		−0.14 (0.04)	−3.42***	538.50		−0.13 (0.03)	−4.55***	54.30	

Notes: RT: response time in seconds; Coef.: coefficient from multilevel equations (1) and (2) in the text; Est.: Estimate. *df* and *p*-values were determined with the R package lmerTest (Kuznetsova et al., 2015). The reported R^2 values are quasi-R^2 values which represent the proportion of Level 1 residual variance that is reduced by the predictors in the model (compared with the null model). *$p < .05$; **$p < .01$; ***$p < .001$.

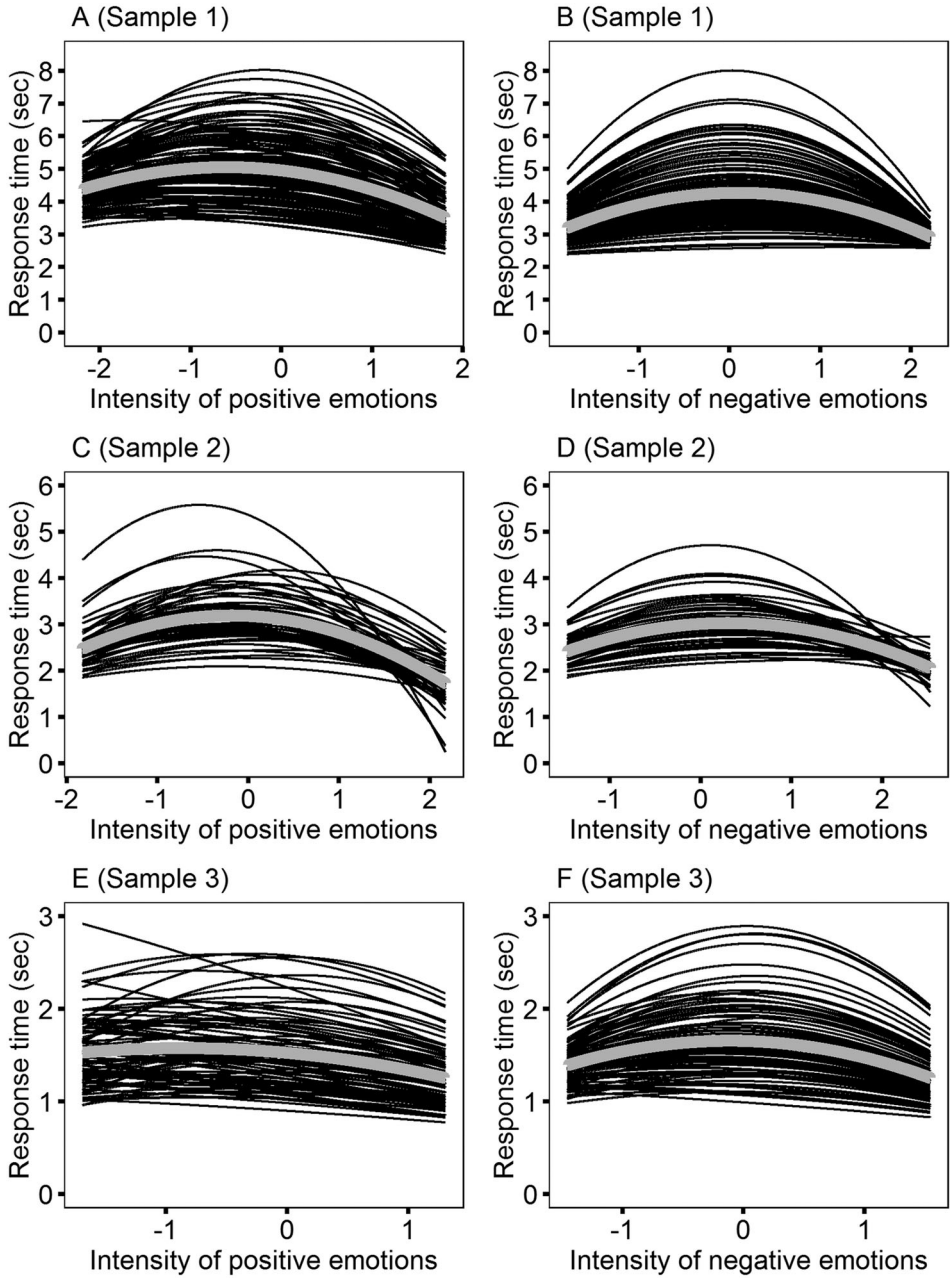

Figure 2. Intra-individual relations between emotional intensity (grand-mean centred) and the corresponding RTs for positive and negative emotions. The bold grey curves represent the fixed effects, and the black curves represent the random effects across persons.

to both global self-reports and aggregated values of reappraisal and suppression. The only finding that confirmed our expectation for the RT measure was the positive correlation between RT to negative emotions and global self-reports of suppression in Sample 3. The results were similar when we controlled for linear and squared emotional intensity in theses analyses.

In addition to these analyses on the between-persons level, we investigated whether RT and daily emotion regulation were related within persons (i.e. whether on days with longer RT individuals reported

Table 4. Bivariate correlations between all study variables at the person level (Samples 1–3).

	1	2	3	4	5	6	7	8	9	10	11
Sample 1											
1. RT pos.	–										
2. RT neg.	.41***	–									
3. Intensity pos.	.09	.10	–								
4. Intensity neg.	−.01	.05	.41***	–							
5. Clarity (lab)	.01	.05	.15	−.03	–						
6. Supp. (lab)	−.02	−.06	−.19*	−.06	−.32***	–					
