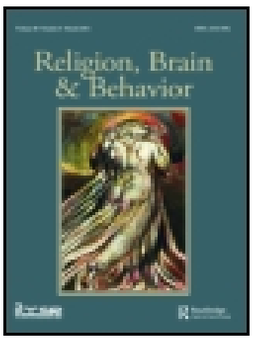

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# Reasoning about nature's agency and design in the cultural context of China

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**ABSTRACT**

Research has found that non-religious adults have an automatic tendency to construe natural phenomena as intentionally created. Related work has focused on whether Western and non-Western adults spontaneously assign functions to natural phenomena but, to date, no studies have explored whether an assumption of intentional origins extends to a non-Western culture without an Abrahamic cultural tradition and associated design discourse. We therefore explored whether adults in China display an intentional design bias. Participants performed a speeded judgment task in which they evaluated whether depicted items were intentionally created or not. Chinese adults favored a design-based construal of natural phenomena under processing constraints. We also created a novel culturally sensitive survey to more fully document supernatural beliefs and practices. The survey confirmed participants' primarily atheistic self-identification while also revealing various supernatural practices and animistic beliefs. Aspects of these folk beliefs positively predicted design intuitions about nature. Cumulatively, these results demonstrate that intuitions about intentional origins are present independent of any Western creationist discourse or Abrahamic God belief. They provide first evidence of a potentially universal intentional design bias in adults. They also point to the need for more nuanced, culturally sensitive, survey approaches to explicit supernatural belief and practice.

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Agency; design; intention; nature; China; dual process

## Introduction

Research exploring people's beliefs about intentional design in nature has often been conducted in conjunction with surveys about people's acceptance of evolution. In these studies, the tendency to construe nature as intentionally created is often characterized as an exclusive feature of religious believers. This characterization implies that beliefs about the intentional origins of natural phenomena are restricted to individuals who explicitly believe in a monotheistic God, affiliate with a religious community that endorses creationist beliefs, and reject evolution to some degree (see, e.g., Clément, 2015; Hill, 2014a, 2014b; Miller, Scott, & Okamoto, 2006; Pew Research Center, 2013). However, recent findings suggest that explicit theistic belief in a creator God is neither the sole expression nor the only cause of people's tendency to view nature as intentionally designed.

Specifically, studies have found that tendencies to construe nature in terms of an agent's purposeful actions are present even in the minds of non-religious individuals (Järnefelt, Canfield, & Kelemen, 2015; see also Banerjee & Bloom, 2014; Heywood & Bering, 2014; Kelemen & Rosset, 2009; Kelemen,

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Rottman, & Seston, 2013; Rottman et al., 2017). For example, Järnefelt et al. (2015; see also Järnefelt, 2013) conducted a series of studies with North American and Finnish adults, who expressed explicit disbelief in any kind of higher power, God, or gods. Participants were asked to look at pictures of living and non-living natural entities (e.g., fish, tree, rock, hurricane) and decide whether they thought that the things in the pictures were "purposefully made by some being or not." Drawing on dual processing models of reasoning (e.g., Evans & Stanovich, 2013; Kahneman, 2011), a major focus of these studies was on the automatic nature of this type of reasoning and whether, despite their explicit reflective disbeliefs, people have an underlying gut intuition that natural phenomena are purposefully designed. Using a common method for accessing gut intuitions (e.g., Eidson & Coley, 2014; Evans & Curtis-Holmes, 2005; Goldberg & Thompson-Schill, 2009; Kelemen & Rosset, 2009; Kelemen et al., 2013; Roberts & Newton, 2001), one group of participants were asked to make their judgments at speed so that they would not have time to reflect on their answers and suppress an automatic response. In contrast, the second group were given time to reflect on their choices.

