Culture as a Moderator of Epistemically Suspect Beliefs

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Abstract

A consistent finding is that epistemically suspect beliefs, such as belief in the paranormal, are less frequently endorsed by individuals with a greater tendency to engage in analytic thinking. However, these results have been obtained almost exclusively with Western participants. The current study explores various individual difference factors known to predict epistemically suspect beliefs across Western and Eastern cultures. Across four studies ($N = 1,316$ Japanese and Western individuals) we found that the association between thinking style and epistemically suspect beliefs varied as a function of culture. Specifically, while Western individuals scoring higher on measures of analytic thinking endorsed less epistemically suspect beliefs, this association was not observed in our Japanese samples, suggesting that the often observed negative association between analytic thinking and epistemically suspect beliefs may be exclusive to Western samples. Additionally, we demonstrate that a tendency to think holistically (specifically with regards to causality) was positively associated with the endorsement of epistemically suspect beliefs, both within Western and Eastern samples. Overall, we discuss how various individual difference factors predict the endorsement of epistemically suspect beliefs across cultures.

Keywords: epistemically suspect beliefs, bullshit reception, cultural differences, analytic thinking, analytic-holistic cognition

(7,198 words)

Culture as a Moderator of Epistemically Suspect Beliefs

Fundamentally, scientists are in the business of improving the accuracy of both theirs and humanity's beliefs via the collection of information about the universe. As such, it is no surprise that a community of researchers have become profoundly interested in epistemically suspect beliefs (ESBs), which refer to beliefs that do not coincide with established scientific evidence (e.g., paranormal beliefs; Lobato et al., 2014). Previous studies investigating ESBs have focused on the individual differences of believers and skeptics, including differences in cognitive ability, reasoning skills, and thinking style. These findings suggest that those who endorse ESBs are less educated (Aarnio & Lindeman, 2005; Gray & Mill, 1990), perform worse on some reasoning tasks (Blackmore & Trościanko, 1985; Roberts & Seager, 1999), and engage less in analytic thinking compared to skeptics (Lindeman & Aarnio, 2006; Pennycook et al., 2012).

Many studies have shown that the tendency to engage in analytic thinking is negatively associated with various forms of ESBs including religious belief (Gervais & Norenzayan, 2012; Pennycook et al., 2014; Pennycook et al., 2012), belief in the paranormal (Aarnio & Lindeman, 2005; Lobato et al., 2014), and pseudoscientific beliefs (Lindeman, 2011; Lobato et al., 2014). Relatedly, analytic thinking has been shown to be negatively associated with receptivity to superficially impressive yet vacuous statements (i.e., pseudo-profound bullshit; Pennycook, Cheyne, Barr, Koehler, & Fugelsang, 2015; Walker et al., 2019). On the basis of such findings, many scholars have argued that ESBs are rooted in intuitive processing (Type-1 processes in dual-process theory; Evans, 2008; Evans & Stanovich, 2013) which can be overridden by effortful and analytic (Type-2) processes (Pennycook, Fugelsang, & Koehler, 2015).

Although the negative association between ESBs and analytic thinking appears robust, it may be reasonable to be skeptical about the underlying mechanisms proposed. First, in the

domain of religious belief, studies have shown contradictory findings. For example, the role of analytic thinking in supporting religious disbelief has been challenged by research showing that promoting analytical thinking did not promote religious disbelief (Sanchez, et al., 2017; Yonker et al., 2016). Furthermore, most studies examining the association between cognitive style and ESBs have been conducted exclusively with WEIRD (Western, Educated, Industrialized, Rich and Democratic; Henrich et al., 2010) participants. Therefore, it remains an open question whether the link between analytic thinking and ESBs generalizes to non-WEIRD populations.

Recent work has begun to investigate cross-cultural differences as they relate to ESBs. For example, compared to Westerners, Chinese individuals have been found to be more likely to endorse paranormal beliefs (Shiah et al., 2010) and Turkish individuals more likely to endorse conspiracy beliefs (Bruder et al., 2013). Relatedly, Bahçekapili and Yilmaz (2017) reported a series of studies featuring Muslim populations showing that analytic thinking was negatively associated with intrinsic/extrinsic motivations for religiosity (e.g., personal duty or societal pressure), but positively associated with religiosity dealing with an open-minded seeking of answers to existential questions. On the basis of these findings, Bahçekapili and Yilmaz suggest that the link between analytic thinking and religiosity depends on how religiosity is expressed among individuals. In the domain of paranormal and pseudoscientific belief, Japanese individuals self-reporting a strong tendency towards rational thinking were more likely to hold paranormal and pseudoscientific beliefs (Karasawa et al., 2015; Majima, 2015), providing initial evidence that the commonly observed negative association between rationality and ESBs may not always generalize to non-WEIRD populations. Nevertheless, participants' level of rational thinking was self-reported within this study leaving open the possibility that they were simply mis-calibrated in their self-assessment. Conversely, it could be that the link between rationality

and ESBs is absent in Japanese samples, perhaps due to the fact that ESBs may be less in violation of Japanese as opposed to Western cultural norms.

Along with differences in ESBs, findings from cultural psychology have demonstrated differences in cognitive style within Western and Eastern cultures. These findings suggest that Westerners are more likely to adopt analytic modes of cognition, while Easterners are more likely to take holistic approaches (Nisbett et al., 2001; Nisbett & Miyamoto, 2005). Generally speaking, analytic individuals tend to focus on the specific attributes or elements of an object or problem, rather than the larger context as a whole. In contrast, rather than focusing on individual elements, holistic individuals tend to focus on the totality of an object or problem, including the overarching context. Furthermore, holistic thinking has been shown to predict the acceptance of mutually conflicting statements (naïve dialecticism; Spencer-Rodgers et al., 2010) and complex causality (Maddux & Yuki, 2006). It may be the case that differences in the endorsement of ESBs across Western and Eastern cultures may be explained, at least partially, by these cultural differences in analytic versus holistic thinking. It is reasonable to assume that holistic thinkers may be more likely to accept mutually conflicting statements and as a result may show greater endorsement of ESBs than those engaging in more analytic modes of reasoning. Therefore, the tendency for Eastern individuals to think holistically may offer one explanation for why Eastern individuals seemingly endorse more ESBs compared to Western individuals.

The Present Research

The present research investigates endorsement of ESBs (e.g., paranormal and pseudoscientific beliefs) within samples of Western (North American and Western European) and Eastern (Japanese) participants. We seek to not only assess the frequency of ESBs across Western and Eastern cultures, but also investigate whether such beliefs are predicted by the same

individual difference variables (e.g., analytic thinking) across cultures. Based on past work (Bruder et al., 2013; Shiah et al., 2010), we expect Western participants to endorse ESBs less than Eastern participants. We examine whether such a difference can be explained by Western participants preferring more analytic and linear styles of thinking compared to Eastern participants, who more frequently engage in holistic and dialectic styles of thinking (Nisbett et al., 2001; Nisbett & Miyamoto, 2005).

Lastly, we investigate receptiveness to pseudo-profound bullshit across Western and Eastern cultures. Similar to holding ESBs, endorsement of pseudo-profound bullshit (i.e., statements that are superficially impressive yet consist of a largely random assortment of profound-sounding words) have been argued to result from a failure to engage analytic thinking (Pennycook et al., 2015; Pennycook & Rand, 2020). That is, endorsement of pseudo-profound bullshit shares a common cognitive mechanism with acceptance of ESBs. Relatedly, studies have demonstrated positive associations between bullshit receptivity and real-world beliefs, such as the endorsement of paranormal beliefs (Pennycook et al., 2015) and “fake news” (Pennycook & Rand, 2020). Nevertheless, the claim that bullshit receptivity naturally follows from a failure to engage analytic thinking may be incomplete as other factors such as the tendency to perceive patterns or maintain radically subjective beliefs may similarly explain receptiveness to pseudo-profound bullshit statements (Turpin et al., 2019; Walker et al., 2019). These factors likely vary widely based on culture and so too may receptiveness to pseudo-profound bullshit.

Study 1

Method

Participants

A sample of 298 participants were recruited from two online crowdsourcing platforms, 147 Japanese participants (59% Female; $M_{\text{age}} = 38.37$, $SD_{\text{age}} = 9.45$) from CrowdWorks (CW) and 151 North American and European participants (47% Female; $M_{\text{age}} = 33.23$, $SD_{\text{age}} = 11.50$; 36% U.S. residents, 38% U.K. residents, 25% other) from Prolific Academic (ProA).¹ All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an online questionnaire. For all studies, participants from crowdsourcing pools were required to possess an approval rating of 95% or higher in order to be eligible to participate. We collected our full sample prior to data analyses, report all data exclusions, all manipulations, and all measures used.

