Psychophysiology, 53 (2016), 41–51. Wiley Periodicals, Inc. Printed in the USA.

DOI: 10.1111/psyp.12579

Convergence in feeling, divergence in physiology: How culture influences the consequences of disgust suppression and amplification among European Americans and Asian Americans

JOSÉ A. SOTO,[a]‡ ELIZABETH A. LEE,[b]‡ AND NICOLE A. ROBERTS[c]

[a]Department of Psychology, The Pennsylvania State University, University Park, Pennsylvania, USA
[b]Office of Organizational Effectiveness, Central Washington University, Ellensburg, Washington, USA
[c]School of Social and Behavioral Sciences, Arizona State University, Phoenix, Arizona, USA

Abstract

Much empirical work documents the downsides of suppressing emotions. Emerging research points to the need for a more sophisticated and culturally informed approach to understanding the consequences of emotion regulation. To that end, we employed behavioral, self-report, and psychophysiological measures to examine the consequences of two types of emotion regulation (suppression and amplification) in a sample of 28 Asian Americans and 31 European Americans. Participants were shown a neutral film and then a series of disgust-eliciting films during which they were asked to regulate their response by suppressing or amplifying their emotional behavior (counterbalanced). Despite self-reporting equal levels of disgust, European Americans showed greater skin conductance reactivity than Asian Americans in both regulation conditions, but not in response to a neutral film. These findings extend work on divergence in the consequences of emotion regulation across different cultural groups, which could help identify optimal emotion regulation strategies for health and well-being.

Descriptors: Suppression, Cultural differences, Emotion regulation, Psychophysiology, Asian Americans, Amplification

Emotion regulation has been linked to a number of important outcomes, including well-being, social functioning, and indicators of physical and mental health (Engebretson, Matthews, & Scheier, 1989; Gross & Muñoz, 1995; John & Gross, 2004). Specifically, past research has shown that suppressing one's emotional expressions (commonly referred to as suppression, expressive suppression, or emotional inhibition) is associated with negative outcomes such as increased physiological arousal, increased risk for depression, impaired memory, disrupted interpersonal functioning, diminished expression and experience of positive emotion, decreased immune system functioning, and decreased satisfaction with life (Butler et al., 2003; Gross & John, 2003; Gross & Levenson, 1993; Petrie, Booth, & Pennebaker, 1998; Richards & Gross, 2000; Wenzlaff, Rude, Taylor, Stultz, & Sweatt, 2001). To a large extent, these findings reflect the historical focus on individual differences in the study of emotional reactivity and regulation (Gross & John, 2003).

Recently, there has been a call to supplement the individual differences approach to emotion regulation with an examination of contextual variables, especially culture (Butler & Gross, 2009; Perez & Soto, 2011). Studies taking this approach have revealed that the outcomes and perhaps mechanisms associated with certain emotion regulation strategies, particularly suppression, are not universal (Butler, Lee, & Gross, 2007; Mauss & Butler, 2009; Soto, Perez, Kim, Lee, & Minnick, 2011). This has been especially true when comparing Western contexts/values with Eastern contexts/values. This variation makes sense given that cultural norms within these groups have been passed down over generations, presumably because they are or have been adaptive within that particular cultural context. Nevertheless, Western society and institutions have typically prescribed a one-size-fits-all approach, suggesting that it is healthier to express than to suppress emotions. Unpacking this assumption is warranted in light of the dearth of empirical tests of this notion and recent findings that actually challenge this idea (Cheung & Park, 2010; Consedine, Magai, & Bonanno, 2002; Su, Lee, & Oishi, 2013; although see Park et al., 2011 for contrasting findings). In order to better understand the physiological consequences not only of suppression, but also of emotion regulation in general, the present study examines whether European Americans and Asian Americans differ in their self-reported and physiological responses to suppression and amplification of disgust in a laboratory setting.

We would like to thank the members of the Culture, Health and Emotion lab for their assistance in collecting data and for comments on earlier drafts of the manuscript. Parts of this manuscript are based on the doctoral dissertation of Elizabeth A. Lee.

‡First authorship is shared by José A. Soto and Elizabeth A. Lee.

Address correspondence to: José A. Soto, 310 Moore Building, University Park, PA 16802, USA. E-mail: josesoto@psu.edu

Consequences of Suppression vs. Expression

Emotionally evocative situations often elicit conscious and/or unconscious efforts to regulate one's emotional response (Mauss, Bunge, & Gross, 2007). One regulation strategy involves the conscious effort to not let emotional experience manifest in outward behavior (expressive suppression; Gross & Levenson, 1993, 1997). For example, one may suppress the display of intense anger during a fight to avoid escalation or suppress crying behavior after being embarrassed in order to avoid garnering more negative attention. While such a strategy may seem necessary in the moment, ample evidence points to suppression, at best, being disruptive and, at worst, harmful for one's health (Brosschot, Van Dijk, & Thayer, 2007; Butler et al., 2003; Gross & John, 2003; Gross & Levenson, 1993; Pennebaker & Francis, 1996; Petrie et al., 1998; Spera, Buhrfeind, & Pennebaker, 1994). One of the pathways proposed to mediate the negative effects of suppression is increased physiological arousal, particularly sympathetic nervous system arousal, which may be induced as a result of increased psychological or physical effort during suppression. Indeed, studies have shown that some of the short-term responses to suppression include increased physiological activation (Demaree et al., 2006; Gross & Levenson, 1993; Krantz & Manuck 1984; Richards & Gross, 2000) and delayed physiological recovery (Dorr, Brosschot, Sollers, & Thayer, 2007).

On the other side, expression has typically been viewed as an adaptive emotion regulation strategy. Characterized by the open display of one's emotions, expression is a practice that traces its roots to Freudian thought on the positive effects of catharsis (Breuer & Freud, 1957; Hokanson, Willers, & Koropsak, 2006; Pennebaker & Beall, 1986). Expression can serve multiple functions. Studies on the utility of expression suggest benefits such as decreased stress and depression, enhanced cognitive processing of aversive memories, enhanced immune system functioning, facilitation of communication, and motivating others to engage in adaptive behaviors (Consedine et al., 2002; Pennebaker & Francis, 1996; Pennebaker & Seagal, 1999; Polivy, 1998). Thus, expression can assist with multiple domains of intrapersonal and interpersonal functioning. However, the majority of findings with regards to the consequences of suppression and expression have largely been documented with White/European American participants. Further, no studies to our knowledge have examined cultural differences in suppression compared to the other end of the spectrum—an exaggeration or amplification of emotions.

Cultural Differences in the Consequences of Emotion Regulation

The overrepresentation of one cultural group in research on emotion regulation is a critical oversight because of how culture can shape emotional experience and expression (Markus & Kitayama, 1991). For the purposes of the current paper, we define culture as a shared system of values, beliefs, practices, and products that shape the individual mind *and* brain in a cycle of mutual constitution (Ryder, Ban, & Chentsova-Dutton, 2011; Soto, Chentsova-Dutton, & Lee, 2012). Thus, culture helps explain how individuals in a group collectively subscribe to social norms and values that lead to what is believed to be adaptive practice in that cultural context. In the field of cultural psychology, research has particularly focused on differences between individuals from collectivistic cultures (e.g., East Asians) and individualistic cultures (e.g., European Americans). Consequently, studies examining biological convergence or divergence across cultures (e.g., cultural neuroscience) often include comparisons of East Asian and European American participants (Adams et al., 2010; Murata, Moser, & Kitayama, 2013; Tang et al., 2006). In the case of the present study, we believe that individuals carefully selected from these two cultural contexts (East Asian and European American) can represent meaningful differences in beliefs and preferences about emotion regulation, which can manifest in what is observed outwardly (self-reported psychological experience), as well as what is measured internally (physiological experience).