7. Reap. (lab)	.08	−.09	.09	.04	.06	.04	–				
8. Daily supp. pos.	−.06	.15	−.24**	.08	−.22**	.33***	−.14	–			
9. Daily supp. neg.	−.04	−.01	−.13	−.14	.03	.26**	.16	.21*	–		
10. Daily reap. neg.	.15	.12	.00	.03	.08	−.17	.25**	−.04	.14	–	
Sample 2											
1. RT pos.	–										
2. RT neg.	.76***	–									
3. Intensity pos.	.18	.11	–								
4. Intensity neg.	.01	.06	.62***	–							
5. Clarity (lab)	−.03	.00	.09	.12	–						
6. Supp. (lab)	.11	.15	−.21	−.32*	−.06	–					
7. Reap. (lab)	−.19	−.25	.18	−.07	.00	.14	–				
Sample 3											
1. RT pos.	–										
2. RT neg.	.55***	–									
3. Intensity pos.	−.27*	−.20	–								
4. Intensity neg.	−.31**	−.13	.69***	–							
5. Clarity (lab)	.04	−.15	.07	.08	–						
6. Supp. (lab)	.16	.31**	.10	.22*	−.37***	–					
7. Reap. (lab)	.01	−.07	.06	−.08	−.06	.04	–				
11. Confidence pos.	−.17	−.05	.37**	.20	.14	.24**	.30**				–
12. Confidence neg.	−.29*	−.39***	.24	.28*	.12	.19	.12				.39**

Notes: RT: response time (baseline speed partialled out); lab: global self-reports assessed in the laboratory session; supp.: suppression; reap.: reappraisal. $N_{Sample\ 1}$ = 108–140; $N_{Sample\ 2}$ = 50–51; $N_{Sample\ 3}$ = 63–84. *N* differed within the samples because of missing occasions and the branched item presentation. *$p < .05$; **$p < .01$; ***$p < .001$.

using less reappraisal and more suppression).[8] Multilevel analyses revealed that individuals used more suppression after negative events on days when RT to negative emotions was longer (Table 6, Model 1). RT to positive events was unrelated to suppression after positive events, and RT to negative events was unrelated to reappraisal.[9] The results were similar when controlling for linear and squared emotional intensity (Table 6, Model 2).

