Cultural Differences in Rumination and Psychological Correlates: The Role of Attribution

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Abstract

Cross-cultural research suggests that rumination may have weaker maladaptive effects in Eastern than in Western cultural contexts. This study examines a mechanism underlying cultural differences in mental health correlates of rumination from sociocultural cognition perspective. We propose that cultures differ in how people attribute rumination, which can lead to cultural differences in the link between rumination and mental health correlates. We developed the Attribution of Rumination scale, tested cultural differences (Study 1), and examined its relationship with theoretically related constructs (Study 2). In Study 3, self-doubt attribution moderated the association between rumination and mental health, partly explaining cultural differences in the rumination-mental health link. Study 4 replicated self-doubt attribution moderating the link between rumination and mental health among Asians. Further, greater exposure to American culture was associated with self-doubt attribution. This work provides a novel approach to understanding cultural differences in the association between rumination and negative psychological correlates.

Cultural Differences in Rumination and Psychological Correlates: The Role of Attribution

Many researchers have suggested that rumination, or "dwelling in the past," is associated with worse emotional and mental health issues (for review, Aldao, Nolen-Hoeksema, & Schweizer, 2010), even though such thinking is common (Papageorgiou & Wells, 2001b). Although there have been efforts to understand variations in the associations between rumination and mental health (e.g., Ayduk & Kross, 2010; Ciarocco, Vohs, & Baumeister, 2010; Pennebaker & Graybeal, 2001), such studies have been conducted mostly within Western contexts. However, a growing body of cross-cultural research suggests that rumination may not have the same maladaptive effects across cultures. While people in East Asian cultures engage in rumination more compared to Western cultures, it is associated with less harmful correlates in East Asian cultures (Chang et al., 2010; Kwon et al., 2013). Despite such findings, the underlying mechanism is not fully understood yet.

Thus, we aim to contribute to the existing literature on rumination by applying a sociocultural cognition perspective. Based on the extant research on cultural differences in perception of change (Peng & Nisbett, 1999), the current research proposes that cultures differ in how people attribute rumination, which can contribute to cultural variations in psychological correlates of attribution. We first developed and validated a scale to capture such attributions. Then, we examined whether the attributions explain the cultural variation found in the association between rumination and psychological correlates.

Rumination and Psychological Correlates

There are many theories on rumination that differ in scope, mechanisms, affective states assumed to be involved in the process of rumination, and consequently the effects of rumination

(for review, see Smith & Alloy, 2009). Similarities examined across these theories are that ruminative thinking involves repetitive thinking of past experience, and is largely associated with the onset of negative emotions. Among them, Response Styles Theory (RST; Nolen-Hoeksema, 1991) is the most widely accepted and examined theory. RST defines rumination as repetitively thinking about the causes, consequences, and symptoms of one's negative affect, and has found rumination to be associated with depressive symptoms in adults (e.g., Lam et al., 2003; McIntosh & Martin, 1992), as well as predictive of major depressive episodes in initially non-depressive individuals (e.g., Nolen-Hoeksema, 2000). Further, laboratory-induced rumination reliably led to worsened negative mood among those who were already in a dysphoric mood before the manipulation (Lyubomirsky & Nolen-Hoeksema, 1995; Watkins & Teasdale, 2001). Manipulated rumination was positively correlated with increased levels of trait and state anxiety as well (Harrington & Blankenship, 2002). Therefore, although rumination does not always lead to negative outcomes (e.g., Martin & Tesser, 2006; Pennebaker & Graybeal, 2001; Wilson & Gilbert, 2008), ruminative thinking does often lead to maladaptive outcomes (Aldao et al., 2010).

Cultural Perspective on Rumination

While rumination has been largely considered as maladaptive, cross-cultural studies have shown cultural differences in how frequently people engage in ruminative thinking and how it is associated with psychological outcomes (e.g., Chang et al., 2010; Kwon et al., 2013). Specifically, European Americans tend to ruminate less often than Asian Americans (Chang et al., 2010) and South Koreans (Kwon et al., 2013). However, the tendency to ruminate had a weaker association with measures of adjustment (e.g., depressive symptoms, anxious symptoms) among Asian Americans compared to European Americans (Chang et al., 2010) and even had a positive association with problem-solving among Japanese (Sakamoto et al., 2001). Similarly,

the correlation between reflective pondering and depressive symptoms was smaller among South Koreans compared to European Americans (Kwon et al., 2013; see Grossmann & Kross, 2010, for similar findings based on the comparison of Russians and Americans in regards to brooding). Overall, these cross-cultural studies provide preliminary evidence for cultural differences in the frequency of rumination and how they are linked with other outcomes. However, cognitive and affective processes behind cultural differences in the link between rumination and mental health outcomes are not yet clear. Thus, the present research leverages cultural differences in thinking styles to explicate cultural differences in rumination.

Culture and Perception of Change

Based on cross-cultural comparisons of East Asians and European North Americans, Peng and Nisbett (1999) suggested that cognitive differences exist between Western and Asian cultures in the degree to which they are oriented toward the interconnections in the universe (i.e., analytical vs. dialectical thinking). One difference is in how people perceive change. In East Asian cultural contexts, people tend to engage in dialectical thinking, which involves a belief that objects, events, and states of being in the world, are continuously alternating between two extremes or opposites (Peng & Nisbett, 1999). Thus, they perceive various states and objects as malleable. On the other hand, in European American cultural contexts, people tend to engage in analytical thinking, and expect the states of the world to be more stable and changes to occur in a linear trend. Such varying assumptions about the world have been found to affect how one predicts whether a current situation will change in the future (L.-J. Ji et al., 2001). Researchers found that Chinese participants predicted a greater likelihood of change in a variety of scenarios (e.g., a person who has been winning would lose the next game; adversaries will become lovers) compared to Americans. Further, Americans believed that their happiness across time was more

or less linear, whereas Chinese believed that their life happiness was nonlinear (L.-J. Ji et al., 2001).

Studies have also shown that dialectical thinking leads East Asians to tend to perceive personal attributes and behavior to have less consistency and stability across contexts, various aspects, and time, compared to Westerners (Spencer-Rodgers et al., 2010). For instance, when asked to predict what would happen to someone's traits, abilities, and behaviors in the future, Chinese participants believed a person's traits, behaviors, and abilities would change more than did Canadian participants (Ji & Zhang, 2003). In addition, compared to European Americans, East Asians perceive greater changes in their own dispositions than European Americans (Spencer-Rodgers et al., 2009). Similarly, building on implicit theories of attributes (Dweck, 2006; Dweck et al., 1995), researchers have suggested personal attributes, such as intelligence, are considered to be more malleable in East Asian cultures than in Western cultures (c.f., Heine et al., 2001). Taken together, there is considerable evidence on cultural differences in the extent to which people see change in various aspects of the world, including personal attributes and behavior of others and their own.

The Role of Attribution of Rumination

Cultural differences in perception of change may influence the extent to which people attribute the act of rumination to motivation for change and to improve or self-doubt over one's ability. If Asians are more likely than Westerners to perceive change and flexibility in personal attributes and behaviors, Asians may be more likely to see the room for change after a negative experience (e.g., difficult exam, poor impression during an interview). Thus, ruminative thinking may be considered to be a way to think about how one could overcome and avoid past failure the next time one encounters a similar situation, and be perceived as driven by one's motivation to

do better (i.e., *self-improvement* attribution). On the other hand, if Westerners are less likely than Asians to perceive changes in personal attributes and behaviors, they may see less room for change after a negative experience. Therefore, the act of ruminating may be considered to be less productive and perceived as a manifestation of doubt about one's ability (i.e., *self-doubt* attribution). It is important to note that attributions to self-improvement and self-doubt are not mutually exclusive or opposites. Because one can simultaneously be motivated to overcome the current situation while holding doubt over one's ability to do so, people may infer that both self-improvement and self-doubt can be reasons for rumination. Thus, people may attribute ruminative thinking to both self-improvement and self-doubt, just to different degrees.

Cultural differences in attributions of rumination, in turn, may play a role in moderating the relationship between rumination and the subsequent outcomes. While rumination may be related to negative outcomes (e.g., depression) in general, such association may be weaker for those who attribute the act of rumination more to self-improvement or less to self-doubt. By believing that rumination is more for reasons of improvement or less for doubt, the act of ruminating itself may not be as detrimental for the individual. Rather, they may engage in such a thinking process as an opportunity to develop and improve.

In line with our theorization, studies on implicit theories of attributes (Dweck, 2006; Dweck et al., 1995) have shown positive effects of having a growth mindset (i.e., perceiving personal attributes as malleable and susceptible to growth) compared to a fixed mindset, such as dampened associations between stressful life events and psychological distress (Schroder et al., 2015). Further, more relevant to rumination, other researchers have shown that rumination can have weaker associations with negative outcomes when it was action-focused rumination (i.e., focusing on correcting past mistakes and active goal achievement) than state-focused rumination

(i.e., focusing on the failure; Ciarocco, Vohs, & Baumeister, 2010). Although action-focused/state-focused rumination and self-improvement/self-doubt attribution differ in whether they target content or attribution of rumination, they share some similarities as well; both focus on possible positive and negative aspects of ruminating about the negative event. Considering such similarities, making more self-improvement and/or less self-doubt attribution about rumination may lead to reduced associations between rumination and psychological correlates, thereby providing a potential mechanism underlying cultural differences in the association.

Overview

The current work was conducted to test our hypotheses that people vary across cultures in their attribution of rumination, whether it is for self-improvement or self-doubt reasons, and such attribution explains cultural differences in the association between rumination and psychological correlates. As no prior measures exist to assess attributions of rumination, we first developed the Attributions of Rumination scale to capture how people attribute the act of rumination. Study 1 was conducted to test the internal consistency of the scale and to test measurement invariance to make sure that the scale was compatible across our cultural groups of interest. We then tested whether attributions of rumination vary by cultural background. Study 2 examined how the developed scale is related to dialecticism and growth mindset, two constructs that are theorized to be related to such attributions. Based on previous findings suggesting cultural differences in the association between rumination and negative psychological correlates, such as depression (Chang et al., 2010; Kwon et al., 2013), Study 3 attempted to replicate such cultural differences and to further examine whether attributions of rumination explains the cross-cultural variation. Study 4 focused on Asians in the US and examined the role of acculturation in attribution of rumination, and also tested if the findings of Study 3 can be replicated.

The data for all studies are available at https://osf.io/pveyn/?view_only=8a9b2ddfe55b4e39bb90ae68b7f60c73. Survey items for all studies are available in supplemental materials.