Materials

Paranormal belief scale. We assessed the degree to which participants endorsed various paranormal beliefs by asking them to judge the plausibility of 12 paranormal belief items (B_{PA}). These items were drawn from the Psi questionnaire (6-items; Roberts & Seager, 1999) and Revised Paranormal Belief Scale (6-items; adopted from Tobacyk, 2004). Participants judged the plausibility of each B_{PA} item (e.g., How likely is it that you possess some form of ‘psychic ability’?) using a 5-point scale ranging from 1 (*Extremely Unlikely*) to 5 (*Certain*). Ratings given to each item were averaged to calculate a B_{PA} score for each participant. A complete list of items (for all studies) can be viewed in Part A of the supplementary materials.

Pseudoscientific belief scale. We assessed the degree to which participants endorsed pseudoscientific beliefs with 12 pseudoscientific belief (B_{PS}) items. This scale consisted of six items from Majima (2015), 3 items from Lobato and colleagues (2014), and 3 items from Dekker

¹ Some studies suggest that people of Asian ethnicity living in Western countries provide responses resembling an intermediate between Asian people living in Eastern countries and European people living in Western countries (Norenzayan et al., 2002). Therefore, it is noteworthy that the present results (featuring our full sample) did not differ when excluding Japanese participants with a non-Asian origin and Western participants with an Asian origin.

and colleagues (2012). Participants were asked to judge their agreement with each item on a 5-point scale ranging from 1 (*Disagree*) to 5 (*Agree*). Once again, ratings given to each item were averaged to obtain a B_{PS} score for each participant.

Cognitive style measures. We assessed participants' tendency to engage in rational (analytic) and experiential (intuitive) thinking with 12 items drawn from Naito et al.'s (2004) Information-Processing Style Inventory (IPS). The original IPS contains 24 items adapted from Pacini and Epstein's (1999) Rational-Experiential Inventory (REI), consisting of six items from each of the four REI subscales (rational engagement, rational ability, experiential engagement, and experiential ability). In order to reduce participants' work load, we chose 12 items (three items from each subscales) showing high factor loading scores in studies with Western (Pacini & Epstein, 1999) and Japanese (Naito et al., 2004) participants. For each item, participants were presented with a statement and asked to judge the extent to which the statement was true of themselves on a 5-point scale (1 = *Definitely not true*, 5 = *Definitely true*). Responses to six rationality items and six experiential items were summed to obtain a rationality and experientiality score for each participant.

Participants were also presented with a three item Cognitive Reflection Test (CRT; Frederick, 2005), designed to provide a behavioral measure of participants' ability to suppress an intuitive incorrect response in favor of an analytical correct answer. For all CRT items participants provided their answers in a free-entry text box.

Lastly, we administered the Analysis-Holism scale (AHS; Choi et al., 2007) to assess participants' tendencies to engage in analytic versus holistic thinking. The original AHS scale consisted of 24 items evenly split into four subscales (causality, attitude towards contradiction, perceived change, and locus of attention). However, to reduce participants' work load, we only

administered 12 AHS items (3 items for each subscale). Participants were presented each item individually and responded using a 7-point scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Within each subscale, ratings given to each item were summed to obtain an AHS subscale score.

Cognitive ability measures. We assessed participants' cognitive ability with a syllogistic reasoning (cf. Majima, 2015) and numeracy task. We measured participants' logical reasoning ability using syllogistic reasoning task adopted from Markovitz & Nantel (1989). The syllogistic reasoning task presented participants with eight syllogisms, all of which featured a conflict between the logical validity of the syllogism and the believability of its conclusion. Importantly, this design ensured that for each item the intuitive response (based on conclusion believability) would need to be overridden in order to answer correctly. For each syllogism, participants were asked to indicate whether the conclusion followed logically from the premises presented, irrespective of the believability of the concluding sentence. The sum of correctly solved syllogisms was used as an index of the logical reasoning ability of each participant. Additionally, we measured participants' numeracy using the Subjective Numeracy Scale (SNS; Fagerlin et al., 2007). This scale was developed and validated as a conventional self-evaluation scale of numeracy. We computed an unweighted mean of Percent of Maximum Possible (POMP; Cohen et al., 1999) scores for both our syllogistic reasoning and numeracy task in order to obtain a joint measure of cognitive ability (CAB).

Procedure

Participants were administered an online questionnaire in which they were asked to complete several tasks in the following order: pseudoscientific belief items, paranormal belief items, information-processing style inventory items (we refer to this scale as the REI hereafter

referencing the origin of these items), a syllogistic reasoning task, the SNS, the AHS, and the CRT. Following completion of these tasks participants were asked a series of demographic questions (i.e., age, gender, nationality, ethnicity, native language, and highest educational level). All materials were presented in Japanese for CW participants and in English for ProA participants.

Results and Discussion

Table 1 displays the descriptive statistics and bivariate correlations for all key variables. With the exception of AHS subscales (α ranged from .60 to .75)², all scales showed good internal consistency (α ranged from .79 to .94). A series of independent samples *t*-tests found that our two samples did not differ in cognitive ability, CRT performance, or experientiality scores (all *ps* > .10). First, Westerners scored higher on our measure of rationality (i.e., the six rationality subscale items included in the REI), $t(296) = 6.22, p < .001, d = 0.72$. Consistent with past work, Japanese participants endorsed more paranormal, $t(296) = 5.81, p < .001, d = 0.66$, and pseudoscientific beliefs, $t(296) = 4.81, p < .001, d = 0.56$, than Westerners. They also scored higher in three of the four AHS subscales: causality [$t(296) = 3.09, p = .002, d = 0.36$], perception of change [$t(296) = 3.00, p = .003, d = 0.35$], and locus of attention [$t(290) = 5.92, p < .001, d = 0.69$]. Surprisingly, no difference between samples was observed for the attitude toward contradiction AHS subscale, $t(296) = 1.02, p = .307, d = 0.12$.

[[insert Table 1 here]]

Cultural Differences and Determinants of Epistemically Suspect Beliefs

In order to identify potential determinants of ESBs we conducted multiple regression analyses predicting ESBs (i.e., paranormal beliefs and pseudoscientific beliefs; see Table 2). In

² Note that the reliability scores for AHS subscales were similar to those found in the original study (α ranged from .56 to .71; Choi et al., 2007).

order to identify whether effects of our independent variables were moderated by cultural affiliation, we adopted a hierarchical regression approach. In the first step, all independent variables were entered simultaneously into the model. Next, the interaction terms of culture and other independent variables were entered. We excluded cognitive ability and three subscales of the AHS (attitude towards contradiction, perception of change, and locus of attention) from these analyses because preliminary analyses failed to show any contribution of these variables to differences in ESBs. For paranormal beliefs, ΔR^2 s demonstrated a significant improvement in the prediction of paranormal beliefs by introducing interaction terms of culture and other independent variables ($\Delta R^2 = .02, p = .005$). We also found significant improvements in predicting pseudoscientific beliefs ($\Delta R^2 = .01, p = .043$). The final models for both paranormal and pseudoscientific beliefs can be viewed in Table 2 (left panel).

[[insert Table 2 here]]

We observed a significant gender difference for both ESBs in which women were more likely to have stronger ESBs compared to men ($B_{PA}: \beta = -.45, p < .001, B_{PS}: \beta = -.23, p = .027$). As predicted, CRT performance was found to be negatively associated with ESBs ($B_{PA}: \beta = -.36, p < .001, B_{PS}: \beta = -.38, p < .001$), whereas a holistic understanding of causality was positively associated with ESBs ($B_{PA}: \beta = .14, p = .023, B_{PS}: \beta = .24, p < .001$). Additionally, we observed significant experientiality x culture ($B_{PA}: \beta = .24, p = .016, B_{PS}: \beta = .21, p = .042$) and CRT x culture interactions for both ESBs ($B_{PA}: \beta = .33, p = .001, B_{PS}: \beta = .26, p = .013$). Subsequent simple slope analyses revealed culture to be a significant moderator of the association between experientiality and ESBs. The unstandardized simple slopes for Japanese participants were, $B_{PA} = 0.08, p < .001$, and $B_{PS} = 0.04, p < .001$, and $B_{PA} = 0.04, p = .004$, and $B_{PS} = 0.01, p = .250$ for Western participants. Lastly, we found culture to be a significant moderator of the association

between CRT performance and ESBs. The unstandardized simple slopes for Japanese participants were, $B_{PA} = -0.02, p = .709$, and $B_{PS} = -0.07, p = .121$, and $B_{PA} = -0.31, p < .001$, and $B_{PS} = -0.21, p < .001$ for Western participants. Therefore, CRT performance predicted beliefs in our Western sample but not Japanese sample, possibly reflecting differences in cultural values with regards to avoiding ESBs.