Table 5. Results (fixed effects) of the three-level cross-classified multilevel models predicting confidence of emotion ratings by emotional intensity (Sample 3).

Outcome Predictor	Coef.	Est. (*SE*)	*t*	*df*	R^2
Confidence pos. emotions					.14
Intercept	γ_{000}	2.37 (0.04)			
Intensity	γ_{100}	0.27 (0.03)	10.19***	80.20	
Intensity^2	γ_{200}	0.07 (0.02)	3.21**	733.30	
Confidence neg. emotions					.10
Intercept	γ_{000}	2.29 (0.05)			
Intensity	γ_{100}	0.15 (0.03)	4.43***	304.86	
Intensity^2	γ_{200}	0.12 (0.04)	3.45***	312.80	

Notes: Coef.: coefficient from multilevel Equation (1) in the text (with confidence instead of RT as the dependent variable); Est.: Estimate. *df* and *p*-values were determined with the R package lmerTest (Kuznetsova et al., 2015). The reported R^2 values are quasi-R^2 values which represent the proportion of Level 1 residual variance that is reduced by the predictors in the model (compared with the null model). **$p < .01$; ***$p < .001$.

Discussion

In the present paper, we wanted to shed more light on the response process that occurs when individuals rate emotion items so that theoretical and practical questions surrounding the use of RTs to emotion items as an indirect measure of emotional clarity can be answered. In particular, we analysed whether emotional intensity might be systematically associated with RTs to emotion items and the form of this association. Moreover, we investigated the role of confidence in this response process as a means of analysing convergent validity. Finally, another aim was to add to the limited research on emotional clarity and the use of specific regulation strategies by testing whether emotional clarity is related to reappraisal and suppression.

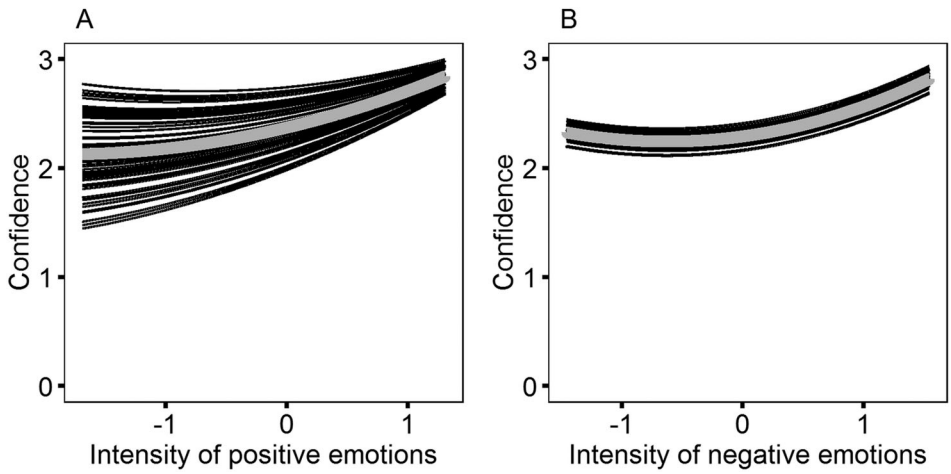

Figure 3. Intra-individual relations between emotional intensity (grand-mean centred) and the corresponding confidence for positive and negative emotions (Sample 3). The bold grey curves represent the fixed effects, and the black curves represent the random effects across persons. As described in the Methods section, only significant random slopes were retained in the models. Differences in the variability of the curves stem from different restrictions (the random intercepts model was suitable only for the model for negative emotions).

Inverted U-shaped relation between emotional intensity and RT

Across three ESM studies, the theoretically assumed inverted U-shaped relation between emotional intensity and RT was confirmed on the item level – the level of analysis that is most closely related to the response process. Very intense and very weak emotions were rated more quickly than moderately intense emotions. These results are in line with the notion that the absence of an emotion as well as an extreme emotion may provide less ambiguous cues and can thereby be rated more easily. In a similar vein, in personality assessment (e.g. Akrami et al., 2007; Amelang et al., 1991), inverted U-shaped relations between the standing on a dimension and RT were explained by variation in the consistency between item content and the self-schema.