Study 1

Study 1 was conducted to develop and validate the Attribution of Rumination scale and to examine whether people's attributions for rumination vary by cultural background. Several studies suggest that how people perceive other's thinking and beliefs may influence their own psychological processes over and beyond their own thoughts and beliefs (e.g., Chiu, Gelfand, Yamagishi, Shteynberg, & Wan, 2010). In addition, considering cultural differences in self-serving attribution (Mezulis et al., 2004), asking questions about the self may confound such a tendency (i.e., European Americans may be less likely to endorse negative statements and more likely to endorse positive statements about the self). Therefore, the Attribution of Rumination scale asks respondents to make attribution of another student's act of rumination rather than that of themselves. We predicted that compared to European Americans, East Asian descents would be more likely to attribute rumination to self-improving motivation (i.e., self-improvement attribution), and less likely to attribute rumination to doubt over one's ability (i.e., self-doubt attribution).

We report the psychometric properties of the scale as well as results from exploratory and confirmatory factor analyses to validate the hypothesized factor structure of the scale. In addition, we report the results from measurement invariant testing to assess the psychometric equivalence of a construct across our two cultural groups of interest (i.e., European Americans and East Asians). Lastly, we report the results that tested the cultural differences in the pattern of attributing rumination.

Methods

Item generation and pilot studies.

We focused on a negative experience that would be most relevant to students: academic stress (i.e., exams). The scale presents a hypothetical individual ruminating over a stressful academic situation (i.e., doing poorly on an exam) and asks respondents to judge the extent to which self-improvement or self-doubt are potential reasons why the individual is ruminating. Self-improvement items focused on possible changes and improvement in their grades or performance (e.g., "The student wants to improve his/her grades.", "The student wants to do better on the next exam.") through motivation (e.g., "The student is motivated to do better."). These items were relevant to perceived malleability in one's ability to perform on the exam. On the other hand, self-doubt attribution items involved doubt over their ability (e.g., "The student is doubting if s/he has the capability needed for the class.", "there is nothing s/he can do to do better") and doubt over better future outcome (e.g., "s/he will not be able to get a better grade"). These items reflect the (low) belief in malleability of one's ability. Each item was rated on a 7-point likert scale (1 = very unlikely; 7 = very likely).

To test the internal consistency and robustness of the initial items, we administered the scale across three separate pilot samples (Sample 1: 16 UW-Madison students; Sample 2: 84 MTurk workers[1]; Sample 3: 101 MTurk workers[2]). With Sample 3, the internal consistency suggested that the scale was appropriate for broader dissemination. The final scale appears in Appendix A.

[1] Mean Age = 32.58 (SD = 10.25), 21.7% Female, 67.47 % white, 13.3% Asian, 7.2% African American, 4.8% Hispanic, 7.2% Other.
[2] Mean Age = 31.46 (SD = 10.53), 32.7% Female, 75.8 % white, 10.9% Asian, 4.0% African American, 4.0% Hispanic, 5.9% Other.

Participants and Procedure

A sample of at least 500 is recommended when conducting confirmatory factor analysis using robust maximum likelihood (Bandalos, 2014). The final sample consisted of 1468 UW-Madison college students taking an introductory psychology course (Mean Age = 18.64 (SD = 1.18), 59.06% Female, 73.30% White/Caucasian, 17.92% Asian, 1.29% African American/ Black, 2.79% Hispanic/ Latinx, 0.68% Arab/ Middle Eastern, 0.27% Native American/ American Indian/ First Nation, 0.07% Pacific Islander/ Native Hawaiian, 3.61% Multiple, 0.07% Other). When testing measurement invariance (i.e., testing whether the scale is compatible across different groups) and our predictions, we focused on European American and East Asian descents (N = 1339) because our predictions and theoretical background are based on the comparison between European Americans and East Asians. East Asian participants were defined as those with ancestral backgrounds from China, South Korea, or Japan. European Americans were defined as those who are considered Caucasian and their native language is English. If the participant identified as being from a background other than East Asian and/or European American background, or both, they were excluded from the final sample. Participants completed the questionnaire as part of a mass survey within the first 2-3 weeks of the semester.

Results

Psychometric properties of the AR: Means, variance, and internal consistency.

The mean, variance, and skewedness of each attribution facet were examined to see how individuals responded to each facet. The mean score of self-improvement attribution was 5.63 (SD = 0.96) and that of self-doubt attribution was 5.06 (SD = 1.09). Both attribution factors have high internal consistency; Cronbach's alpha was .78 for the self-improvement attribution and .81 for the self-doubt attribution (Table 1). The two factors were weakly positively correlated, r =

0.09. Responses for each attribution facet did not pass the tests of normality as they were negatively skewed. To deal with the non-normality of the data, we used the maximum likelihood robust estimation for confirmatory factor analysis (CFA).

Exploratory Factor Analysis.

We used random sampling to split the sample into Sample 1 (N = 740) for the exploratory factor analysis (EFA), and Sample 2 for the confirmatory factor analysis (CFA; N = 728). There was no significant difference in age and gender between the two randomized samples. We first started with EFA to assess the underlying factor structure of the scale using maximum likelihood estimation and oblique solution. The decision on the number of factors to extract was based on parallel analysis (Horn, 1965). Exploratory factor analysis results using Sample 1 suggested retaining two factors that accounted for a meaningful variance. The two factors were positively correlated (r = .18).

Confirmatory Factor Analysis.

CFA using maximum likelihood robust estimation (Rosseel, 2012) was conducted to evaluate the EFA-informed a priori theory about the measure's factor-structure and psychometric properties (Costello & Osborne, 2005; Henson & Roberts, 2006; Worthington & Whittaker, 2006). Full Information Maximum Likelihood (FIML) was used to treat missing values (Brown, 2006). To assess the absolute model fit, we used RMSEA, SRMR, and CFI as our criterion (Chen & West, 2008). Root mean square error of approximation (RMSEA) is a measure of discrepancy between the observed and model implied covariance matrices per degree of freedom. Based on Browne & Cudeck (1993), RMSEA values of .05 or less indicate good fit, .08 or less indicates adequate fit. Standardized root mean square residual (SRMR) is a measure of the average of the standardized fitted residuals (Hu & Bentler, 1999). A value of less than .08

indicates a good fit (range: 0.00-1.00). Comparative Fit Index (CFI) is derived from the comparison of a restricted model (one in which a structure is imposed on the data) with a null model (one in which each observed variable represents a factor; Bentler, 1990). The CFI provides a measure of complete covariation in the data, a value of larger than .90 indicates adequate fit to the data.

Confirmatory factor analyses confirmed a two-factor structure of the Attribution of Rumination scale. Items loaded on one factor were negative items, involving doubt over their ability (e.g., "The student is doubting if s/he has the capability needed for the class."), helplessness (e.g., "The student feels helpless."), and lack of change in the future (e.g., "The student thinks s/he will not be able to get a better grade."). Items loaded on to the second factor were positive items, focusing on the motivation to improve (e.g., "The student wants to improve his/her grades.") and grow from their failure (e.g., "The student wants to learn from his/her mistakes."). Following such loading pattern, we labeled each factor as self-doubt attribution and self-improvement attribution, respectively (Fit statistics: Table 2; factor loadings and residuals of each item: Figure 1). We also directly compared our CFA model (i.e., two-factor model) with an alternative model (i.e., single-factor model) to test whether our theorized two-factor model is a better fit for the data compared to a single-factor model. We used the $\Delta\chi 2$ (Chi-square change), which directly compares the fit of the two models after adjusting for differences in the degrees of freedom. Results show that the $\Delta\chi 2$ was significant ($p < .001$), suggesting the superiority of the hypothesized two-factor model over the one-factor model.

Measurement Invariance.

In addition, to examine whether the developed scale measures the same construct across European Americans and East Asian descents (i.e., measurement invariance), further analyses

were needed. Using the sample of European Americans and East Asian descents, multiple group confirmatory factor analysis (MGCFA) using maximum likelihood robust estimation (Rosseel, 2012) was conducted to test measurement invariance. Measurement invariance across cultures was tested at different levels (Putnick & Bornstein, 2016): configural invariance (i.e., each group has the same factor structure, but loadings, intercepts, and residual variance can vary), metric invariance (i.e., loadings are fixed to be equal across groups), and scalar invariance (i.e., loadings and intercepts are fixed to be equal across groups). We first determined whether the model for configural invariance had adequate fit. Once that model was supported, we further tested measurement invariance. Specific standards to determine model fit followed suggestions from Putnick & Bornstein (2016). We used CFI as the main criterion and supplemented with RMSEA or SRMR. When testing for metric invariance, the cut-off point used for CFI was -.020, RMSEA was .015, and SRMR was .030, when testing for scalar invariance, the cut-off point used for CFI was -.010, RMSEA was .015, and SRMR was .010.

The results from multiple group confirmatory factor analysis (MGCFA) are presented in Table 3. First, the model for configural invariance showed adequate fit, RMSEA = .091, SRMR = .059, CFI = .909. The model for metric invariance showed adequate fit as well (RMSEA = .093, SRMR = .061, CFI = .908) and based on the measurement invariance criterion, metric invariance was supported, suggesting that the factor loadings were equal across the two groups. We further tested for scalar invariance (i.e., constrained loadings and intercepts to be equal across groups) but the model was not supported. Inspection of the modification indexes suggested that freeing the constraints for two items (item 5 and 6) would improve the fit of the model. After relaxing the equality constraints of these intercepts, the model showed adequate fit,

RMSEA = .091, SRMR = .062, CFI = .905[3] and passed the invariance cut-off criterion. Overall, these findings provide strong support for the two-factor structure of the scale and also show that the scale is compatible across the two cultural groups of interest.

Cultural Differences in Attribution of Rumination.

After the scale was validated and considered compatible across our two groups of interest (i.e., White/Caucasian, East Asian descent), we further tested our predictions by conducting a linear mixed-effects model with type of attribution (self-improvement vs. self-doubt) as a within-subject variable and culture (European American vs. East Asian descent) as a between-subject variable, while controlling for age and gender. The culture by attribution type interaction was not significant, b = 0.18, SE = 0.10, t(1324.54) = 1.84, p = 0.066. Though, as predicted, post hoc analyses show that European Americans scored higher on self-doubt attribution (M = 4.94, SD = 1.12) compared to East Asian descents (M = 4.67, SD = 1.23), b = -0.23, SE = 0.05, t(1330.23) = -2.98, p = 0.003, $\Delta R^2 = 0.005$ (Figure 4). However, there was no cultural difference in self-improvement attribution (European Americans: M = 5.64, SD = 0.94; East Asian descent: M = 5.59, SD = 0.99), b = -0.05, t(1332.43) = -0.78, $p = 0.436$.

