

The Effects of Self-Enhancement and Self-Improvement on Recovery From Stress Differ Across Cultural Groups

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Abstract

Extant research shows that individuals can reflect either adaptively or maladaptively over negative experiences. However, few studies have examined how culture influences this process. We examined the effects of self-enhancement and self-improvement reflection on emotional and physiological recovery from a laboratory social stressor among 56 Asian Americans (interdependent cultural group) and 58 European Americans (independent cultural group). The extent to which people gained emotional and physiological benefits from self-reflection depended on whether the self-reflection processes were congruent with individuals' heritage cultural backgrounds. When there was a cultural match, participants showed improved emotional recovery, quicker return to baseline levels of cortisol, and greater persistence following the stressor. These findings provide evidence suggesting culturally distinct processes through which individuals recover from negative experiences.

Keywords

self-reflection, negative affect, cortisol, persistence, culture

Reflecting on negative experiences can help individuals make sense of their emotions and actions, facilitating understanding of problems and self-awareness (Pennebaker & Graybeal, 2001). In particular, self-enhancement, or the process of focusing on favorable information about the self (Heine & Hamamura, 2007), can restore positive self-regard and has been linked to improved psychological well-being during stressful experiences (Taylor & Brown, 1988). However, the extent to which self-enhancement is normative and adaptive may depend on the cultural context (Heine & Hamamura, 2007), given cultural differences in independent and interdependent self-construals (Markus & Kitayama, 2010).

The independent self-construal is prevalent in individualistic Western cultures and views the self as an entity defined by internal, stable attributes (Markus & Kitayama, 1991). Under this entity view, compensatory self-enhancement is functional in maintaining self-esteem when confronted with a threat to self (Heine, Kitayama, & Lehman, 2001). In contrast, the interdependent self-construal is prevalent in collectivistic Asian cultures and holds that the self is a relational entity that is malleable and dictated by context. Under this incremental view, self-improvement is propelled by open consideration of one's shortcomings and failures (Dweck, Chiu, & Hong, 1995; Heine, Lehman, Markus, & Kitayama, 1999). Cultural differences in sources of self-esteem (i.e., personal vs. relational) may also underlie differential use of self-enhancement and self-improvement processes (Taylor & Brown, 1988).

Personal self-esteem involves knowledge of one's abilities, whereas relational self-esteem involves approval from others. Self-enhancement motivation may lead European Americans to focus on areas of relative strengths to restore a sense of competence (i.e., personal self-esteem), whereas self-improvement motivation may lead Asian Americans to focus on areas of weakness to avoid losing "face" with others (i.e., relational self-esteem). Supporting these East–West differences, a meta-analysis of 91 cross-cultural studies demonstrated that self-enhancing motivations appear weaker among individuals of East Asian descent compared with those of European descent (Heine & Hamamura, 2007).

Prior work suggests that engaging in culturally congruent self-motivational processes may be beneficial. Specifically, Tsai, Lau, Niles, et al. (2015) found that expressive writing marked by self-enhancement themes was associated with decreased depression and anxiety symptoms for European Americans, whereas expressive writing marked by self-improvement themes was associated with decreased depressive and anxiety symptoms for Asian Americans. Extant research has also documented the effects of self-enhancement and

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self-improvement on task motivation. In one study, European Americans were less likely to endorse the credibility of tests when they received negative feedback, whereas Japanese individuals were less likely to do so when they received positive feedback (Heine et al., 2001). In another study, Japanese participants tended to persist in working on a difficult task when given failure feedback, whereas European Americans tended to elect a novel task when given failure feedback (Heine, Kitayama, Lehman, Takata, et al., 2001).

Whether these findings extend across distinctive outcomes of stressful experiences remains to be tested. This is an important gap to address because stressful experiences are commonplace and have consequences for emotional and physical health. Stressful life events increase negative affect (Bolger, DeLongis, Kessler, & Schilling, 1989) and risk for depression (Hammen, 2005). Stress also activates the hypothalamic–pituitary–adrenal (HPA) axis, resulting in the secretion of the hormone cortisol. Although this biologically facilitates management of stress, prolonged activation of the HPA axis or a failure to shut down can disrupt homeostasis and result in dysregulation (McEwen, 1998), which in turn increases the risk for adverse physical health outcomes (Cohen, Janicki-Deverts, & Miller, 2007). The implications of culturally congruent self-reflection processes for persistence in the face of stress are also important to examine because persistence through challenge is essential in achievement contexts.