Researchers have begun to elaborate on how the extent to which emotion regulation strategies are considered optimal or not depends on what is culturally normative (Burns, Quartana, & Bruehl, 2007; Lai & Linden, 1992; Markus, Mullally, & Kitayama, 1997). For example, Soto and colleagues (2011) found that among a group of Hong Kong Chinese, a group known to encourage use of emotion suppression, suppression and psychological functioning were not correlated, whereas the European American comparison group in the study followed the typical pattern of associations described earlier. Similarly, work conducted by Noh, Beiser, Kaspar, Hou, and Rummens (1999) showed that suppression in response to perceived discrimination was actually helpful in warding off depression for Asians. Even the endorsement of values consistent with an Asian/Eastern ideology of emotional restraint has been associated with an attenuation of the negative social and physiological effects of suppression (Butler et al., 2007; Mauss & Butler, 2009).

Further evidence of the importance of considering cultural norms with regard to the relative "healthiness" of emotion regulation strategies comes from research within clinical psychology. Chentsova-Dutton and colleagues (2007, 2010) demonstrated that what was considered unhealthy or dysregulated emotional practice among depressed and nondepressed Asian Americans and European Americans was antithetical to the cultural norms of the group. Thus, depressed Asian Americans were more likely to express their emotions compared to nondepressed Asian Americans, whereas depressed European Americans were more likely to suppress their emotions compared to nondepressed European Americans. These findings further reinforce the notion that suppression and expression may be the healthier practice among Asian Americans and European Americans, respectively.

Engebretson and colleagues (1989) posit a similar idea about the importance of considering normative practice in their discussion of the physiological effects of suppression. Their matching hypothesis states that the physiological consequences of suppression depend on whether a person habitually uses suppression. Here, the variation in one's chronic use of suppression was conceived of as an individual difference, but it can also be due to a cultural norm. Similarly, the "neuro-culture interaction model" (Kitayama & Uskul, 2011) proposes that the repetition of culturally sanctioned experiences can shape biological mechanisms, given the brain's plastic nature over the life span. Recent work in the area of genetics and culture has demonstrated that culturally normative behavior can both influence and be influenced by genetic variability, as cultural values co-evolve with their physical and social environments (Chiao & Blizinsky, 2010; Kim & Sasaki, 2012). Thus, cultural values and norms may not only reflect social and biological differences between groups, but biological divergences between groups may also be markers of differences in cultural values.

Empirical support for the above theories can be found in a handful studies. For example, Suchday and Larkin (2004) showed that suppression of anger after a frustrating interaction with a confederate resulted in *faster* cardiovascular recovery (relative to expression) in a South Asian sample, a group whose cultural norms

support or encourage the use of suppression. Similar divergences in physiological responses across cultural groups were found by Dorr and colleagues (2007) when they asked African Americans and European Americans to inhibit or express anger after a stressful debate (Dorr et al., 2007). African Americans who were allowed to express their anger (relative to those who inhibited their anger) demonstrated slower physiological recovery across a number of sympathetic and parasympathetic indices of arousal; no such differences were observed among European Americans. Dorr and colleagues argue that these findings reflect societal norms which condition African Americans to inhibit their anger displays to avoid incurring more negativity from others. At the neurophysiological level, Murata and colleagues (2013) found evidence that Asian Americans, relative to European Americans, show decreased processing of emotion (as indexed by ERP responses) when asked to suppress their emotional response. To our knowledge, the only laboratory study to not find cultural differences in physiological responses to suppression was Roberts, Levenson, and Gross (2008), but differences between groups were hypothesized. Most previous work has demonstrated that demographic groups with contrasting emotion norms also show differences in emotion experience, expression, and/or regulation (Lai & Linden, 1992; Suchday & Larkin, 2004), and even in corresponding neural activation (Murata et al., 2013). Thus, understanding how suppression (or emotional expression) affects physiological responses across different cultural groups requires further investigation.

The Present Study

The present study examines the consequences of suppressing or amplifying emotional behavior among Asian Americans and European Americans. Importantly, studies falling in the domain of cultural neuroscience can differ substantially in how culture can be operationalized, ranging from status markers such as national origin (Adams et al., 2010) to racial identification (Mathur, Harada, & Chiao, 2012) to behavioral indicators of culture such as native-language usage (Tang et al., 2006). Because we were particularly interested in capturing representatives of two broad cultural groups whose traditional values regarding emotion expression and regulation are quite distinct, we employed stringent criteria that made use of behavioral markers of cultural orientation, family origin criteria, and self-identification to operationalize our cultural groups. These criteria are outlined in the methods and are meant to increase the likelihood that the cultural groups studied reflect the traditional norms and values associated with their respective cultural heritages, which include differential preferences for the suppression (among Asian Americans) and expression (among European Americans) of emotion as described above.

To induce emotion we used a common paradigm using disgust-eliciting films (Demaree et al., 2006; Kunzmann, Kupperbusch, & Levenson, 2005; Roberts et al., 2008). In order to examine a full range of emotional responses, measures from three response channels of emotion were collected: (a) emotional behavior during the films, (b) self-reported emotion ratings after the films, and (c) physiological responding (cardiac interbeat interval [IBI] and skin conductance level [SCL]) before and during the films. We chose disgust because this induction has elicited similar and strong levels of subjective emotional experience across cultural groups in other studies (e.g., Roberts et al., 2008). The lack of cultural differences in self-reported disgust in prior research may be due to the largely visceral nature of disgust and/or the relatively more private aspect of self-reporting emotion (versus facial displays), which may leave less room for cultural influence. By using a paradigm that was likely to induce similar levels of subjective experience even while manipulating facial behavior, we were able to examine physiological differences specifically due to emotion regulation, rather than to differential responses to the emotion induction itself (such as reported by Mauss, Butler, Roberts, & Chu, 2010).

For the present study we were particularly interested in the effect of instructions to either suppress or amplify emotional behavior in response to the films (i.e., instructed regulation). By including a condition that focuses on a regulation strategy that contrasts with suppression, we could more clearly differentiate findings due to suppression, in particular, or emotion regulation, in general. Amplification also may be considered similar to "expression" but in a more extreme form that still requires regulation ("up-" rather than "downregulation"; Demaree et al., 2006), which again makes it possible to compare the physiological correlates of two regulation strategies, rather than one regulation strategy (suppression) and a "natural" condition (expression) as often is done. Importantly, while past studies have included amplification conditions in their manipulations (Demaree et al., 2006; Kunzmann et al., 2005), these studies did not examine cultural differences in the response to amplification.

Hypotheses. We expected that the experiential (self-report) response to suppression would not differ between Asian Americans compared to European Americans, consistent with prior studies examining disgust (Tsai, Chentsova-Dutton, Freire-Bebeau, & Przymus, 2002) and disgust suppression (Roberts et al., 2008) in these groups, and given the powerful nature of the stimuli used here as well as the more private nature of self-report (relative to behavior). In contrast to the expected similarities in self-reported disgust, we hypothesized differences in physiological reactivity during suppression, such that European Americans were expected to show greater physiological reactivity than Asian Americans. Specifically, we predicted greater increases in SCL and smaller increases in IBI, relative to baseline responding. This latter prediction was based on the fact that cardiac deceleration (slower heart rate), as reflected by increases in IBI, typically characterizes responses to the type of disgust elicited by our films, but suppression is typically associated with greater sympathetic activation, which should mitigate the cardiac deceleration associated with disgust. This hypothesis is consistent with the findings from some previous studies (Lai & Linden, 1992; Suchday & Larkin, 2004;) and the theoretical premise that suppression of emotional behavior should be more physiologically taxing for European Americans relative to Asian Americans, given the relative emphasis on cultural moderation within the latter group (Mauss et al., 2010; Soto, Levenson, & Ebling, 2005).

Similarly, in the amplification condition we expected to find no differences in the subjective report of emotion, based on previous work by Demaree and colleagues (2006) demonstrating that amplification of facial behavior was not associated with a change in self-reported emotional responses to disgust eliciting films. Thus, we expected that members of both groups would be able to comply with the amplification instructions equally well. However, we expected Asian American participants to show greater physiological reactivity relative to European Americans (i.e., greater increases in SCL, and smaller increases in IBI), because exaggeration of emotional behavior should be less taxing for European Americans given the relative emphasis in Western culture on the open expression of emotions (Bellah, Madsen, Sullivan, Swindler, & Tipton, 1985).