Discussion

Study 1 validated the Attribution of Rumination scale, which measures attributions for rumination within a specific context (i.e., after an exam). Results also provided evidence for measurement equivalence of the scale across European Americans and East Asians. The data

[3] To manage partial non-invariance, Chen (2008) suggested comparing the means across groups using a partially invariant model (i.e., constraining intercepts of invariant items only) to those using a fully invariant model (i.e., constraining intercepts on all items). If the substantive conclusions using the two models are similar, we can conclude that non-invariance had little impact on the results. When comparing the two models with our data, there was no substantial difference between the two models. Therefore, we accepted the partial scalar invariance model and moved forward with testing further measurement invariance.

supported our hypothesis that European Americans would be more likely to attribute rumination to doubt than East Asian descents. Results did not, however, support the prediction that East Asian descents would be more likely to attribute rumination to self-improvement reasons than European Americans. Thus, the interaction between culture and the type of attribution was mainly driven by the cultural difference in self-doubt attribution. The lack of difference in self-improvement attribution indicates that, across cultures, people perceive that the motivation to do better contributes to rumination. Rather, cultural difference was confined to attributing rumination to doubt in one's ability to progress. Although speculative, this may be because a belief that rumination is a coping mechanism (Papageorgiou & Wells, 2001b) may contribute and override the cultural differences in self-improvement attribution. We will further discuss this in the General Discussion. Based on our findings, we focused on self-doubt attribution as the focal mediator, with additional analyses using self-improvement attribution, in Study 3.

While Study 1 supported our prediction that attributions for rumination differ by culture, it is unclear whether it is related to other constructs relevant to perception of change (i.e., dialecticism, growth mindset). Thus, an online survey was conducted to test the association of these constructs with the Attribution of Rumination scale.

Study 2

The main goal of Study 2 was to examine the relationship between the Attribution of Rumination scale and constructs relevant to perception of change: dialecticism and growth mindset. We expected that higher dialectical thinking style and growth mindset, respectively, would be related to higher self-improvement attribution and lower self-doubt attribution. We also predicted that the Attribution of Rumination scale is related to, but not a redundant measure of, growth mindset and dialecticism.

Methods

Participants and Procedure

Based on suggestions on heterotrait-monotrait ratio of correlations (HTMT; Henseler, Ringle, & Sarstedt, 2014), we collected 100 MTurk workers through CloudResearch (previously TurkPrime), Mean Age = 22.45 (SD = 1.53), 43.6% Female, 47.5% white, 17.8% Asian, 11.9% African American, 9.9% Hispanic, 12.9% Other. As we wanted individuals for whom the scale's hypothetical context (i.e., exam) is most relevant, we limited the age range of our sample to 18-25 years of age[4]. Participants completed an online survey on Amazon's Mechanical Turk and TurkPrime in exchange for $1.50. After reading the consent information, participants were asked to reply to questionnaire items. Those who did not give the correct answer to at least one of the filler questions were automatically excluded and no longer able to complete the survey.

Measures

Attribution of Rumination Scale. We used the scale developed in Study 1. Cronbach's alpha was 0.83 for self-improvement attribution and 0.80 for self-doubt attribution.

Dialecticism. Participants' dialecticism was measured by using the Dialectical Self Scale (DSS, Spencer-Rogers, Srivastava, Boucher et al., 2015), which is a scale to assess dialectical thinking in the domain of self-perception. Participants rated their agreement with 32 statements (e.g., "I often find that my beliefs and attitudes will change under different contexts", "I am constantly changing and am different from one time to the next") on a 7-point likert scale (1 = strongly disagree; 7 = strongly agree). The DSS has been demonstrated to have adequate cross-

[4] Despite prescreening for age, one participant reported their age as being above our age range, and thus was excluded from our analyses.

cultural validity and reliability (Hamamura et al., 2008; Spencer-Rodgers et al., 2009). Cronbach's alpha was 0.81.

Growth Mindset. Individuals' belief on whether they can increase their intelligence if they work at it was measured through the short three-item Growth Mindset Scale (Dweck, 2006). Participants were asked to indicate the extent that they agree/disagree with the statements regarding the malleability of intelligence (e.g., "You have a certain amount of intelligence, and you really can't do much to change it") on a 5-point scale. The sum of the reverse-coded answers is used, with a lower score indicating a more static view of intelligence. Cronbach's alpha was 0.89.

Results

We first conducted zero-order Pearson correlations across the measures (Table 4). Self-improvement attribution was positively correlated with growth mindset ($r = 0.29$) and dialecticism ($r = 0.29$). Self-doubt attribution was only negatively associated with dialecticism ($r = -0.21$). In order to evaluate the proposition that the Attribution of Rumination scale is different from growth mindset and dialecticism, we assessed the heterotrait-monotrait (HTMT) ratio of correlations (Henseler et al., 2014). All values were below 0.85, suggesting discriminant validity of the Attribution of Rumination scale (Table 5)[5]. Together, these findings supported our theoretical assumption that how people attribute the act of ruminating was associated with

[5] When dialecticism was further divided into contradiction ($\alpha = 0.71$) and change (i.e., behavioral and cognitive; $\alpha = 0.76$), contradiction was not related to neither self-improvement ($r = 0.14$, n.s.) nor self-doubt attribution ($r = -0.11$, n.s.), while change was related to both (self-improvement: $r = 0.31$, $p = 0.002$; self-doubt: $r = -0.23$, $p = 0.022$). Such findings suggest that the correlation between dialecticism and attribution of rumination was mainly driven by the change construct than contradiction.

dialectical beliefs about the self and a belief about their intelligence (i.e., malleable vs fixed; though only for the self-improvement attribution), but is a distinct construct from the two.

Discussion

Study 2 supported our prediction that how people attribute rumination is related to dialecticism and growth mindset, which we have theorized to lead to cultural differences in attribution of rumination. At the same time, data shows that the Attribution of Rumination scale is still distinct enough from the other two constructs to be considered a construct of its own. Interestingly, whereas dialecticism was related to attributing rumination to both self-improvement and self-doubt, growth mindset was only related to attributing rumination to self-improvement but not self-doubt. This suggests that believing that intelligence can change through effort plays a role in attribution to self-improvement but not in attribution to doubt about one's ability. Attributing rumination to self-doubt may be related to the general dialectical belief about the changing nature of the self rather than to the belief about the intelligence.

Study 3

Study 3 was conducted to examine whether the attribution of rumination may help explain the variation in the magnitude of the association between rumination and negative psychological correlates that has been observed across cultures. While our main focus was on depressive symptoms, we were also interested in exploring if cultural differences can be generalized to anxious symptoms, which have been suggested to be related to rumination as well (e.g., Harrington & Blankenship, 2002). We first examined whether East Asians would show weaker associations between rumination and negative psychological correlates compared to European Americans, replicating previous findings (Chang et al., 2010; Kwon et al., 2013).

Then, if so, we tested whether such cultural differences can be partially explained by cultural differences in attribution of rumination, predicting a moderated mediation model.

Methods

Participants

We used G*Power to determine a sufficient sample size to conduct multiple regression analyses using an alpha of 0.05, a power of 0.80, and a small effect size ($f^2 = 0.04$; Faul, Erdfelder, Buchner, & Lang, 2009), which suggested a sample size of 199. University of Wisconsin – Madison undergraduate students participated in the online survey (N = 331). These students were either students recruited through the Subject Pool (N = 251) or students who volunteered to complete the survey (N = 14). Subject pool participants were prescreened for ethnicity (East Asian descent, European American) based on their demographic data. Survey volunteers were recruited through social network systems and were screened for ethnicity post-participation. Same as Study 1 and 2, East Asian descents were defined as those with ancestral backgrounds from China, South Korea, or Japan. Eight participants who identified as multiracial, and 58 participants (European Americans = 50, East Asian descent = 8) who did not give the correct answer to at least one of the filler questions were excluded from the final sample. The final sample was 265 participants, consisted of 142 European Americans (Female = 88; mean age of 18.48 years ± 0.79) and 122 East Asians (Female = 75; mean age of 19 years ± 1.32). Among those who identified as East Asian descent, 68.29% were East Asian internationals (i.e., non-US citizen of East Asian ancestry or origin) and 31.71% were East Asian Americans (i.e., US citizen of East Asian ancestry or origin). East Asian internationals were mostly from China (85.71%), followed by South Korea (7.14%), Hong Kong (3.57%) and China (3.57%). 95.2% of East Asian internationals lived in the United States for 5 years or less, with the rest (N = 5)

reporting living in the US for more than five years but all their life. Among East Asian Americans, 41.03% were first generation immigrants (i.e., born outside of US), with 35.90% born in China, 2.56% born in South Korea, 2.56% born in Taiwan, and less than 1% born in Japan or Hong Kong. The remaining 58.97% were second or third generation immigrants (i.e., born in the US).

Procedure

After participants read the consent information sheet, they completed the online survey that contained the following measures.

Measures

Attribution of Rumination. The validated Attribution of Rumination scale from Study 1 was used. Cronbach's α was 0.85 for self-improvement attribution (European American = 0.86; East Asian descent = 0.88) and 0.77 for self-doubt attribution (European American = 0.70; East Asian descent = 0.81).

Rumination. Rumination was measured by using Brooding and Reflective Pondering subscales (10 items) from the Ruminative Response Scale (RRS; Nolen-Hoeksema, 1991; Treynor, Gonzalez, & Nolen-Hoeksema, 2003). Participants responded on a scale from "almost never"(1) to "almost always"(4). Cronbach's α for the final sample was 0.87 (European American = 0.87; East Asian descent = 0.86).

Depressive Symptoms. Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CESD; Radloff, 1977). Participants reported how often they felt or behaved each way over the past week on a scale ranging from none of the time/less than 1 day (1) to most of the time/5 – 7 days (4). Thus, the possible score range is 20-80. Example items include "I felt that everything I did was an effort" and "I felt sad."

Cronbach's α for the final sample was 0.90 (European American = 0.91; East Asian descent = 0.86).

Trait Anxiety Symptoms. Trait anxiety symptoms were measured using the trait anxiety scale from the Spielberger State-Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970). The scale consists of 20 items describing recent (i.e., "over the past few days") feelings of anxiety with 4-point response scale ranging from not at all (1) to very much (4). Example items include "I felt anxious" and "I felt tense." Cronbach's α for the final sample was 0.91 (European American = 0.91; East Asian descent = 0.90).