Results across these speeded design bias tasks revealed that non-religious adults in speeded conditions were more likely to identify both living and non-living natural phenomena as "purposefully made by some being." Such findings are consistent with earlier theoretical proposals, that the tendency to view natural phenomena as intentionally designed is, in part, a consequence of deep-seated automatic cognitive biases (e.g., Barrett, 2004, 2012; Bloom, 2007; Boyer, 2003; Evans, 2001; Hood, 2009; Kelemen, 2004). That is, while it may be further elaborated in certain cultural contexts, a spontaneous tendency to construe nature in terms of an agent's intentional design is not solely dependent on explicitly taught cultural or religious ideas (Järnefelt et al., 2015; Kelemen, 2004; see also Wolpert, 2006). Indeed, it might have developmentally predictable (or innate) cognitive foundations that mean that it can exist quite independently of formal culture-specific theological beliefs in God, Jesus, or other codified religious agents.

However, even though results suggesting an automatic design bias were obtained in two different cultural contexts – the United States and Finland – that vary in their degree of cultural religiosity, no studies have yet explored whether this tendency extends beyond a Western cultural context of Christian or Abrahamic monotheism.

Such research is obviously essential if generalizations about cognitive tendencies are to be made beyond Western individuals and if proposals about the universality of intentional design intuitions are to be explored (Henrich, Heine, & Norenzyan, 2010). Arguably, previous research has already offered some reasons to suspect such universality. For example, studies have explored the development and cross-cultural recurrence of potentially related intuitions, specifically, teleological notions that objects and events exist in order to perform functions. Findings from this work suggest that broad tendencies to explain living and non-living natural phenomena in functional terms (e.g., eyes exist to see, rain exists to water plants) emerge early in development in both Western and Eastern cultural samples (Kelemen, 1999a, 1999b; Schachner, Zhu, Li, & Kelemen, 2017). Under speeded conditions, they also appear to persist as automatic gut intuitions in Western adults – even those motivated to reject them as scientifically unwarranted – and in members of overtly secular, Eastern cultural groups (Kelemen & Rosset, 2009; Kelemen et al., 2013; Rottman et al., 2017). However, tendencies to construe phenomena in functional terms and tendencies to view phenomena as having intentional origins are not synonymous and while they may be intimately related in context of mature reasoning about human-made artifacts (see Kelemen & Carey, 2007, for review), they may be entirely conceptually independent in the context of reasoning about the natural world. For example, it is perfectly feasible that people might maintain the belief that hearts exist to pump blood without any reference to an intuition that bodies are intentionally designed – the two notions need have no causal relationship to each other (Kelemen & DiYanni, 2005; Lombrozo & Carey, 2006).

In consequence, while suggestive, prior work on the teleological bias does not answer questions about the cross-cultural robustness of a bias to assume intentional origins in nature in non-Western cultures. The current study therefore addresses this gap in the literature by extending research using

a speeded design bias task to China – a cultural context that represents a particularly interesting case for several reasons.

First, China is often characterized as the world's most atheistic society (see, e.g., Farha, 2012). Consistent with this, surveys and public polls that have examined people's religious self-identity show that Chinese adults are highly inclined to define themselves as "non-religious," religiously unaffiliated, or atheist (e.g., WIN-Gallup International, 2012, 2015). Second, unlike other highly secular countries that otherwise share a common intellectual heritage with the United States (e.g., Finland, Denmark, Sweden), the roots of Chinese intellectual traditions do not trace to the Ancient Greeks or stem from Abrahamic monotheism. China therefore offers a distinctive opportunity to explore whether a design bias about nature can really exist independent of the cultural influence of formal Abrahamic creationist beliefs. Furthermore, because Chinese culture is rich in an array of folk beliefs and practices that are neither rooted in monotheism nor necessarily derived from any formal, institutionalized or codified religion, China offers an opportunity to explore what kinds of non-creationist and non-Abrahamic cultural conceptions and behaviors might relate to an agent-based construal of how living and non-living natural phenomena originate. If the design bias is a general property of human information processing rather than a culture-specific product of creationist belief, various cultural constructs – or none – might be associated with it. In prior Western research, an informal animistic folk conception of Nature (i.e., the "Gaia" notion that earth or nature has intrinsic agency and is alive) has been found to relate to secular individuals' intuitions that natural phenomena result from intentional design (Järnefelt et al., 2015; see also Kelemen & Rosset, 2009; Kelemen et al., 2013).

