Cultural Influences in Somatosensory Amplification and Their Association with Negative

Affective States

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Abstract

Previous research has indicated that, reflecting East Asians' holistic attentional style, they are likely to emphasize more somatic symptoms and perceive their internal visceral states less accurately compared with Westerners. Based on these findings, comparing representative samples of Americans and Japanese participants, this research examined whether somatosensory amplification would vary across cultures. Moreover, by controlling for confounding factors, including neuroticism and chronic disorders, the possibility that the association between somatosensory amplification and negative affective states differs across cultures was also tested. The results showed that Japanese exhibit higher somatosensory amplification than Americans do. In both cultures, as neuroticism and the number of chronic disorders increased, negative affective states also increased, leading to higher somatosensory amplification. Whereas negative affective states completely mediated the paths of neuroticism and chronic disorders to somatosensory amplification in the US, such mediation was partial in Japan. Moreover, the association between somatosensory amplification and negative affective states was weaker in Japanese than in Americans.

Keywords: culture; somatosensory amplification; negative affective states; chronic disorders; neuroticism

Evidence suggests that the shared ideas and beliefs and scripted behavioral patterns of norms in a culture influence various psychological processes, including self-perception (e.g., Kanagawa, Cross, & Markus, 2001), cognition (e.g., Nisbett, Peng, Choi, & Norenzayan, 2001), and mental and physical health (e.g., Kitayama et al., 2015; Ryder et al., 2008). Despite a growing number of studies addressing cultural differences in psychological processes, few have investigated cultural influences in somatic awareness. Do cultures influence the extent to which individuals pay attention to their bodies? Do cultures moderate the effects of related factors such as psychological distress on somatic awareness? The present research asks these questions, focusing on somatosensory amplification and using two nationally representative samples from the US and Japan.

Barsky, Goodson, Lane, and Cleary (1988) proposed that somatosensory amplification indicates a tendency to experience somatic and visceral sensations as unusually intense, noxious, and disturbing. They assume that somatosensory amplification involves hypervigilance, a tendency to focus on weak and rare sensations, and the disposition to reappraise somatic sensations as more alarming, ominous, and disturbing. While the assumption is made for the amplification of internal body sensations, somatosensory amplification has recently been considered as the amplification of various types of perceived threats—including external ones—to the integrity of the body (Köteles & Witthöft, 2017). Previous studies suggest that somatosensory amplification reflects individual differences in personality traits and emotional states. For example, neuroticism, which is a personality trait referring to the extent to which individuals experience negative distress emotions, is considered to be related to somatosensory amplification (e.g., Costa & McCrae, 1987; De Gucht, Fischler, & Heiser, 2004). Chronic medical conditions and the experience of psychological distress, including negative affect and

anxiety, are also related to somatosensory amplification, as the conditions and experience related to health concerns likely lead individuals to attend to bodily sensations and report bodily symptoms (e.g., Aronson, Barrett, & Quigley, 2001; Barsky & Borus, 1999; Costa & McCrae, 1987). In addition, participants with idiopathic environmental intolerances, defined as a subjective odor-mediated hypersensitivity to chemicals, likely score high in somatosensory amplification and trait anxiety (Bailer, Witthöft, Bayerl, & Rist, 2007).

To date, cultural differences in somatosensory amplification have not been tested. However, related evidence suggests that cultural differences may exist. For instance, Tsai, Simeonova, and Watanabe (2004) demonstrated that Chinese Americans who were less acculturated to American culture were more likely than European Americans to use somatic words in their verbal emotional expression more frequently. Related to this, Kanagawa et al. (2001) showed that Japanese are more likely than Americans to describe themselves in terms of physical attributes and appearance. Moreover, Chinese are more likely than Westerners to emphasize somatic symptoms of depression, although this tendency is less consistent than another tendency whereby Westerners are more likely than Chinese to emphasize psychological symptoms of depression (Ryder et al., 2008; see also Kirmayer & Ryder, 2016, for a recent review). These findings suggest that East Asians are more likely than Westerners to report bodily sensations and put weight on bodily states.