Results

Descriptive Analyses

Table 6 presents the descriptive statistics of the sample. The European American sample was younger (M = 18.48, SD = 0.79) than the East Asian descent sample (M = 19.00, SD = 1.32), $t(264) = 3.61$, $p < 0.001$, but did not differ in gender ratio ($\chi 2 = .03$, *n.s.*). Replicating Study 1, East Asian descents showed less self-doubt attribution compared to European Americans, $t(263) = -3.82$, $p < 0.001$, $\Delta R^2 = 0.045$, but no difference in self-improvement attribution. We also found significant cultural difference in rumination, $t(263) = 4.89$, $p < 0.001$, $\Delta R^2 = 0.084$. Specifically, East Asians reported ruminating more compared to European Americans, which are in line with previous findings (Chang et al., 2010; Kwon et al., 2013). East Asian descents also showed greater trait anxiety symptoms ($t(263) = 4.58$, $p < 0.001$) and greater depressive symptoms ($t(263) = 3.18$, $p = 0.002$). Such differences remained significant even after controlling for age and gender.

Culture as a Moderator of the Association between Ruminative Thinking and Psychological Correlates

To test if previous findings on cultural differences in the correlation between ruminative thinking and depressive symptoms (Chang et al., 2010; Kwon et al., 2013) would replicate, we conducted a simultaneous regression analysis, regressing depressive symptoms on ruminative thinking, culture (European American vs. East Asian), and the interaction between ruminative thinking and culture, controlling for age and gender (detailed results in Supplementary Material – Table B). Results showed a significant interaction of ruminative thinking and culture, b = -4.57, SE = 1.45, 95% CI [-7.43, -1.72], F(1, 259) = 9.98, p = 0.002, $\Delta R^2 = 0.023$ (Figure 3). Post hoc analyses showed that the association between rumination and depressive symptoms was stronger among European Americans (b = 10.57, SE = 0.98, 95% CI [8.65, 12.50], F(1, 259) = 116.76, p < 0.001, $\Delta R^2 = 0.27$) than that from East Asian descents (b = 6.00, SE = 1.07, 95% CI [3.90, 8.10], F(1, 259) = 31.58, p < 0.001, $\Delta R^2 = 0.07$). We also explored if similar cultural moderation would be found for anxiety symptoms and found no cultural differences in the link between rumination and anxiety symptoms, b = -1.78, F(1, 259) = 1.23, *n.s*. We thus did not conduct further analyses with anxious symptoms as our dependent variable.

Attribution of Rumination as a Moderator of the Association between Rumination and Psychological Correlates

To test if attribution moderates the link between rumination and depressive symptoms, we conducted simultaneous regression analyses where we regressed depressive symptoms on rumination, self-doubt attribution, and the interaction of the two, controlling for age and gender (see Supplementary Material – Table B for details). In addition to a significant association between self-doubt attribution and depressive symptoms, b = 1.45, SE = 0.50, 95% CI [0.47,

2.43], F(1, 259) = 8.55, p = 0.004, ΔR^2 = 0.031, there was a significant interaction of rumination and self-doubt attribution, b = 1.68, SE = 0.53, 95% CI [0.65, 2.72], F(1, 259) = 10.21, p = 0.002, ΔR^2 = 0.023. Supporting our hypothesis, the association between rumination and depressive symptoms were stronger with increase in self-doubt attribution (Figure 4). However, a parallel analysis with self-improvement attribution showed that self-improvement attribution, while significantly negatively associated with depressive symptoms, b = -1.66, SE = 0.40, 95% CI [-2.45, -0.86], F(1, 259) = 16.84, p < .001, ΔR^2 = 0.038, did not moderate the relationship between rumination and depressive symptoms, b = -0.68, SE = 0.55, 95% CI [-1.77, 0.40], F(1, 259) = 1.54, *n.s*. (Please see Supplementary Material – Study 3 Additional Analyses for analyses by rumination subscales)

Attribution of Rumination as Mediator

To test our main hypothesis that attribution of rumination mediates cultural variations in the link between rumination and depressive symptoms, we tested a moderated mediation model where the rumination X culture interaction on depressive symptoms is mediated by the rumination X doubt interaction. As the first step, we first regressed self-doubt attribution on culture, controlling for age and gender. As examined earlier, East Asians scored lower in self-doubt attribution compared to European Americans, b = -0.50, SE = 0.14, 95% CI [-0.78, -0.23], F(1, 261) = 12.70, p < .001, ΔR^2 = 0.044. The next step involved running a simultaneous regression model predicting depressive symptoms with the rumination X self-doubt interaction while also including the direct effect of the rumination X culture interaction (see Supplementary Material – Table B for details). We found a significant rumination X self-doubt interaction, b = 1.35, SE = 0.53, 95% CI [0.30, 2.40], F(1, 257) = 6.42, p = 0.012, ΔR^2 = 0.014. The rumination X culture interaction remained significant, though the magnitude of the association decreased, b

= -4.02, SE = 1.45, 95% CI [-6.88, -1.16], F(1, 257) = 7.67, p = 0.006, $\Delta R^2 = 0.017$. We then used a bootstrapping procedure to compute a 95% confidence interval around the indirect effect. The result supported the moderated mediation model, b = -0.29, 95% CI [-0.73, -0.04] (Figure 5).

Alternative Hypothesis

Our moderated mediation model was structured to position depressive symptoms as the outcome and rumination as the moderator. However, there is a limitation to this statistical model as there is also a possibility that the association may work in the opposite direction (i.e., depressive symptoms as the moderator and rumination as the outcome). Thus, we conducted an alternative moderated mediation model where we placed depressive symptoms as the moderator and rumination as the outcome. The alternative moderated mediation model was not supported (specific path coefficients presented in Figure C under Supplemental Material).

Discussion

Study 3 findings are in line with the previous findings on cultural differences in the association between rumination and depressive symptoms (e.g., Chang et al., 2010). Findings also replicated Study 1, where European Americans scored higher on self-doubt attribution compared to East Asian descents. Most importantly, the study showed that cultural differences in the association between rumination and depressive symptoms can be partly explained by cultural differences in self-doubt attribution of rumination. That is, rumination was especially strongly associated with depressive symptoms among those who were likely to attribute rumination to self-doubt, which partly explained the stronger association between rumination and depressive symptoms among European Americans compared to among East Asians. We also tested an alternative moderated mediation model and found only our proposed model to be supported,

providing further support for the directionality of the model (i.e., rumination predicting depressive symptoms).

Although we found cultural differences in the association between rumination and depressive symptoms, cultural differences did not generalize to anxiety symptoms. Being hopeless about the future and negative evaluations of the self have been suggested to underlie the link between rumination and depressive symptoms (Nolen-Hoeksema, 2000), whereas striving to gain control and coping with uncertainty have been suggested to underlie the link between rumination and anxiety symptoms (Lyubomirsky et al., 1999; Nolen-Hoeksema, 2000). While future research needs to explore whether such factors play a role in the differential patterns we observed for depressive and anxiety symptoms, our findings imply that culture may be playing a larger role in the rumination's link with depression than with its link with anxiety symptoms.

Study 4

Although Studies 1 and 3 showed cultural differences in attribution of rumination and Study 3 further showed that attribution of rumination partly explains cultural differences in the link between rumination and depressive symptoms, whether the observed cultural differences were due to cultural factors or other confounding factors was unclear. For instance, theory of mind, the ability to construe people in terms of their mental states and traits (Premack & Woodruff, 1978), has been suggested to underlie attribution (Lillard & Skibbe, 2005). Thus, though there are somewhat mixed findings with regard to cultural differences in theory of mind (Ahn & Miller, 2012; Liu et al., 2008), there is a possibility that such a tendency could confound the observed cultural differences in attribution of rumination. In addition, we have so far only compared Asians against European Americans at the group level and did not examine potential variations among Asians in terms of their levels of acculturation to American culture. If cultures

do underlie the observed group differences, we should see that among Asian descents, those who have a higher level of acculturation to American culture show tendencies more similar to European Americans and attribute rumination to self-doubt. Therefore, we conducted Study 4 to further examine whether theory of mind and acculturation levels among Asian descents play a role in the attribution of rumination and whether the findings of Study 3 (i.e., the moderating role of self-doubt attribution in the relationship between rumination and depressive symptoms) will replicate even just among Asians.

Methods

Participants

Based on the interaction effect size from Study 3 ($f^2 = 0.021$), G*Power suggested a sample size of at least N = 376 to conduct multiple regression analyses using an alpha of 0.05 and a power of 0.80. Participants were between the age of 18 and 26 and were prescreened for ethnicity (i.e., Asian descent) based on their demographic data. [6] Those who did not give the correct answer to at least one of the filler questions were excluded from the final sample. As a result, the final sample consisted of 396 participants: the University of Wisconsin – Madison undergraduate students who were recruited through the Subject Pool (N = 50), and participants recruited through Cloud Research (N = 121) and Qualtrics (N = 225). Among the final sample, 51.26% were second generation Asian Americans (i.e., US citizen of Asian ancestry or origin and born in the US), 29.80% were first generation Asian Americans (i.e., US citizen of Asian

[6] For the respondents recruited outside the Subject Pool, we had to expand our demographic range to recruit respondents with Asian ancestry or origin as a whole. Overall, 56.49% of first Asian generation Americans and Asian internationals were born in East Asia (i.e., China, Japan, Korea, Taiwan, and Hong Kong). Other countries included India and Philippines. All second generation Asian Americans were born in the US. Among second generation Asian Americans, 39.41% identified as of East Asian descent. Other countries included India and Philippines.

ancestry or origin and born outside of the US), and 18.94% were Asian internationals (i.e., non-US citizen of Asian ancestry or origin). The majority of the sample was female (61.11%; male = 36.87%; non-binary, trans, etc. = 2.02%), with the average age at 21.38 (SD = 2.51; Table 6). In terms of the highest education level, 41.41% were currently enrolled in college or had some college experience, 39.65% had an associate's degree or higher, and 18.94% had a high school degree or lower.

Procedure

After participants read the consent information sheet, they completed the online survey that contained the following measures.

Measures

In addition to measures used in Study 3 (i.e., Attribution of Rumination, ruminative thinking), we additionally measured acculturation levels and theory of mind. Cronbach's α was above 0.70 for ARNE ($\alpha_{\text{self-doubt attribution}} = 0.77$, $\alpha_{\text{self-improvement attribution}} = 0.78$), ruminative thinking ($\alpha = 0.85$). We also used a shorter measure of depressive symptoms (see below).