We additionally analysed the relation between emotional intensity and RT scores that were aggregated across multiple items for each event. With only one exception, we found evidence for the proposed inverted U-shaped relation on the level of

Table 6. Results of the two-level analyses predicting emotion regulation by RTs to emotion items and emotional intensity (Sample 1).

Outcome		Model 1				Model 2			
Predictor	Coef.	Est. (*SE*)	*t*	*df*	R^2	Est. (*SE*)	*t*	*df*	R^2
Suppression (pos. emotions)					.00				.08
Intercept	γ_{00}	1.93 (0.04)				1.94 (0.04)			
RT pos.	γ_{10}	0.01 (0.02)	0.45	448.10		0.01 (0.02)	0.77	446.80	
Intensity	γ_{20}					−0.25 (0.03)	−7.09***	573.20	
Intensity^2	γ_{30}					−0.01 (0.03)	−0.39	544.10	
Suppression (neg. emotions)					.02				.03
Intercept	γ_{00}	2.41 (0.06)				2.43 (0.07)			
RT neg.	γ_{10}	0.12 (0.05)	2.26*	229.16		0.12 (0.05)	2.12*	232.60	
Intensity	γ_{20}					−0.13 (0.05)	−2.65**	318.40	
Intensity^2	γ_{30}					−0.02 (0.05)	−0.39	317.50	
Reappraisal (neg. emotions)					.00				.03
Intercept	γ_{00}	2.12 (0.06)				2.19 (0.07)			
RT neg.	γ_{10}	0.04 (0.05)	0.73	228.30		0.02 (0.05)	0.38	228.80	
Intensity	γ_{20}					0.12 (0.05)	2.54*	325.80	
Intensity^2	γ_{30}					−0.08 (0.04)	−1.80	310.20	

Notes: RT: response time; coef.: coefficient from multilevel equations; Est.: estimate. *df* and *p*-values were determined with the R package lmerTest (Kuznetsova et al., 2015). The reported R^2 values are quasi-R^2 values which represent the proportion of Level 1 residual variance that is reduced by the predictors in the model (compared with the null model). *$p < .05$; **$p < .01$; ***$p < .001$.

aggregated scores, too. A practical implication that can be derived from our findings is that future research using an RT measure of emotional clarity at the level of measurement occasions should routinely check whether emotional intensity is systematically related to RT in a linear or quadratic fashion. Thus, the present research builds on and extends Thompson et al.'s (2015) findings by showing that it might be necessary to control for not only a linear but also a quadratic emotional intensity term when using RTs to emotion items as an outcome or a predictor.

Convergent validity of the RT measure of emotional clarity

The hypothesis that confidence (as a direct indicator of momentary emotional clarity) and RT (as an indirect indicator of momentary emotional clarity) are negatively related was partially supported. Answers to positive emotion items were given more quickly when individuals had more confidence in their ratings. For negative emotions, such a relation was found on the person level rather than on the item level. Individuals who had more confidence in their answers to negative emotion items were faster at rating these items than individuals who had less confidence, which can be taken to indicate convergent validity for the RT measure.

The RT measure was unrelated to global self-reports of emotional clarity in all three studies. This is in line with previous studies (Lischetzke et al., 2005, 2011; Thompson et al., 2015) and might be due to different modalities (indirect vs. direct) and different time frames (state vs. trait) (Lischetzke et al., 2005). Previous research showed that correlations between indirect measures and direct measures of the same target construct are typically low to moderate (e.g. Cunningham, Preacher, & Banaji, 2001; Robinson & Neighbors, 2006).