In other words, the hypotheses above predict an interaction of culture and emotion regulation condition, taking into consideration

that Asian Americans and European Americans endorse contrasting norms around the experience and regulation of emotion (e.g., Mauss et al., 2010; Tsai, 2007), and are therefore not expected to have comparable physiological consequences when asked to regulate their emotions. Group differences emerging at the physiological level, but not at the self-report level would constitute evidence of potential cultural differences in brain–behavior relationships.

Method

Participants

The final sample consisted of 59 undergraduate students recruited at a large university in the northeastern United States, 28 Asian American (13 female) and 31 European American (19 female). Missing demographic data prevented us from obtaining the ages of 18 of our participants; the ages of the remaining participants ranged from 18 to 34 years, with a mean of 19.51. A demographic screener survey was used to determine participant eligibility (see below) for both the Asian American and European American groups. Similar to the criteria employed in other studies of culture and psychophysiology (see Soto & Levenson, 2009 and Soto et al., 2005), we relied on several pieces of culturally relevant information, including behavioral information, to go beyond racial or ethnic self-identification to characterize our groups. All participants were either recruited from introductory psychology classes and compensated with course credit or recruited from the general campus community and paid $18 for their participation. All procedures were approved by the university's institutional review board and conducted in accordance with the American Psychological Association's ethical standards.

Eligibility Criteria. European Americans must have been born and raised in the United States and had to self-identify as White or European American. Participants' parents and grandparents also had to report being born in the United States and identify as White or European American (for a more in-depth discussion of these cultural criteria, see Soto et al., 2005). In addition, European American participants had to report being of Christian or Catholic religion, or growing up with these religions being practiced in their households. Finally, participants had to report that over 50% of their friends while growing up and over 40% of their neighborhood while growing up were of European American background.

Asian American participants had to self-report their ethnicity as Asian or East Asian (e.g., Chinese, Korean, Japanese, and Vietnamese) and have been born either in an East Asian country or in the United States. South Asian participants from countries such as India, Pakistan, or Bangladesh were not eligible. In addition, participants' parents and grandparents also had to meet the same birth-country requirements. Furthermore, participants had to be conversant, though not fluent, in both English and in the Asian language of their culture of origin. There were no religious criteria for the Asian American participants. The criteria around childhood friends and neighborhood were also not applied to this group because immigrant populations may have limited choice as to where they geographically settle and therefore this may have been an unrealistic standard for the Asian American participants in the community from which participants were sampled.

Procedures

Participants arrived at the lab room, gave informed consent, and sat in a comfortable chair 3 feet away from a 19" LCD monitor. The monitor was connected to a computer running E-prime software to collect self-report responses and to present instructions and stimuli for the experiment. An experimenter of the same gender applied the physiological sensors before the film presentations began.

Participants watched a total of five film clips previously used in emotion regulation research (Gross & Levenson, 1993; Kunzmann et al., 2005). Before each film, participants were presented with a brief fixation cross followed by directions to "clear your mind of all thoughts, feelings, and memories." The screen then remained blank for 1 minute, serving as the prefilm baseline period. Next, directions instructed participants to watch the film carefully and to alert the experimenter if they find the film "too distressing," in which case the film was stopped. After each film, the screen remained blank for 2 minutes, serving as the recovery period, followed by the self-report measure of emotion. All films were between 52 and 62 seconds in duration, with the exception of the first film which lasted 22 seconds.

Film 1 was the same across all participants and was a neutral film (seagulls flying over a beach). Film 5 was also the same across all participants and was a relaxation film (depicts various animals in nature). Films 2–4 were the disgust films. The first disgust film (Film 2) always depicted an eye operation and was not associated with any specific emotion regulation instructions (i.e., "watch" condition). The next two films were of a burn victim's skin graft and an arm amputation. The order of regulation instructions and the actual film presentation for films 3 and 4 were counterbalanced. The instructions to amplify [suppression instructions in brackets] emotions were: "This time, if you have any feelings as you watch the film clip, try your best [not] to let those feelings show. In other words, as you watch the film clip, try to behave in such a way so that a person watching you would clearly [not] know how you were feeling. To summarize, as you watch the film clip, try to show [hide] your feelings as much as you can."

Measures and Data Reduction

Self-reported emotional experience. Immediately after the 2-min recovery period for each film, participants were asked to use a 9-point Likert scale (0 = *none* and 8 = *the most in my life*) to rate their current experience of 16 different emotions: *amusement, anger, arousal, confusion, contempt, contentment, disgust, embarrassment, fear, happiness, interest, pain, relief, sadness, surprise*, and *tension.* Previous work has used this rating scale to measure the experience of specific emotions (Ekman, Friesen, & Ancoli, 1980; Gross & Levenson, 1993). The emotion ratings were collected after the recovery period, as opposed to immediately after the film, in order to allow participants' physiology to return to baseline naturally. Only the self-report ratings of disgust were used for the present study.

Emotional behavior. In order to collect data on participants' emotional behavior, video cameras recorded participants' face and upper torso during all the film trials. Trained research assistants (3 female European Americans, 4 male European Americans), blind to participant condition, rated the intensity of participants' disgust displays during each of the three disgust films using a 4-point Likert scale (0 = *not at all*, 1 = *low*, 2 = *medium*, 3 = *high*). Facial behavior during the neutral and relax films were not coded due to the low base rate of any emotional behavior at all. Additionally, the raters noted whether participants asked to stop a film (see procedures). Research assistants were trained using the Facial Action Coding System (Ekman & Friesen, 1978) to identify typical facial movements indicative of disgust. Intraclass correlation coefficients (ICCs) were calculated to test the interrater reliability of the

research assistants' ratings. Interrater reliability was adequate for the ratings of disgust (ICCs ranged from .73–.77 across conditions). The scores across the seven raters were averaged for a final rating of participants' disgust behavior.

Psychophysiological measures. Electrocardiography (EKG) and SCL were recorded using a Mindware impedance cardiograph (MW2000) in conjunction with a Biopac© MP150 device consisting of an eight-channel polygraph and a microcomputer. All physiological data were collected second-by-second using AcqKnowledge© data acquisition software and analyzed using Mindware Biolab© software. EKG, which provides a measurement of cardiac activity, was measured through three Biopac pregelled, self-adhering, disposable electrodes placed at three locations on the torso: the right clavicle at the midclavicular line, just above the last bone of the rib cage at the left midaxillary line, and just below the last bone of the rib cage at the right midaxillary line (ground electrode). From the EKG signals, we derived the cardiac IBI. IBI is calculated as the elapsed time between heartbeats in milliseconds (*ms*). Thus, longer IBIs (reflected by higher values) are indicative of slower heart rate (HR) or lower physiological arousal. We used IBI as our metric instead of HR for consistency with our and others' prior work (e.g., Demaree et al., 2006; Roberts et al., 2008) and given that at least one of our films was quite short (only 22 *sec*).

SCL provides an index of sweat gland activity at the surface of the skin in microsiemens (μS). This index was measured using two reusable electrodes filled with isotonic recording gel that were placed on the middle phalange of the first and third fingers of the nondominant hand, and secured with Velcro straps and medical tape. Increased physiological arousal is indicated by higher levels of SCL.

Mean reactivity levels were calculated for both IBI and SCL by subtracting the mean of the 1-minute prefilm baseline from mean responses during each film. For IBI, negative IBI change scores indicate less time between heartbeats (faster heart rate or cardiac acceleration) in response to the film relative to the preceding baseline. Conversely, positive change scores indicate greater time between heartbeats during the film (slower heart rate) relative to the preceding baseline period and thus a cardiac deceleration—a typical response associated with disgust. Therefore, positive change scores for IBI reflect the expected response to disgust, with higher positive scores indicative of a stronger response. To the extent that regulation induces greater sympathetic activation, we therefore would expect smaller increases in IBI—namely, smaller yet still positive values—in the regulation conditions (and qualified by interactions with culture). For SCL, positive change scores indicate greater SCL activation during the film relative to the preceding baseline period—which is the typical response to disgust for SCL—whereas negative change scores indicate less activation to the film. These change scores allowed us to account for individual differences in baseline IBI and SCL.