Acculturation. To assess the level of exposure to American cultures among Asian descents living in the US, following de Leersnyder, Mesquita, & Kim (2011), we used the proportion of life spent in host culture, which was computed by dividing the number of years each respondent lived in the US by the age of the respondent. As the explicit measure of acculturation, we also included the Vancouver Index of Acculturation (VIA; Ryder, Alden, & Paulhus, 2000), which consisted of two subscales, one measuring attitudes toward acculturating to host culture (10 items; e.g., "I believe in mainstream American values"; Cronbach's $\alpha = 0.90$) and the other measuring attitudes toward maintaining heritage culture (10 items, e.g., "It is

important for me to maintain or develop the practices of my heritage culture."; Cronbach's α = 0.91). The responses were made on a scale from 1 (Disagree) to 9 (Agree). [7]

Theory of Mind. To assess theory of mind, we used items from the Advanced Subscale from the Theory of Mind Inventory-Second Edition, Self-Report (TOMI-2-Advanced; Hutchins, Prelock, & Bonazinga, 2012) as adapted by Crehan, Althoff, Riehl, Prelock, & Hutchins (2020). The advanced subscale from the TOMI-2, consisted of a total of 16 items on a 20-unit continuum anchored by 5 points (i.e., 'definitely not', 'probably not', 'undecided', 'probably', and 'definitely'), assesses theory of mind achievements that emerge in the school years and adolescence, including self-conscious emotion recognition and mixed emotions. Following Crehan et al. (2020), the adult version we used adopts the first-person language (e.g., "I understand that people often have thoughts about other peoples' thoughts."). Cronbach's α was 0.93.

Depressive Symptoms. Slightly different from Study 3, depressive symptoms were measured using the short 10-item version of the Center for Epidemiologic Studies Depression Scale (CESD-10; Andresen, Malmgren, Carter, & Patrick, 1994). Participants reported how often they felt or behaved each way over the past week on a scale ranging from none of the time/less than 1 day (1) to most of the time/5 – 7 days (4). The possible score range is 20-40. The Cronbach's alpha was 0.85.

Demographics. In addition to age and gender, we also asked participant's highest education level completed at the time of survey completion. For all analyses, we controlled for

[7] Before responding to VIA, respondents were asked to specify their heritage culture. When analyzing attitudes toward maintaining heritage culture, we excluded 8 respondents who did not specify Asian culture as their heritage culture.

age (continuous), gender (categorical; reference = female), and education (categorical; reference = some college or currently enrolled in college.

Results

Descriptive Analyses

The descriptive statistics of the sample are presented in Table 7. On average, participants lived in the US for 15.46 years (SD = 7.75) and spent 0.72 (SD = 0.35) of their life in the US. Further, participants reported generally positive attitudes toward both acculturating to host culture (M = 6.20, SD = 1.50) and maintaining heritage culture (M = 6.46, SD = 1.65). The proportion of life spent in the US was correlated with attitudes toward acculturating to host culture (r = .13 p = .005) and maintaining heritage culture (r = -.14, p = .007; Pearson correlation of variables presented in Supplemental Materials – Table C).

Acculturation as Predictor of Attribution of Rumination

We first conducted a simultaneous regression analysis where self-doubt attribution was regressed on the proportion of life spent in the US and theory of mind, controlling for age, gender, education, and theory of mind. The analysis yielded a significant association between the proportion of life spent in the US and self-doubt attribution, b = 0.72, SE = 0.17, 95% CI [0.39, 1.05], $F(1,388) = 18.59$, $p < 0.001$, $\Delta R^2 = 0.044$, suggesting that greater exposure to American culture was associated with greater self-doubt attribution. Theory of mind, on the other hand, was not a significant predictor of self-doubt attribution, b = 0.01, SE = 0.01, 95% CI [-0.01, 0.02], $F(1,388) = 0.79$, $p = 0.374$. A parallel simultaneous regression analysis was conducted with self-improvement attribution as the dependent variable. The proportion of life spent in the US was not significantly associated with self-improvement attribution, b = -0.11, SE = 0.17, 95% CI [-0.46, 0.23], $F(1,388) = 0.44$, $p = 0.510$, $\Delta R^2 = 0.001$, while theory of mind was positively

associated with self-improvement attribution, b = 0.02, SE = 0.01, 95% CI [0.003,0.038], F(1,388)=5.46, p =0.020, $\Delta R^2 = 0.013$. [8] These findings suggest that the more exposure Asian participants had to American culture, the more likely they were to attribute rumination to self-doubt, even after controlling for theory of mind. Conversely, exposure to American culture was not related to the extent to which they attribute rumination to self-improving motivation.

We also ran simultaneous regression analyses predicting self-doubt attribution with each subscale of the VIA (i.e., attitudes toward acculturating to American culture, attitudes toward maintaining heritage culture) entered in separate analyses, controlling for age, gender, education, and theory of mind. While weak, attitudes toward acculturating to American culture were positively associated with self-doubt attribution, b = 0.08, SE = 0.04, 95% CI [0.001, 0.158], F(1,388) = 3.93, p =0.048, $\Delta R^2 = 0.010$. Yet, attitudes toward maintaining heritage culture were not significantly associated with self-doubt attribution, b = 0.06, SE = 0.04, 95% CI [-0.01. 0.13], F(1,380) = 2.74, p =0.099, $\Delta R^2 = 0.007$. Parallel analyses conducted with self-improvement attribution showed that both attitudes toward acculturating to American culture, b = 0.13, SE = 0.04, 95% CI [0.05, 0.21], F(1,388) = 10.51, p =0.001, $\Delta R^2 = 0.026$, and attitudes toward maintaining heritage culture, b = 0.16, SE = 0.04, 95% CI [0.09, 0.24], F(1,380) = 20.46, p <0.001, $\Delta R^2 = 0.050$, were significantly associated with self-improvement attribution. These findings imply that self-doubt attribution was predicted only by attitudes toward acculturating to American culture, whereas self-improvement attribution was predicted by both attitudes toward acculturating to American culture and attitudes toward maintaining heritage culture.

[8] Considering the skewedness in the proportion of life spent in the US, where 44% of the sample was 1 (i.e., lived all their life in US), we ran parallel analyses excluding those who lived all their lives in the US. Significance of the results did not differ.

Attribution of Rumination as a Moderator of the Association between Rumination and Depressive Symptoms

We further examined the moderating role of self-doubt attribution in the relationship between rumination and depressive symptoms to see if the findings from Study 3 replicate among the Asian respondents in Study 4. Specifically, we conducted a simultaneous regression analysis regressing depressive symptoms on rumination, self-doubt attribution, and their interaction while controlling for age, gender, education, and theory of mind. The analysis revealed a significant rumination X self-doubt interaction, b = 1.04, SE = 0.34, 95% CI [0.37, 1.71], F(1,386) = 9.39, p =0.002, $\Delta R^2 = 0.01$. Replicating our finding from Study 3, the association between rumination and depressive symptoms was stronger among those with high (i.e., +1 SD) compared to low (i.e., -1 SD) self-doubt attribution (Figure 6). Furthermore, in line with Study 3, a parallel analysis with self-improvement attribution as the potential moderator did not yield a significant rumination X self-improvement interaction, b = -0.31, SE = 0.36, 95% CI [-1.01, 0.38], F(1,386) = 0.78, p =0.377.

Discussion

In general, findings from Study 4 supported our predictions. Replicating our finding from Study 3, individuals with lower self-doubt attribution showed a weaker association between rumination and depressive symptoms even just among Asians. Such findings remained significant even controlling for theory of mind. Moreover, individuals with higher exposure to American culture reported higher self-doubt attribution even after controlling for theory of mind, while theory of mind did not relate to self-doubt attribution. Together, findings provide support for our theorization that cultural factors underly between-group differences in self-doubt attribution.

Explicit attitudes toward acculturating to American culture were also positively associations with self-doubt attribution, though the association was weak. Such a weaker association with explicit attitudes than with the length of exposure is in line with the previous work on acculturation (de Leersnyder et al., 2011). Using the same measures of acculturation across various groups of immigrants, De Leersnyder and colleagues found that the proportion of life spent in host culture was consistently associated with the extent to which immigrants attuned their psychological tendencies to the host culture, whereas explicit attitudes toward acculturation yielded weaker or null associations. It is possible that while immigrants may habituate their ways of thinking more as they live in and are exposed to American culture for an extended period of time, this may not necessarily engender more positive explicit attitudes toward acculturating to American culture. In fact, the correlation between the proportion of life spent in the US and attitudes toward acculturating to host culture was relatively small ($r = .13$).

Further, it is interesting to note the findings on self-improvement attribution. While the proportion of life spent in the US was not associated with self-improvement attribution, both attitudes toward acculturating to American culture and attitudes toward maintaining heritage culture were positively related to self-improvement attribution. Althogh speculative, it might be possible that supporting American and Asian cultural values may contribute to self-improvement attribution for different reasons. While Asian cultural values may foster self-improvement attribution through the perception of change (as we theorized), endorsing American cultural values could contribute to self-improvement attribution via placing emphasis on achievement motivation (McClelland, 1961). Further research needs to test whether this is the case.

General Discussion

Through these studies, we present a novel approach to understanding the factors underlying cultural differences in the association between rumination and outcomes. We developed a scale to capture our proposed construct and found cultural differences in attributing rumination to self-doubt. Further, the developed scale was related, but not redundant, with associated constructs (i.e., growth mindset, dialecticism; Study 2). In Study 3, we not only provided evidence supporting previous cross-cultural findings in the link between rumination and depressive symptoms (Chang et al., 2010; Kwon et al., 2013), but also further identified a mechanism that partly underlies such cultural differences. Lastly, Study 4 provided supporting evidence for acculturation underlying the findings of Study 3.

While the primary aim of developing the scale was to provide a mechanism to explain cultural differences, we also believe that this scale can be used to explain within-culture variance in the link between rumination and outcomes. In fact, there have been contradicting findings in the effects of rumination. Several researchers have demonstrated that ruminating about and making meaning out of negative experiences has been generally considered helpful (e.g., Greenberg, 2005; Rachman, 1980), while others have suggested that such "dwelling in the past" is associated with a range of negative outcomes, such as depression (e.g., Nolen-Hoeksema, Wisco, & Lyubomirsky, 2008). The effort to understand such variance has generally been focused on how people engage in rumination (e.g., Kross & Ayduk, 2011) or what type of rumination people engage in (e.g., Ciarocco et al., 2010). Our approach takes a different perspective, focusing on how people perceive and attribute the act of rumination, therefore contributing to the existing literature on rumination.

We predicted cultural differences in people's attribution of rumination to both self-improvement and self-doubt, but only found cultural differences in the latter. We speculate that other beliefs or mechanisms may contribute and override cultural differences in self-improvement attribution. For example, studies done in Western cultures found that patients with recurrent major depression believe that rumination is a helpful coping mechanism for them to solve problems, gain insight, and prevent future mistakes and failures (Papageorgiou & Wells, 2001b, 2001a). It is possible that even non-depressed individuals within Western cultures recognize such reasons for people to ruminate, which could have led to a relatively high attribution of rumination to self-improvement even in Western cultures. In addition, Study 4 findings point to the possibility that both American and Asian cultural values may contribute to self-improvement attribution via different routes. Future research needs to entangle such potential factors underlying self-improvement attribution.