The Current Study

The current study examines the effects of self-enhancement versus self-improvement-oriented reflection following a laboratory social stressor. More specifically, we examined whether these distinct motivational processes had differential effects on mood, HPA axis recovery, and persistence across interdependent (Asian American) and independent (European American) cultural groups. We hypothesized that culturally syntonetic self-reflection processes would result in improved emotional (i.e., greater reduction in negative affect) and physiological (i.e., quicker return to baseline levels of cortisol) recovery and greater persistence (i.e., declarative response to challenge) both within and across the self-enhancement and self-improvement conditions. Across conditions, we predicted that Asian Americans would experience improved recovery and greater persistence when engaged in self-improvement writing than in self-enhancement writing, whereas European Americans would experience improved recovery and greater persistence following self-enhancement writing than self-improvement writing. Within conditions, we predicted that European Americans would experience greater recovery than Asian Americans in the self-enhancement condition and that Asian Americans would experience greater recovery than European Americans in the self-improvement condition. Lastly, we hypothesized that there would be no ethnic group differences in motivation, emotional, or physiological recovery in the control condition.

Method

Participants

Participants were 56 Asian American and 58 European American undergraduate students who participated in exchange for psychology course credit. Our target sample size of at least 80 participants was based on previously published research (Taylor, Welch, Kim, & Sherman, 2007) with a similar 2 (ethnicity) $\times$ 3 (condition) experimental design using the Trier Social Stress Task (TSST; Kirschbaum, Pirke, & Hellhammer, 1993). Of the 114 participants, 66 (58%) were female. Ages ranged from 18 to 40, $M = 19.64$, $SD = 2.70$. Among the 56 Asian Americans in the sample, 77% were first generation (i.e., foreign born) and 23% were second generation (i.e., U.S. born). Sixty-six percent were Chinese, 5% were Japanese, and 29% were Korean. Among the 58 European Americans, 7% were first generation, 10% were second generation, and 83% were postsecond generation. The four first generation European Americans have lived in the United States for at least 9 years.

Inclusion criteria were (1) first- or second-generation East Asian Americans (i.e., Korean, Chinese, or Japanese), (2) European American, (3) nonsmoker, (4) not currently on hormonal contraceptives or pregnant, and (5) free from any major medical or mental health conditions. Inclusion criteria 3 to 5 were to rule out artifacts to salivary cortisol levels. Twenty-four hours prior to the laboratory visit, participants were instructed to refrain from consuming alcoholic beverages 24 hr before the experiment, dairy products 3 hr prior to the session, and any food or beverage an hour prior to the session. Due to experimenter errors (e.g., dropped salivettes and mistimed saliva collection times), six participants were dropped from the cortisol analyses.

Procedure

All experimental sessions were scheduled at either 1.00 p.m. or 3.30 p.m. to control for the diurnal rhythm of cortisol (Kudielka, Schommer, Hellhammer, & Kirschbaum, 2004). Upon arrival, participants provided informed consent and were fitted with a blood pressure cuff. Participants then browsed through neutral content magazines for 8 min to allow them to acclimate to the experimental environment (baseline). After this baseline period, participants provided the first saliva sample and completed measures of demographic information and current affect.

Next, participants were administered a brief semi-structured interview by the experimenter designed to identify the participants' occupational goal after graduation and a job position they would need to meet their goals. Participants were then given instructions for a modified version of the TSST, a laboratory stressor that reliably produces an increase in cortisol levels (Dickerson & Kemeny, 2004). This marked the onset of the stressor. In the modified TSST, participants delivered a speech in front of an evaluative panel substantiating why they would be a good candidate for the job position they had previously

identified. The evaluative panel consisted of one male and one female ethnically matched confederates (e.g., Asian American participants were evaluated by Asian American confederates) trained to behave in a stoic manner.