## Methods

### Participants

Participants were 254 Chinese adults (55% female; mean age = 22 years, *SD* = 2 years) from a Beijing area university. This sample size provided more than 80% power to detect an effect ($\alpha = .05$) with a moderate effect size, which was expected based on prior studies (Järnefelt et al., 2015). Approximately 56% of participants had completed or were completing their Bachelor's degree; 44% had completed or were completing their Master's degree. Various disciplines were represented including Engineering (31%), Science or Social Science (21.5%), Agriculture (18%), Humanities, Education, and Other (29.5%). When asked about religious preference (宗教偏好), as expected, a large proportion (50%) of the participants identified as atheist. Only 5% identified with an Abrahamic monotheistic religion (see Figure 1).

The final sample of 254 participants represented individuals who met inclusion criteria used in prior research (Järnefelt et al., 2015; Kelemen et al., 2013) by completing over 50% of the test items and/or passing at least 75% of the control items in each condition. An additional 147 participants were tested but did not meet these criteria. This level of exclusion is consistent with prior studies employing similar methods (e.g., Järnefelt et al., 2015; Oppenheimer, Meyvis, & Davidenko, 2009) and occurred primarily in the speeded condition due to effects of cognitive load and cognitive dissonance.

### Materials and procedure

Participants were randomly assigned to one of four conditions for the Speeded Design task (Järnefelt, 2013; Järnefelt et al., 2015) which was performed first: speeded being-made group ($n = 68$), unspeeded being-made group ($n = 73$), speeded human-made group ($n = 50$) or unspeeded human-made group ($n = 63$).

#### Being-made group

Participants assigned to speeded and unspeeded conditions were sequentially presented with 120 pictures (40 test trials, 80 control/cognitive load trials) in random order on a computer. Participants'

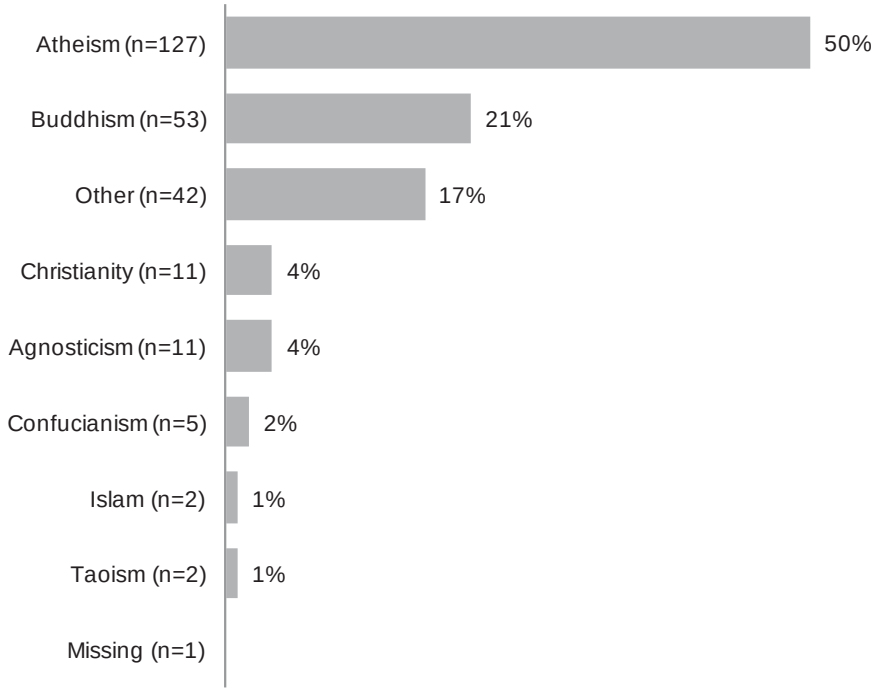


**Figure 1.** Participants' religious preference.

task was to identify if any being (主体) purposefully created the item at some point in time or whether the item (or a precursor) just happened (自行出现) and was therefore not made by any being. When prompted to give a response under each picture, participants were asked to consider "did any subject purposefully make this?" and respond either "yes" or "no" by pressing relevant keyboard response keys.