We would like to clarify that we do not claim that one style of thought is better or more adaptive than the other. In fact, it is possible that there are contexts where East Asians' way of cognitive processes could be associated with worse outcomes compared to that of Westerners, such as social sharing of negative experiences (Kim et al., 2008). In fact, in Study 3, East Asian descents showed higher depressive and anxious symptoms compared to European Americans. Such findings suggest that while rumination may not be as disadvantageous for Asians, there must be other maladaptive factors among East Asian descents that are contributing to their higher depressive and anxious symptoms. Future research, therefore, is needed to examine other potential factors that may account for such negative outcomes.

Despite our theoretical assumption that dialectical thinking contributes to perception of positive changes following a negative experience (e.g., potential future improvement after failure

in exam), it is yet unclear how optimism may also play a role in the cultural variation in attribution to rumination. Previous studies on cultural differences in the level of optimism has provided some mixed findings. Whereas several studies found higher optimism among European Americans than among Asian Americans (e.g., Chang, 1996), there is also evidence showing higher optimism in response to SARS outbreaks among Chinese than among Canadians (L. J. Ji, Zhang, Usborne, & Guan, 2004; for similar results in the context of the recent COVID-19 outbreak, see L. J. Ji et al., 2021). Thus, it is possible that Asians may show optimism in the context of a specific negative event. Futhemore, the role of optimism in East Asian cultures relative to American culture has been found to be relatively complex (Chang, 1996; L. J. Ji et al., 2004; Peng & Nisbett, 1999). It would be fruitful for future research to examine the role of optimism in attribution to rumination and in the links to psychologicla adjusments across cultures.

Further, our main analyses did not differentiate between the two subscales of rumination, namely brooding and reflective pondering, because our aim was to focus on ruminative thinking as a whole as our first step in examining the role of attribuition of rumination. At the same time, we conducted follow-up exploratory analyses in Study 3 (see the Supplemental Materials) and found similar patterns across two subscales (i.e., both culture and self-doubt attributuon moderated the association between each subscale of rumination and depressive symptoms in separate analyses) though the mediation effect for reflective pondering was weak. Such patterns are in line with previous findings that found cultural differences in the association between subsclaes of rumination, i.e., brooding (Grossman & Kross, 2010) and reflective pondering (Kwon et al., 2013), and depression symptoms. Further examination of different types of

rumination will benefit better understanding of the role of culture and attribuition of rumination in the associations between rumiantion and depressive symptoms.

A potential limitation of the developed scale is that the scenario is specific and most relevant to students in the academic context (i.e., “After the exam, …”). Thus, whether this scale will show similar patterns across populations other than students and different types of negative experiences (e.g., breaking up with a partner, losing a job) is unclear. It is possible that cultural differences in perception of change can be similarly applied to varying experiences; ruminating about the loss of a loved one, for instance, could still be attributed to doubting one’s ability to move beyond the past negative experience. In addition, because the current scale of attribution of rumination used a third-person perspective, one may wonder to what extent it corresponds to self-attribution. Of note is that when under the presented scenario (i.e., failure after difficult exam), not all individuals may ruminate to begin with, which makes it hard to assess how individuals attribute their own act of rumination without confounding it with the frequency of rumination. It would be fruitful for future research to develop ways to assess self-attribution of rumination and examine its association with the current scale of attribution of rumination.

Further, our current study focused on attribution and did not examine how the construct is related to other constructs that focus on the content of negative thoughts (e.g., Ciarocco et al., 2010; Kross & Ayduk, 2011). It would be fruitful for future research to explore how attribution of rumination, particularly self-doubt attribution, could be related to the content and the type of rumination people engage in. For example, people who attribute rumination to self-doubt may tend to recount the concrete details of the experience (i.e., self-immersion; Kross & Ayduk, 2011) and to focus on future impacts of their failure (i.e., state-focused rumination; Ciarocco et al., 2010) when they ruminate about a past negative event.

Another limitation is in the participant sample. Our recruitment of East Asian participants is limited to individuals currently living within the United States as international students or US citizens. By recruiting and comparing East Asians currently living in their own countries may provide a clearer picture of the cultural difference. Another limitation is that the present research is a cross-sectional correlational design. Although we ruled out theory of mind in Study 4, it is hard to rule out all other potential factors playing a role in the association between rumination and negative outcomes. One possible factor is uncontrollability of negative thought, a characteristic of rumination that has been linked to depressive symptoms (Raes & Williams, 2010). Thus, further research is necessary to examine how the scale is related to such uncontrollability, particularly in relation to depression. In addition, our theoretical and experimental approach is based on the general comparison of two commonly compared groups in literature: European Americans and East Asians. While we are proposing attribution of rumination as a mechanism to explain cultural variation in the association between rumination and outcomes, it is unclear whether there are other cultural factors behind such observation and how well the current findings generalize to people from other cultures. For example, self-distancing has been proposed to underlie cultural differences in the association between rumination and outcomes between Russians and Americans (Grossmann & Kross, 2010). Therefore, further investigation is needed to examine if other cultural factors, such as self-distancing, might also underlie cultural differences between East Asians and European Americans and also to explore if attribution of rumination plays a role among different cultural groups, such as Russians.

Notwithstanding these limitations, the present work provides initial evidence in cultural differences in attributing rumination to self-doubt, and that such cultural differences partially

explain cultural variation in the association between rumination and depressive symptoms. As such, our findings work as a starting point to help understand cultural differences, as well as individual differences in the magnitude of the association between rumination and depressive symptoms.

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Tables

Table 1. Descriptive Data for the attribution facets of the Attribution of Rumination Scale.

	Self-Improvement Attribution	Self-Doubt Attribution
N	1468	1467
M	5.63	5.03
SD	0.96	1.09
Skewedness	-0.46	-0.14
Statistics	*1092.99***	*450.04****
Kurtosis	-0.18	-0.33
Statistics	*24.19****	*21.42****
Cronbach's α	0.78	0.83
Mean item intercorrelation	0.48	0.44

*** $p < .001$.

Table 2. Summary of fit statistics for comparing fit of the Attribution of Rumination Scale.

	df	χ^2	CFI[a]	RMSEA[b]	SRMR[c]	Δdf	$\Delta\chi^2$
Single Factor Model	27	873.33***	0.570	0.208	0.154		
Two Factor Model	26	197.36***	0.913	0.095	0.060	1	286

[a] CFI: Comparative fit index.

[b] RMSEA: Root mean square error of approximation.

[c] SRMR: Standardized root mean square residual.

*** $p < .001$.

Table 3. Summary of fit statistics for testing measurement invariance of the Attribution of Rumination Scale.

	df	χ^2	CFI[a]	RMSEA[b]	SRMR[c]	*Model Comparison*	*Δdf*	$\Delta\chi^2$	Invariant
Configural (M1) [d]	52	321.71***	.909	.091	.059				
Metric (M2) [e]	59	330.17***	.908	.093	.061	M2-M1	7	8.46	Yes
Scalar (M3) [f]	66	436.65***	.893	.095	.063	M3-M2	7	106.48	No
Partial Scalar (M4) [g]	64	393.77***	.905	.091	.062	M4-M2	5	63.60	Yes

[a] CFI: Comparative fit index.

[b] RMSEA: Root mean square error of approximation.

[c] SRMR: Standardized root mean square residual.

[d] Configural: an unrestricted model in which each group has the same factor structure, but loadings and intercepts can vary.

[e] Metric: a model in which loadings are fixed to be equal across groups.

[f] Scalar: a model in which loadings and intercepts are fixed to be equal across groups.

[g] Partial Scalar: a model in which all loadings and a subset of intercepts (i.e., excluding item 5, 6) are fixed to be equal across groups.

*** $p < .001$.

Table 4. Correlation Matrix of Study 2 Variables.

	1	2	3
1. Self-Improvement Attribution	-		
2. Self-Doubt Attribution	-0.21*	-	
3. Growth Mindset	0.29**	-0.13	-
4. Dialecticism	0.29**	-0.21*	0.00

* $p < 0.05$

** $p < 0.01$

Table 5. Heterotrait-Monotrait Ratio of Correlations in Study 2.

	1	2	3
1. Self-Doubt Attribution	-		
2. Self-Improvement Attribution	0.31	-	
3. Growth Mindset	0.16	0.37	-
4. Dialecticism	0.46	0.42	0.30

Table 6. Descriptive statistics of the key variables and cultural differences in Study 3.

	European American			East Asian descent		
	N	M (or %)	SD	N	M (or %)	SD
Age***	142	18.48	0.8	123	18.99	1.32
Gender	142	62.40		123	61.50	
Rumination***	142	1.95	0.63	123	2.32	0.62
Self-Improvement	142	5.54	1.08	123	5.67	1.14
Self-Doubt***	142	4.22	1.01	123	3.65	1.28
Anxious Symptoms***	142	41.04	9.51	123	46.32	9.21
Depressive Symptoms**	142	34.77	9.79	123	38.43	8.43

