Abstract

Emotion differentiation, the ability to identify and label distinct emotions, has been associated with emotion regulation and mental health. However, studies have largely focused on Western populations, overlooking how diverse languages, cultures, and beliefs across countries may shape these emotional processes. Here, we propose to recruit participants from over 20 countries through the Psychological Science Accelerator network. This study will examine associations between emotion differentiation and internalizing symptoms (depression and anxiety), and between emotion differentiation and emotion regulation. In particular, we will test whether such associations differ across countries. We plan to use a multimethod approach, including task-based and self-report measures of emotion differentiation and emotion regulation. Results will advance our understanding of links between emotion differentiation, emotion regulation, and mental health, and how they may vary across countries. These findings will offer insights for developing mental health interventions that are sensitive to regional differences.

Introduction

After a tough day, you might find yourself feeling some negative emotions. Are you just 'stressed', or can you tease apart frustration from anxiety, or disappointment from sadness? The ability to identify and label emotions as distinct from one another is known as *emotion differentiation*. Prior studies have consistently found that weaker emotion differentiation abilities are associated with depression symptoms (Demiralp et al., 2012; Starr, Hershenberg, et al., 2020; Starr, Shaw, et al., 2020; Willroth et al., 2020). These associations hold even after controlling for mean negative emotion intensity (Demiralp et al., 2012; Willroth et al., 2020), underscoring that it is the ability to differentiate between emotions, and not merely the intensity of them, that drives an association with wellbeing. Importantly, these studies largely find that associations are specific to differentiation of negative, but not positive, emotions. Meta-analyses have shown poorer negative emotion differentiation to also be associated with maladaptive behaviors including binge drinking, non-suicidal self-injury, and treatment noncompliance (Seah & Coifman, 2022). Though less well-studied, there is further evidence that low negative emotion differentiation is associated with anxiety (Kashdan & Farmer, 2014; Matt et al., 2016) and borderline personality disorder (Tomko et al., 2015). Together, these findings underscore the importance of emotion differentiation in mental health and adaptive functioning, with poorer differentiation linked to psychological disorders and maladaptive behaviors.

The mechanisms responsible for these associations between emotion differentiation and wellbeing are not yet clear, though researchers have put forward emotion regulation as a key candidate. If individuals with high emotion differentiation abilities can conceptualize and label their affective experiences in a granular and situation-specific way, this may help them to effectively regulate their emotions and deal with the situation at hand (Kashdan et al., 2015). As discussed by others (Ottenstein & Lischetzke, 2020), this idea combines insights from Schwarz's (1990, 2012) feelings-as-information theory with Gross' (2015) extended process model of emotion regulation. Feelings-as-information theory posits that people attend to their feelings as a source of information about the present situation, and that experiencing a particular emotion (rather than a general negative mood) indicates that some set of appraisal criteria has been met (Schwarz, 2012). Following this, individuals with a greater ability to identify specific emotions should have access to more detailed and accurate information about the situation. Gross (2015) identifies three stages of emotion regulation: identification (whether to regulate), selection (what regulation strategy to use), and implementation (implementing a particular strategy). An increased ability to specifically identify one's emotions could improve the ability to evaluate whether a regulation goal should be activated, determine which regulation strategies are suitable based on contextual factors, and implement strategies through situation-specific tactics.

In line with this hypothesis, prior research has found greater emotion differentiation to be associated with more frequent use of emotion regulation strategies (Barrett et al., 2001), though some work finds these associations may not hold after controlling for mean negative emotions (O'Toole et al., 2021). Self-reported emotion differentiation ability is positively associated with self-reported tendency to use cognitive reappraisal (Ottenstein & Lischetzke, 2020; Wabnegger et al., 2024), an adaptive regulation strategy that predicts psychological

wellbeing (Haga et al., 2009; Riepenhausen et al., 2022). Other work reveals more nuanced relationships between differentiation and regulation. One study finds that the use of emotion regulation strategies was more strongly associated with increased negative emotion among low compared to high differentiators (Kalokerinos et al., 2019), suggesting that low emotion differentiation could hinder successful emotion regulation. Another study showed that for individuals with high social anxiety, those with poor emotion differentiation use cognitive reappraisal less than those with high differentiation abilities (O'Toole et al., 2014). Again, this points to a positive association between differentiation and use of adaptive emotion regulation strategies like cognitive reappraisal. While these studies provide some promising evidence for links between emotion differentiation and emotion regulation, variability in study design and the measures used to assess both differentiation and regulation limits the consistency and generalizability of findings. Overcoming these limitations requires large-scale, coordinated studies that incorporate diverse measures of both emotion differentiation and regulation. By employing multiple assessments across independent studies with sufficiently large samples, we can achieve a robust understanding of the interplay between these constructs.

Moreover, existing research has largely focused on Western populations, relying on samples from North America and Europe. While these studies have provided valuable insights into the associations between emotion differentiation, emotion regulation, and psychological outcomes, they may not capture the diversity of emotional processes across countries. Cultural norms and values significantly shape how emotions are experienced, expressed, and regulated, raising questions about the generalizability of findings from predominantly Western samples (Ip et al., 2024; Tan et al., 2022). For instance, studies have found that American, British, and German participants show lower negative emotion differentiation than Japanese, Indian, and Russian participants (Grossmann et al., 2016). Culture also moderates associations between suppression of negative emotions and wellbeing (Schunk et al., 2022).