If the RT measure captures clarity-related processes, the inverted U-shaped relation between emotional intensity and RT should translate into a U-shaped relation between emotional intensity and confidence. Our results showed that the intensity–RT curves and the intensity–confidence curves followed similar functional (quadratic) forms, which lends support to the idea that both RT and confidence tap into emotional clarity-related processes and shows that the curvilinear relation between emotional intensity and RT is not an RT-specific artefact.

Implications of the inverted U-shaped relation between emotional intensity and RT for theoretical accounts of emotional processing

To the extent that RT reflects momentary emotional clarity, the findings inform us about situational conditions of becoming clear about one's feelings: Based on our analyses and findings, one might conclude that emotions of moderate intensity represent the largest challenge for emotional awareness, and not emotions of very high intensity (as suggested by previous analyses by Thompson et al., 2015, using linear regression models). Although the need for emotion regulation might be highest in situations that trigger intense emotions (Gross, 2015), a focus on how to become clear about the (more prevalent) daily emotions of moderate intensity might be particularly helpful in counselling practice and psychotherapy to help individuals more effectively regulate their affective experiences in daily life. More generally, our findings point to the intra-individual variability in emotional clarity from moment to moment (or day to day). For emotional clarity research, this implies that emotional clarity should be considered as a characteristic that not only differs between persons, but also fluctuates within persons (and hence, is influenced by situation-specific conditions). Future research might investigate the temporal stability and context-dependency of emotional clarity more systematically.

Emotional clarity and emotion regulation

We tested whether higher emotional clarity was related to more adaptive emotion regulation (i.e. less suppression and more reappraisal). The present research extends the literature on emotional clarity and the use of emotion regulation strategies by assessing not only global self-reports of suppression and reappraisal but also ESM measures of regulation strategy use in daily life. Across three samples, individuals with high emotional clarity did not report greater use of reappraisal than individuals with low emotional clarity (sample size weighted average correlations across studies: $\bar{r}_{RT\ pos} = .01$, $\bar{r}_{RT\ neg} = -.12$; Hunter & Schmidt, 2004, p. 81), and this finding generalised to reappraisal use measured in daily life. These results are in line with some previous studies (Boden et al., 2012, 2013; Gross & John, 2003) that found that reappraisal (as measured by the ERQ) and emotional clarity were unrelated. Previous studies that found a positive

bivariate association between emotional clarity and reappraisal included a coping measure of positive reinterpretation (Gohm & Clore, 2002; Gohm et al., 2005) whose items did not directly assess cognitive change but described positive consequences that arose from or after a stressful experience (John & Eng, 2014). For suppression, some of the empirical relations confirmed our expectation. In particular, higher self-reported emotional clarity was related to less suppression as measured by global self-report (in two out of three samples). This finding generalised to a measure of suppression of positive emotions in daily life. For the RT measure of emotional clarity, most between-persons relations with suppression measures were not significantly different from zero (sample size weighted average correlations across studies: $\bar{r}_{RT\ pos} = .06$, $\bar{r}_{RT\ neg} = -.11$; Hunter & Schmidt, 2004, p. 81). Within-persons analyses showed that on days when individuals needed more time to rate their negative emotions, individuals used more suppression after negative events. Taken together, there was some evidence that lower emotional clarity was related to a greater use of suppression. Given the correlational nature of the data, this finding is in line with the idea that hiding one's emotions hinders becoming clear about them (i.e. that suppression leads to lower momentary emotional clarity; Gross & John, 2003), but also with the idea that being unclear about one's emotions interferes with emotional expression (i.e. that low emotional clarity leads to suppressive behaviour; Kennedy-Moore & Watson, 1999). However, given that the results on the clarity–suppression link did not fully replicate across samples or assessment methods, future research is needed to clarify the nature of this link.