Note. Asterisks indicate cultural differences

** $p < 0.01$

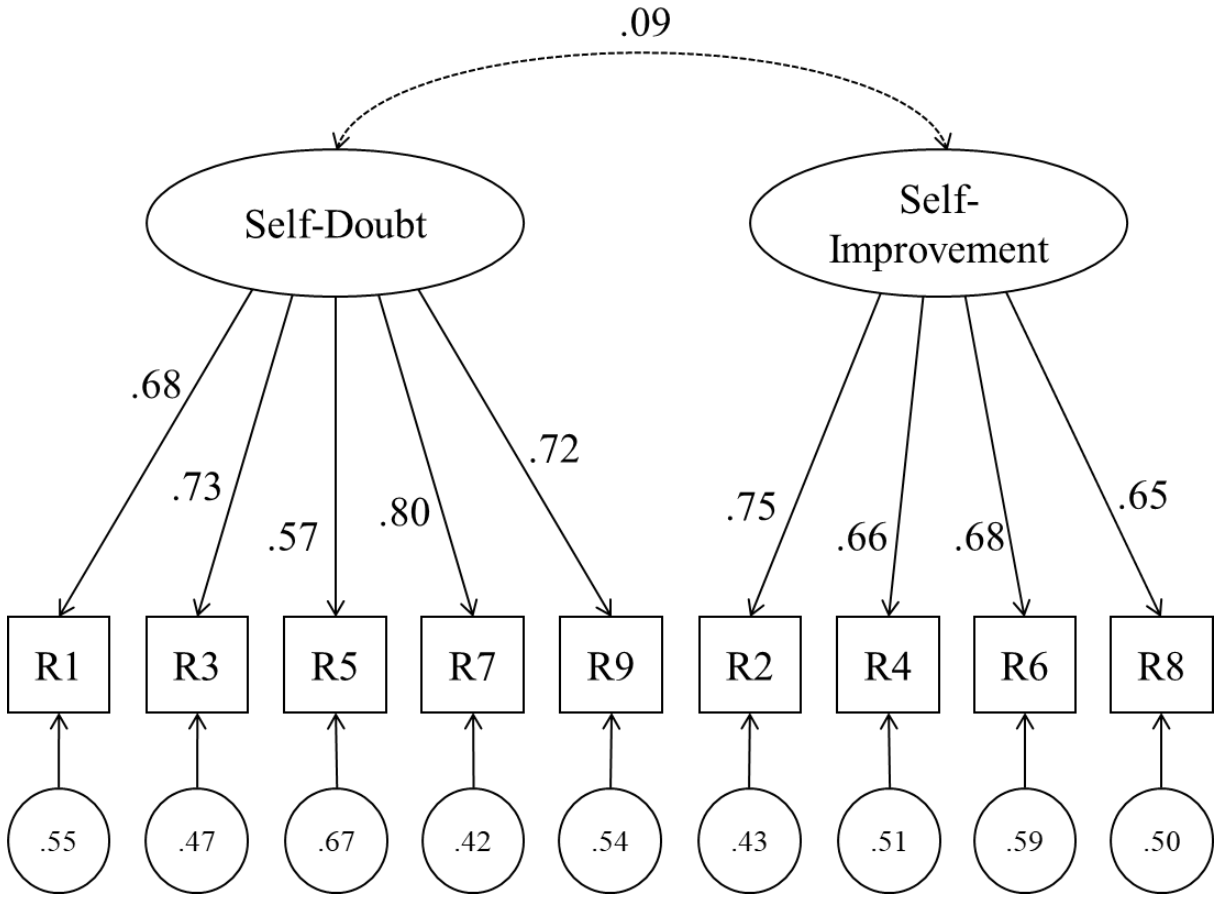
*** $p < 0.001$

Table 7. Descriptive statistics of the key variables and cultural differences in Study 4 (N = 396).

	M (SD)
Age	21.38 (2.51)
Gender (%)	
Female	61.11%
Male	36.87%
Other (Non-Binary; Trans)	2.02%
Education (%)	
HS or lower	18.94%
Some College or Currently Enrolled	41.41%
Associate's Degree or higher	39.65%
Length of Stay in US	15.46 (7.75)
Ratio (Relative to Age)	0.72 (0.35)
Depressive Symptoms (CESD-10)	22.13 (6.29)
Rumination	2.47 (0.62)
Self-Doubt Attribution	4.56 (1.18)
Self-Improvement Attribution	5.14 (1.50)
Acculturation to American Culture	6.20 (1.50)
Attitude toward Maintaining Heritage Culture	6.46 (1.65)
Theory of Mind	45.93 (6.77)

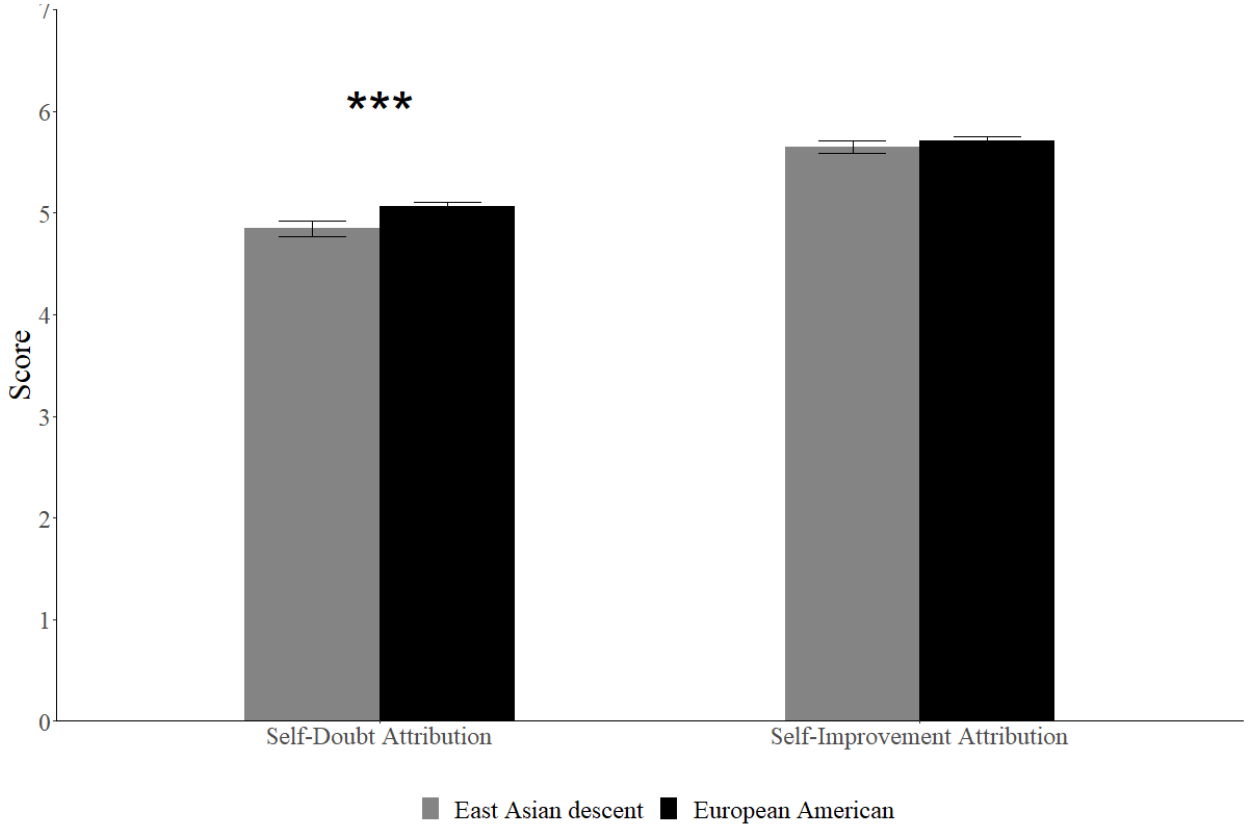
Figures

Figure 1. The two-factor model of the Attribution of Rumination Scale.



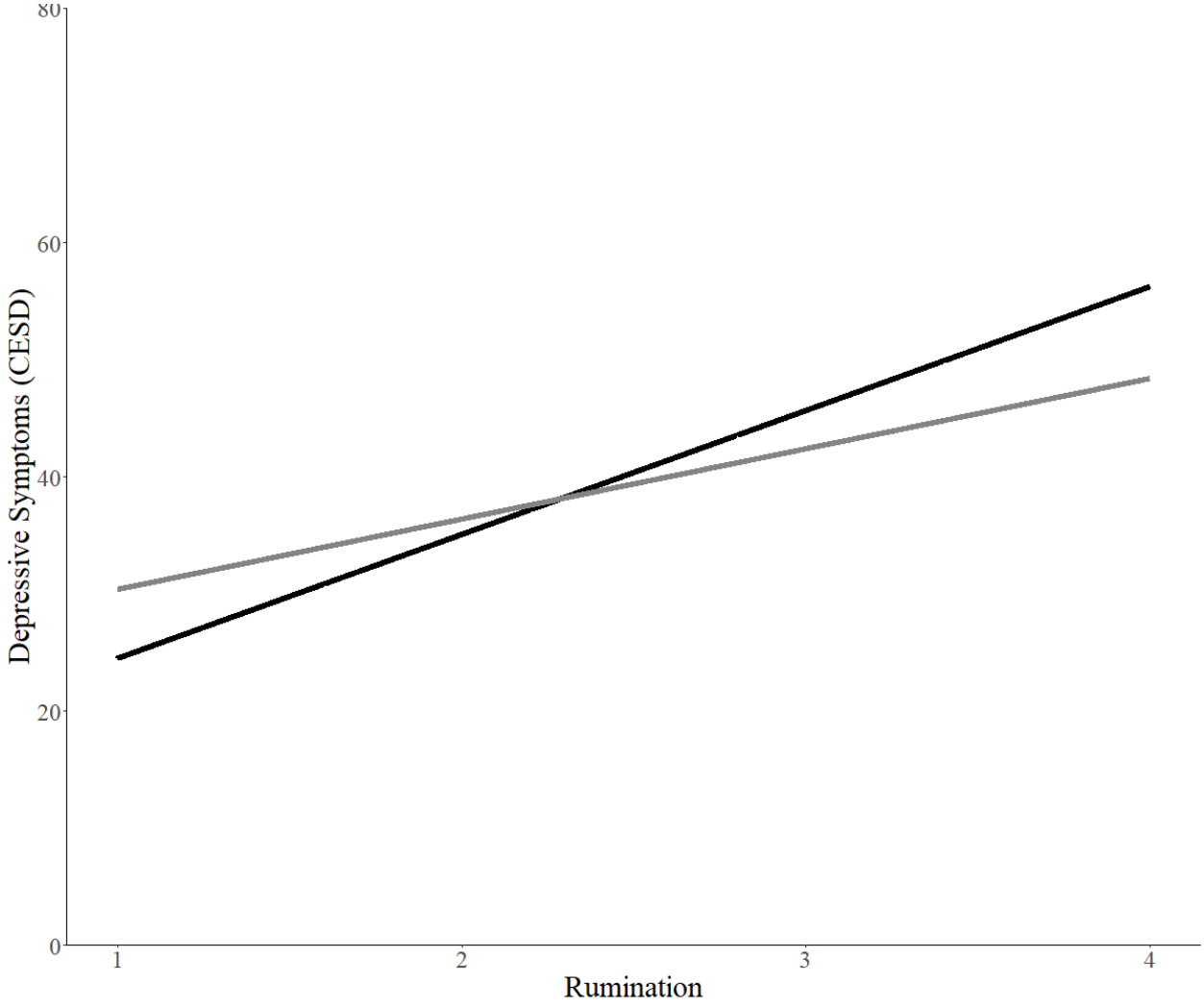
Note. R1-9 = item number of Attribution of Rumination scale. For specific item information, please refer to Appendix A.

Figure 2. Cultural differences in Attribution of Rumination scale.