On the other hand, evidence suggests cultural differences in interoceptive accuracy. Ma-Kellams, Blascovich, and McCall (2012) found that Asians were less accurate than European Americans in perceiving their own visceral states (e.g., heart rate). Chentsova-Dutton and Dzokoto (2014) found that West Africans showed higher levels of interoceptive awareness, whereas they were less accurate in perceiving their own visceral states than European

Americans. Although somatic awareness and interoceptive accuracy are distinct concepts in that the former focuses on how often people report bodily sensations while the latter focuses on one's ability to detect bodily changes—and while the findings on cultural differences in somatic awareness and interoceptive accuracy are limited—these differences might be explained by cultural differences in attentional styles. Numerous studies on culture and cognition have demonstrated that, compared with North Americans, East Asians perceive and think more holistically, considering the surrounding context in understanding an object (e.g., Nisbett et al., 2001). A recent study found that Japanese are more likely than European Canadians to perceive a target person's emotion holistically by attending to the body expression and considering its consistency or inconsistency with the facial expression (Bjornsdottir, Tskhay, Ishii, & Rule, 2017). Whereas this holistically attentional style might lead East Asians to focus more on externally contextual cues, take more of a third-person perspective, and accordingly emphasize more bodily cues, it might also lead them to be less attentive to their internal states and thus less accurate in their perception of interoceptive states, compared to Westerners.

Based on the previous findings, the present research expected that Japanese would exhibit higher somatosensory amplification compared to Americans. Moreover, this research explored whether the associations of somatosensory amplification with psychological distress, including negative affect and anxiety, would vary across cultures. Japanese decreased attention to internal states, which is assumed by their attentional style, may weaken the effect of state affect in their somatic awareness. Accordingly, the associations of somatosensory amplification with psychological distress might become weaker in Japanese than in Americans.

Method

Participants

The data on the American participants were drawn from the second wave of the Midlife

Development in the United States (MIDUS II) study. MIDUS I was a nationally representative

telephone and mail survey conducted in 1995–1996, with more than 7,000 American

participants aged 25–74 years. MIDUS II was conducted in 2004–2006 as a follow-up study to

MIDUS I. The present study focused on a subsample of MIDUS II participants ($N = 1{,}052$) who

completed an additional session of biomarker assessment in which the variables of perceived

stress and social anxiety were included. The data on the Japanese participants were drawn from

the Midlife in Japan (MIDJA) study, which was conducted in 2008, with more than 1,000

participants aged 30–79 years in the Tokyo metropolitan area. The Japanese participants

completed a self-administered questionnaire, including measures that paralleled those in

MIDUS II. The present study focused on a sample of the MIDJA participants ($N = 1{,}027$).

Measures

Somatosensory amplification. The measure of somatosensory amplification was

collected as part of self-administered questionnaires in both MIDUS II and MIDJA. It was

assessed with a five-item scale consisting of "I am often aware of various things happening

within my body," "Sudden loud noises really bother me," "I hate to be too hot or too cold," "I

am quick to sense hunger contractions in my stomach," and "I have a low tolerance for pain"

(Barsky et al., 1998). The participants rated their level of somatosensory amplification on a

4-point rating scale (1: Not at all true, 2: A little bit true, 3: Moderately true, 4: Extremely true).

The mean score was computed for each participant. Cronbach's alphas were .52 and .59 for

Americans and Japanese, respectively. The low internal consistency partly resulted from the

fact that some of the inter-item correlations with the item "I am often aware of various things

happening within my body" were quite low in both cultures. Although the alphas remained low

if the item was excluded (US: .53, Jpn: .56), a single-factor model had a better fit to the data

after the item was excluded in both cultures (US: $\chi2 = 0.56$, $p = .76$, Comparative Fit Index

[CFI] = 1.00, Root Mean Square Error of Approximation [RMSEA] = 0.00, Jpn: $\chi2 = 3.09$, p

= .21, CFI = 0.997, RMSEA = 0.023), compared to when the original five items were used (US:

$\chi2 = 35.95$, $p < .001$, CFI = 0.907, RMSEA = 0.077, Jpn: $\chi2 = 22.34$, $p < .001$, CFI = 0.959,

RMSEA = 0.059). The data from the four items were thus used to test the predictions in the

following analyses.

Negative affect. The participants in MIDUS II and MIDJA were asked to rate how much

of the time during the past 30 days they had felt each emotion on a 5-point rating scale (1: None

of the time, 2: A little of the time, 3: Some of the time, 4: Most of the time, 5: All of the time;

Mroczek & Kolarz, 1998). The participants rated six items on negative affect ("so sad nothing

could cheer you up," "nervous," "restless or fidgety," "hopeless," "that everything was an

effort," and "worthless"). The mean score was computed for each participant. Cronbach's

alphas were .85 and .86 for Americans and Japanese, respectively.