The material was first back-translated from English to Mandarin and back to English by two English-Mandarin speakers. These translations were then further evaluated by a panel that included both the translators and English- and Chinese-speaking authors to ensure that the nuances in meaning were translated accurately (see Appendix A for the full instructions in both English and Mandarin Chinese). In reference to the translations, it is important to mention some of the unavoidable issues encountered when translating some of the terms. The expression 主体 literally translates in English as "subject." This particular term was used because extensive discussions with our Mandarin translation team indicated that it was the best language term to convey the idea of a being as an abstract agency without specificity to any particular kind of agent, such as only a human or only a god. This lack of specificity in the being-made condition was needed in order to draw a contrast to the human-made control groups (described below) in which participants considered whether the objects were made by humans. Participants were provided with a clarification about the meaning of the phrase in the task instructions as follows: "It is important for you to note that by using the term 'being' we are deliberately non-specific. For us, 'being' might refer to anything capable of intentionally creating things." We also need to point out that when contrasting the notion of intentional creation with the idea that something "just happened," we used the expression 自行出现, which literally translates in English as "appeared on their own" or "self-actuated appeared." Although this was the most accurate translation available, this expression is arguably not totally free from traces of animism, or the idea of the item creating itself. Nevertheless, given results across all conditions and control trials, it appears that our participants understood the contrast being drawn.

As in Järnefelt et al. (2015), test trial items were 40 photographs of living and non-living natural phenomena (e.g., giraffe, maple tree, tiger's paw, mountain, stalagmite, hurricane). All pictures of living things depicted adult or full-grown organisms. The 80 control/cognitive load trials consisted of three types and were included to track participants' understanding of the instructions, their abilities to respond at speed, as well as response biases and strategies that were likely to occur given non-religious participants' potentially high motivations to "beat the task" by adopting strategies intended to protect against ever endorsing answers that might read as religious or creationist. "No-bias control" trials (10 items) represented various kinds of human-made objects (e.g., scissors, cello, bicycle). These pictures were included to control for and monitor participants' potential bias to respond "no" to all pictures and deny creation for all items – even for the artifacts that were unequivocally "purposefully made by some being" and therefore should have always yielded "yes" responses regardless of condition or personal atheistic beliefs.

In addition to the "no-bias controls," we included "yes-bias controls" (60 items) that counterbalanced the potential "yes" and "no" responses in the design. In these trials, participants saw different kinds of colorful geometrical shapes and were specifically instructed: "When you see a geometrical shape, always press NO." This task was developed to control for yes-biases because, in the event participants displayed an automatic creation bias, no item category would have been unambiguously interpretable as *not* created. These trials also served to monitor participants' attentiveness and understanding of the instructions.

Finally, and again replicating the original study, "cognitive load control" trials (10 items) were included to increase the complexity of the task and prevent participants from adopting another low-level strategy for "beating the task," which became apparent during pilot testing of the original research. This strategy was a superficial category-based approach of perceptually scanning for artifacts and answering "yes" and scanning for non-human-made objects and answering "no." To foil this strategy, cognitive load trials involved human-made artifactual representations of living things, specifically cartoon characters (e.g., Eeyore, Spiderman). These trials, therefore, paralleled test trials of natural entities except that they were human-made caricatures that, as artifacts, were "purposefully made by some being" but were sufficiently ambiguous to interfere with participants using an attentionally undemanding category-based heuristic throughout the whole task. High levels of inaccurate "no" responses to cognitive load trials were informative as to participants' engagement or difficulty with the task as well as their level of motivation to avoid answering "yes" on test trials. Across all control trial types, correct answers were weighted towards "no" judgments. This increased the likelihood that a pre-potent response to all trial types – whether they were test or control trials – was "no," thereby increasing the conservatism of the design bias measure.