Despite these known regional differences, no studies have directly examined whether the association between emotion differentiation and mental health varies across countries, nor has research assessed whether the relationship between emotion differentiation and regulation is moderated by country. This represents a critical gap, as cultural norms and values could shape how these constructs interact and influence psychological outcomes. For example, regions that emphasize expression over suppression of one's emotions (Butler et al., 2007) may show stronger associations between high emotion differentiation, adaptive regulation strategies like cognitive reappraisal, and positive mental health outcomes. The present study will measure emotion differentiation, emotion regulation, and mental health symptoms in participants from at least 20 countries, offering a unique opportunity to investigate cross-cultural variability in these constructs.

There are several considerations regarding the measurement of emotion differentiation and regulation. The existing literature employs diverse methodologies to measure these constructs, each with distinct strengths and limitations. Correlation-based measures, particularly intraclass correlations (ICCs), are well-established tools for assessing emotion differentiation. ICCs quantify the variance between and within repeated emotion ratings to index how distinctly individuals experience and report their emotions across time

or contexts. ICCs are often used to index differentiation in ecological momentary assessment or daily diary designs (e.g., Brown et al., 2021; Kashdan & Farmer, 2014). Several studies also compute ICCs from emotion ratings in image-based tasks, where participants view a series of emotional stimuli and rate the intensity of their emotional responses to each image (e.g., Nook et al., 2018). Negative emotion differentiation as measured by this task has been correlated with depression (Erbas et al., 2014). In another emotion differentiation exercise described by Edwards & Wupperman (2017), participants write about a series of life experiences and complete several emotion ratings for each experience. In this study, lower global emotion differentiation (average of negative and positive differentiation) was correlated with difficulties in emotion regulation as well as impulsive aggression. In addition to these task-based measures, self-reported questionnaires are another approach for assessing emotion differentiations. These measures, such as the Range and Differentiation of Emotional Experiences Scale (RDEES), allow participants to reflect on and evaluate their overall capacity to differentiate emotions. Self-reported emotion differentiation has been associated with depression symptoms, with emotion regulation acting as a partial mediator of this link (Ottenstein, 2020). Importantly, studies consistently show that questionnaire-based and task-based measures of ED are not correlated (Ottenstein & Lischetzke, 2020), suggesting that these tools may assess distinct dimensions of the construct.

Similarly, several tools exist for measuring emotion regulation. As with emotion differentiation, task-based and self-report measures of emotion regulation often fail to correlate (e.g., Guassi Moreira et al., 2022). Cognitive reappraisal is the most well-studied emotion regulation strategy (Buhle et al., 2014; Hu et al., 2014), and methods have been developed to measure the tendency and ability to use reappraisal to downregulate one's negative emotions. Self-report questionnaires, such as the Emotion Regulation Questionnaire (ERQ; Gross & John, 2003), assess general tendencies to use strategies like cognitive reappraisal. Prior work shows that ERQ scores are correlated with self-reported emotion differentiation (Ottenstein & Lischetzke, 2020). The ERQ has also been adapted to measure an individual's perceived capacity to regulate their emotions effectively (e.g., Goldin et al., 2012), though it is currently unknown whether this ability is correlated with emotion differentiation. Task-based methods also allow us to measure the ability to reappraise negative emotions effectively. These paradigms often use emotional image stimuli, where participants are instructed to either simply look at the image or reappraise the stimuli to reduce its emotional impact (e.g., Buhle et al., 2014). Reappraisal capacity can be computed as the percentage reduction in negative affect from the average ratings in the "Look" condition to the "Reappraise" condition (Guassi Moreira et al., 2022). However, prior studies have not yet investigated whether emotion differentiation is associated with task-based reappraisal. Whether the ability to differentiate emotions in response to negative images is associated with the capacity to reappraise similar stimuli is a key question that remains unknown.

To address the variation in methodological approaches and provide a comprehensive assessment, this study will incorporate multiple well-established measures of both emotion differentiation and emotion regulation. For emotion differentiation, we will include (1) an image-based task, where ICCs will be derived from participants' ratings of emotional responses to visual stimuli; (2) a retrospective written task, from which ICCs will be similarly

calculated based on emotion ratings; and (3) a self-report measure (RDEES; Kang & Shaver, 2004). For emotion regulation, we will assess participants' (1) self-reported tendency to use reappraisal (ERQ; Gross & John, 2003); (2) self-reported reappraisal capacity (ERQ - modified; Goldin et al., 2012); and (3) a task-based cognitive reappraisal paradigm. By leveraging multiple methods, we aim to account for the variability in prior findings and enhance the robustness of our conclusions about how emotion differentiation and emotion regulation interact and relate to mental health symptoms. We propose to assess depression symptoms, as emotion differentiation shows consistent associations with depression (Demiralp et al., 2012; Starr, Hershenberg, et al., 2020; Starr, Shaw, et al., 2020; Willroth et al., 2020). We will additionally measure anxiety symptoms, which tend to correlate highly with depression (Spitzer et al., 2006), and have also been associated with emotion differentiation (Kashdan & Farmer, 2014). Using these measures of emotion differentiation, emotion regulation, and internalizing symptoms, our study aims to answer the following primary research questions:

1) Is emotion differentiation associated with depression and anxiety symptoms, and do these associations depend on country?
    a) Do associations between emotion differentiation and symptoms hold after controlling for mean negative affect?