Participants were given 5 min to prepare for their speech, after which they delivered their speech while being video recorded. Following the speech delivery, participants observed the confederates ostensibly rate their speech performances. Soon after the confederates left the room, the experimenter returned to inform the participants of their scores. All participants received the same scores of 4, 5, and 6 on a 10-point Likert-type scale on speech persuasiveness, clarity, and content, respectively. Self-reported affect was assessed again after the speech delivery to assess changes in mood.

Following the assessment of postspeech affect, participants were asked to reflect on their speech performance in an 8-min writing task. Participants were randomly assigned to one of three conditions: (1) self-enhancement, (2) self-improvement, or (3) neutral (control). The experimenter was blind to participant's assigned condition. Following the self-reflection task, participants reported their affect, completed questionnaires, and provided three additional saliva samples at 25 min after the TSST onset to assess cortisol reactivity and 35 and 45 min after the TSST onset to assess cortisol recovery. After completing the questionnaires, participants were debriefed.

Experimental Conditions

The self-enhancement and self-improvement condition prompts were created from a comprehensive review of the self-enhancement literature (see Heine & Hamamura, 2007).

Self-enhancement. Participants were primed to write self-enhancement themes such as identifying reasons why the negative feedback was not credible or representative, making downward social comparisons, and situational attributions for poor performance.

Specific instructions were:

Please examine and reflect on your scores from your speech performance. Think about how your scores may not accurately reflect your true abilities and potential. Perhaps you were more successful and effective in similar situations in the past, but the conditions and the judges negatively impacted your performance. Think about the factors or conditions that would have enabled you to better showcase your abilities and potential. Can you think of people you know who would have done the same or worse than you in this same situation? Please write your thoughts down continuously for the next 8 min. It is completely anonymous and confidential. Don't worry about grammar, spelling, sentence structure, and erasing or crossing things out.

Self-improvement. Participants were primed to write self-improvement themes such as identifying reasons why the negative feedback was credible or representative, making upward

social comparisons, and dispositional attributions for poor performance.

Specific instructions were:

Please examine and reflect on your scores from your speech performance. Think about how your scores may accurately reflect your true abilities and potential. Perhaps your performance today was consistent with how you did in similar situations in the past, as the conditions and the judges are similar to those you have encountered elsewhere. Think about your areas of weakness and realistic steps you could take to correct them. Can you think of people you know who would have done better than you in this same situation? Please write your thoughts down continuously for the next 8 min. It is completely anonymous and confidential. Don't worry about grammar, spelling, sentence structure, and erasing or crossing things out.

Control. Adapted from Pennebaker (1990), participants were asked to write chronologically and in great detail about what they had done that day since waking.

Specific instructions were:

Please reflect on your day so far. Think about what you have done since waking up this morning. Think about the routines and events of your day, focusing on the details of what you've done so far. Perhaps you brushed your teeth, took a shower, ate something, made the trip to campus or to class, and eventually you came here. It is important that you recall your day with as much detail as possible, focusing on specific events rather than on your thoughts or feelings about them. Please write your thoughts down continuously for the next 8 min. It is completely anonymous and confidential. Don't worry about grammar, spelling, sentence structure, and erasing or crossing things out.

Manipulation Check

A judge blind to assignment read each essay and coded them according to which condition instructions they appeared to be responding to. Of the 114 essays, 109 (95.6%) were correctly classified. Five out of 40 self-enhancement condition essays were incorrectly assigned to the self-improvement condition.¹ All of the self-improvement and control condition essays were correctly assigned.

We used the Linguistic Inquiry Word Count program (Francis & Pennebaker, 1993) to examine the number of positive emotion (e.g., "happy"), negative emotion (e.g., "hurt"), and cognitive process (e.g., "cause"), words written in each essay. As expected, we found significant main effects of condition for each word category, such that participants wrote more positive/negative emotion and cognitive process words in the self-enhancement and self-improvement condition than the control condition. However, there were no significant differences in these word categories between the self-enhancement and self-improvement condition, suggesting that observed differences across these conditions may not be explained simply by

differences in mood induction or engagement in general cognitive processing.