Participants in the speeded condition had a maximum of 865 ms to respond and were instructed to respond as quickly as possible. The response time was defined based on the average response time for pilot participants in a separate pretest. Participants in the unspeeded condition were allowed to proceed through the task at their own pace and were instructed to think about their answers long and carefully. In both conditions, participants began the experiment by responding to eight practice items that presented examples of each picture category. In the main task, pictures were then presented in five blocks of 24 pictures. Each block contained a proportional number of pictures from each category (8 test items, 2 no-bias controls, 12 yes-bias controls, and 2 cognitive load items), presented in random order. Programming of the task was done by using MySQL, PHP, and JavaScript with the CakePHP framework, which enabled the blocks to preload before the participant saw any items so that the speed of participants' internet connection, browser or computer did not affect the standardized timing of the speeded condition.

### *Human-made group*

Participants assigned to the speeded or unspeeded conditions of this group performed an identical procedure to the being-made group except that they judged whether a human 人类 purposefully made the things in the pictures. This control group was designed to disambiguate being-made

group results. Namely, results from the being-made condition could not, in isolation, entirely clarify whether tendencies to respond "yes" to test trials under speeded conditions might derive from an underlying general design bias or, for example, from more specific artificialist tendencies to view all test natural entity items as human products (e.g., bred plants and animals, built landscapes). However, if speeded participants in both the being-made and human-made conditions showed very similar (high) patterns of "yes" responding, it would suggest that either this artificialist view or a general inability to negate intentional agency was in play (Rosset, 2008). By contrast, if participants in the speeded condition of the human-made group showed lower test item endorsement than those in the speeded being-made group, it would clarify that, under cognitive load, participants could reliably negate the involvement of human agency and also, in combination with control trials, demonstrate they were not subject to "yes" bias.

### *Chinese supernatural practices and beliefs survey*

The Speeded Design task was created to measure non-culture-specific intuitions about agent-based origins. However, we were also interested in measuring the relationship of these intuitions to a range of common culture-specific Chinese folk beliefs and practices that make reference to supernatural and superhuman forces and abilities. In China, these are not characterized as "religious" because they fall outside of a codified organization, theology or canon and are not explicitly identified with a formal religious tradition. Because they are outside of formal religion, they have also been generally underrepresented in traditional survey research exploring religious ideas (Gries, Su, & Schak, 2012; Harrison, 2006; Paper, 2008; Thoraval, 1996; Wong, 2011; Yang & Hu, 2012). To address this, we therefore developed a new culturally sensitive, culture-specific 42-item survey to ensure broad sampling of potentially relevant cultural beliefs and practices in addition to those associated with Abrahamic Gods and Western religious concepts (see Appendix B).

For example, it is very common in China for people to consult individuals, such as fortune tellers, who are believed to possess supernatural abilities that allow them to foresee the future and therefore make recommendations that can increase someone's luck and harmony in life (e.g., Homola, 2013; Wong, 2011; Yang & Hu, 2012). It is also frequent for people to acknowledge the existence and powers of deceased individuals, spirits, and ghosts and – in cases where these deceased persons are regarded as ancestors – to engage in ritualistic venerations and offerings that demonstrate filial piety and promote intergenerational harmony with them given their continuing influence on the living (e.g., Hu, 2016; Yang & Hu, 2012; Yeh, Yi, Tsao, & Wan, 2013). Finally, there is a range of supernatural agency beliefs that are associated with reasoning about nature. For instance, Chinese conceptions of nature often incorporate notions of a divine or ordained natural order, and the interconnection between Heaven, earth, and humanity gets acknowledged and considered in everyday life (Grumbine & Xu, 2011; Paper, 2008). Similarly, while less scholarly attention may have been paid to its agentive nature, there is the concept of *qi* which is commonly construed as a vitalistic or animistic life force that circulates through not only living things but the structures, contours, or "veins" of the land (Paton, 2007; see also Grumbine & Xu, 2011; Legare, Zhu, & Wellman, 2013). Qi is popularly acknowledged via the practice of *feng shui*, which focuses on creating harmony with qi's flow or the Earth's power in the landscape and environment. Qi is carefully taken into consideration when making physical changes or placing artifacts (e.g., buildings, furniture, graves) in the environment. The qi concept is also closely intertwined with beliefs and practices related to ancestor worship (Paper, 2008; Paton, 2007).