Study 2

Study 1 demonstrated that holistic understanding of causality partially explained participants' endorsement of ESBs. However, participants' attitude toward contradiction was not associated with endorsement of ESBs. This may be due to the fact that individuals' attitude toward contradiction in the current context doesn't reflect their propensity toward naïve dialecticism (i.e., the belief that things are changing continuously, tolerance of contradiction, and the preference for endorsing moderate options centered between two opposing options; cf. Zhang et al., 2015). Therefore, in Study 2, we further explored the association between dialectic thinking and endorsement of ESBs.

Method

Participants

A sample of 316 participants were recruited from two online crowdsourcing platforms, 167 Japanese participants (56% Female; $M_{age} = 39.26, SD_{age} = 9.45$) from CW and 149 Western participants (42% Female; $M_{age} = 30.60, SD_{age} = 10.04$) from ProA. All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an approximately 16-minute online questionnaire. As gender was a predictor in our regression analyses, two participants from ProA, and one from CW were excluded from due to not reporting gender.

Materials

The materials used in Study 2 were nearly identical to those used in Study 1, with the following exceptions. First, we reduced the number of REI items we administered from 12 to 10 (now including 5 rational subscale and 5 experiential subscale items). These items were adopted from the REI-10 (Epstein et al., 1996), and assessed individual differences in thinking style. Second, we no longer administered the AHS, instead presenting participants with 32 Dialectical Self Scale items as our measure of holistic cognition.

Dialectical Self Scale. In Study 2 we presented participants with 32 Dialectical Self Scale items (DSS; Spencer-Rodgers et al., 2004). This scale measures participants' degree of dialectical thinking (i.e., the degree to which participants are able to synthesize competing ideas or viewpoints) within the domain of self-perception. Participants responded to each DSS item using a 7-point scale ranging from 1 (*Strongly disagree*) to 7 (*Strongly agree*). Responses to all 32 items were averaged for each participant to obtain a DSS score.

Procedure

Participants were administered an online questionnaire in which they were asked to respond to various items in the following order: pseudoscientific belief items, paranormal belief items, REI items, a syllogistic reasoning task, the SNS, the DSS, and the CRT. Following the completion of these tasks participants were asked a series of demographic questions (i.e., age, gender, ethnicity, and native language). As in Study 1, all materials were presented in Japanese for CW participants and in English for ProA participants.

Results and Discussion

Table 3 displays the descriptive statistics and bivariate correlations of all key variables. A series of independent samples *t*-tests demonstrated that our two samples did not differ in cognitive ability or CRT performance (both *ps* > .19). In contrast, we observed differences in our

measures of paranormal beliefs, pseudoscientific beliefs, dialectical thinking, rationality, and experientiality between Japanese and Western samples. As in Study 1, Japanese participants endorsed more paranormal, $t(313) = 4.42, p < .001, d = 0.50$, and pseudoscientific beliefs, $t(314) = 3.97, p < .001, d = 0.45$. Japanese participants also demonstrated a greater degree of dialectic thinking compared to Western participants, $t(314) = 9.75, p < .001, d = 1.10$. Lastly, Western participants scored higher on both the rationality, $t(314) = 6.50, p < .001, d = 0.73$, and experientiality, $t(314) = 6.40, p < .001, d = 0.72$, subscales of the REI-10.

[[insert Table 3 here]]

Cultural Differences and Determinants of Epistemically Suspect Beliefs

As in Study 1, we conducted multiple regression analyses predicting ESBs (i.e., paranormal beliefs and pseudoscientific beliefs) in order to identify potential determinants of ESBs (see Table 2). We adopted a hierarchical regression approach to identify whether effects of our independent variables were moderated by cultural affiliation. Consistent with Study 1, we found that women were more likely to endorse paranormal beliefs ($\beta = -.32, p = .015$) and older individuals more likely to endorse pseudoscientific beliefs ($\beta = -.22, p = .041$). Additionally, experientiality was positively associated with ESBs ($B_{PA}: \beta = .43, B_{PS}: \beta = .35, ps < .001$) and CRT performance ($B_{PA}: \beta = -.27, p = .001, B_{PS}: \beta = -.38, p < .001$) and rationality ($B_{PA}: \beta = -.17, p = .041, B_{PS}: \beta = -.28, p < .001$) negatively associated with ESBs. Lastly, DSS scores were found to be positively associated with the endorsement of paranormal but not pseudoscientific beliefs ($B_{PA}: \beta = .19, p = .016, B_{PS}: \beta = .02, p = .804$).

We observed multiple interactions between various cognitive traits and culture. For belief in the paranormal, we found significant rationality x culture ($\beta = .35, p = .003$) and experientiality x culture interactions ($\beta = -.24, p = .036$), and a marginally significant CRT x

culture interaction ($\beta = .21, p = .057$). Deconstructing the rationality x culture interaction, we found a negative slope within our Western sample (unstandardized slope = $-0.038, p = .040$) and a positive slope within our Japanese sample ($0.045, p = .015$). Similarly, CRT performance was shown to be negatively associated with paranormal beliefs in our Western sample ($-0.212, p < .001$) and not associated with such beliefs in our Japanese sample ($-0.058, p = .321$).

Deconstructing the experientiality x culture interaction, we found a positive simple slope in our Western sample ($0.104, p < .001$) and a more moderate, but significant, positive slope in our Japanese sample ($0.050, p = .007$). For belief in pseudoscience, we observed significant rationality x culture ($\beta = .26, p = .019$) and marginally significant DSS x culture interactions ($\beta = .22, p = .065$). Simple slope analyses revealed that rationality was negatively associated with belief for Western participants ($-0.044, p < .001$), but not associated with belief for Japanese participants ($-0.001, p = .917$). Thus, highly rational Westerners were less likely to endorse ESBs whereas rationality scores were not associated with ESBs in our Japanese sample.

Conversely, DSS scores were positively associated with pseudoscientific belief in our Japanese sample ($0.236, p = .015$), but not in our Western sample ($0.019, p = .814$), demonstrating that Japanese participants high in dialectical thinking endorsed more pseudoscientific beliefs while the same was not true in our Western sample. Overall, the results of Study 2 provide further evidence suggesting that the mechanisms underlying ESBs differ across cultures.

Study 3

In Studies 1 and 2, we observed that a tendency toward holistic cognition was positively associated with ESBs. However, we failed to find an association between propensity toward contradiction and ESBs. As discussed earlier, the self-rated measure of attitude toward contradiction, namely, the attitude toward contradiction subscale of the AHS, may not reflect an

individual's dialectical thinking behavior. Therefore, Study 3 was conducted to see whether individuals who think dialectically have stronger paranormal and pseudoscientific beliefs than those who do not. To this end, participants in Study 3 were asked to indicate to what extent they endorsed statements expressing epistemically suspect beliefs (pro-belief), as well as statements which explicitly deny epistemically suspect beliefs (anti-belief).

Method

Participants

A sample of 301 participants were recruited from two online sources, 151 Japanese participants (69% Female; $M_{\text{age}} = 36.62$, $SD_{\text{age}} = 8.99$) from CW and 150 Western participants (43% Female; $M_{\text{age}} = 32.91$, $SD_{\text{age}} = 11.42$; 17% U.S. residents, 41% U.K. residents, 39% other) from ProA. All participants received compensation (CW = 240 JPY; ProA = £2.00) upon completion of an approximately 18-minute online questionnaire. One participant from our CW sample was excluded from our analyses due to providing incomplete responses to belief tasks.

Materials

The materials used in Study 3 were similar to those used in Study 1, with the following exceptions. First, we administered only 12 AHS items (those from the causality and attitude towards contradiction subscales), removing the 12 AHS items associated with the Perception of Change and Locus of Attention subscales on account of responses to these items failing to explain endorsement of ESBs. Second, we chose five paranormal belief and five pseudoscientific belief items from Studies 1-2 (e.g., "Some people can have a dream that has predicted some future events") and created anti-belief statements for each item (e.g., "No one can have a dream that has predicted future events"). The resulting 10 pairs of statements were divided into two sets, such that each set contained five pro- and five anti-belief items. We ensured that pro- and

anti-belief statements for the same item were not included in the same set. As in Studies 1-2, participants rated their agreement with each presented statement on a 7-point scale ranging from “1 (*Strongly disagree*)” to “7 (*Strongly agree*).” A paranormal (B_{PA}) and pseudoscience (B_{PS}) score was calculated for each participant by taking the average of their responses to paranormal and pseudoscientific pro-belief statements respectively.