We had derived our hypothesis that higher emotional clarity would be related to a greater use of reappraisal and less use of suppression from (a) theoretical assumptions that emotional clarity should facilitate adaptive and effective emotion regulation (Gross, 2015; Hemenover et al., 2008; Larsen, 2000) and (b) a large body of research demonstrating that the habitual use of reappraisal is associated with positive outcomes and the habitual use of suppression is associated with negative outcomes in terms of interpersonal functioning and psychological health (e.g. Gross, 2015; John & Eng, 2014). Which processes might explain why emotional clarity was largely unrelated to the use of reappraisal in the present research? It might be that emotional clarity is only adaptive for persons experiencing high stress or intense emotions, "where the press for emotion regulation is greatest" (see Feldman Barrett, Gross, Christensen, & Benvenuto, 2001, p. 715). In our sample, we did not find any interaction between emotional intensity and clarity in predicting emotion regulation. Hence, the small and largely nonsignificant relations between emotional clarity and the use of emotion regulation strategies might be partly due to the selection of our samples (pure student samples). Future studies should therefore test whether emotional clarity might be related to more adaptive emotion regulation in samples that include individuals who experience higher stress levels or more intense emotions.

Another explanation for the zero and/or inconsistent relations between emotional clarity and emotion regulation is that the selection of specific emotion regulation strategies might be very context specific. Gross (2015) posited that "Different regulation strategies have different consequences, but the outcome profile that is 'best' in a particular case will depend upon the details of the person, the situation and the goals that person has in that situation" (p. 17). Thus, a person who is clear about his or her present emotions might choose the regulation strategy that fits best with the demands of the current situation and his or her situation-specific goals. In some situations, this "perfect" regulation strategy might be reappraisal; but in other situations, another regulation strategy (e.g. suppression) might be preferable for reaching the desired outcome. Future ESM studies should focus more on situational characteristics that have an impact on the choice of a particular emotion regulation strategy and investigate whether emotional clarity facilitates the context-sensitive selection of regulation strategies (for an overview of the construct of emotion regulation flexibility, see Aldao, Sheppes, & Gross, 2015; Bonanno & Burton, 2013).

Valence-specificity of emotional clarity

On the basis of a recent empirical finding that it might be important to examine emotional clarity as a function of valence (Thompson et al., 2015), we analysed RT to emotion items separately for positive and negative events. Across the three samples, the inverted U-shaped relation between emotional intensity and RT emerged for both positive and negative emotions, a finding that might indicate that certainty-related processes are captured in a similar way by RTs to positive and negative emotions. However, this finding does not rule out the possibility that the emotional clarity

of positive and negative emotions might be differentially related to other constructs or might play a different role in the emotion regulation process. In the present research, within- and between-persons relations between (baseline-speed corrected) RT to positive and negative emotion items were moderate to high, indicating substantial overlap between the clarity of positive and negative emotions. Although the RTs to positive and negative emotion items also showed a few differential correlations with emotion regulation measures, the overall correlational pattern was similar across valence. Future research might profit from analysing the clarity of negative emotions and the clarity of positive emotions under more controlled circumstances in the laboratory (e.g. using affect induction procedures) to test whether they are differentially related to regulatory behaviour or personality variables.

Limitations and conclusion

Despite the strengths of using ESM methodology to scrutinise the properties of an indirect measure of emotional clarity, there are at least three limitations of the present research. First, our samples comprised students only. Future investigators should examine the properties of the indirect measure of emotional clarity and emotional clarity's role in the emotion regulation process in more diverse samples and in samples that include individuals who experience higher stress levels or more intense emotions (e.g. clinical samples). Second, we analysed the relation between emotional clarity and emotion regulation for a small subset of regulation strategies (reappraisal and suppression) only. Future studies should include other types of regulation strategies, too (e.g. rumination about negative emotions or savouring positive emotions). Third, we focused exclusively on the degree to which individuals reported using (i.e. implementing) emotion regulation strategies. In future research, it might be promising to also look at the effectiveness of used regulation strategies (e.g. Sheppes & Gross, 2012).