2) Is emotion regulation associated with emotion differentiation, and do these associations depend on country?
    a) Do associations between emotion differentiation and emotion regulation hold after controlling for mean negative affect?

Methods

Sample:

To inform a power analysis for the present study's sample size, we used effect sizes from prior literature testing correlations between emotion differentiation and maladaptive outcomes. One meta-analysis finds a small negative correlation (r = -.15) between negative emotion differentiation and maladaptive outcomes (Seah & Coifman, 2022). Other work finds negative emotion differentiation to be correlated with self-report depression scales, r = -.23 (Thompson et al., 2021). Negative emotion differentiation is also correlated with interviewer-assessed depression, $-.20 < r\text{s} < .30$ (Starr, Hershenberg, et al., 2020). At the country level, 346 participants are required to detect a small correlation effect of r = .15 at a significance level of .05 with 80% power. We aim for at least 20 countries to participate, yielding a total sample of $N \geq 6920$.

Ideally, participants will complete the study in-person, if this is feasible across labs. If not, the study can be conducted online. Labs can select their own recruitment methods, which may include sampling from student populations as well as the local community. We expect that students will make up the majority of our sample, given that this population is typically easily recruited and compensated.

Inclusion and exclusion criteria: Participants must be 18-40 years old and must be fluent, native speakers of the language in which the study is conducted at each respective lab. We will include three attention check questions throughout the study. Participants will be excluded if they fail ≥ 2 attention checks. In addition, we will determine whether participants' reading speeds fall within a plausible range for the questionnaire measures. We will use international mean character reading speed estimates (Trauzettel-Klosinski et al., 2012) to calculate a critical score by adding 2 standard deviations to the mean characters/min value (to account for the fastest 95% of readers). We will compare participants' reading speed, across all questionnaires, to this critical score. Participants will be excluded if they spend less than the minimum calculated reading time on the questionnaires. Finally, participants must have <10% missing data for every task/questionnaire to be included in analyses (see Missing data in Analysis plan). Each country should have a final usable sample of ≥346 participants after exclusions.

Procedure:

Participants will read and sign a consent form before beginning the study. Participants will first complete three tasks (emotion differentiation - image, emotion differentiation - written, and cognitive reappraisal), which will be presented in a random order. Then, participants will complete five questionnaires (RDEES, ERQ, ERQ-capacity, GAD-7, PHQ-8), again presented in a randomized order. Finally, participants will complete a demographics questionnaire. At the end of the study session, participants will be provided with a debrief that explains the study aims as well as a list of psychological resources that are tailored to the location of each participating laboratory.

We anticipate that the entire study will take approximately 75 minutes to complete. Please see **Feasibility** for further discussion on study duration.

Ethics:

We will ensure that relevant ethical approvals are obtained by all participating research labs. All participants will be required to give informed consent prior to the study. Participant compensation method and rates will be decided by each lab.

There are minimal risks to participants related to their participation in this study. All measures proposed here have been used in prior work, including in our lab, with no adverse effects. Overall, we believe that there will be no lasting negative impact or harm to participants due to participating in the proposed research. However, we acknowledge that participants may experience temporary distress or other negative feelings due to images displayed during the emotion differentiation and reappraisal tasks. We will minimize these risks by 1) informing participants about the presence of emotional stimuli in the consent form, 2) informing participants that they can stop the study at any time, 3) limiting the length of tasks such that participants are not overburdened with emotional material, 4) providing a list of support resources upon study completion, and 5) providing contact details so that participants can contact researchers with any concerns.

Transparency and Openness:

We plan to pre-register the study methods and analysis plan on the Open Science Framework. We would also be willing to submitting a registered report for this study, if supported by the PSA network. Upon study completion, study materials, anonymized datasets, and analysis code will be made publicly available on the Open Science Framework.

Measures:

We will work with the PSA and participating labs to translate the following tasks and questionnaires, ensuring that interpretation remains true to the original design. Further details on task design and questionnaire items are in the Supplementary Material.

Tasks

Emotion Differentiation Task - Image. We will adapt tasks from prior work (Erbas et al., 2014; Nook et al., 2018) to assess the degree to which participants differentiate between their negative emotions in response to emotional image stimuli. In this task, participants view a series of 15 negative images drawn from the Open Affective Standardized Image Set (OASIS; Kurdi et al., 2017). Each trial will display a fixation cross for 2 seconds followed by an image for 5 seconds. Underneath the image, participants will use slider scales to rate how strongly (0-100) they feel five different negative emotions (angry, disgusted, scared, upset, sad). The order of trials, and emotion ratings within each trial, will be randomized. Participants will complete two practice trials prior to the full task.