Lastly, we assessed Dialectic Thinking (DT) using a methodology featured in past work (Zhang, et al., 2015). In order to calculate a DT score for each participant, believability ratings for paired pro- and anti-belief statements were standardized (Z-scores) for each issue such that the midpoint “4” was set to equal zero. Next, both Z-scores were summed to create a DT score for a particular item. Finally, all five DT scores were averaged for paranormal (DT_{PA}) and pseudoscientific items (DT_{PS}), separately, creating a DT score pertaining to paranormal beliefs and another score pertaining to pseudoscientific beliefs.

$$\text{Z-score } P_k (Z_{Pk}) = (\text{raw rating of Pro-belief statement of item } k - 4) / SD_{Pk+Ak}$$

$$\text{Z-score } A_k (Z_{Ak}) = (\text{raw rating of Anti-belief statement of item } k - 4) / SD_{Pk+Ak}$$

$$DT \text{ score} = \frac{1}{5} \sum_{k=1}^5 |Z_{Pk} + Z_{Ak}|$$

Procedure

Participants were administered an online questionnaire in which they were asked to respond to various items in the following order: a belief task, REI-10 items, the AHS, a second belief task, a syllogistic reasoning task, the SNS and the CRT. Following the completion of these tasks, participants were asked a series of demographic questions (i.e., age, gender, nationality, ethnicity, and native language). As in Studies 1 and 2, all materials were presented in Japanese for CW participants and in English for ProA participants.

Results and Discussion

Table 4 shows the descriptive statistics and bivariate correlations for all key variables. Once again, we conducted a series of independent samples *t*-tests to investigate differences across our Japanese and Western samples. We observed no differences between Western and Japanese participants with regards to their attitude towards contradiction, CRT performance, cognitive ability, or endorsement of pseudoscientific beliefs (all *ps* > .09). Replicating the findings of Studies 1 and 2, Western participants scored higher in our measure of rationality, $t(299) = 6.14, p < .001, d = 0.72$, and endorsed less paranormal beliefs, $t(299) = 5.15, p < .001, d = 0.60$. Western participants also scored higher in our measure of experientiality, $t(299) = 5.29, p < .001, d = 0.61$, whereas Japanese participants scored higher in causal perception (as measured by the causality subscale of the AHS), $t(299) = 3.50, p < .001, d = 0.40$.

[[insert Table 4 here]]

Cultural Differences and Determinants of Epistemically Suspect Beliefs

As in Studies 1 and 2, we investigated potential determinants of ESBs by conducting hierarchical regression analyses. We excluded our measure of cognitive ability and attitude towards contradiction subscale as preliminary analyses failed to show any contribution of these variables in predicting the endorsement of ESBs. With the exception of these exclusions, all independent variables were entered simultaneously into our model in Step 1. In Step 2 we entered the interaction terms with culture. The introduction of these interaction terms marginally improved our model for pseudoscientific beliefs ($\Delta R^2 = .02, p = .056$), but not paranormal beliefs ($\Delta R^2 = .01, p = .143$). In Step 3 we entered DT scores for both ESB domains (pseudoscientific and paranormal beliefs) as well as the DT x culture interaction into our model. These additions improved our model for pseudoscientific beliefs ($\Delta R^2 = .04, p < .001$), but not paranormal beliefs

($\Delta R^2 = .002, p = .243$). Both Step 2 (without DT scores) and Step 3 (with DT scores) models for both paranormal and pseudoscientific beliefs can be viewed in Table 5.

[[insert Table 5 here]]

As in Study 1, our measure of experientiality was positively associated with ESBs ($\beta_{PA} = .25, \beta_{PS} = .19, ps < .05$) and CRT performance was negatively associated with ESBs ($\beta_{PA} = -.14, \beta_{PS} = -.26, ps < .05$). Additionally, holistic understanding of causality was positively associated with ESBs ($\beta_{PA} = .38, \beta_{PS} = .32, ps < .001$). Therefore, consistent with past theorizing, the tendency to think holistically may leave one susceptible to ESBs while analytic thinking may suppress such beliefs. Unlike in Studies 1 and 2, significant interactions with culture were found only for dialectic thinking pertaining to pseudoscientific beliefs ($\beta = -.24, p = .019$). Simple slope analysis revealed that dialectic thinking was positively associated with pseudoscientific beliefs in our Western sample ($0.047, p < .001$), but not our Japanese sample ($0.018, p = .116$). Thus, Western participants high in dialectical thinking endorsed more pseudoscientific beliefs while the same was not true in our Japanese sample. Interestingly, the actual behavior of dialectic thinking exhibited a slightly different pattern of results from self-report measures of dialecticism. Overall, Study 3 provided further evidence suggesting that the mechanisms underlying ESBs differ across cultures.

Study 4

Study 4 explored cultural differences in receptivity to pseudo-profound bullshit. The fact that individuals' receptivity to pseudo-profound bullshit is positively associated with their acceptance of ESBs suggests common cognitive mechanisms underlying bullshit receptivity and acceptance of ESBs. While past work has examined the mechanisms underlying bullshit receptivity (Pennycook et al., 2015; Walker et al., 2019), no work (to our knowledge) has

examined these mechanisms cross-culturally. As evidenced by Studies 1-3, the association between various individual difference measures (e.g., analytical thinking) and ESBs (e.g., pseudoscientific belief) may vary between cultures. Similar to ESBs, bullshit receptivity has been found to be negatively associated with analytical thinking (Pennycook et al., 2015; Pennycook & Rand, 2020), however, such studies have relied heavily on WEIRD samples. Thus, in Study 4 we aim to investigate whether the same mechanisms (e.g., analytical thinking) underlie bullshit receptivity across Western (American) and Eastern (Japanese) participants. Furthermore, recent studies have demonstrated how individual differences in illusory pattern perception relate to bullshit receptivity (Walker et al., 2019) and various ESBs (van Prooijen et al., 2018). Therefore, in Study 4, we also assessed participants' performance on a pattern perception task. We predict that individuals demonstrating greater illusory pattern perception will also show a greater receptivity to pseudo-profound statements. Additionally, we assess whether the association between illusory pattern perception and bullshit receptivity differs between American and Japanese individuals.

Method

Participants

A sample of 401 participants were recruited from two online crowdsourcing platforms, 201 Japanese participants (46% Female; $M_{age} = 39.45$, $SD_{age} = 10.02$) from CW and 200 U. S. residents (37% Female; $M_{age} = 34.30$, $SD_{age} = 10.67$) from Amazon's Mechanical Turk (MTurk). All participants received compensation (CW = 270 JPY; MTurk = \$2.50) upon completion of an approximately 15-minute online questionnaire.

Materials

In Study 4, we administered the CRT and AHS (24-item version; Choi et al., 2007) along with two new measures: a modified snowy pictures task (Whitson & Galinsky, 2008) and a profundity judgment task (Pennycook et al., 2015).

Modified Snowy Pictures Task. The modified snowy pictures task (MSPT; Whitson & Galinsky, 2008) was used to measure participants' ability to detect real patterns and avoid endorsing illusory patterns. Participants were presented with 24 pictures, 12 of which contained a difficult to perceive object and 12 of which contained only visual noise. For each picture, they were asked whether the presented image contained an object and responded with either a "yes" or "no" response. A non-illusory pattern perception score was calculated for each participant by determining how many object present items they correctly endorsed as containing an object. Similarly, an illusory pattern perception score was calculated for each participant by determining how many object absent items participants correctly endorsed as not containing an object. Higher scores were indicative of a greater tendency to identify real patterns and a reduced tendency to endorse illusory patterns respectively.

Profundity Judgments. Participants were presented with 30 statements (10 pseudo-profound bullshit statements, 10 motivational quotations, and 10 mundane statements) and were asked to assess the profundity of each statement on a 5-point scale ranging from "1 = *Not at all profound*" to 5 "*Very profound*." All statements originated from Pennycook and colleagues (2015). Pseudo-profound bullshit statements were originally obtained from two websites (<http://wisdomofchopra.com> and <http://sebpearce.com/bullshit/>) able to create superficially impressive yet meaningless statements by randomly arranging a list of profound sounding words in a way that maintains syntactic structure. A bullshit receptivity score (BSR) was created for each participant by calculating their mean profundity rating given to pseudo-profound bullshit

items, with higher scores indicating greater bullshit receptivity. Ten motivational quotations and mundane statements were also presented to participants, contrasting the meaningless nature of pseudo-profound bullshit statements. All motivational quotations were originally obtained via an internet search and were designed to communicate something meaningful and reasonably profound (e.g., “A wet man does not fear the rain”). Mundane statements also communicated something meaningful however they were designed so that the message being communicated was banal (e.g., “New born babies require constant attention”). Identical to that of the BSR, a motivational quotation (MQ) and mundane statement (MS) score was calculated for each participant by determining their mean profundity rating given to motivational and mundane items respectively.