Perceived stress. A 10-item perceived stress scale (Cohen, Kamarck, & Mermelstein,

1983) was used (e.g., "felt that you were unable to control the important things in your life,"

"found that you could not cope with all the things that you had to do," and "felt difficulties

were piling up so high that you couldn't overcome them"). Participants were asked to rate how

often they felt uncontrollable, unpredictable, and overloaded in the past month on a 5-point

rating scale (1: Never, 2: Almost never, 3: Sometimes, 4: Fairly often, 5: Very often). The sum

of scores was computed for each participant. Cronbach's alphas were .86 and .76 for Americans

and Japanese, respectively.

Social anxiety. The social anxiety scale (Fresco et al., 2001) consisted of nine items. The

participants were presented with situations (e.g., "Talking to people in authority," "Going to a

party," and "Talking with people you don't know very well") and asked to rate how much fear

or anxiety they generally feel for each situation on a 4-point rating scale (1: None, 2: Mild, 3:

Moderate, 4: Severe). The mean score was computed for each participant. Cronbach's alphas

were .85 and .89 for Americans and Japanese, respectively.

A latent factor of negative affective states with negative affect, perceived stress, and

social anxiety as indicators was created to test the predictions in the following analyses. An

explanatory factor analysis suggested the validity of a one-factor model in both cultures (for

factor loadings of negative affect, perceived stress, and social anxiety, US: .66, .71, and .55,

Jpn: .78, .80, and .49).

Control variables. Age, gender, subjective and objective social status, neuroticism, and

chronic health conditions were controlled to test the predictions, as they could have

confounding effects on the association of negative affective states with somatosensory

amplification. To measure their subjective social status, participants were presented with a

picture of a 10-rung ladder (1: lowest rung, 10: highest rung) and asked to place themselves on

the ladder based on where they stood compared with other people in their community (adopted

from Adler et al., 1994). As a marker of objective social status, the participants' educational

attainment was assessed on a 7-point scale (1: 8th grade, junior high school, 7: attended or

graduate from graduate school). The neuroticism personality trait was assessed with four

adjectives ("Moody," "Worrying," "Nervous," and "Calm"). The participants rated the extent to

which each of the adjectives described them on a 4-point scale (1: Not at all, 2: A little, 3: Some,

4: A lot). Cronbach's alphas were .76 and .51 for Americans and Japanese, respectively. Finally,

the MIDUS II and MIDJA participants were asked to report their chronic health conditions.

They were presented with a list of 30 chronic conditions (e.g., asthma, stroke, and chronic sleep

problems) and asked to check off the ones they had experienced in the past 12 months. As the

total number of chronic conditions checked was positively skewed, it was log-transformed for

each participant.

Results

Table 1 shows the descriptive statistics for the variables for each cultural group and the

cultural differences between them. As expected, somatosensory amplification was significantly

higher in Japanese than in Americans, $F(1, 2069) = 286.6$, $p < .001$, $\eta^2_p = .12$. Moreover,

neuroticism, negative affect, and perceived stress were also significantly higher in Japanese than

in Americans. There was no cultural difference in either social anxiety or chronic disorders.

Furthermore, somatosensory amplification was significantly positively correlated with negative

affect, perceived stress, social anxiety, neuroticism, and chronic disorders in both cultures

(Table 2).

To examine the relationship between somatosensory amplification and negative affective

states, a structural equation model was constructed based on the lavaan package in R. First, a

model in which somatosensory amplification is predicted by negative affective states as well as

control variables was initially tested for each culture. However, the model fit was poor in both

cultures (US: $\chi2 = 828.39$, CFI = 0.553, RMSEA = 0.125, Jpn: $\chi2 = 638.50$, CFI = 0.647,

RMSEA = 0.113). A modified model (Figure 1) was then constructed based on modification

indices in which paths between negative affective states and control variables and a covariance

between perceived stress and social anxiety were included, which showed acceptable fit in both

cultures (US: $\chi2 = 134.65$, CFI = 0.947, RMSEA = 0.047, Jpn: $\chi2 = 198.66$, CFI = 0.906,

RMSEA = 0.063). Moreover, a multi-group model with regression coefficients set equal across

cultures was compared to its unconstrained model to test if links between the variables differed across cultures. The analysis showed a significant difference (χ2 difference = 31.79, df = 13, *p* = .003). In both cultures, higher levels of neuroticism and chronic disorders were associated with higher levels of negative affective states, which led to higher levels of somatosensory amplification. However, the direct paths of neuroticism and chronic disorders to somatosensory amplification were nonsignificant in the US (βs = -.20 and .05), whereas they were still significant in Japan (βs = .27 and .39) despite the significant effect of negative affective states on somatosensory amplification. Furthermore, as predicted, a multi-group model comparison also showed that the standardized regression coefficient of negative affective states was statistically greater in the US (β = .71) than in Japan (β = .40), χ2 difference = 8.26, df = 1, *p* = .004.