Following prior work (Nook et al., 2018), we will compute an intraclass correlation coefficient (ICC) from each participant's ratings across all trials. A large ICC indicates that participants rated emotions similarly across trials and thus did not make nuanced distinctions between these emotions across the task. In contrast, a small ICC indicates that the participant rated emotions differently across trials, suggesting greater nuance in distinguishing between emotions in response to the various images. We will use Fisher *r*-to-z transform the ICCs and reverse score the values so that high scores indicate high emotion differentiation and low scores indicate low differentiation.

We will also compute each participant's mean affect from the average of all emotion ratings across all trials.

Emotion Differentiation Task - Written. To assess emotion differentiation in a more naturalistic context, we will use the written exercise described by Edwards & Wupperman (2017). In this task, participants will follow prompts that instruct them to recall six past experiences (three negative and three neutral or positive). For each one, participants respond to a series of writing prompts ("How did the experience make you feel?; What aspects of the event made you feel that way? What did the experience make you think about?"). Participants will be given 4 minutes to respond to the writing prompts in each trial. After completing the writing for each trial, participants will complete the Positive and Negative Affect Schedule (PANAS; Watson et al., 1988).

The PANAS consists of 20 items that assess the intensity of 10 positive and 10 negative emotions. The scale yields two subscales - Positive Affect and Negative Affect. Prior work has used the PANAS to assess emotion differentiation (Edwards & Wupperman, 2017; Pond et al., 2012). ICCs will be calculated between like-valenced emotions and transformed using Fisher r-to-z transformations. ICCs will then be reverse scored, such that higher scores indicate higher emotion differentiation.

We will compute each participant's mean affect from the average of their PANAS affect ratings.

Cognitive Reappraisal Task. We will use a cognitive reappraisal paradigm adapted from prior work (McRae et al., 2012; Ochsner et al., 2002) to examine how successfully participants can downregulate their negative affect during cognitive reappraisal of emotional image stimuli. 15 neutral and 30 negative emotional images will be taken from OASIS (Kurdi et al., 2017). Negative images will be matched on valence. The task will consist of 45 trials. Each trial will begin with a fixation cross (4 sec), then instructions to "Look" or "Reappraise" (2 sec) followed by an image (8 sec). Neutral images will always be paired with a "Look" instruction, while negative images will randomly be assigned "Look" or "Reappraise". For the "Look" condition, participants will be instructed to look at and respond naturally to the image. For the "Reappraise" condition, participants will be instructed to reinterpret the image in a way that makes them feel better about it. Next, participants will rate their negative affect on a sliding scale ("How negative do you feel?", 0-100; 4 sec). There will be 15 trials per condition (Look Neutral, Look Negative, Reappraise Negative). Reappraisal capacity will be computed as the % change in negative affect between the average affect ratings in the Look

Negative and Reappraise Negative conditions i.e., ([Look Negative - Reappraise Negative] / Look Negative) * 100 (Guassi Moreira et al., 2022).

Questionnaires

Emotion differentiation. Participants will complete the 14-item Range and Differentiation of Emotional Experiences Scale (RDEES; Kang & Shaver, 2004). Each item is rated on a 4-point Likert Scale (1 = strongly disagree, 4 = strongly agree). The 7-item Differentiation subscale score will be used as our self-report questionnaire measure of emotion differentiation.

Emotion regulation difficulties. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) consists of 36 items, which are each rated on a 5-point Likert scale (1 = almost never, 5 = almost always). The total score will be used as a measure of general difficulties with emotion regulation.

Cognitive reappraisal tendency. The 10-item Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) assesses a person's tendency to use two different emotion regulation strategies: cognitive reappraisal and suppression. Each item is rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

Cognitive reappraisal ability. Following prior work (Goldin et al., 2012; Guassi Moreira et al., 2022; Troy et al., 2017), we will administer a modified 8-item version of the ERQ to assess participants' belief about their reappraisal abilities. Instead of asking about the frequency of strategy use, the items instead ask about one's ability to regulate (e.g., *When I really want to, I am very capable of controlling my emotions by changing the way I'm thinking about the situation I'm in."*). Each item is rated on a 7-point Likert scale (1 = strongly disagree, 7 = strongly agree).

Anxiety. The 7-item Generalized Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006) will be used to measure anxiety symptoms. Prior work supports the validity and reliability of this measure (Löwe et al., 2008). In this scale, participants rate how often, over the past 2 weeks, they have been bothered by symptoms of generalized anxiety. Items are rated on a 4-point Likert scale (0 = not at all, 3 = nearly every day) and items are summed to calculate the total score.

Depression. The 8-item Patient Health Questionnaire (PHQ-8; Kroenke et al., 2009) is a widely-used measure for diagnosing and assessing severity of depression. The PHQ-8 shows excellent validity and reliability for diagnosing depression (Shin et al., 2019), including across countries (Torre et al., 2023). In this questionnaire, participants rate how often they have been bothered by symptoms of depression over the last 2 weeks. Items are rated on a 4-point Likert scale (0 = not at all, 3 = nearly every day) and summed to calculate the total score.

Demographics. We will ask participants to report their age, sex assigned at birth, gender identity, race/ethnicity, education, and annual income. We will also collect information about the city or region where they reside, to provide coarse geographic data.