Data Analytic Approach

Our first step was to conduct a manipulation check by comparing the emotional behavior of participants in the watch condition and the two regulation conditions (there were no behavioral data for the neutral film condition). Successful implementation of the manipulation would predict that behavioral expressions of disgust would be highest in the amplification condition and lowest in the suppression condition, with the watch condition falling in between.

Next, to examine differences in self-reported disgust and physiology we employed a 2 (Culture: Asian American, European American) × 3 (Condition: neutral, suppression, amplification) repeated measures analysis of variance (ANOVA) with emotion regulation condition as a within-subjects variable and culture as a between subjects variable for self-reported disgust and each of our physiological measures (IBI and SCL change scores). We expected to find no differences in self-reported disgust, but hypothesized a Culture × Condition interaction for physiology, whereby cultural differences would emerge in the regulation conditions, but not the neutral film condition.

We included the neutral film as the comparison of choice in these analyses so that we could examine the effects of regulation versus no regulation, given that the neutral film was not likely to evoke any significant negative emotion and would therefore be unlikely to result in any regulation efforts. By contrast, the watch condition was expected to be a powerful disgust elicitor which may or may not have triggered spontaneous or automatic regulation efforts (Mauss et al., 2007). We ran a duplicate set of analyses for self-report and physiology that also included the watch condition and our main effect and interaction results as reported here were unchanged.

Finally, across the different sets of analyses there were different degrees of missing data. In general, missing data were due largely to hardware and/or software malfunction or experimenter error that affected either self-report, behavioral, or physiological data. These errors were distributed equally across the two groups. This resulted in specific analyses having between 21 and 31 participants per group for the different comparisons made (i.e., total sample size for the analyses ranged from $N = 44$ to $N = 59$, where the latter reflects the complete sample).

Results

Manipulation Check: Emotional Behavior

In order to gauge the success of the emotion regulation manipulation, we analyzed participant disgust behavior using repeated measures ANOVA, with condition (watch, suppression, amplification) included as a within-subjects variable. This analysis revealed a significant condition effect, $F(2, 106) = 31.58$, $p < .001$, $\eta^2 = .37$. Overall, participants were following the directions of the manipulation: the least amount of disgust was displayed in the suppression condition ($M = .33$, $SD = .67$), the most disgust in the amplification condition ($M = 1.47$, $SD = .98$), and an intermediate amount during the watch condition ($M = .89$, $SD = .97$). However, these effects were qualified by a significant Culture × Condition interaction, $F(1, 106) = 4.18$, $p = .02$, $\eta^2 = .03$. Follow-up pairwise comparisons revealed that European Americans displayed more disgust ($M = 1.71$, $SD = 1.04$) in the amplification condition than Asian Americans ($M = 1.09$, $SD = .88$), $t(53) = 2.37$, $p = .02$, $d = .62$. The two groups did not differ in the watch and suppression conditions. There was no main effect of culture, $F(1, 53) = 1.83$, $p = .18$, $\eta^2 = .03$. Thus, the manipulation worked as expected, with the amplification condition perhaps working particularly well for European Americans.

Self-Reported Disgust

Asian Americans were expected to report equal levels of disgust relative to European Americans in both the suppression and amplification conditions, given that the manipulation only targeted behavioral expression and not subjective experience. We conducted a 2 (Culture: Asian American, European American) × 3 (Condition: neutral, suppression, amplification) repeated measures ANOVA with emotion regulation condition as a within-subjects variable to test this hypothesis. As noted earlier, we included the neutral film in these

and all further analyses given the potential difficulty in interpreting findings from the "watch" condition. In support of our hypotheses, there was not a significant Culture x Condition interaction, $F(2, 92) = .99$, $p = .38$, $\eta^2 = .02$, nor was there a main effect of culture, $F(1, 46) = .27$, $p = .61$, $\eta^2 = .01$. There was, however, a significant main effect of condition, $F(2, 92) = 44.03$, $p < .001$, $\eta^2 = .37$. Follow up tests indicated that participants reported feeling significantly more disgust in the suppression ($M = 2.63$, $SD = 2.45$) than the neutral condition ($M = .40$, $SD = .82$), $t(47) = 6.77$, $p < .001$, and more disgust in the amplification ($M = 2.83$, $SD = 2.45$) than the neutral condition, $t(47) = 7.54$, $p < .001$. There were no differences in self-reported disgust between the suppression and amplification conditions, $t(47) = 1.12$, $p = .27$. Thus, these analyses confirmed our expectation that the disgust films would elicit more disgust than the neutral clip, and that the subjective experience of disgust would not vary by cultural group in either regulation condition.

Physiological Reactivity

Before proceeding with our main physiological analyses, we first tested for baseline differences in IBI and SCL between groups in order to understand the nature of any preexisting differences in resting physiology. There were no cultural group differences in IBI during the resting baselines prior to the neutral film or either of the regulation films (all $ps > .34$). In contrast, European Americans showed higher SCL than Asian Americans during all three prefilm baselines (all $ps < .005$). As noted earlier, our primary analyses used change scores (from baseline to the film) to examine physiological reactivity, allowing us to account for preexisting individual or group baseline differences.

Next, two 2 (Culture: European American, Asian American) × 3 (Condition: neutral, suppression, amplification) repeated measures ANOVAs with condition as a within subjects factor were conducted using the IBI and SCL change scores as the dependent variables. Contrary to our hypotheses, the analysis of the IBI change scores revealed no Culture × Condition interaction, $F(2, 86) = .02$, $p = .98$, $\eta^2 < .001$. There was also no main effect of culture, $F(2, 43) = .18$, $p = .67$, $\eta^2 < .001$. However, analyses of the IBI change scores yielded a significant main effect of condition, $F(2, 86) = 20.47$, $p < .001$, $\eta^2 = .32$. Follow up analyses revealed that the IBI change scores were significantly lower in the neutral condition ($M = -20.96$, $SD = 41.6$) relative to the suppression condition ($M = 41.59$, $SD = 58.66$), $t(44) = -5.94$, $p < .001$ and the amplification condition ($M = 7.84$, $SD = 59.01$), $t(44) = -2.85$, $p < .01$. There was also a significant difference in IBI change scores between suppression ($M = 39.59$, $SD = 61.24$) and amplification ($M = 7.71$, $SD = 60.55$), $t(47) = 3.97$, $p < .001$. The negative change score in the neutral condition relative to the positive change scores in the two regulation conditions indicates that participants showed a cardiac acceleration (increased heart rate) from baseline to film in the neutral condition. Participants demonstrated a pronounced cardiac deceleration in the suppression condition and a significantly smaller cardiac deceleration in the amplification condition. Therefore, we see an IBI response that is consistent with disgust in the two regulation conditions (i.e., slower heart rate) and this pattern does not vary by cultural group (see Figure 1a).