The 42-item survey was developed with a structure that involved three distinct groups of questions. These tapped: belief in the existence of various agents; belief in the effects of ritual practices; frequency of ritual practice. On 14 belief questions, participants used a five-point Likert scale (1 = strongly disagree, 5 = strongly agree) to rate their agreement with various statements about their belief in the existence of supernatural or superhuman agents. These included: "I believe in the existence of spirits such as ghosts, ancestral spirits, demons, etc."; "I believe some people are born with supernatural abilities such as the ability to see the future, interpret dreams, read other people's

minds, etc."; "I believe Nature is a powerful being" (see Appendix B, Beliefs). On 18 practice-effect questions, participants rated on a five-point Likert Scale (1 = negative outcome, 3 = no difference, 5 = positive outcome) whether they believed that various practices had effects when they were performed, or when there was a failure to perform them. These included whether: something positive or negative would happen if they made offerings every day to gods or ancestors; violated the principles of feng shui; got advice from a fortune teller but chose not to follow it (see Appendix B, Practice-effects). These ratings were later recoded on a three-point scale (1 = no difference, 2 = some outcome, 3 = outcome) so that negatively and positively valanced items could be compared in analyses. On 12 practice frequency questions, participants rated how often they took part in various kinds of supernatural or religious activities on a five-point Likert scale (1 = rarely or never, 5 = often or always). Questions concerned practices that included: reading religious texts; meditating; praying; making offerings to local gods; venerating ancestors at home; wearing talismans; visiting fortune tellers; and using feng shui to improve one's fortune (Appendix B, Practice frequency). Importantly, the survey did not force participants to choose between different beliefs or practices: people could simultaneously endorse various items (see also Gries et al., 2012).

### *Conceptual Inventory of Natural Selection (CINS)*

To briefly measure their scientific understanding, participants also answered an eight-question subset of the Conceptual Inventory of Natural Selection (Anderson, Fisher, & Norman, 2002) on Galapagos finch diversity.

## Results

### *Speeded Design task*

Across both conditions (speeded, unspeeded) and groups (being-made, human-made), "yes" responses on test items were coded as 1 and "no" responses were coded as 0 to yield a proportional mean design endorsement score between 0 and 1. Control and cognitive load items were coded to yield proportional mean inaccuracy scores between 0 and 1.

Figure 2 displays the means of the speeded and unspeeded conditions of both being-made and human-made groups in the Speeded Design task. A 2 (Speed: speeded vs. unspeeded) × 2 (Type: being-made vs. human-made group) ANOVA on test item endorsement revealed main effects of Speed, $F(1, 242) = 12.14$, $p < .01$, $\eta_p^2 = .05$), and Type, ($F(1, 242) = 247.01$, $p < .001$, $\eta_p^2 = .50$). Across both conditions, participants endorsed nature as purposefully created more often under speeded than unspeeded conditions (Figure 2). However, they endorsed intentional creation far more frequently in the being-made group ($M = 75\%$, $SD = 32\%$) than the human-made group ($M = 16\%$, $SD = 25\%$).