We are mindful of minimizing study burden on participants, but we welcome feedback from the PSA regarding the inclusion of additional measures. For example, it may be useful to assess cultural assimilation (e.g., Demes & Geeraert, 2014) and to measure whether emotional expressivity (Kring et al., 1994) varies across countries.

Feasibility:

We believe that this study is feasible for the PSA's network to carry out. Prior PSA studies have recruited >10,000 participants from >20 countries, indicating that our target sample size is feasible. We do not require specific study populations; we anticipate that all participating labs will be able to recruit local student and community samples. We expect that collaborating labs will be able to obtain ethical approval to carry out this study (see **Ethics** section). All labs will use the same platforms to collect data for the study, which will allow for data outputs to easily be combined. At present, our lab primarily uses Qualtrics for questionnaires. We use Gorilla for experimental tasks, since it allows for flexible task designs and strict control of trial timing. However, we would be happy to use entirely open-source software such as *formr* and *jspsych* to ensure that the study design is accessible and straightforward for each lab to administer.

We expect the study session to last 75 minutes, including initial consent and the final debrief. We expect that this duration will be long enough for students to receive credit while also being appealing to participants from local communities, increasing the likelihood of a diverse and adequate sample size. This duration should make the study a cost-effective option for compensating participants, either through monetary payments or student credit. Having run studies of this length in our lab, with similar tasks and questionnaires, we expect that participants will remain engaged and will not be too distressed by the emotional material. However, we realise that this is a longer duration than most prior PSA studies. If study length is a concern, we would remove the written emotion differentiation task, which is less well-studied than the image-based task and the self-report questionnaire. Doing so would reduce the study length to 45 minutes.

Analysis plan

We will first conduct bivariate correlations between all pairs of symptom, emotion differentiation, and emotion regulation measures. We expect depression and anxiety scores to be highly correlated, as found in prior work (Spitzer et al., 2006). If the correlation is large, (i.e., $r \geq .65$), we will compute an internalizing symptom score for each participant from the sum of their depression and anxiety scores (Kroenke et al., 2016; Nook et al., 2022).

We do not expect self-reported and ICC-based emotion differentiation measures to be correlated, given null correlations found in prior studies (Ottenstein & Lischetzke, 2020). We also do not expect self-reported and task-based cognitive reappraisal measures to be correlated (Guassi Moreira et al., 2022). However, if correlations between ED measures, or between ER measures, are strong ($r > .65$), we will compute composite scores and use these scores in analyses.

1. **Is emotion differentiation associated with depression and anxiety symptoms, and do these associations depend on country?**

For each of the three emotion differentiation (RDEES, ED image task, ED written task) measures, we will compare three models:

Model 1: Symptoms ~ ED
Model 2: Symptoms ~ ED + (1|Country)
Model 3: Symptoms ~ ED + (ED|Country)

We will use AIC values to determine the model that best fits the data. If **Model 1** has the lowest AIC, this suggests that country does not impact the ED-symptom association, indicating that this relationship is consistent across countries. If **Model 2** has the lowest AIC, this implies that country impacts symptom levels (intercept), but not the relationship between ED and symptoms. If **Model 3** has the lowest AIC, this suggests that country influences both baseline symptoms and the strength of the association between ED and symptoms, indicating that the impact of ED on symptoms is moderated by country.

For each of the three emotion differentiation measures, we will report and interpret significant fixed and random effects for the best fitting model. Where models with random slopes for country fit the data best, we will extract and plot the country-specific slopes and their confidence intervals. While random slopes cannot strictly be used to test hypotheses about specific country slopes or compare them, reporting and plotting the effect estimates and confidence intervals will offer insights into the variability across countries. In particular, CIs that do not overlap would suggest that slopes are different for those countries. CIs that include zero suggest no evidence of an association between differentiation and symptoms for that country. We could also plot effect sizes and CIs for the correlations between symptoms and emotion differentiation for countries with the largest sample sizes, following the approach taken by prior PSA studies (Wang et al., 2021).

1b. Do associations between emotion differentiation and symptoms hold after controlling for mean negative affect?

Some work finds that associations between emotion differentiation and mental health hold even after controlling for mean negative affect (Demiralp et al., 2012; Willroth et al., 2020), while others find the opposite (Dejonckheere et al., 2019; Matt et al., 2016). It is important to clarify the role of mean negative affect in these associations to determine whether emotion differentiation independently predicts mental health outcomes or if its effects are confounded by the general intensity of negative emotions. Thus, for the two task-based emotion differentiation measures, we will compute mean affect ratings from participant responses. Using these, we will examine whether any significant associations between emotion differentiation and symptoms hold after controlling for mean negative affect in the best fitting model.

For example, if Model 3 is selected, and there is a significant association between ED and Symptoms, we will test the following:

Model 4: Symptoms ~ ED + (ED|Country) + mean_affect

2. **Is emotion regulation associated with emotion differentiation, and do these associations depend on country?**

We will repeat the model selection procedure outlined in research question 1 to test associations between each pair of emotion regulation and emotion differentiation measures:

Model 1: ED ~ ER
Model 2: ED ~ ER + (1|Country)
Model 3: ED ~ ER + (ER|Country)

We will report and interpret significant fixed and random effects from the best fitting models, as described for research question 1.