Measures

State affect. Negative affect was assessed with the negative affect subscale of the Positive and Negative Affect Schedule (PANAS; Watson, Clark, & Tellegen, 1988). The PANAS is a 20-item self-report measure of positive and negative affectivity with 10 items to assess for positive affectivity (e.g., “cheerful”) and 10 items to assess for negative affectivity (e.g., “scared”). Participants rated the way they felt *right now* for each item using a 5-point Likert-type scale ranging from 1 (*very slightly*) to 5 (*extremely*). Higher scores indicate higher levels of negative affect. Evidence for construct validity has been reported in past research, indicating significant correlations with measures of depressive symptoms and adequate test–retest reliabilities (Watson et al., 1988). The PANAS was administered at baseline (T1), immediately after speech delivery (T2), and writing task (T3). Change scores were calculated by subtracting T3 negative affect from T2 negative affect. Thus, higher scores indicate greater *reduction* in negative affect.

Cortisol. Four saliva samples were collected using Salivettes (Sarstedt, Inc., Germany) at baseline (T1), 25 min (T2), 35 min (T3), and 45 min (T4) after the onset of the TSST. Saliva samples were frozen at -20°C until sent to University of Trier, Germany, where they were assayed for cortisol. Cortisol levels were determined employing a competitive solid phase time-resolved fluorescence immunoassay with fluoremic end point detection. Cortisol recovery was calculated in two ways by subtracting (1) T3 from T2 cortisol and (2) T4 from T3 cortisol. Thus, higher positive values indicate *quicker* recovery to baseline.

Persistence. Participant’s behavioral intentions to persist with challenge despite receiving a negative evaluation were assessed immediately after T3 negative affect with a single self-report item: “If I was asked to present another speech under the same circumstances, I would choose to practice for ____.” Responses to the item were answered using a 6-point Likert-type scale (e.g., 1 = *less than 3 min*, 4 = *7–10 min*, to 6 = *more than 15 min*). Thus, higher scores indicated a more persistent declarative response to challenge.

Potential confounds. Participants reported on health behaviors that could interfere with HPA functioning. These included smoking, physical activity, sleeping patterns, and caffeine and alcohol consumption during the past week and 24 hr, general physical health, and current medication use (Kirschbaum & Hellhammer, 1989). General physical health was assessed with the 54-item Pennebaker Inventory of Limbic Languidness (PILL; Pennebaker, 1982). The PILL assessed a number of common physical symptoms (e.g., “chills”). Participants indicated how often they have experienced each symptom on a 5-point Likert-type scale (1 = *never or almost never* and 5 =

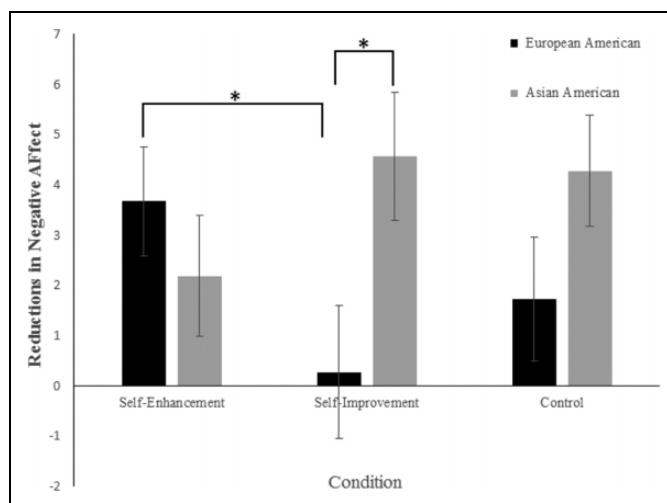


Figure 1. Condition $\times$ Ethnicity interaction in predicting change in negative affect. $*p < .05$.

more than once every week). Word count was tested as a covariate to control for engagement with the writing task.

Results

Effect of Culture and Condition on Negative Affect

At baseline, an independent samples *t*-test demonstrated no significant differences in negative affect between Asian Americans and European Americans, $M_s = 13.70$ and 13.55 , $SD_s = 4.79$ and 5.21 , $t(112) = .15$, $p > .05$. Controlling for baseline positive affect, we conducted a 2 (ethnicity: Asian American vs. European American) $\times$ 3 (condition: self-enhancement vs. self-improvement vs. control) analysis of covariance (ANCOVA) to examine participants’ reduction in negative affect.² We found a significant Ethnicity $\times$ Condition interaction in predicting reduction in negative affect, $F(2, 100) = 3.9$, $p = .04$, $\eta_p^2 = .06$ (see Figure 1). There were no significant main effects of condition or ethnicity.