To ensure that the Chinese participants' increased tendency to default to design endorsement under speed in the being-made group did not simply result from overall confusion or general response sets, we conducted a 2 (Speed: unspeeded vs. speeded) × 4 (Item Type: test items vs. no-bias controls vs. yes-bias controls vs. cognitive load items) repeated-measures ANOVA on test item endorsement and inaccurate control item performance in the being-made group. This analysis revealed that participants understood the instructions, and that the findings in test item endorsement were not due to the use of any alternative response strategy or as a result of yes- or no-biases. Although, there was an overall effect of speeded responding on task performance, $F(1, 136) = 6.57$, $p < .05$, $\eta_p^2 = .05$, participants responded very differently to test versus control items, $F(1.49, 203.19) = 475.13$, $p < .001$, $\eta_p^2 = .78$, and an Item Type × Speed interaction, $F(1.49, 203.19) = 4.17$, $p < .05$, $\eta_p^2 = .03$, indicated that speeded effects differed across item types (results are reported with a Greenhouse-Geisser correction, as tests of sphericity were significant). Specifically, participants were more likely to endorse test items under speeded conditions ($M_{diff} = 13\%$) whereas the difference between speeded and unspeeded groups was much smaller when responding to cognitive load items ($M_{diff} = 1\%$), no-bias controls ($M_{diff} = 3\%$), or yes-bias controls ($M_{diff} = -1\%$; see Table 1).

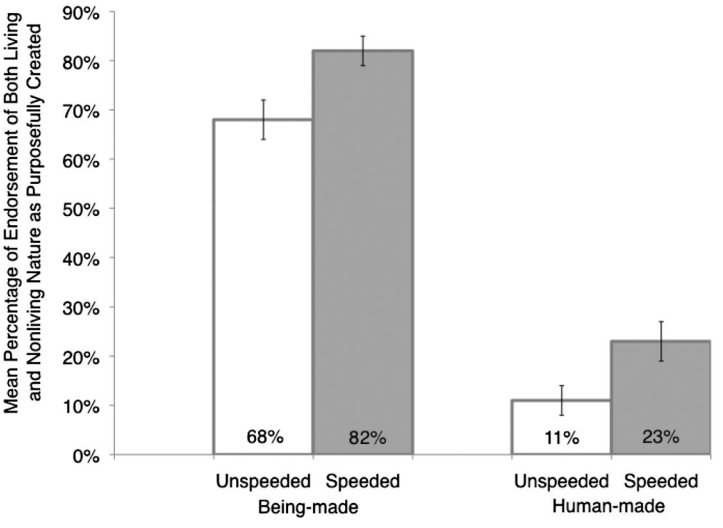


**Figure 2.** Mean percent test item endorsement in being-made and human-made groups.

Parenthetically, it is worth noting that, by contrast, performance in the cognitive load items in the human-made group was particularly weak. This suggests that when tasked with judging whether items were human-made artifacts, participants experienced particularly high cognitive load when considering the ambiguity of hand-drawn cartoons that depicted living things. Item analysis did not reveal any single item that carried this effect.

As a final check, we examined whether the effects on being-made test item endorsement were solely carried by responses to items representing living organisms, which would imply that participants were focusing on whether a particular item was the product of intentional biological reproduction rather than on whether living and non-living natural *categories* were purposefully created. To explore this, we conducted a 2 (Test Item Type: living nature vs. non-living nature) × 2 (Speed: unspeeded vs. speeded) repeated-measures ANOVA. Just as in the previous analysis, there was a main effect of Speed, $F(1, 139) = 5.30$, $p < .05$, $\eta_p^2 = .037$, with higher endorsement under speeded conditions. The analysis also revealed a main effect of Item Type, $F(1, 139) = 14.96$, $p < .001$, $\eta_p^2 = .10$, indicating that participants were slightly more likely to endorse the intentional creation of living organisms ($M = 78\%$, $SD = 32\%$) than non-living natural things ($M = 71\%$, $SD = 35\%$). However, there was no significant interaction between Test Item Type and Speed, indicating that the speeded effect on test item endorsement was driven by *both* living and non-living natural entities. That is, participants were more likely to endorse purposeful creation in nature under speeded conditions regardless of whether the items depicted living or non-living nature.