With 3 emotion differentiation measures and 4 emotion regulation measures, there will be 12 models in total. We will apply a false discovery rate correction to correct for multiple comparisons.

2b. Do associations between emotion differentiation and emotion regulation hold after controlling for mean negative affect?

For the eight models that include task-based emotion differentiation measures, we will examine whether any significant associations between emotion regulation and emotion differentiation hold after controlling for mean negative affect.

Missing data. Participants will be required to respond to all questionnaire items and task prompts/ratings, thus we do not expect missing data. However, we acknowledge that technical glitches may lead to missing at random data. For any questionnaire or task, if <10% of a participant's data is missing, we will impute their missing responses (multiple imputation may be the most rigorous approach, but we welcome feedback on this). Otherwise, we will exclude their data.

Conclusion

The proposed study addresses a critical need to establish relationships between emotion differentiation, emotion regulation, and mental health. It examines how these associations may vary across countries - a topic that remains underexplored despite evidence that emotional processes are shaped by cultural norms and values. The PSA's collaborative infrastructure is ideally positioned to execute this ambitious yet highly feasible project. We are confident that this study will advance theoretical understanding of how emotion differentiation interacts with mental health and emotion regulation across a broad range of countries. By clarifying how these associations may be amplified or attenuated across regions, this research will set a standard for culturally informed approaches in the field. Ultimately, this work could inform the development of more effective, culturally sensitive strategies to improve mental health outcomes across the globe.

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Supplementary Material

Tasks

Emotion Differentiation - Image.

Stimuli are obtained from the Open Affective Standardized Image Set (OASIS; Kurdi et al., 2017). This open-access stimulus set contains 900 images with normative ratings for valence and arousal, which are two key dimensions of affect (Barrett & Bliss-Moreau, 2009). Stimuli along with valence and arousal ratings are available at https://osf.io/6pnd7/.

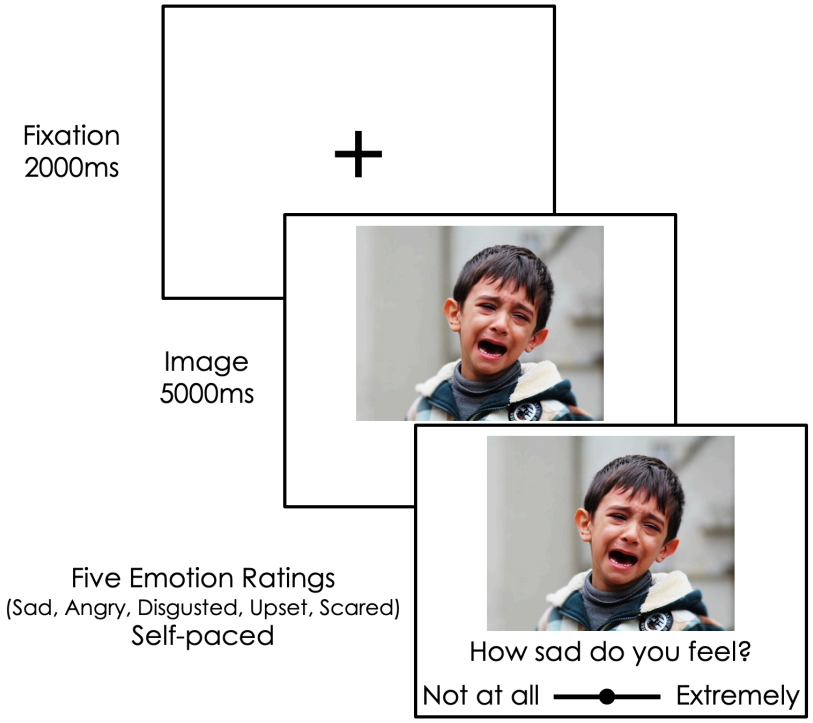

Fig 1. Example of a single trial from the image-based emotion differentiation task. Participants rate how strongly each image makes them feel five negative emotions. Emotions remain the same across trials.

Emotion Differentiation Task - Written.

We will adapt the task procedure outlined by Edwards & Wupperman (2017).

Participants will be given the following prompts:

- Think about a time in your life in which you felt rejected, unaccepted, or left out.
- Think about a time in your life in which you felt threatened, intimidated, or forced to do something you didn't want to do.
- Think about a time in your life in which you felt hurt or damaged - but don't include a time when a partner dumped you.
- Think about a recent time in which you watched your favorite television show.
- Think about a recent time in which you ate a delicious meal.
- Think about a recent time in which you received a satisfactory grade on an assignment.

Participants are provided with the following questions to guide their writing:
How did the experience make you feel?; What aspects of the event made you feel that way?; What did the experience make you think about?

After 4 minutes writing about each prompt, participants complete the 20-item Positive and Negative Affect Schedule (PANAS; Watson et al., 1988) to describe how they felt at the time of the experience. There are 10 negative terms (afraid, scared, nervous, jittery, irritable, hostile, guilty, ashamed, upset, distressed) and 10 positive terms (active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud, strong). Each item is rated on a 5-point Likert Scale (1 = Very slightly or not at all, 2 = A little, 3 = Moderately, 4 = Quite a bit, 5 = Extremely).