Procedure

Participants were once again administered an online questionnaire for which they completed 30 profundity judgments, 24 MSPT items, 24 AHS items, the CRT, and a host of demographic questions in that order. As in previous studies, all materials were presented in Japanese for CW participants and in English for MTurk participants.

Results and Discussion

Descriptive statistics and bivariate correlations for all variables can be viewed in Table 6. Independent samples *t*-tests revealed that Japanese participants scored higher on 3 of the 4 subscales of the AHS [Causality: $t(399) = 2.17, p = .030, d = 0.22$; Change: $t(399) = 3.83, p = .001, d = 0.38$; Attention: $t(399) = 2.66, p = .008, d = 0.27$] demonstrating an overall greater tendency to engage in holistic thinking compared to US participants. No differences were observed between Japanese and US participants with regards to CRT performance, illusory pattern perception or bullshit receptivity (all *ps* > .220). Furthermore, consistent with past work (Walker

et al., 2019), bullshit receptivity was found to positively correlate with illusory pattern perception (US: $r(198) = .33, p < .001$; Japan: $r(198) = .25, p < .001$). Also consistent with past work (Pennycook et al., 2015; Pennycook & Rand, 2020), CRT performance was found to negatively relate to bullshit receptivity within our US sample, $r(198) = -.38, p < .001$. Interestingly, no association was found between CRT performance and bullshit receptivity for Japanese participants, $r(198) = -.05, p = .487$.

[[insert Table 6 here]]

Next, we conducted multiple regression analyses predicting bullshit receptivity with individual differences in CRT performance, holistic cognition (as measured by the AHS), illusory pattern perception, and interactions of these variables with culture. Since preliminary analyses revealed that the AHS subscales of attitude toward contradiction, perception of change, and locus of attention failed to predict individuals' receptivity to bullshit, the causality subscale was the only measure of holistic thinking included in our model. Analyses of ΔR^2 showed that our model was significantly improved at all steps (Step 1: $\Delta R^2s = .144, p < .001$; Step 2: $\Delta R^2s = .057, p < .001$). The final model can be viewed in Table 7. These results show that individual differences in CRT performance ($\beta = -.50, p < .001$), illusory pattern perception ($\beta = -.34, p < .001$), and holistic cognition (as measured by the causality subscale of the AHS; $\beta = .18, p = .002$) predicted bullshit receptivity. Furthermore, we observed a significant CRT x culture interaction ($\beta = .48, p < .001$). A simple slope analysis revealed that CRT was negatively associated with bullshit receptivity within our US sample ($-0.48, p < .001$), and shared no association with bullshit receptivity in our Japanese sample ($-0.023, p = .66$), suggesting that the mechanisms underlying bullshit receptivity, like ESBs, may differ across cultures.

[[insert Table 7 here]]

General Discussion

The present study investigated cultural differences related to the endorsement of ESBs and pseudo-profound bullshit. Specifically, we examined the cognitive mechanisms supporting these beliefs across Eastern (Japanese) and Western (United States and Western Europe) cultures, revealing the generality versus specificity of cognitive mechanisms proposed in the literature surrounding ESBs. A number of key findings emerged from the current series of studies. First, consistent with past work (Shiah et al., 2010), Easterners, such as Japanese participants, showed stronger paranormal beliefs (Studies 1-3) and some evidence of stronger pseudoscientific beliefs (Studies 1-2) compared to Western participants. Conversely, receptivity to pseudo-profound bullshit statements did not differ across cultures. Individual differences in holistic cognition partly explained differences in ESBs and bullshit receptivity. Specifically, individual differences in the holistic understanding of causality (i.e. multiple and complex causality) played a key role in explaining differences in ESBs and bullshit receptivity. However, contrary to expectations, participants' attitudes towards contradictions failed to explain ESBs and bullshit receptivity, suggesting that the stronger endorsement of ESBs in our Japanese sample was not due to a cultural difference in receptiveness to contradiction. Furthermore, individual differences in thinking style also explained differences in ESBs and bullshit receptivity, with a propensity to engage in analytic thinking negatively associated with the endorsement of ESBs and pseudo-profound bullshit statements as profound. Interestingly, the association between analytic thinking style (as measured by the CRT) and ESBs differed across cultures. That is, for Westerners, individuals high in analytic thinking were less likely to endorse ESBs and pseudo-profound bullshit whereas no association was found between analytic thinking and either ESBs or bullshit receptivity in our Japanese sample. Thus, the present findings suggest that a

propensity to engage in analytic thinking suppresses ESBs in Western individuals, but may not do so across cultures (specifically Eastern cultures).

Cultural psychologists have proposed a framework to understand cultural differences in cognitive styles between Western and Eastern individuals, distinguishing between analytic and holistic cognition (Ishii, 2013; Nisbett et al., 2001; Nisbett & Miyamoto, 2005). Related to this distinction, we hypothesized that individuals demonstrating a high tolerance for contradictions would be more likely to endorse ESBs, as we suspected that those accepting contradictions would tend to perceive pro-ESB statements as plausible even when they did not specifically endorse the ESB themselves. However, our results suggest that it is not a tendency to accept contradictions that positively relates to the endorsement of ESBs, but rather the consideration that causality is complex and multifaceted and that events may have multiple causes which need not necessarily contradict. Holistic thinkers, therefore, may be less impacted by conflicts caused by scientifically unsound claims and be generous to alternative explanations of events.

Within three of our four studies, we observed a culture by CRT interaction on ESBs and bullshit receptivity. Therefore, individuals CRT performance (an assessment of their tendency to engage in analytic thinking) related differently to endorsement of ESBs and receptiveness to pseudo-profound bullshit across cultures. Consistent with past work (Pennycook et al., 2012; 2015), CRT performance was negatively associated with ESBs and bullshit receptivity within our Western sample, suggesting that more deliberative modes of thinking suppress these seemingly irrational beliefs. However, a different pattern of results was observed in our Japanese samples, for which CRT was unrelated to the endorsement of ESBs and pseudo-profound bullshit. Therefore, the present study suggests that the often observed negative association between analytic thinking and various ESBs may be exclusive to Western individuals.

Nevertheless, it remains an open question as to *why* analytic thinking relates differently to the endorsement of ESBs across cultures. One possibility is that measures of analytic thinking (such as the CRT) in part measure a tendency to oppose cultural norms. In support of this claim is the finding that cognitive reflection is positively associated with religious disbelief within highly religious countries but shares no association with religious disbelief in less religious countries (Gervais et al., 2018). If true, we may expect the association between cognitive reflection and ESBs to differ between cultures with different cultural norms surrounding ESBs. Therefore, in the present context, the weak association between cognitive reflection and ESBs in our Japanese sample may arise due to the fact that these beliefs may not necessarily violate prevailing cultural norms, while the same may not be true of a Western sample.

Summary

The present research investigates cultural differences in ESBs and bullshit receptivity. Critically, we demonstrate how the importance of analytic thinking for suppressing ESBs (often observed in Western samples) fails to generalize across cultures (i.e., Japanese samples). Of course, the current work is not intended to be definitive; therefore, future studies should explore how factors such as analytic thinking predict other important real-world beliefs (e.g. endorsement of conspiracy theories and “fake news”) across cultures. Nevertheless, we provide initial evidence demonstrating that not only does the endorsement of ESBs differ across cultures, but so to might the cognitive mechanisms supporting these beliefs, calling into question the generality of various cognitive mechanisms often thought to support ESBs.

Data Availability

Data and analysis scripts of all studies are available at <https://osf.io/cbfwj/>

Declaration of Conflicting Interests

The authors declared no potential conflicts of interests with respect to the research, authorship, and/or publication of this article.