To determine whether the interaction reflected the predicted patterns, we conducted planned comparisons for each cultural group and condition. Asian Americans ($M = 4.57$, $SD = 1.27$) experienced significantly greater reduction in negative affect than European Americans ($M = 0.27$, $SD = 1.32$) in the self-improvement condition, $p = .02$. By contrast, European Americans experienced significantly greater reduction in negative affect in the self-enhancement condition ($M = 3.67$, $SD = 1.09$) than the self-improvement condition ($M = 0.27$, $SD = 1.32$). Lastly, there was no significant difference in reduction of negative affect between Asian Americans ($M = 4.27$, $SD = 1.11$) and European Americans ($M = 1.72$, $SD = 1.24$) in the control condition, $p > .05$.

Effect of Culture and Condition on Cortisol Recovery

The distribution of cortisol concentration at each time point was significantly positively skewed, and, thus, values were

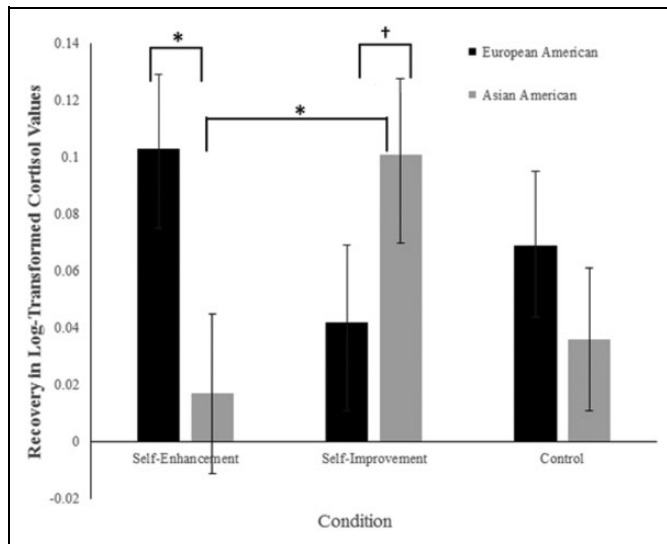


Figure 2. Condition $\times$ Ethnicity interaction in predicting cortisol recovery. $^{\dagger}p < .10$. $*p < .05$.

natural log transformed. An independent samples *t*-test demonstrated no significant differences in baseline cortisol values between Asian Americans and European Americans, $M_s = 0.51$ and 0.61 , $SD_s = 0.33$ and 0.27 , $t(105) = 1.59$, $p > .05$. There were no significant main effects of ethnicity, condition, or Ethnicity $\times$ Condition interaction in cortisol reactivity, indicating successful random assignment.

Next, we examined the effects of self-reflection on cortisol recovery (i.e., T2–T3 cortisol and T3–T4 cortisol). Controlling for baseline cortisol value and general physical health, we conducted two 2×3 ANCOVAs to examine the effect of self-reflection on participants' cortisol recovery.³ There was a significant interaction in predicting cortisol recovery at T3 (i.e., 35 min post-TSST onset), $F(2, 98) = 3.44$, $p = .04$, $\eta_p^2 = .07$ (see Figure 2). European Americans ($M = 0.09$, $SD = 0.02$) had significantly faster cortisol recovery from the TSST than Asian Americans ($M = 0.01$, $SD = 0.03$) in the self-enhancement condition, $p = .04$. Asian Americans ($M = 0.11$, $SD = 0.03$) experienced marginally faster cortisol recovery than European Americans ($M = 0.03$, $SD = 0.03$) in the self-improvement condition, $p = .08$. By contrast, Asian Americans had significantly faster recovery to the TSST in the self-improvement condition ($M = 0.11$, $SD = 0.03$) than the self-enhancement condition ($M = 0.01$, $SD = 0.03$), $p = .03$. European Americans did not experience differences in cortisol recovery between the self-enhancement ($M = 0.09$, $SD = 0.02$) and self-improvement condition ($M = 0.03$, $SD = 0.03$), $p = .14$.