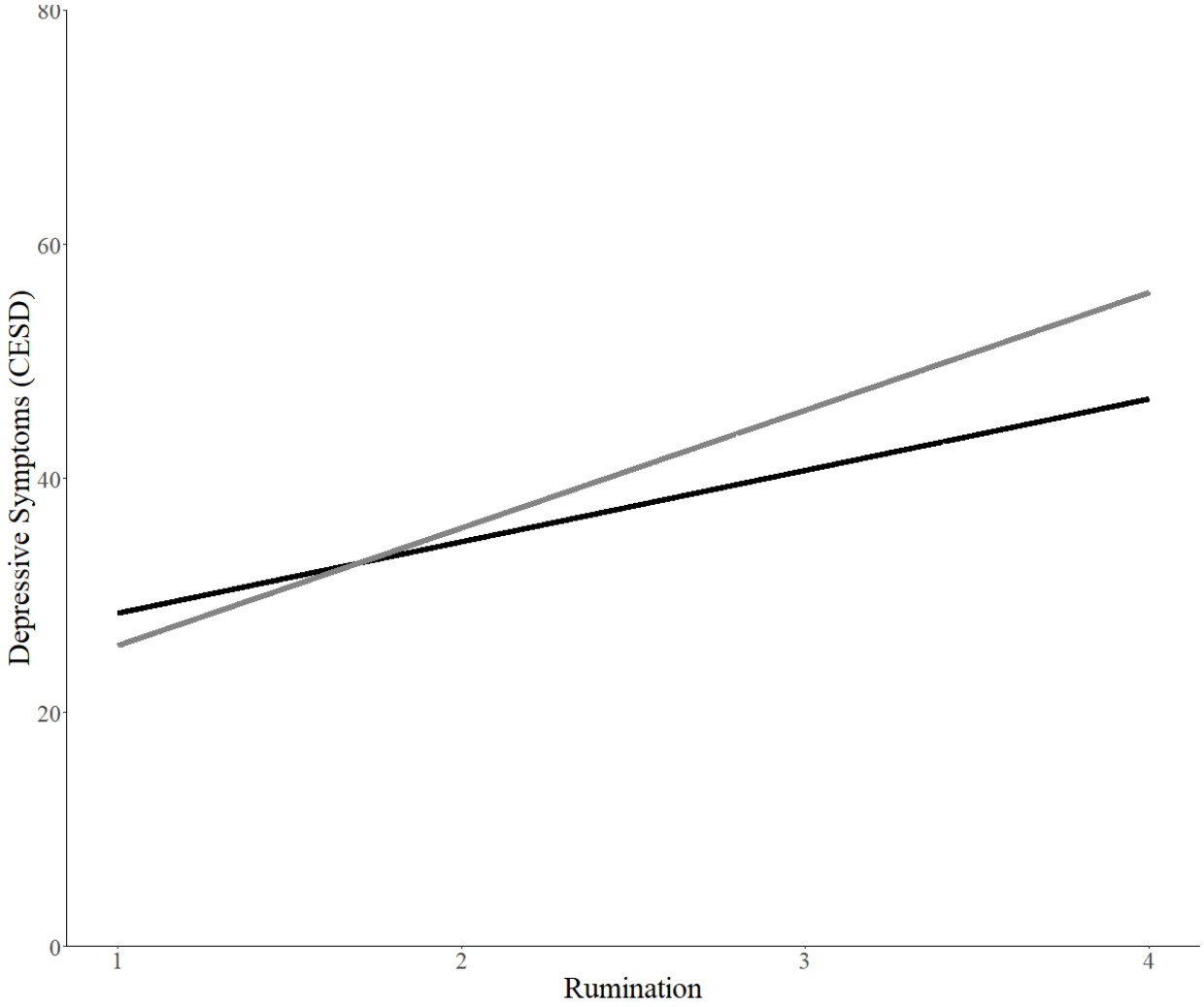
*** $p < 0.001$

Figure 3. Association between Rumination and Depressive Symptoms by Cultural Background in Study 3.



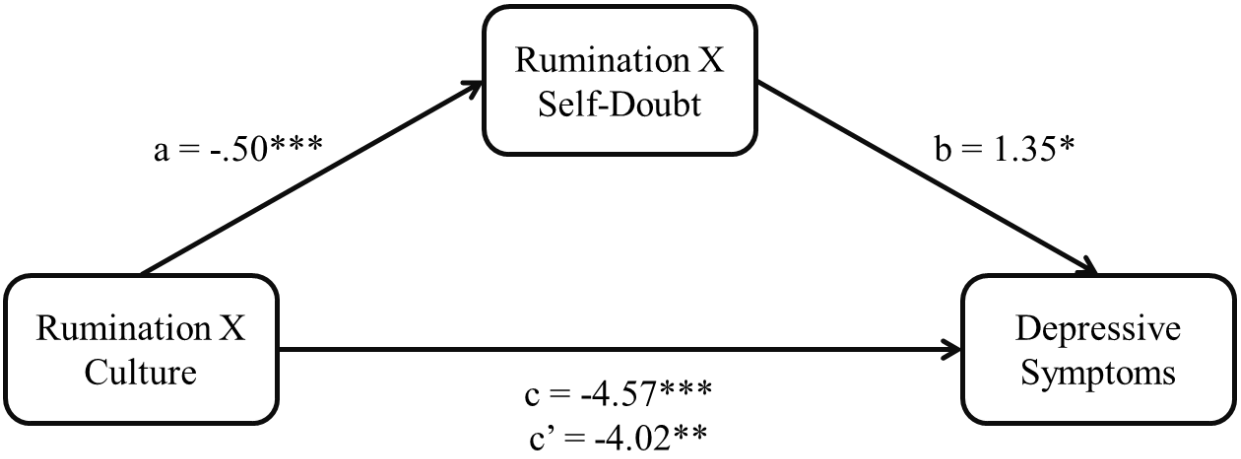
Note. Black line = European American; Grey line = East Asian descent.

Figure 4. Association between Rumination and Depressive Symptoms by Self-Doubt Attribution in Study 3.



Note. Black line = -1 standard deviation of self-doubt attribution; Grey line = + 1 standard deviation of self-doubt attribution.

Figure 5. Unstandardized Path Coefficients for Moderated Mediation Model.

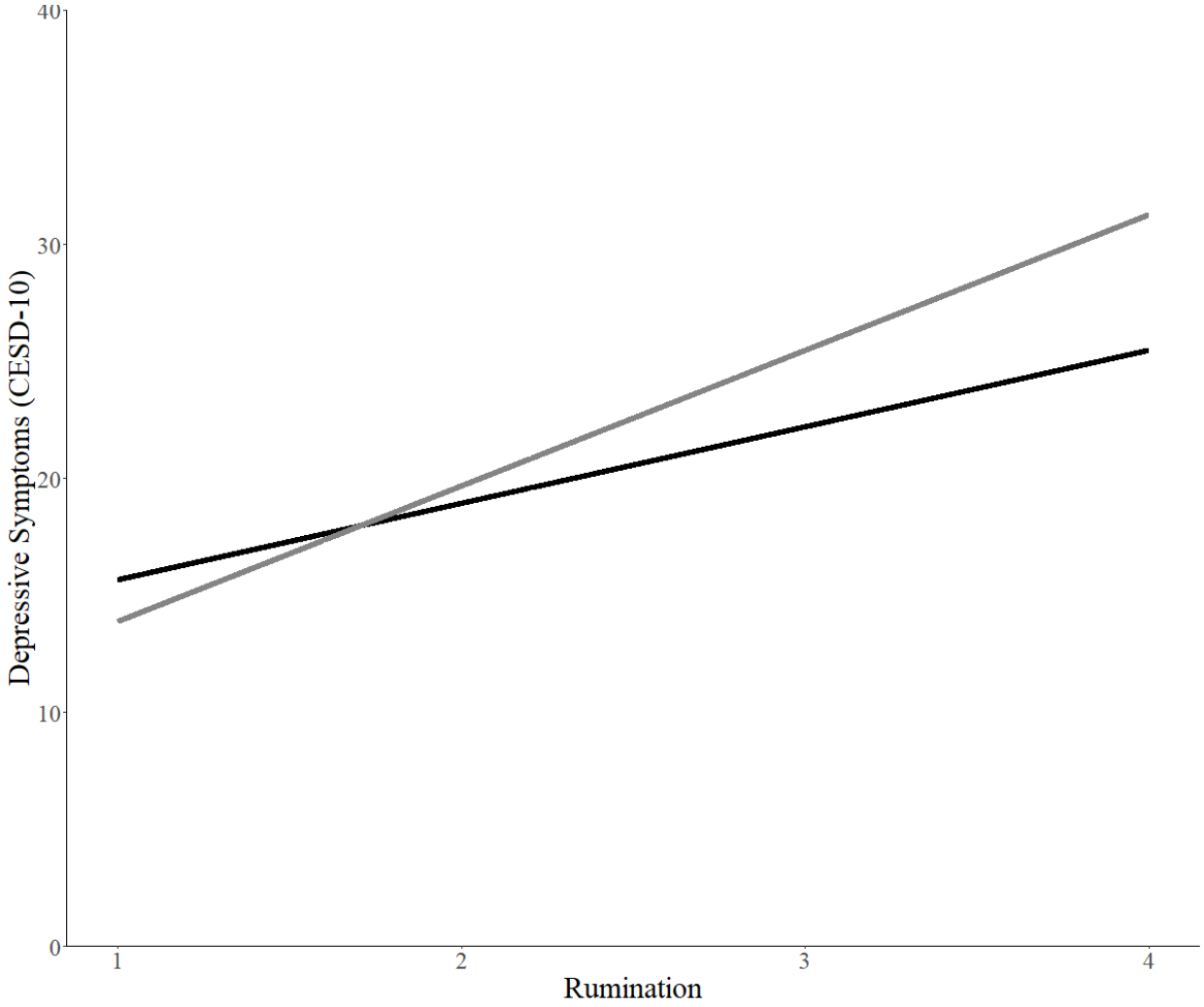


* p < 0.05

** p < 0.01

*** p < 0.001

Figure 6. Association between Rumination and Depressive Symptoms by Self-Doubt Attribution among Asians in Study 4.



Note. Black line = -1 standard deviation of self-doubt attribution; Grey line = + 1 standard deviation of self-doubt attribution

Appendix A: Attribution of Rumination Scale

After the exam, a student thinks he/she did not do well. The student starts to reflect deeply about the exam he/she has just finished. From a scale of 1 – 7, rate the likelihood that you think the following is a reason why this student is reflecting deeply on the negative performance.

1 = Very Unlikely

2

3

4 = Neither Unlikely nor Likely

5

6

7 = Very Likely

1. The student feels there is nothing s/he can do to do better in the class.
2. The student wants to do better on the next exam.
3. The student thinks s/he will not be able to get a better grade.
4. The student wants to learn from his/her mistakes.
5. The student cannot focus on anything else.
6. The student wants to improve his/her grades.
7. The student feels helpless.
8. The student is motivated to do better.
9. The student is doubting if s/he has the capability needed for the class.

Items 2, 4, 6, 8 = Self-Improvement Attribution

Items 1, 3, 5, 7, 9 = Self-Doubt Attribution