Consistent with our hypothesis, analyses of the SCL change scores yielded a significant Culture × Condition interaction, $F(2, 88) = 4.75$, $p = .01$, $\eta^2 = .10$. This significant interaction qualified a significant effect of condition, $F(2, 88) = 9.84$, $p < .001$, $\eta^2 = .18$ and a marginal main effect of culture, $F(1, 44) = 3.58$, $p = .07$, $\eta^2 = .08$. To further unpack the interaction, follow-up pairwise comparisons by group revealed that although there were no cultural group differences in SCL change scores in the neutral condition ($M = .02$, $SD = .13$ for EA vs. $M = .07$, $SD = .24$ for AA), $t(55) = 0.94$, $p = .35$, $d = 0.05$, European Americans showed higher SCL reactivity (i.e., greater activation during film relative to baseline) than Asian Americans both in the suppression condition ($M = .19$, $SD = .23$ vs. $M = .05$, $SD = .14$), $t(39.8) = 2.57$, $p = .01$, $d = .14$, and in the amplification condition ($M = .24$, $SD = .21$ vs. $M = .11$, $SD = .13$), $t(45) = 2.52$, $p = .02$, $d = .13$. Although we did not make predictions about the relative change in physiology from the neutral to the regulation conditions within subjects, we examined these means within each group to further understand the pattern of physiological reactivity. European Americans demonstrated significantly greater SCL reactivity during suppression ($M = .19$, $SD = .23$) relative to the neutral condition ($M = .02$, $SD = .14$), $t(23) = 3.79$, $p = .001$, $d = .18$, and during amplification ($M = .23$, $SD = .22$) relative to the neutral condition, $t(23) = 4.93$, $p < .001$, $d = .22$. No difference in SCL reactivity was observed between suppression and amplification for European Americans. Among Asian Americans the change in SCL reactivity was not significantly different among any of the three conditions (see Figure 1b).

Additional Analyses: Correlations Among Emotion Measures

The divergence in physiological findings between European Americans and Asian Americans relative to the lack of differences in expressed disgust behavior and self-reported disgust suggested that the degree of coherence between physiology and these other channels may vary across cultural groups. Although our sample was rather small for correlational analyses of this type, we conducted an exploratory examination of the degree of coherence between physiology (IBI and SCL change scores) and disgust behavior and self-report by condition separately for each group. For European Americans, more disgust behavior during the suppression condition was related to greater SCL change in response to the suppression film, $r(24) = .48$, $p = .02$, and to smaller IBI change scores, $r(24) = -.48$, $p = .02$, indicating relatively faster heart rate (either cardiac acceleration or less cardiac deceleration). For Asian Americans, disgust behavior during the suppression condition was unrelated to either SCL change, $r(19) = .14$, $p = .58$, or IBI change, $r(20) = -.18$, $p = .46$. Disgust behavior during amplification was not related to physiology for either group (all $ps > .26$). Similarly, self-reported disgust during suppression and amplification was unrelated to physiology in their respective conditions across both groups (all $ps > .26$).

Discussion

The current work sought to extend the small but growing body of research examining how engaging in particular emotion regulation strategies might relate to different physiological consequences for European Americans and Asian Americans in an experimental setting (Butler et al., 2007; Mauss & Butler, 2009; Soto et al., 2011). In the present study, we included an opportunity for participants to downregulate their emotional behavior (suppression) and also upregulate their emotional behavior (amplification). Including both of these regulation conditions was critical to the interpretation of our findings, as we found evidence of divergence in physiological responding to both suppression *and* amplification, suggesting that *any* regulation effort might lead to physiological divergence

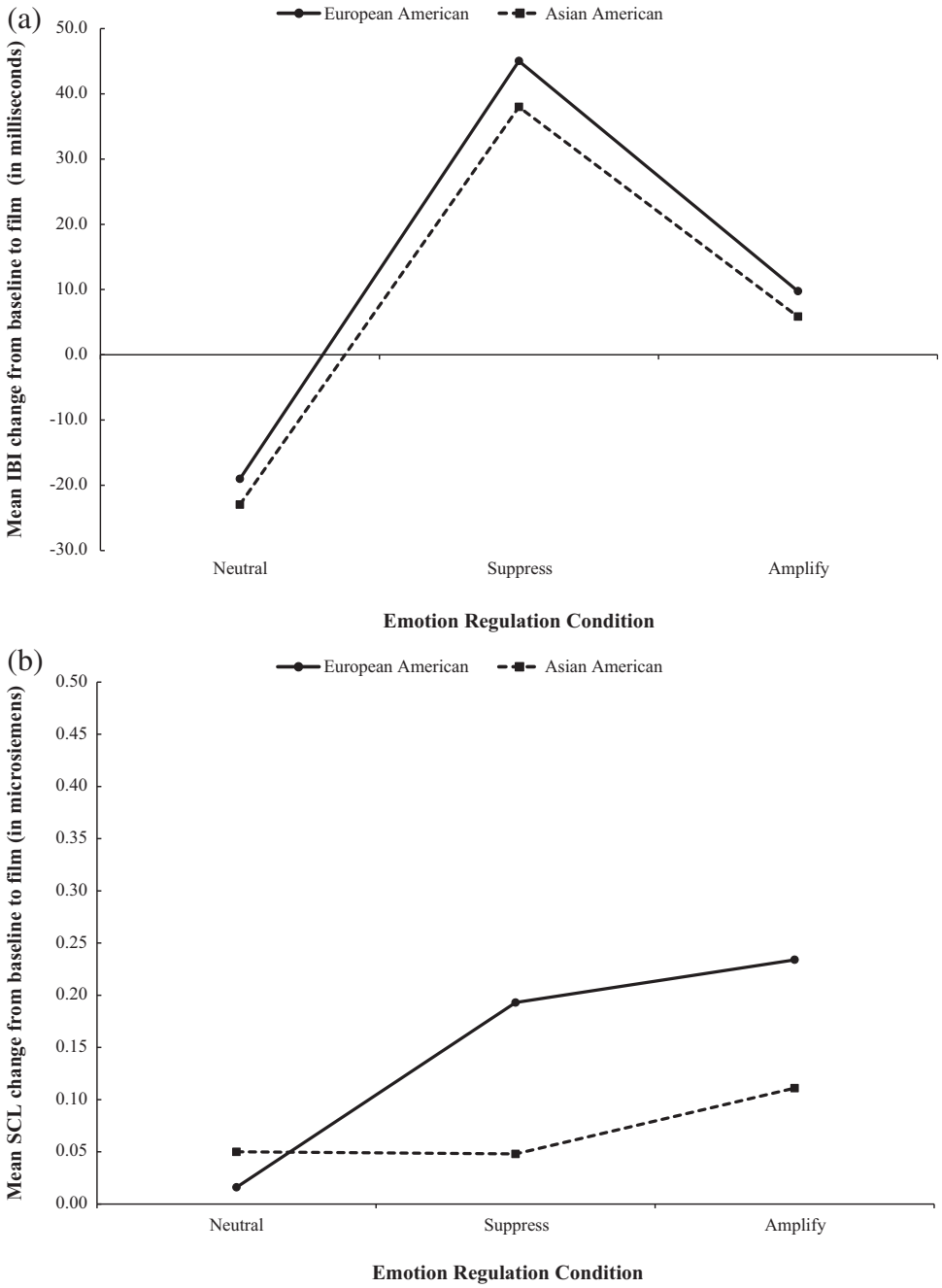

Figure 1. (a) Mean change in IBI responses (*ms*) from baseline to film during neutral, suppression, and amplification conditions for Asian Americans and European Americans. Negative scores reflect decreases in IBI from baseline to film, indicating cardiac acceleration (faster heart rate). Positive scores reflect increases in IBI from baseline to film, or cardiac deceleration (slower heart rate). **(b)** Mean change in SCL responses (μ*S*) from baseline to film during neutral, suppression, and amplification conditions for Asian Americans and European Americans. Positive scores indicate increases in SCL response from baseline to film, and therefore greater sympathetic activity.

between these two groups. The fact that these physiological differences emerged in conjunction with no differences in subjective reports provides preliminary evidence of cultural differences in brain–behavior relationships.

Cultural Differences in Suppression and Amplification

In support of our hypothesis, European Americans experienced greater SCL reactivity (greater increases in skin conductance levels from baseline to film) compared to Asian Americans during the suppress condition. This finding is consistent with the notion that suppression is nonnormative for European Americans and thus should be more taxing (Engebretson et al., 1989). We found this despite evidence that the subjective reports and behavioral expressions of disgust did not differ across groups in the suppression condition, consistent with previous research (Roberts et al., 2008). Importantly, these differences in SCL reactivity were above and beyond the observed baseline differences between the two groups. Therefore, while baseline differences between the two groups could be attributable to factors such as skin pigmentation differences—

even though such differences have been found more consistently when comparing European Americans with African Americans (Bouscein, 1993), rather than with Asian Americans (see Levenson, Soto, & Pole, 2007)—it is unlikely that the SCL differences in response to the regulation films were due to race-based, rather than culture-based, differences.