References

- Aarnio, K., & Lindeman, M. (2005). Paranormal beliefs, education, and thinking styles. *Personality and Individual Differences*, 39(7), 1227-1236. doi:10.1016/j.paid.2005.04.009
- Bahçekapili, H. G., & Yilmaz, O. (2017). The relation between different types of religiosity and analytic cognitive style. *Personality and Individual Differences*, 117, 267-272. doi:10.1016/j.paid.2017.06.013
- Blackmore, S., & Trościanko, T. (1985). Belief in the paranormal: Probability judgements, illusory control, and the 'chance baseline shift'. *British Journal of Psychology*, 76(4), 459-468. doi:10.1111/j.2044-8295.1985.tb01969.x
- Bruder, M., Haffke, P., Neave, N., Nouripanah, N., & Imhoff, R. (2013). Measuring individual differences in generic beliefs in conspiracy theories across cultures: Conspiracy Mentality Questionnaire. *Frontiers in Psychology*, 4. doi:10.3389/fpsyg.2013.00225
- Choi, I., Koo, M., & Choi, J. A. (2007). Individual differences in analytic versus holistic thinking. *Personality and Social Psychology Bulletin*, 33(5), 691-705. doi:10.1177/0146167206298568
- Cohen, P., Cohen, J., Aiken, L. S., & West, S. G. (1999). The problem of units and the circumstance for POMP. *Multivariate Behavioral Research*, 34(3), 315-346. doi:10.1207/S15327906MBR3403_2
- Dekker, S., Lee, N. C., Howard-Jones, P., Jolles, J., Kuan-Chung, C., & Jordan, A. (2012). Neuromyths in education: Prevalence and predictors of misconceptions among teachers. *Frontiers in Psychology*, 3, 1-8. doi:10.3389/fpsyg.2012.00429
- Epstein, S., Pacini, R., Denes-Raj, V., & Heier, H. (1996). Individual differences in intuitive-experiential and analytical-rational thinking styles. *Journal of Personality & Social*

- Psychology*, 71(2), 390-405. doi:10.1037/0022-3514.71.2.390
- Evans, J. S. B. T. (2008). Dual-processing accounts of reasoning, judgment, and social cognition. *Annu Rev Psychol*, 59(1), 255-278. doi:10.1146/annurev.psych.59.103006.093629
- Evans, J. S. B. T., & Stanovich, K. E. (2013). Dual-process theories of higher cognition: Advancing the debate. *Perspectives on Psychological Science*, 8(3), 223-241. doi:10.1177/1745691612460685
- Fagerlin, A., Zikmund-Fisher, B. J., Ubel, P. A., Jankovic, A., Derry, H. A., & Smith, D. M. (2007). Measuring numeracy without a math test: Development of the Subjective Numeracy Scale. *Medical Decision Making*, 27(5), 672-680. doi:10.1177/0272989x07304449
- Frederick, S. (2005). Cognitive reflection and decision making. *Journal of Economic Perspectives*, 19(4), 25-42. doi:10.1257/089533005775196732
- Gervais, W. M., & Norenzayan, A. (2012). Analytic thinking promotes religious disbelief. *Science*, 336(6080), 493-496. doi:10.1126/science.1215647
- Gervais, W. M., van Elk, M., Xygalatas, D., McKay, R. T., Aveyard, M., Buchtel, E. E., . . . Bulbulia, J. (2018). Analytic atheism: A cross-culturally weak and fickle phenomenon? *Judgment and Decision Making*, 13(3), 268-274.
- Gray, T., & Mill, D. (1990). Critical abilities, graduate education (Biology vs. English), and belief in unsubstantiated phenomena. *Canadian Journal of Behavioural Science*, 22(2), 162-172. doi:10.1037/h0078899
- Henrich, J., Heine, S. J., & Norenzayan, A. (2010). The weirdest people in the world? *Behavioral and Brain Sciences*, 33(2-3), 61-83. doi:10.1017/S0140525X0999152X
- Ishii, K. (2013). Culture and the mode of thought: A review. *Asian Journal of Social Psychology*, 16(2), 123-132. doi:10.1111/ajsp.12011

- Karasawa, K., & Tsukimoto, T. (2010). The effect of information processing style on beliefs toward paranormal phenomena. *Journal of Human Environmental Studies*, 8, 1-5.
doi:10.4189/shes.8.1
- Lindeman, M. (2011). Biases in intuitive reasoning and belief in complementary and alternative medicine. *Psychology & Health*, 26(3), 371-382. doi:10.1080/08870440903440707
- Lindeman, M., & Aarnio, K. (2006). Paranormal beliefs: Their dimensionality and correlates. *European Journal of Personality*, 20(7), 585-602. doi:10.1002/per.608
- Lobato, E., Mendoza, J., Sims, V., & Chin, M. (2014). Examining the relationship between conspiracy theories, paranormal beliefs, and pseudoscience acceptance among a university population. *Applied Cognitive Psychology*, 28(5), 617-625. doi:10.1002/acp.3042
- Maddux, W. W., & Yuki, M. (2006). The “Ripple Effect”: Cultural differences in perceptions of the consequences of events. *Personality and Social Psychology Bulletin*, 32, 669-683.
doi:10.1177/0146167205283840
- Majima, Y. (2015). Belief in pseudoscience, cognitive style and science literacy. *Applied Cognitive Psychology*, 29(4), 552-559. doi:10.1002/acp.3136
- Markovits, H., & Nantel, G. (1989). The belief-bias effect in the production and evaluation of logical conclusions. *Memory & Cognition*, 17(1), 11-17. doi:10.3758/BF03199552
- Naito, M., Suzuki, K., & Sakamoto, A. (2004). Development of rational and intuitive information-processing style inventory. *The Japanese Journal of Personality*, 13(1), 67-78.
doi:10.2132/personality.13.67
- Nisbett, R. E., Choi, I., Peng, K., & Norenzayan, A. (2001). Culture and systems of thought: Holistic versus analytic cognition. *Psychological Review*, 108(2), 291-310.
doi:10.1037/0033-295X.108.2.291

- Nisbett, R. E., & Miyamoto, Y. (2005). The influence of culture: Holistic versus analytic perception. *Trends in Cognitive Sciences*, 9(10), 467-473. doi:10.1016/j.tics.2005.08.004
- Norenzayan, A., Smith, E. E., Kim, B. J., & Nisbett, R. E. (2002). Cultural preferences for formal versus intuitive reasoning. *Cognitive Science*, 26, 653-684. doi: 10.1207/s15516709cog2605_4
- Pacini, R., & Epstein, S. (1999). The relation of rational and experiential information processing styles to personality, basic beliefs, and the ratio-bias phenomenon. *Journal of Personality and Social Psychology*, 76(6), 972-987. doi:10.1037/0022-3514.76.6.972
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2014). Cognitive style and religiosity: The role of conflict detection. *Memory & Cognition*, 42(1), 1-10. doi:10.3758/s13421-013-0340-7
- Pennycook, G., Cheyne, J. A., Barr, N., Koehler, D. J., & Fugelsang, J. A. (2015). On the reception and detection of pseudo-profound bullshit. *Judgment & Decision Making*, 10(6), 549-563.
- Pennycook, G., Cheyne, J. A., Seli, P., Koehler, D. J., & Fugelsang, J. A. (2012). Analytic cognitive style predicts religious and paranormal belief. *Cognition*, 123(3), 335-346. doi:10.1016/j.cognition.2012.03.003
- Pennycook, G., Fugelsang, J. A., & Koehler, D. J. (2015). Everyday consequences of analytic thinking. *Current Directions in Psychological Science*, 24(6), 425-432. doi:doi:10.1177/0963721415604610
- Pennycook, G., & Rand, D. G. (2020). Who falls for fake news? The roles of bullshit receptivity, overclaiming, familiarity, and analytic thinking. *Journal of Personality*, 88(2), 185-200.
- Roberts, M. J., & Seager, P. B. (1999). Predicting belief in paranormal phenomena: A

- comparison of conditional and probabilistic reasoning. *Applied Cognitive Psychology*, 13(5), 443-450. doi:10.1002/(SICI)1099-0720(199910)13:5<443::AID-ACP592>3.0.CO;2-K
- Sanchez, C., Sundermeier, B., Gray, K., & Calin-Jageman, R. J. (2017). Direct replication of Gervais & Norenzayan (2012): No evidence that analytic thinking decreases religious belief. *PLoS ONE*, 12(2), e0172636. doi:10.1371/journal.pone.0172636
- Shiah, Y.-J., Wu, M.-H., Tam, W.-C. C., & Chang, F. (2010). Paranormal beliefs and religiosity: Chinese version of the revised paranormal belief scale. *Psychological Reports*, 107(2), 367-382. doi:10.2466/08.09.17.Pr0.107.5.367-382
- Spencer-Rodgers, J., Peng, K., Wang, L., & Hou, Y. (2004). Dialectical self-esteem and East-West differences in psychological well-being. *Personality and Social Psychology Bulletin*, 30(11), 1416-1432. doi:10.1177/0146167204264243
- Spencer-Rodgers, J., Williams, M. J., & Peng, K. (2010). Cultural differences in expectations of change and tolerance for contradiction: A decade of empirical research. *Personality and Social Psychology Review*, 14(3), 296-312. doi:10.1177/1088868310362982
- Tobacyk, J., J. (2004). A revised paranormal belief scale. *International Journal of Transpersonal Studies*, 23(1), 94-98.
- Turpin, M. H., Walker, A. C., Kara-Yakoubian, M., Gabert, N. N., Fugelsang, J. A., & Stolz, J. A. (2019). Bullshit makes the art grow profounder. *Judgment and Decision Making*, 14(6), 658-670.
- van Prooijen, J.-W., Douglas, K. M., & De Inocencio, C. (2018). Connecting the dots: Illusory pattern perception predicts belief in conspiracies and the supernatural. *European Journal of Social Psychology*, 48, 320-335. doi:10.1002/ejsp.2331