Taken together, our investigation of the response process involved in rating momentary emotion items revealed inverted U-shaped relations between emotional intensity and RT at the item level and at the event level (i.e. when emotional intensity ratings and RTs were aggregated across multiple emotion items). Given this systematic nonlinear relation between emotional intensity and RT, future research that uses RTs to emotion items as an indicator of emotional clarity should control for emotional intensity by including both linear and squared emotional intensity terms in the model. A direct measure of momentary emotional clarity (confidence in one's emotion ratings) was also related to emotional intensity. Hence, researchers who study the role of momentary emotional clarity in the affect regulation process might consider controlling for (linear and squared) emotional intensity in order to determine the unique contribution of emotional clarity, irrespective of the type of clarity measure used (indirect or direct).

In our studies, emotional clarity was unrelated to the use of reappraisal. We found some evidence that lower emotional clarity was related to a more frequent use of suppression. A challenge for future research might be to more directly test whether (momentary) emotional clarity facilitates the context-sensitive selection of regulation strategies.

Notes

1. We additionally investigated the RT to binary responses. RT to yes/no responses was positively related to RT to Likert items. The relations between RT to yes/no responses with confidence and emotion regulation were largely the same as for RT to Likert items.
2. First, we excluded RTs that were higher than $M + 3$ *SD*s across all RTs of all participants (Sample 1: 1.7% out of 4690 RTs; Sample 2: 1.3% out of 6745 RTs; Sample 3: 0.7% out of 8896 RTs). Next, we computed person-specific cut-off values (intra-individual $M + 3$ *SD*s) and excluded RTs that were higher than a participant's cut-off value (Sample 1: 1.9% out of 4609 RTs; Sample 2: 2.3% out of 6656 RTs; Sample 3: 2.3% out of 8831 RTs).
3. Before computing the median across setting items, RT outliers (larger than interindividual $M + 3$ *SD*s) were deleted.
4. When group-mean (i.e. person-mean) centring was used instead of grand-mean centring to estimate the "pure" within-persons relation between emotional intensity and RT (see Enders & Tofighi, 2007), very similar results, which led to the same conclusions, emerged.
5. In a few models, convergence problems occurred when random slopes were specified for all predictors, which sometimes happens "when we try to estimate too many random (variance) components that are actually close or equal to zero" (Hox, 2010, p. 42). In this case, we used a forward (instead of a backward) strategy to test the significance of random slopes (i.e. each random slope term was tested separately against the random intercept model).
6. To test whether distributional characteristics of the RTs such as skewness were responsible for the curvilinear relation between emotional intensity and RT (cf. Cohen, Cohen, West, & Aiken, 2003, p. 250), the same multilevel

models were also specified with log-transformed RTs and rank-transformed RTs as the dependent variables. In both cases, the inverted U-shaped relation between emotional intensity and RT held.

7. One reason for the differences between Sample 3 and the other samples might be the item branching used in Sample 3 (where the intensity item was presented only when the previous item, asking whether a specific emotion was experienced, was answered affirmatively). Compared with the other two samples that used a non-branching item format, the frequency of very weak emotional intensity was very small, and thus, the estimation of the left part of the curve may have been less precise than in Samples 1 and 2. However, future research should more closely examine the effects that item branching has on both the response itself (e.g. in terms of the reported intensity levels) and the response time.
8. Additionally, we investigated whether there were changes in RT and emotion regulation over the study time. Multilevel growth curve models revealed that in all three samples, RT to positive and negative emotion items decreased over study time with a stronger decrease at the beginning of the studies. This is plausible because participants get more familiar with the handling of the handheld devices or smartphones and after a few occasions they know which questions are included in the questionnaire. In contrast, emotion regulation did not change over study time. This could be interpreted to show that the repeated assessment of momentary emotional experiences did not act as an emotion regulation intervention in people's daily life.
9. To test whether RT and emotional intensity interacted in the prediction of emotion regulation, we specified moderated multilevel models. There were no significant interactions ($|b| \leq 0.07$, $|t| \leq 1.15$, $p > .05$).

Disclosure statement

No potential conflict of interest was reported by the authors.

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