Contrary to our hypothesis, when examining change in cardiac IBI from baseline to film, we did not find evidence of greater physiological activation associated with suppression for European Americans relative to Asian Americans. These findings also replicate those of Roberts and colleagues (2008) who examined four different ethnic groups in their response to disgust and found no differences across groups. Thus, it is possible that the cardiac response to suppression may be less susceptible to variation across cultural lines, at least when it comes to suppressing disgust, whereas electrodermal responses may be more sensitive.

With regard to the physiological responses during amplification, we again found that European Americans showed significantly greater SCL reactivity than Asian Americans, and that there were no differences between groups in IBI. The SCL finding ran counter to our prediction that Asian Americans would demonstrate greater increases in SCL relative to European Americans during amplification because strong expression of emotions is inconsistent with the norms of this group (Markus & Kitayama, 1991; Tsai, 2007). One possible explanation for this difference in physiological responding is that it reflects greater physical exertion associated with European Americans' greater facial disgust behavior relative to Asian Americans in the amplification condition. This rationale, however, is inconsistent with the fact that European Americans also showed greater SCL reactivity in the suppression condition, during which the groups showed no differences in expressive behavior.

Another possibility suggested by the pattern that groups showed SCL differences in the suppression and amplification conditions but not the neutral condition is that instructed regulation, in general, may be more cognitively taxing or psychologically effortful for European Americans whose emotional norms encourage free (as opposed to regulated) expression. Adjusting one's emotions due to external demands is far more common among Asian Americans (e.g., to maintain interpersonal harmony; Markus & Kitayama, 1991) and may thus be less psychologically taxing or effortful. This is consistent with previous findings pointing to neurophysiological divergence during suppression between these two groups (Murata et al., 2013). Therefore, the SCL findings may represent another true divergence in the physiological consequences of external demands for emotion regulation. This conclusion is somewhat bolstered by the findings that SCL and disgust behavior demonstrated good coherence in the suppression condition for European Americans, but not for Asian Americans. That this pattern of different SCL results was found among two cultural groups that, in the present sample, likely possessed several commonalities given their shared environmental context (e.g., both living and attending college in a predominantly White, rural setting) suggests that a comparison of groups in more disparate contexts (e.g., European Americans in the United States and Asians in Asia) could yield even greater divergence in physiology.

Somewhat unexpectedly, we found that European Americans displayed higher amounts of disgust behavior than Asian Americans when asked to amplify their disgust expression. We expected that the artificial quality of the instructed changes in expressive behavior would lead to similar degrees of expressive behavior. However, European Americans may simply be more comfortable and practiced at providing clear and unambiguous displays of their emotions given cultural norms within this group (Bellah et al., 1985). Although we do not believe exaggerated expression is the same as routine or even disinhibited emotion expression, it perhaps is more similar to a normative model of free expression than a norm of emotion suppression or moderation would be. Thus, our instructions may simply have provided a platform for European Americans to demonstrate this more practiced skill of emotion expression, and may have been a greater challenge for the Asian Americans in our sample, especially given that all of our behavior coders were European American.

The Physiology of Suppression and Amplification

It is worth noting that across both groups, examination of the IBI data demonstrated a familiar pattern of change in physiological response during disgust relative to a neutral film (i.e., greater cardiac deceleration from baseline to film; Demaree et al., 2006; Kunzmann et al., 2005). Furthermore, the increased magnitude of deceleration during the suppression condition relative to the amplification condition is also consistent with prior data indicating that suppression is associated with slowing of the heart when compared to those who are able to express themselves freely (Gross & Levenson, 1993, 1997). Somewhat in contrast to the findings by Kunzmann and colleagues (2005) and Demaree and colleagues (2006), however, we also saw a cardiac deceleration in the amplification condition as opposed to a cardiac acceleration, albeit a less pronounced one. We suspect that our findings reflect the counteracting effects of a pronounced subjective experience of disgust (as indicated by the self-report) which would be associated with a strong cardiac deceleration, coupled with sympathetic activation associated with amplification (leading to cardiac acceleration).

The pattern of change in SCL from baseline to film in the neutral, suppression and amplification conditions was consistent with previous literature for European Americans, but not for Asian Americans. Studies of both suppression and amplification have largely pointed to increased skin conductance associated with both of these regulation strategies, although this response may vary depending on the specific emotion studied (Gross & Levenson, 1997). The lack of difference in SCL change scores between the suppression and amplification conditions, as shown by both groups in our sample, is also a point of continuity with the findings of Kunzmann and colleagues (2005). Thus, when taken as a whole, findings from our European Americans show much agreement with previous studies examining the physiological consequences of suppression and amplification, but the pattern of SCL reactivity (or lack thereof) among Asian Americans represents a departure from previous literature.

Limitations and Future Directions

One possible concern regarding our data is that the final sample may have ultimately been too small. Missing data resulted in the exclusion of participant data which compromised our power. Thus, estimates of effect size provided in this study may be more informative than the actual tests of significance. That said, our sample size per cell is still slightly larger than the sample size per cell used in previous studies using a similar methodology, but with a between group design (see Demaree et al., 2006). Our use of a within-subjects design therefore helps to compensate for the loss in

power resulting from missing data, and our power may therefore be quite comparable to that reported in previously published work.

Several issues related to the psychophysiological findings are worth noting. First, as is common with psychophysiological studies, findings were not consistent across our two measures (SCL and IBI) suggesting that additional research using multiple physiological indicators may be useful for understanding the specific channels for which the consequences of emotion regulation converge and diverge across cultural groups. Second, although accounted for in our primary analyses, the presence of consistent baseline differences in SCL between European Americans relative to Asian Americans might be indicative of other trait differences related to reactivity between our groups that may have indirectly influenced our findings. Third, our findings cannot fully disentangle what part of the physiological response was due to the often-potent response elicited by disgust and what part was due to the instructed behavioral regulation (Kappas, 2011). This also limited our ability to use the "watch" condition (a disgust film without regulation instructions) as a point of comparison, given that spontaneous regulation may have been occurring during this viewing. Being able to more definitively separate these aspects of the physiological emotional response would be a difficult but worthwhile endeavor.

From an emotion research perspective, we felt that a strength of our study was its inclusion of both suppression and amplification in the same study. Nevertheless, it may also be fruitful to study additional forms of emotion regulation in future research. For example, examining the consequences of reappraisal versus suppression may be an interesting comparison. We suspect that such a study would reveal few or no group differences in physiological reactions to reappraisal, given that there appears to be greater consistency in how Asian and European American groups endorse the use of this strategy relative to suppression (see Soto et al., 2012); the subjective or behavioral consequences of reappraisal might, however, reveal subtle differences. Future work should also include specific measures about emotion values and beliefs in order to understand more fully the influence of culture on the hypothesized mechanisms. Although we employed careful eligibility criteria, we also relied on cultural group membership to reflect these beliefs. Finally, although the focus of this research was on cultural differences in the consequences of emotion regulation, the lack of attention to gender remains a limitation of the present study. Given strong gender norms around appropriate displays and experiences of emotion, examining the effects of gender and possible interactions between culture and gender would be prudent for future studies.