Discussion

Comparing representative samples of Americans and Japanese, this research examined whether somatosensory amplification would vary across cultures. It also explored the associations between somatosensory amplification and factors related to psychological distress, which might differ across cultures. Previous research has suggested that reflecting East Asians' holistic attentional style, they are likely to emphasize more somatic awareness and perceive their internal visceral states less accurately compared with Westerners. Extending the previous findings, this research offers the first evidence that Japanese are higher in somatosensory amplification compared to Americans, and the association between somatosensory amplification and negative affective states is weaker in Japanese than in Americans.

As found in previous studies, somatosensory amplification was positively associated with negative affective states, neuroticism, and chronic disorders in both cultures. However, the

pattern drawn from the structural equation model suggests that negative affective states fully

mediate the effects of neuroticism and chronic disorders on somatosensory amplification in the

US, whereas the mediation is partial in Japan. While the pattern suggests that negative affective

states play a greater role as a mediator in the US than in Japan, it may also suggest that

especially in Japanese cultural contexts, neuroticism and chronic disorders foster holistic

perceptions and thought leading to attention to bodily cues. At a minimum, the effect of

neuroticism on holistic attention is indirectly supported by genetic evidence that East Asians

who have the G allele of the serotonin 1A receptor polymorphism, which is characterized by

reduced serotonergic transmission and is linked to neuroticism, tend to show increased attention

to the context (Kim et al., 2010). Moreover, neuroticism (Stokes, 1985) and chronic disorders

(Penninx et al., 1999) are likely connected to loneliness. The connection may foster people's

fear of isolation, especially in the Japanese culture, where interdependence and harmonious

relationships with others are highly valued. Evidence suggests that a fear of isolation accounts

for cultural differences in terms of sensitivity to context. People feeling a higher level of fear of

isolation are more sensitive to context (Kim & Markman, 2006). Future research will be needed

to address these speculations on the relationships with somatosensory amplification.

There are several limitations in the present research. First, the internal consistency of the

somatosensory amplification scale was low in both cultures. This tendency has been reported in

many studies, reflecting that the scale includes items that are associated not only with

interoception but also with exteroception (Köteles & Witthöft, 2017). Although the scale is the

only one available for measuring somatosensory amplification, this conceptual ambiguity might

result in unclear conclusions on what aspects of somatosensory amplification cultures influence.

Second, although East Asians' holistic attention has been assumed in the predictions, this

research could not include a direct measurement of individuals' attentional styles. As in

Ma-Kellams et al. (2012) and Ryder et al. (2008), demonstrating the role of individuals'

attentional styles as a mediator of cultural differences in somatosensory amplification will be

needed in future work. Third, this research was based on an East–West comparison, although it

relied on representative samples of Japanese and Americans. As in Chentsova-Dutton and

Dzokoto (2014), future research in another non-Western culture would be helpful for

generalizing the current findings. Fourth, because this research relied on a cross-sectional

survey, the cultural effect in somatosensory amplification could not be traced longitudinally.

Cross-cultural examination of the longitudinal influence would enhance our understanding of

the nature of somatosensory amplification and the underlying mechanisms influenced by

cultural contexts. Finally, this research examined only a self-reported measurement of

somatosensory amplification. Due to the cross-sectional design of the survey, it was not

possible to exclude retrospective bias, which may have been present in the participants'

self-reports. Employing other measurements—including a more objective one with

physiological methods—along with the self-reported measurement would be useful for testing

the hypotheses in future work.

Despite its limitations, this study advances our understanding of somatosensory

amplification from the perspective of cultural influences. Consistent with the previous findings,

East Asians' emphasis on somatic awareness resulting from their holistic type of attention

revealed a higher level of somatosensory amplification in Japanese than in Americans.

Moreover, reflecting their decreased attention to internal states, the association between

somatosensory amplification and negative affective states became weaker in Japanese than in

Americans. The results are solid and worthwhile, as this research drew on representative

samples in both cultures. Thus, the findings contribute to further understanding the cultural

influences in psychological processes, especially by focusing on an untested aspect related to

self-perception, cognition, and health. Further investigations based on the directions this

research suggests will provide a better understanding of cultural influences in terms of

somatosensory amplification.