As expected of healthy young adults who typically recover from stress tasks, we did not find a significant Ethnicity $\times$ Condition interaction in predicting cortisol recovery after 45 min, $p > .05$. This suggests that all individuals have recovered to baseline levels of cortisol values, which is consistent with prior research showing that poststressor cortisol levels return to baseline levels by 41–60 min poststressor (Dickerson &

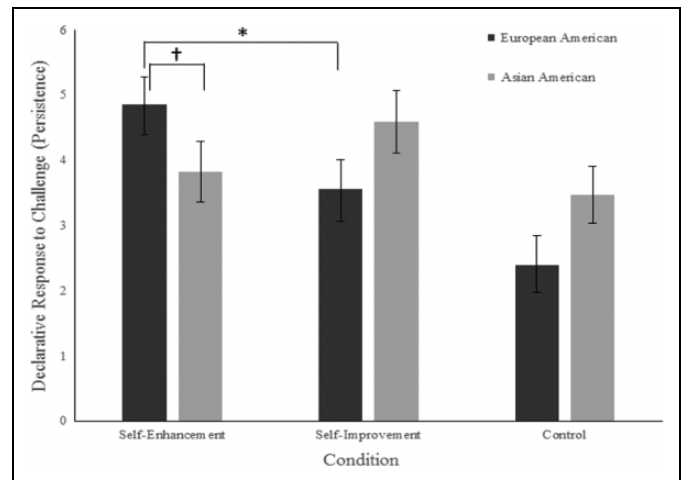


Figure 3. Condition $\times$ Ethnicity interaction in predicting persistence. $^{\dagger}p < .10$. $*p < .05$.

Kemeny, 2004). Lastly, there were no ethnic group differences in cortisol recovery in the control condition.

Effect of Culture and Condition on Persistence

Next, we examined the effects of self-reflection on persistence. Controlling for gender, we conducted a 2×3 ANCOVA to examine the effect of self-reflection on participants' persistence.⁴ We found a significant main effect of condition such that individuals in both the self-enhancement and self-improvement condition endorsed greater persistence than individuals in the control condition. We also found a significant interaction in predicting persistence, $F(2, 104) = 3.82$, $p = .03$, $\eta_p^2 = .07$ (see Figure 3). European Americans ($M = 4.87$, $SD = 0.42$) endorsed marginally greater persistence than Asian Americans ($M = 3.82$, $SD = 0.46$) in the self-enhancement condition, $p = .09$. The difference between Asian Americans ($M = 4.58$, $SD = 0.48$) and European Americans ($M = 3.54$, $SD = 0.46$) in the self-improvement condition was not statistically significant, $p > .05$. Lastly, European Americans endorsed significantly greater persistence in the self-enhancement condition ($M = 4.87$, $SD = 0.42$) than self-improvement condition ($M = 3.54$, $SD = 0.46$), $p = .03$. Persistence did not differ in the control condition across groups.

Discussion

Based on previous research on self-enhancement and self-improvement, we hypothesized that a cultural match in ethnicity and self-reflection processes would lead to greater benefits from emotional disclosure through writing. The overall pattern of findings confirmed this prediction, although not all of the planned contrasts were confirmatory. We found that Asian Americans had considerably greater reductions in negative affect than European Americans in the self-improvement condition. However, there were no significant differences in affective outcomes between groups in the self-enhancement

condition. Across conditions, European Americans benefited more from self-enhancement than self-improvement, but no differences were found between conditions among Asian Americans. With regard to cortisol recovery, we found that Asian Americans experienced quicker recovery to baseline in the self-improvement condition than in the self-enhancement condition, but there were no differences in European Americans between these conditions. Lastly, we found that European Americans experienced quicker recovery to baseline cortisol than Asian Americans in the self-enhancement condition and that Asian Americans experienced marginally quicker recovery to baseline cortisol than European Americans in the self-improvement condition. Although not all hypothesized planned contrasts were significant, the overall pattern of findings suggest that the extent to which people gain emotional and physiological benefits depends on whether the self-reflection processes are congruent with individuals' heritage cultural backgrounds. These findings add to a growing body of research demonstrating important cultural differences in the most adaptive approach to reflect upon negative personal experiences (Lu & Stanton, 2010; Tsai & Lau, 2013).