Conclusion

The current work demonstrates some of the complexity involved in investigating the consequences of emotion regulation given the existence of contrasting cultural norms around emotions and their expression. Although any given emotion regulation strategy may be considered normative and adaptive for a particular group, how those benefits are manifested may be equally diverse, which highlights the importance of employing a mixed methods approach to capturing the effects of emotion regulation. Further, our work highlights the importance of examining the variation in physiological response due to cultural factors. Ultimately, we saw some support for the predictions regarding suppression's benefits for Asian Americans. This relative benefit, in the form of reduced physiological reactivity, appears to extend to other types of emotion regulation as well. Had we only examined European Americans (or Asian Americans), we may have incorrectly come to the conclusion that engaging in either expressive suppression or amplification is "universally" associated with heightened SCL arousal (or no change at all). Thus, the subtle nuances that were captured by our cultural comparison can have a drastic impact on interpretation of data. Theories regarding the consequences of emotion regulation strategies should therefore account for the diversity of cultural norms surrounding emotion and consider multiple outcomes related to the enactment of emotion regulation strategies, given that the current study showed that groups feeling similarly may nevertheless diverge in their physiological manifestations of those same emotional experiences.

References

Adams, R. B. Jr., Rule, N. O., Franklin, R. G. Jr., Wang, E., Stevenson, M. T., Yoshikawa, S., … Ambady, N. (2010). Cross-cultural reading the mind in the eyes: An fMRI investigation. *Journal of Cognitive Neuroscience*, *22*, 97–108. doi: http://dx.doi.org/10.1162/jocn.2009.21187

Bellah, R. N., Madsen, R., Sullivan, W. M., Swindler, A., & Tipton, S. M. (1985). *Habits of the heart: Individualism and commitment in American life*. New York: Harper & Row. doi: 10.2307/1903616

Bouscein, W. (1993). Methodological issues in electrodermal measurement. In J.-C. Roy, W. Bouscein, D. C. Fowles, & J. H. Gruzelier (Eds.), *Progress in electrodermal research* (pp. 31–41). New York: Springer US. doi: 10.1007/978-1-4615-2864-7_3

Breuer, J., & Freud, S. (1957). *Studies on hysteria*. Oxford, UK: Basic Books.

Brosschot, J. F., Van Dijk, D., & Thayer, J. F. (2007). Daily worry is related to low heart rate variability during waking and the subsequent nocturnal sleep period. *International Journal of Psychophysiology*, *63*, 39–47. doi: 10.1016/j.ijpsycho.2006.07.016

Burns, J. W., Quartana, P. J., & Bruehl, S. (2007). Anger management style moderates effects of emotion suppression during initial stress on pain and cardiovascular responses during subsequent pain-induction. *Annals of Behavioral Medicine*, *34*, 154–165. doi: 10.1097/PSY.0b013e318199d97f

Butler, E. A., Egloff, B., Wilhelm, F. H., Smith, N. C., Erikson, E. A., & Gross, J. J. (2003). The social consequences of expressive suppression. *Emotion*, *3*, 48–67. http://dx.doi.org/10.1037/1528-3542.3.1.48

Butler, E. A., & Gross, J. J. (2009). Emotion and emotion regulation: Integrating individual and social levels of analysis. *Emotion Review*, *1*, 86–87. doi: 10.1177/1754073908099131

Butler, E. A., Lee, T. L., & Gross, J. J. (2007). Emotion regulation and culture: Are social consequences of emotion suppression culture-specific? *Emotion*, *7*, 30–48. http://dx.doi.org/10.1037/1528-3542.7.1.30

Chentsova-Dutton, Y. E., Chu, J. P., Tsai, J. L., Rottenberg, J., Gross, J. J., & Gotlib, I. H. (2007). Depression and emotional reactivity: Variation among Asian Americans of East Asian descent and European Americans. *Journal of Abnormal Psychology*, *116*, 776–785. http://dx.doi.org/10.1037/0021-843X.116.4.776

Chentsova-Dutton, Y. E., Tsai, J. L., & Gotlib, I. H. (2010). Further evidence for the cultural norm hypothesis: Positive emotion in depressed and control European American and Asian American women. *Cultural Diversity and Ethnic Minority Psychology*, *16*, 284–295. doi: 10.1037/a0017562

Cheung, R. Y. M., & Park, I. J. K. (2010). Anger suppression, interdependent self-construal, and depression among Asian American and European American college students. *Cultural Diversity and Ethnic Minority Psychology*, *16*, 517–525. doi: 10.1037/a0020655

Chiao, J. Y., & Blizinsky, K. D. (2010). Culture-gene coevolution of individualism-collectivism and the serotonin transporter gene (5-HTTLPR). *Proceedings of the Royal Society B: Biological Sciences*, *277*, 529–537. doi: 10.1098/rspb.2009.1650

Consedine, N. S., Magai, C., & Bonanno, G. A. (2002). Moderators of the emotion inhibition–health relationship: A review and research agenda.

Review of General Psychology, *6*, 204–228. http://dx.doi.org/10.1037/1089-2680.6.2.204

Demaree, H. A., Schmeichel, B. J., Robinson, J. L., Pu, J., Everhart, D. E., &Berntson, G. G. (2006). Up- and down-regulating facial disgust: Affective, vagal, sympathetic, and respiratory consequences. *Biological Psychology*, *71*, 90–99. doi:10.1016/j.biopsycho.2005.02.006

Dorr, N., Brosschot, J. F., Sollers, J. J., & Thayer, J. F. (2007). Damned if you do, damned if you don't: The differential effect of expression and inhibition of anger on cardiovascular recovery in Black and White males. *International Journal of Psychophysiology*, *66*, 125–134. doi: 10.1016/j.ijpsycho.2007.03.022

Ekman, P., & Friesen, W. V. (1978). *Facial action coding system: A technique for the measurement of facial movement*. Palo Alto, CA: Consulting Psychologists Press.

Ekman, P., Friesen, W. V., & Ancoli, S. (1980). Facial signs of emotional experience. *Journal of Personality and Social Psychology*, *39*, 1125–1134. http://dx.doi.org/10.1037/h0077722

Engebretson, T. O., Matthews, K. A., & Scheier, M. F. (1989). Relations between anger expression and cardiovascular reactivity: Reconciling inconsistent findings through a matching hypothesis. *Journal of Personality and Social Psychology*, *57*, 513–521. http://dx.doi.org/10.1037/0022-3514.57.3.513

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: Implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology*, *85*, 348–362. http://dx.doi.org/10.1037/0022-3514.85.2.348

Gross, J. J., & Levenson, R. W. (1993). Emotional suppression: Physiology, self-report, and expressive behavior. *Journal of Personality and Social Psychology*, *64*, 970–986. http://dx.doi.org/10.1037/0022-3514.64.6.970

Gross, J. J. & Levenson, R. W. (1997). Hiding feelings: The acute effects of inhibiting positive and negative emotions. *Journal of Abnormal Psychology*, *106*, 95–103. http://dx.doi.org/10.1037/0021-843X.106.1.95

Gross, J. J., & Muñoz, R. F. (1995). Emotion regulation and mental health. *Clinical Psychology: Science and Practice*, *2*, 151–164. doi: 10.1111/j.1468-2850.1995.tb00036.x

Hokanson, J. E., Willers, K. R., & Koropsak, E. (2006). The modification of autonomic responses during aggressive interchange. *Journal of Personality*, *36*, 403–404. doi: 10.1111/j.1467-6494.1968.tb01481.x

John, O. P., & Gross, J. J. (2004). Healthy and unhealthy emotion regulation: Personality processes, individual differences, and lifespan development. *Journal of Personality*, *72*, 1301–1334. doi: 10.1111/j.1467-6494.2004.00298.x

Kappas, A. (2011). Emotion and regulation are one! *Emotion Review*, *3*, 17–25. doi: 10.1177/1754073910380971

Kim, H. S., & Sasaki, J. Y. (2012). Emotion regulation: The interplay of culture and genes. *Social and Personality Psychology Compass*, *6*, 865–877. doi: 10.1111/spc3.12003

Kitayama, S., & Uskul, A. K. (2011). Culture, mind, and the brain: Current evidence and future directions. *Annual Review of Psychology*, *62*, 419–449. doi: 10.1146/annurev-psych-120709-145357

Krantz, D. S., & Manuck, S. B. (1984). Acute psychophysiological reactivity and risk of cardiovascular disease: A review and methodological critique. *Psychological Bulletin*, *96*, 435–464. http://dx.doi.org/10.1037/0033-2909.96.3.435

Kunzmann, U., Kupperbusch, C. S., & Levenson, R. W. (2005). Behavioral inhibition and amplification during emotional arousal: A comparison of two age groups. *Psychology and Aging*, *20*, 144–158. http://dx.doi.org/10.1037/0882-7974.20.1.144

Lai, J. Y., & Linden, W. (1992). Gender, anger expression style, and opportunity for anger release determine cardiovascular recovery from anger provocation. *Psychosomatic Medicine*, *54*, 297–310. doi: 10.1097/00006842-199205000-00006

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*, 224–253. doi:10.1037/0033-295x.98.2.224

Markus, H. R., Mullally, P. R., & Kitayama, S. (1997). Selfways: Diversity in modes of cultural participation. In U. Neisser & D. A. Jopling (Eds.), *The conceptual self in context: Culture, experience, self-understanding. The Emory symposia in cognition* (pp. 12–61). New York: Cambridge University Press.