Cognitive Reappraisal Task.

Stimuli are obtained from the Open Affective Standardized Image Set (OASIS). Stimuli along with valence and arousal ratings are available at https://osf.io/6pnd7/.

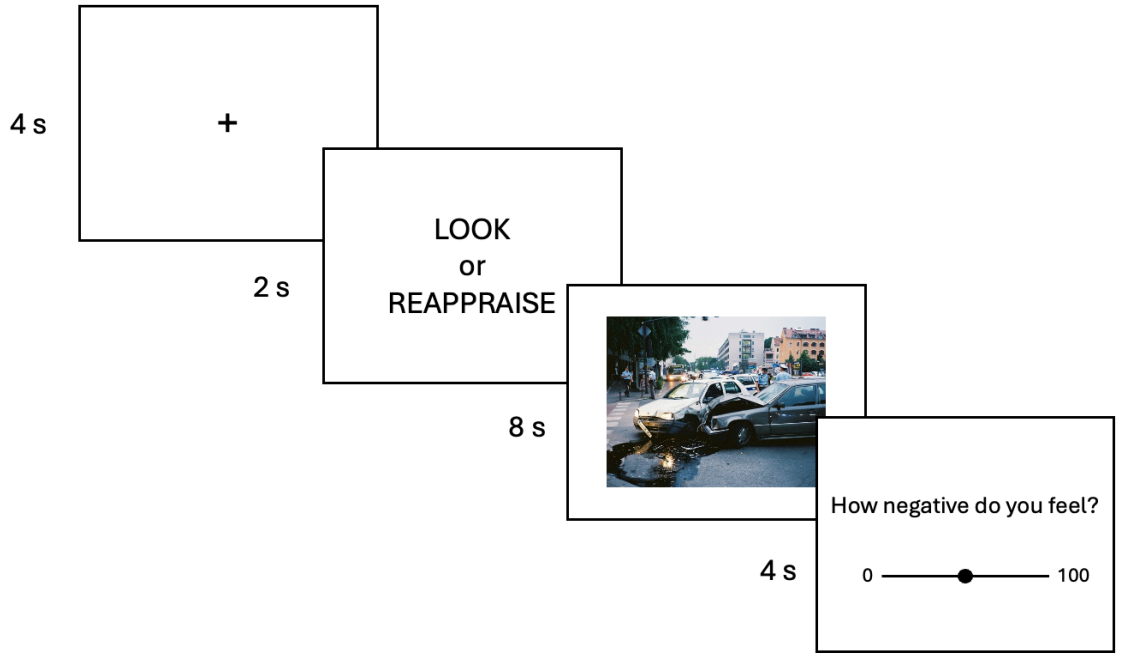

Fig 2. Example of a single trail from the cognitive reappraisal task.

Questionnaires

Emotion Differentiation

Range and Differentiation of Emotional Experiences Scale (RDEES; Kang & Shaver, 2004)

Item
7. I experience a wide range of emotions.
5. I usually experience a limited range of emotions. (R)
1. I don't experience many different feelings in everyday life. (R)
9. I don't experience a variety of feelings on an everyday basis. (R)
13. I tend to experience a broad range of different feelings.
3. I have experienced a wide range of emotions throughout my life.
11. Feeling good or bad — those terms are sufficient to describe most of my feelings in everyday life. (R)
12. I am aware of the subtle differences between feelings I have.
14. I am good at distinguishing subtle differences in the meaning of closely related emotion words.
8. I am aware that each emotion has a completely different meaning.
10. If emotions are viewed as colors, I can notice even small variations within one kind of color (emotion).
4. Each emotion has a very distinct and unique meaning to me.
2. I am aware of the different nuances or subtleties of a given emotion.
6. I tend to draw fine distinctions between similar feelings (e.g., depressed and blue; annoyed and irritated).

Emotion regulation difficulties.

Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004)