Self-enhancement conferred significant emotional and biological benefits for European Americans. By engaging in downward social comparison and attributing their failure performance to the situation, European Americans likely brought to mind valued aspects of the self and restored their positive self-regard. Because European Americans tend to view the self as an independent entity that remains consistent and autonomous across contexts, the ability to restore positive self-regard through self-enhancement becomes important for healthy functioning. In contrast, self-improvement conferred greater emotional and biological benefits for Asian Americans. By exercising vigilance to areas of weakness and identifying high-performing role models, Asian Americans may bring to mind an incremental view of the self that suggests that achievement hinges on effort and not talent. Through this mind-set, a failure experience may provide a valued opportunity to improve. Although Asian Americans experienced greater reductions in negative affect than European Americans in the self-improvement condition, there were no significant differences between Asian Americans in the self-enhancement and self-improvement conditions. Although speculative, engaging in self-reflection processes in general through writing may serve a facilitating function for Asian Americans. For instance, self-reflection through writing may provide a valued opportunity to process the stressor without potentially damaging harmony, a cardinal value in interdependent cultures (Chen & Chung, 1994).

Although cultural mismatch in the use of self-reflection processes resulted in smaller reductions in negative affect and slower cortisol recovery following an acute stressor, it did not lead to greater negative affect. Even though our findings suggest that individuals from all cultural backgrounds can engage in self-enhancement or self-improvement processes without detrimental outcomes (i.e., these processes generally appear ameliorative and not harmful), this may not generalize to the

spontaneous use of culturally mismatched self-reflection processes. Indeed, cultural mismatch in the spontaneous use of self-reflection processes may reflect psychopathology (e.g., depression) that can reduce attention to or concerns with cultural norms of how one experience and cope with stressors, resulting in maladjustment. Lastly, the implications of these differences and changes in immediate distress are not well understood. Future work examining subsequent emotion regulation strategies and coping behaviors following negative self-reflection will provide additional understanding into how individuals from different cultural backgrounds cope with stressful experiences.

With regard to persistence, we found that European Americans endorsed greater behavioral intentions to persist in the self-enhancement condition than in the self-improvement condition. The mechanisms that underlie the intention to rise to challenge may be different across ethnic groups. In the self-improvement condition, Asian Americans may have identified an area of weakness and thus a path toward betterment. By contrast, in the self-enhancement condition, European Americans may have identified an unfair circumstance (e.g., unfriendly judges) or other disadvantage (e.g., uncomfortable setting) that prevented optimal performance, which may have inspired them to prove wrong the negative evaluation. This finding provides compelling evidence for the importance of considering cultural background in improving motivation and persistence following setbacks.

Although this study provides compelling data on the effects of self-reflection processes on psychological and physical well-being, it also has several limitations. First, the findings from the present study are novel with a small sample size, and thus future replication is essential. Second, because our cultural predictor relied on ethnic membership, examining more proximal predictors such as trait self-enhancement will provide stronger empirical support for self-reflection processes as the causal mechanism through which individuals may recover from stressors. Lastly, our categorical operationalization of culture (i.e., Asian American vs. European American) treated them as homogenous groups despite important within-group heterogeneity. Unfortunately, the number of participants in our sample was not sufficiently large to allow for meaningful comparisons along important dimensions (e.g., acculturation and value orientations).

Despite these limitations, this study employed an experimental design to examine the causal role of self-enhancement- versus self-improvement-oriented reflection in facilitating recovery from a lab-based social stressor. The present study is the first, to our knowledge, to show causal evidence that culturally congruent self-reflection processes leads to improved emotional and physiological recovery from stress.

Declaration of Conflicting Interests

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Notes

1. Given our limited sample size, data from the five participants who appeared not to clearly comply with writing instructions were included in the analyses to preserve power. However, the pattern of findings was consistent when these participants were excluded from the analyses.
2. We tested a set of covariates including baseline positive/negative affect, age, gender, and word count. Baseline positive affect was a significant covariate. Nonsignificant covariates were dropped from the model.
3. We tested a set of covariates including age, gender, time of day, baseline cortisol value, general physical health, and daily caffeine intake and physical exercise. Baseline cortisol value and general physical health were significant covariates. Nonsignificant covariates were dropped from the model.
4. We tested a set of covariates including age, gender, and essay word count. Gender was a significant covariate. Nonsignificant covariates were dropped from the model.

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