Mathur, V. A., Harada, T., & Chiao, J. Y. (2012). Racial identification modulates default network activity for same and other races. *Human Brain Mapping*, *33*, 1883–1893. doi: 10.1002/hbm.21330

Mauss, I. B., Bunge, S. A., & Gross, J. J. (2007). Automatic emotion regulation. *Social and Personality Psychology Compass*, *1*, 146–167. doi: 10.1111/j.1751-9004.2007.00005.x

Mauss, I. B., & Butler, E. A. (2009). Cultural context moderates the relationship between emotion control values and cardiovascular challenge versus threat responses. *Biological Psychology*, *84*, 521–530. doi: 10.1016/j.biopsycho.2009.09.010

Mauss, I. B., Butler, E. A., Roberts, N. A., & Chu, A. (2010). Emotion control values and responding to an ager provocation in Asian-American and European-American individuals. *Cognition and Emotion*, *24*, 1026–1043. doi: 10.1080/02699930903122273

Murata, A., Moser, J. S., & Kitayama, S. (2013). Culture shapes electrocortical responses during emotion suppression. *Social Cognitive and Affective Neuroscience*, *8*, 595–601. doi: 10.1093/scan/nss036

Noh, S., Beiser, M., Kaspar, V., Hou, F., & Rummens, A. (1999). Perceived racial discrimination, depression, and coping: A study of Southeast Asian refugees in Canada. *Journal of Health and Social Behavior*, *40*, 193–207. doi: 10.2307/2676348

Park, I. J. K., Sulaiman, C., Schwartz, S. J., Kim, S. Y., Ham, L. S., & Zamboanga, B. L. (2011). Self-construals and social anxiety among Asian American college students: Testing emotion suppression as a mediator. *Asian American Journal of Psychology*, *2*, 39–50. http://dx.doi.org/10.1037/a0023183

Pennebaker, J. W., & Beall, S. K. (1986). Confronting a traumatic event: Toward an understanding of inhibition and disease. *Journal of Abnormal Psychology*, *95*, 274–281. http://dx.doi.org/10.1037/0021-843X.95.3.274

Pennebaker, J. W., & Francis, M. E. (1996). Cognitive, emotional, and language processes in disclosure. *Cognition and Emotion*, *10*, 601–626. doi: 10.1080/026999396380079

Pennebaker, J. W., & Seagal, J. D. (1999). Forming a story: The health benefits of narrative. *Journal of Clinical Psychology*, *55*, 1243–1254. doi: 10.1002/(SICI)1097-4679(199910)55:10 < 1243::AID-JCLP6 > 3.0.CO;2-N

Perez, C. R., & Soto, J. A. (2011). Cognitive reappraisal in the context of oppression: Implications for psychological functioning. *Emotion*, *11*, 675–680. doi: 10.1037/a0021254

Petrie, K. J., Booth, R. J., & Pennebaker, J. W. (1998). The immunological effects of thought suppression. *Journal of Personality and Social Psychology*, *75*, 1264–1272. http://dx.doi.org/10.1037/0022-3514.75.5.1264

Polivy, J. (1998). The effects of behavioral inhibition: Integrating internal cues, cognition, behavior and affect. *Psychological Inquiry*, *9*, 181–204. doi: 10.1207/s15327965pli0903_1

Richards, J. M., & Gross, J. J. (2000). Emotion regulation and memory: The cognitive costs of keeping one's cool. *Journal of Personality and Social Psychology*, *79*, 410–424. http://dx.doi.org/10.1037/0022-3514.79.3.410

Roberts, N. A., Levenson, R. W., & Gross, J. (2008). Cardiovascular costs of emotion suppression cross ethnic lines. *International Journal of Psychophysiology*, *70*, 82–87. doi: 10.1016/j.ijpsycho.2008.06.003

Ryder, A. G., Ban, L. M., & Chentsova-Dutton, Y. E. (2011). Toward a cultural-clinical psychology. *Social and Personality Psychology Compass*, *5*, 960–975. doi: 10.1111/j.1751-9004.2011.00404.x

Soto, J. A., Chentsova-Dutton, Y., & Lee, E. A. (2012). The interplay of culture and relationships in maintaining health. In M. Newman & N. Roberts (Eds.), *Health and social relationships: The good, the bad, and the complicated* (pp. 189–212). Washington, DC: American Psychological Association.

Soto, J. A., & Levenson, R. W. (2009). Emotion recognition across cultures: The influence of ethnicity on empathic accuracy and physiological linkage. *Emotion*, *9*, 874–884. doi: http://dx.doi.org/10.1037/a0017399

Soto, J. A., Levenson, R. W., & Ebling, R. (2005). Cultures of moderation and expression: Emotional experience, behavior, and physiology in Chinese Americans and Mexican Americans. *Emotion*, *5*, 154. doi: http://dx.doi.org/10.1037/1528-3542.5.2.154

Soto, J. A., Perez, C. R., Kim, Y.-H., Lee, E. A., & Minnick, M. R. (2011). Is expressive suppression always associated with poorer psychological functioning? A cross-cultural comparison between European Americans and Hong Kong Chinese. *Emotion*, *11*, 1450–1455. http://dx.doi.org/10.1037/a0023340

Spera, S. P., Buhrfeind, E. D., & Pennebaker, J. W. (1994). Expressive writing and coping with job loss. *Academy of Management Journal*, *37*, 722–733. doi: 10.2307/256708

Suchday, S., & Larkin, K. T. (2004). Psychophysiological responses to anger provocation among Asian Indian and White men. *International Journal of Behavioral Medicine*, *11*, 71–80. doi: 10.1207/s15327558ijbm1102_2

Su, J. C., Lee, R. M., & Oishi, S. (2013). The role of culture and self-construal in the link between expressive suppression and depressive symptoms. *Journal of Cross-Cultural Psychology*, *44*, 316–331. doi: 10.1177/0022022112443413

Tang, Y., Zhang, K., Chen, S., Feng, S., Ji, Y., Shen, J., . . . Liu, Y. (2006). Arithmetic processing in the brain shaped by cultures. *Proceedings of the National Academy of Sciences, USA*, *103*, 10775–10780. doi: 10.1073/pnas.0604416103

Tsai, J. L. (2007). Ideal affect: Cultural causes and behavioral consequences. *Perspectives on Psychological Science*, *2*, 242–259. doi: 10.1111/j.1745-6916.2007.00043.x

Tsai, J. L., Chentsova-Dutton, Y., Freire-Bebeau, L., & Przymus, D. E. (2002). Emotional expression and physiology in European Americans and Hmong Americans. *Emotion*, *2*, 380–397. http://dx.doi.org/10.1037/1528-3542.2.4.380

Wenzlaff, R. M., Rude, S. S., Taylor, C. J., Stultz, C. H., & Sweatt, R. A. (2001). Beneath the veil of thought suppression: Attentional bias and depression risk. *Cognition and Emotion*, *15*, 435–452. doi: 10.1080/02699930125871

(Received November 11, 2014; Accepted August 21, 2015)