Factor	Item
1: Nonacceptance of Emotional Responses (NONACCEPTANCE)	29) When I'm upset, I feel guilty for feeling that way.
	25) When I'm upset, I feel ashamed with myself for feeling that way.
	15) When I'm upset, I become embarrassed for feeling that way.
	14) When I'm upset, I become angry with myself for feeling that way.
	33) When I'm upset, I become irritated with myself for feeling that way.
	27) When I'm upset, I feel like I am weak.
2: Difficulties Engaging in Goal-Directed Behavior (GOALS)	30) When I'm upset, I have difficulty concentrating.
	22) When I'm upset, I have difficulty focusing on other things.
	16) When I'm upset, I have difficulty getting work done.
	38) When I'm upset, I have difficulty thinking about anything else.
	24) When I'm upset, I can still get things done. (r)
3: Impulse Control Difficulties (IMPULSE)	37) When I'm upset, I lose control over my behaviors.
	31) When I'm upset, I have difficulty controlling my behaviors.
	17) When I'm upset, I become out of control.
	23) When I'm upset, I feel out of control.
	4) I experience my emotions as overwhelming and out of control.
	28) When I'm upset, I feel like I can remain in control of my behaviors. (r)
4: Lack of Emotional Awareness (AWARENESS)	7) I am attentive to my feelings. (r)
	3) I pay attention to how I feel. (r)
	12) When I'm upset, I acknowledge my emotions. (r)
	21) When I'm upset, I believe that my feelings are valid and important. (r)
	9) I care about what I am feeling. (r)
	39) When I'm upset, I take time to figure out what I'm really feeling. (r)
5: Limited Access to Emotion Regulation Strategies (STRATEGIES)	20) When I'm upset, I believe that I'll end up feeling very depressed.
	19) When I'm upset, I believe that I will remain that way for a long time.
	35) When I'm upset, I believe that wallowing in it is all I can do.
	40) When I'm upset, it takes me a long time to feel better.
	32) When I'm upset, I believe that there is nothing I can do to make myself feel better.
	26) When I'm upset, I know that I can find a way to eventually feel better. (r)
	41) When I'm upset, my emotions feel overwhelming.
	34) When I'm upset, I start to feel very bad about myself.
6: Lack of Emotional Clarity (CLARITY)	6) I have difficulty making sense out of my feelings.
	5) I have no idea how I am feeling.
	10) I am confused about how I feel.
	8) I know exactly how I am feeling. (r)
	1) I am clear about my feelings. (r)

Cognitive reappraisal tendency.
Emotion Regulation Questionnaire (ERQ; Gross & John, 2003)

1----------2----------3----------4----------5----------6----------7
strongly disagree **neutral** **strongly agree**

1. ____ When I want to feel more *positive* emotion (such as joy or amusement), I *change what I'm thinking about*.

2. ____ I keep my emotions to myself.

3. ____ When I want to feel less *negative* emotion (such as sadness or anger), I *change what I'm thinking about*.

4. ____ When I am feeling *positive* emotions, I am careful not to express them.

5. ____ When I'm faced with a stressful situation, I make myself *think about it* in a way that helps me stay calm.

6. ____ I control my emotions by *not expressing them*.

7. ____ When I want to feel more *positive* emotion, I *change the way I'm thinking* about the situation.

8. ____ I control my emotions by *changing the way I think* about the situation I'm in.

9. ____ When I am feeling *negative* emotions, I make sure not to express them.

10. ____ When I want to feel less *negative* emotion, I *change the way I'm thinking* about the situation.

Cognitive reappraisal ability.
Modified ERQ (Guassi Moreira et al., 2022)

ERQ Capacity Item Label	ERQ Capacity Item Text
ERQ Capacity 1	When I really want to, I am very capable of controlling my emotions by changing the way I think about the situation I'm in.
ERQ Capacity 2	When I really want to, I am very capable of changing what I'm think about when I want to feel less negative emotion (such as sadness or anger).
ERQ Capacity 3	When I really want to, I am very capable of making myself think about a stressful situation in a way that helps me stay calm.
ERQ Capacity 4	When I really want to, I am very capable of changing the way I'm thinking about a situation when I want to feel less negative emotion.
ERQ Capacity 5	When I really want to, I am very capable of changing what I'm thinking about when I want to feel more positive emotion (such as joy or amusement).
ERQ Capacity 6	When I really want to, I am very capable of changing the way I am thinking about a situation that is likely to make me feel strong emotions.
ERQ Capacity 7	When I really want to, I am very capable of reconsidering what relevance the situation really has for me if a situation is likely to make me upset.
ERQ Capacity 8	When I really want to, I am very capable of changing the way I'm thinking about a situation when I want to feel more positive emotion.

Anxiety.

Generalized Anxiety Disorder Questionnaire (GAD-7; Spitzer et al., 2006)

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all sure	Several days	More than half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	☐	☐	☐	☐
2. Not being able to stop or control worrying	☐	☐	☐	☐
3. Worrying too much about different things	☐	☐	☐	☐
4. Trouble relaxing	☐	☐	☐	☐
5. Being so restless that it's hard to sit still	☐	☐	☐	☐
6. Becoming easily annoyed or irritable	☐	☐	☐	☐
7. Feeling afraid as if something awful might happen	☐	☐	☐	☐

Depression.
Patient Health Questionnaire (PHQ-8; Kroenke et al., 2009)

Over the last 2 weeks, how often have you been bothered by any of the following problems?		Not at all	Several days	More than half the days	Nearly every day
1.	Little interest or pleasure in doing things	☐	☐	☐	☐
2.	Feeling down, depressed, irritable or hopeless	☐	☐	☐	☐
3.	Trouble falling or staying asleep, or sleeping too much	☐	☐	☐	☐
4.	Feeling tired or having little energy	☐	☐	☐	☐
5.	Poor appetite or overeating	☐	☐	☐	☐
6.	Feeling bad about yourself – or that you are a failure or have let yourself or your family down	☐	☐	☐	☐
7.	Trouble concentrating on things, such as school work, reading or watching television	☐	☐	☐	☐
8.	Moving or speaking so slowly that other people could have noticed? Or the opposite – being so fidgety or restless that you have been moving around a lot more than usual	☐	☐	☐	☐