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Table 1

Descriptive statistics for the variables for each cultural group and cultural differences in them

Variable	Americans		Japanese		Cultural difference
	M	SD	M	SD	
Age	55.26	11.79	54.36	14.14	$F = 2.47, p = .12$
Gender (% female)	54.8		50.8		$\chi^2 = 3.21, p = .07$
Subjective SES	4.41	1.72	4.97	2.11	$F = 42.50, p < .001$
Educational attainment	5.09	1.58	4.04	1.65	$F = 286.6, p < .001$
Neuroticism	2.03	0.63	2.11	0.56	$F = 8.93, p < .005$
Somatosensory Amplification	2.25	0.58	2.66	0.53	$F = 286.6, p < .001$
Negative Affect	1.49	0.55	1.69	0.65	$F = 57.68, p < .001$
Perceived Stress	21.68	6.16	26.11	5.77	$F = 283.4, p < .001$
Social Anxiety	1.84	0.53	1.81	0.55	$F = 1.11, p = .29$
Chronic Disorders (log)	0.42	0.70	0.44	0.76	$F = 2.16, p = .14$

Table 2

Correlations among related variables for each cultural group

Variable	1	2	3	4	5	6
1. Somatosensory Amplification	---	.30***	.23***	.22***	.29***	.17***
2. Negative Affect	.33***	---	.62***	.38***	.47***	.30***
3. Perceived Stress	.28***	.47***	---	.39***	.46***	.21***
4. Social Anxiety	.27***	.37***	.40***	---	.26***	.13***
5. Neuroticism	.30***	.59***	.47***	.34***	---	.18***
6. Chronic Disorders	.25***	.37***	.20***	.17***	.24***	---

Note. Correlations for Americans ($N = 1052$) are shown below the diagonal, and correlations for

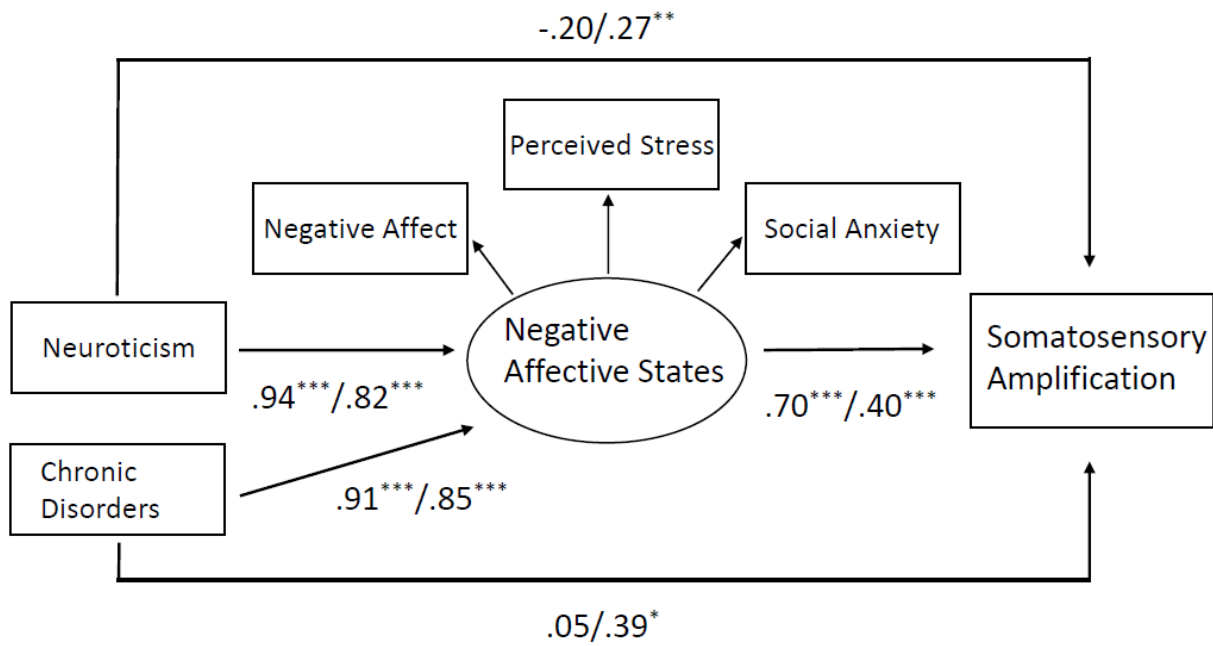Japanese ($N = 1027$) are shown above the diagonal.

*** $p < .001$

Figure 1. Negative affective states mediated the paths of neuroticism and chronic disorders to somatosensory amplification in the US and Japan. Regression coefficients (left: the US, right: Japan) are standardized (*** $p < .001$, ** $p < .01$, * $p < .05$). Paths of the other control variables (i.e., age, gender, subjective SES, and education attainment) to negative affective states and a covariance between perceived stress and social anxiety, which are included in this model, are not presented in this figure for simplification.