- Walker, A. C., Turpin, M. H., Stolz, J. A., Fugelsang, J. A., & Koehler, D. J. (2019). Finding meaning in the clouds: Illusory pattern perception predicts receptivity to pseudo-profound bullshit. *Judgment and Decision Making*, 14(2), 109-119.
- Whitson, J. A., & Galinsky, A. D. (2008). Lacking control increases illusory pattern perception. *Science*, 322(5898), 115-117. doi:10.1126/science.1159845
- Yonker, J. E., Edman, L. R. O., Cresswell, J., & Barrett, J. L. (2016). Primed analytic thought and religiosity: The importance of individual characteristics. *Psychology of Religion and Spirituality*, 8(4), 298-308. doi:10.1037/rel0000095
- Zhang, B., Galbraith, N., Yama, H., Wang, L., & Manktelow, K. I. (2015). Dialectical thinking: A cross-cultural study of Japanese, Chinese, and British students. *Journal of Cognitive Psychology*, 27(6), 771-779. doi:10.1080/20445911.2015.1025792

Table 1. Descriptive Statistics and correlation of key variables (Study 1).

	West (<i>n</i> = 151)			JP (<i>n</i> = 147)		Sample difference			Pearson correlational coefficients ^{a)}										
	<i>α</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age		33.23	11.50	38.37	9.45	4.22	.000	0.49		−.003	.023	−.001	.029	.014	.030	.081	−.044	−.010	.199
2. CAB		66.62	21.10	62.95	18.04	1.61	.108	0.19	.160		.305	−.274	.490	.018	.015	−.040	.002	−.215	−.165
3. RAT	.87	22.80	4.76	19.18	5.29	6.22	.000	0.72	−.063	.453		−.259	.177	.071	.102	.011	.235	−.084	−.106
4. EXP	.88	19.09	5.56	18.23	4.64	1.44	.151	0.17	.033	−.285	−.125		−.299	.029	−.201	−.139	−.147	.481	.372
5. CRT		1.63	1.18	1.44	1.09	1.47	.143	0.17	.098	.646	.342	−.335		.033	−.048	.097	.051	−.255	−.273
6. Cause	.75	14.68	4.11	16.00	3.19	−3.09	.002	0.36	.054	−.151	−.066	.221	−.169		.053	−.057	.195	.081	.133
7. Contra	.66	14.93	3.67	14.51	3.36	1.02	.307	0.12	−.031	−.104	−.068	.178	−.137	.015		−.035	.206	−.079	.121
8. Change	.60	14.23	3.42	15.44	3.55	−3.00	.003	0.35	−.017	−.066	.016	.019	.079	−.162	.003		.014	−.199	−.161
9. Attention	.64	13.52	3.89	15.84	2.74	−5.92	.000	0.69	.001	.017	−.062	.024	−.052	.028	.097	−.075		−.045	−.069
10. B _{PA}	.94	2.24	1.03	2.87	0.83	−5.81	.000	0.66	.126	−.389	−.192	.393	−.486	.283	.112	−.121	−.042		.534
11. B _{PS}	.79	2.53	0.68	2.87	0.53	−4.81	.000	0.56	.183	−.339	−.211	.291	−.454	.353	.110	−.171	−.031	.674	

Notes. *d* = Cohen's *d* statistics. *α* = Cronbach's alpha coefficients. CAB = cognitive ability score described by unweighted mean POMP scores of syllogism and subjective numeracy, RAT = rationality, EXP = experientiality, CRT = Cognitive Reflection Test, Cause = Causality scale of AHS, Contra = Attitude towards Contradiction scale of AHS, Change = Perception of Change scale of AHS, Attention = Locus of Attention of AHS, B_{PA} = Belief in the paranormal, B_{PS} = Belief in pseudoscience.

a) values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicates coefficients for Western sample. The coefficients shown in bold face were significant at *p* < .05.

Table 2. Regression analyses predicting beliefs by cognitive traits, cultural orientation, and interactions with sample.

Predictors	Study 1								Study 2							
	B _{PA} (adj. $R^2 = .39$)				B _{PS} (adj. $R^2 = .33$)				B _{PA} (adj. $R^2 = .22$)				B _{PS} (adj. $R^2 = .30$)			
	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>
(Intercept)	2.33	0.17		.000	2.29	0.12		.000	2.24	0.18		.000	2.26	0.12		.000
Sample ^{a)}	0.57	0.10	.576	.000	0.22	0.07	.343	.001	0.43	0.13	.474	.001	0.20	0.08	.318	.015
Gender ^{b)}	−0.45	0.10	−.454	.000	−0.15	0.07	−.232	.027	−0.20	0.10	−.217	.041	−0.05	0.06	−.076	.450
Age	0.01	0.00	.058	.218	0.01	0.00	.187	.000	0.00	0.01	.048	.398	0.01	0.00	.132	.015
RAT	0.00	0.01	.020	.790	−0.00	0.01	−.025	.758	−0.04	0.02	−.170	.041	−0.04	0.01	−.277	.000
EXP	0.04	0.01	.183	.004	0.01	0.01	.077	.250	0.10	0.02	.431	.000	0.06	0.01	.348	.000
CRT	−0.31	0.06	−.358	.000	−0.21	0.04	−.384	.000	−0.21	0.06	−.271	.001	−0.21	0.04	−.376	.000
Causality	0.04	0.02	.136	.023	0.04	0.01	.238	.000								
DSS									0.29	0.12	.188	.016	0.02	0.08	.018	.804
Sample × RAT	0.01	0.02	.052	.609	0.00	0.01	.036	.738	0.08	0.03	.350	.003	0.04	0.02	.264	.019
Sample × EXP	0.05	0.02	.242	.016	0.03	0.01	.214	.042	−0.06	0.03	−.238	.036	−0.01	0.02	−.057	.596
Sample × CRT	0.29	0.09	.331	.001	0.15	0.06	.264	.013	0.16	0.09	.208	.057	0.07	0.06	.132	.203
Sample × Causality	−0.03	0.03	−.102	.290	−0.02	0.02	−.128	.206								
Sample × DSS									−0.14	0.19	−.089	.473	0.24	0.13	.217	.065

Notes. All continuous variables except for age were mean-centered. a) 1 = Japanese, 0 = Western, b) 1 = Men, 0 = Women

Table 3. Descriptive Statistics and correlations of key variables (Study 2).

	West ($n = 149$)			JP ($n = 167$)		Sample difference			Pearson correlation coefficients ^{a)}							
	α	M	SD	M	SD	t	p	d	Age	CAB	RAT	EXP	CRT	DSS	B _{PA}	B _{PS}
Age		30.60	10.03	39.47	9.34	-7.92	.000	0.92		.063	.118	-.098	.163	-.134	-.098	-.059
CAB		62.49	12.97	60.65	12.39	1.29	.199	0.15	.067		.395	-.208	.441	-.025	-.037	-.304
RAT	.79	18.29	3.85	15.51	3.75	6.50	.000	0.73	.105	.368		-.091	.381	-.209	.117	-.171
EXP	.80	17.97	3.48	15.40	3.64	6.40	.000	0.72	.127	.017	.092		-.201	-.211	.217	.336
CRT		1.41	1.15	1.39	1.19	0.10	.917	0.01	.054	.588	.236	-.015		-.057	-.064	-.329
DSS	.83	3.62	0.59	4.20	0.45	-9.75	.000	1.10	-.171	-.075	-.252	-.166	-.156		.019	.124
B _{PA}	.93	2.24	0.94	2.69	0.85	-4.42	.000	0.50	.159	-.275	-.221	.365	-.334	.197		.468
B _{PS}	.79	2.48	0.69	2.76	0.57	-3.97	.000	0.45	.202	-.317	-.281	.312	-.390	.070	.624	

Notes. DSS = Dialectical Self Scale, B_{PA} = Belief in the paranormal, B_{PS} = Belief in pseudoscience.

a) values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicate coefficients for Western sample. The coefficients shown in bold face were significant at $p < .05$.

Table 4. Descriptive Statistics and correlations of key variables (Study 3).

	West ($n = 135$)		JP ($n = 126$)		Sample difference			Pearson correlation coefficients ^{a)}										
	M	SD	M	SD	t	p	d	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	32.9	11.4	36.6	9.0	-3.13	.002	0.36		.100	.124	-.032	.127	.077	.089	.026	.264	-.158	-.234
2. CAB	61.3	19.1	57.8	17.2	1.69	.092	0.20	-.079		.117	-.046	.454	.068	-.073	-.104	.022	-.053	-.089
3. RAT	18.5	3.6	15.8	3.9	6.18	.000	0.72	-.118	.210		.026	.129	.208	-.120	.078	.099	-.063	-.037
4. EXP	18.3	3.6	16.1	3.4	5.29	.000	0.61	.029	-.251	-.057		-.055	.114	.143	.226	.146	.038	.007
5. CRT	1.3	1.2	1.4	1.0	-0.99	.322	0.11	-.189	.376	.182	-.145		-.057	.062	-.305	-.096	-.143	-.059
6. Cause	30.4	5.3	32.6	5.4	-3.50	.000	0.40	-.087	-.128	.079	.167	.075		.178	.262	.196	.046	.008
7. Contra	28.6	5.9	28.6	4.9	0.03	.978	0.00	-.053	-.111	-.222	-.024	-.179	.158		-.010	.053	-.040	.082
8. B _{PA}	3.0	1.3	3.8	1.4	-5.15	.000	0.60	.058	-.223	-.107	.385	-.225	.417	.070		.430	-.067	-.159
9. B _{PS}	3.7	0.9	3.6	0.8	1.20	.229	0.14	.255	-.291	-.174	.283	-.338	.272	.161	.513		-.059	-.366
10. DT _{PA}	0.4	0.3	0.4	0.3	-0.48	.630	0.06	.042	-.137	-.139	.224	-.048	.034	-.004	.085	.196		.164
11. DT _{PS}	0.5	0.4	0.6	0.4	-2.00	.046	0.23	-.162	-.156	.007	.107	-.109	-.072	.087	-.087	-.046	.226	

Notes. DT_{PA} = Dialectic Thinking score for paranormal items, DT_{PS} = Dialectic Thinking score for pseudoscience items.

a) values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicates coefficients for Western sample. The coefficients shown in bold face were significant at $p < .05$.

Table 5. Regression analyses predicting beliefs by cognitive traits, cultural orientation, dialectical thinking, and interactions with sample.

	B _{PA}								B _{PS}							
	Without DT				With DT				Without DT				With DT			
	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>	<i>b</i>	<i>SE</i>	β	<i>p</i>
(Intercept)	3.09	0.27		.000	3.12	0.28		.000	3.29	0.16		.000	3.39	0.19		.000
Sample ^{a)}	0.77	0.16	.548	.000	1.00	0.24	.552	.000	−0.22	0.10	−.266	.031	0.12	0.15	−.206	.438
Gender ^{b)}	−0.35	0.15	−.247	.022	−0.35	0.15	−.248	.022	−0.19	0.09	−.236	.041	−0.15	0.09	−.184	.106
Age	0.01	0.01	.036	.476	0.00	0.01	.028	.574	0.02	0.00	.232	.000	0.02	0.00	.199	.000
RAT	−0.03	0.03	−.077	.328	−0.03	0.03	−.077	.330	−0.03	0.02	−.123	.142	−0.03	0.02	−.127	.120
EXP	0.10	0.03	.248	.001	0.10	0.03	.248	.001	0.04	0.02	.175	.023	0.04	0.02	.185	.015
CRT	−0.19	0.09	−.144	.031	−0.19	0.09	−.146	.030	−0.19	0.05	−.249	.001	−0.20	0.05	−.263	.000
Causality	0.10	0.02	.379	.000	0.10	0.02	.379	.000	0.05	0.01	.320	.000	0.05	0.01	.316	.000
DT ^{c)}					0.01	0.30	.002	.970					−0.07	0.16	−.035	.649
RAT × Sample	0.05	0.04	.137	.197	0.05	0.04	.131	.218	0.03	0.02	.169	.136	0.03	0.02	.167	.132
EXP × Sample	−0.02	0.04	−.044	.671	−0.02	0.04	−.040	.701	−0.01	0.03	−.039	.722	−0.01	0.02	−.051	.639
CRT × Sample	−0.17	0.13	−.131	.193	−0.19	0.13	−.146	.149	0.13	0.08	.169	.117	0.12	0.08	.161	.126
Causality × Sample	−0.05	0.03	−.206	.044	−0.05	0.03	−.199	.051	−0.03	0.02	−.213	.050	−0.03	0.02	−.198	.064
DT × Sample ^{c)}					−0.61	0.47	−.130	.194					−0.49	0.21	−.241	.019
Adjusted <i>R</i> ²	.31				.31				.21				.25			

Notes. All continuous variables except for age were mean-centered. a) 1 = Japanese, 0 = Western, b) 1 = Men, 0 = Women, c) DT = Dialectical Thinking score of each domain (DT_{PA} for B_{PA} and DT_{PS} for B_{PS})

Table 6. Descriptive Statistics of cognitive traits and beliefs (Study 4).

	West ($n = 181$)		JP ($n = 177$)		Sample difference			Pearson correlation coefficients ^{a)}										
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>t</i>	<i>p</i>	<i>d</i>	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.
1. Age	34.30	10.67	39.45	10.02	-4.97	.000	0.50		.165	.046	.130	.079	-.040	.075	.157	-.101	-.021	-.056
2. CRT	1.54	0.70	1.43	1.11	1.21	.227	0.12	.057		-.087	.084	.050	-.127	.151	-.087	-.049	-.160	-.400
3. Pattern (P)	9.03	2.60	8.55	2.37	1.92	.055	0.19	.084	.059		-.523	.160	-.013	-.012	.139	.155	.234	.036
4. Patten (A)	9.89	2.33	9.61	2.44	1.21	.227	0.12	.014	.165	-.376		-.054	.008	.146	-.071	-.250	-.213	-.242
5. Cause	31.09	5.49	32.17	4.39	-2.17	.030	0.22	-.035	.020	.064	.069		.139	.142	.341	.103	.207	-.026
6. Contra	29.48	6.31	28.39	4.39	2.00	.046	0.20	-.116	.066	.108	-.050	.237		-.133	.292	.024	.177	.079
7. Change	27.15	5.84	29.14	4.50	-3.83	.000	0.38	.084	.142	.097	.225	.014	-.003		-.111	-.023	-.002	-.152
8. Attention	29.68	5.66	30.95	3.67	-2.66	.008	0.27	-.009	-.159	.010	-.004	.230	.244	-.146		.087	.167	-.006
9. BSR	2.60	1.00	2.58	0.75	0.28	.778	0.03	-.157	-.382	.116	-.334	.147	.104	-.169	.089		.527	.332
10. MQ	3.20	0.76	2.99	0.65	2.94	.003	0.29	-.033	-.178	.089	-.270	.130	.267	-.123	.193	.575		.442
11. MS	1.50	0.86	1.96	0.83	-5.52	.000	0.55	-.112	-.358	-.096	-.453	-.062	-.027	-.516	.100	.452	.292	

Notes. Pattern (P) = number of correct responses to object-present items where an object was embedded, Pattern (A) = number of correct responses to object-absent items where an object was not embedded (lower scores illustrate greater illusory pattern perception), BSR = mean profundity rating given to pseudo-profound bullshit statements, MQ = mean profundity rating given to motivational quotes, MS = mean profundity rating given to mundane statements.

a) values above the diagonal indicate coefficients for Japanese sample, and values below the diagonal indicates coefficients for Western sample. The coefficients shown in bold face were significant at $p < .05$.

Table 7. Regression analysis predicting bullshit receptivity by reflective thinking, holistic cognition, illusory pattern perception, and interactions with sample.

	<i>B</i>	<i>SE</i>	β	<i>p</i>
(Intercept)	2.91	0.16		.000
Sample ^{a)}	−0.05	0.08	−.048	.595
Gender ^{b)}	0.10	0.08	.114	.230
Age	−0.01	0.00	−.109	.022
Pattern Absent	−0.13	0.03	−.342	.000
CRT	−0.48	0.08	−.503	.000
Causality	0.03	0.01	.179	.002
Sample × Pattern	0.06	0.03	.152	.100
Sample × CRT	0.46	0.10	.479	.000
Sample × Causality	−0.01	0.02	−.075	.425

Notes. Pattern Absent = number of correct responses to object-absent items where an object was not embedded (lower scores illustrate greater illusory pattern perception). Adjusted $R^2 = .182$, $F(9, 390) = 10.90$, $p < .001$.

a) 1 = Japanese, 0 = Western, b) 1 = Men, 0 = Women