## *Chinese supernatural practices and beliefs survey*

All participants endorsed at least some of the beliefs and practices that the survey probed. That is, there was not a single participant who denied, across all survey items, some belief or engagement in ritual practices. As Table 2 shows, across questions tapping practice frequency, beliefs in practice-effects,

**Table 1.** Control item inaccuracy in the being-made and human-made groups.

| | Being-made group | | Human-made group | |
|---|---|---|---|---|
| | Unspeeded | Speeded | Unspeeded | Speeded |
| No-bias controls | 3 (6) | 5 (7) | 4 (6) | 8 (9) |
| Yes-bias controls | 6 (7) | 5 (5) | 3 (6) | 5 (6) |
| Cognitive load items | 7 (19) | 8 (17) | 13 (20) | 33 (26) |

and belief in the existence of supernatural and superhuman beings, participants' responses indicated, on average, some frequency of participation and/or slight explicit agreement with the beliefs. Highest frequencies occurred for the practices of venerating ancestors at home, in the temple, or at their graves, as well as wearing talismans. Similarly, participants acknowledged some effects of various supernatural practices. Highest endorsements occurred for the effects of praying, meditating, or reciting mantras regularly, the (negative) effects of not making offerings to gods or ancestors on special occasions, such as holidays and grave-cleaning days, as well as the belief that knowingly holding an important event on a day foretold to be unlucky would lead to actual (negative) consequences.

Most marked of all, however, were participants' consistently strong beliefs in Nature's and the Earth's power and animacy. This shows that while many participants in our sample identified as non-religious, this explicit identity was somewhat unrelated to their actual supernatural beliefs and practices. While not religiously affiliated, many regularly participated in non-monotheistic

**Table 2.** Descriptive statistics for the Chinese supernatural beliefs and practices survey and scientific understanding of natural selection.

| | *M*(*SD*) | Range |
|---|---|---|
| Practice frequency | | |
| PF_Venerate | 2.48(1.27) | 1–5 |
| PF_Talismans | 2.42(1.52) | 1–5 |
| PF_Fortune | 2.27(1.23) | 1–5 |
| PF_Red | 2.26(1.31) | 1–5 |
| PF_Mantras | 2.18(1.23) | 1–5 |
| PF_Offerings | 2.15(1.14) | 1–5 |
| PF_FengShui | 1.69(1.11) | 1–5 |
| PF_Services | 1.58(.92) | 1–5 |
| PF_FollowedFortune | 1.56(.90) | 1–5 |
| PF_LuckyDays | 1.55(1.02) | 1–5 |
| PF_Texts | 1.55(.90) | 1–5 |
| PF_TaiChi | 1.52(.91) | 1–5 |
| Practice-effects | | |
| PE_TaiChiHealth | 1.93(.74) | 1–3 |
| PE_Praying | 1.69(.72) | 1–3 |
| PE_NoSpecialOfferings | 1.67(.75) | 1–3 |
| PE_UnluckyDay | 1.67(.69) | 1–3 |
| PE_Services | 1.52(.66) | 1–3 |
| PE_ViolateFengShui | 1.49(.65) | 1–3 |
| PE_PrayStudying | 1.48(.69) | 1–3 |
| PE_TaiChiQi | 1.48(.63) | 1–3 |
| PE_GhostDays | 1.47(.64) | 1–3 |
| PE_Offerings | 1.47(.65) | 1–3 |
| PE_IgnoreFortune | 1.42(.58) | 1–3 |
| PE_NotFollowing | 1.34(.61) | 1–3 |
| PE_ForgotTalisman | 1.27(.52) | 1–3 |
| PE_RedNewYear | 1.27(.58) | 1–3 |
| PE_NotPrayStudying | 1.24(.54) | 1–3 |
| PE_NotPraying | 1.22(.52) | 1–3 |
| PE_NoOfferings | 1.19(.48) | 1–3 |
| PE_NoServices | 1.18(.49) | 1–3 |
| Beliefs | | |
| B_NaturePowerful | 4.44(.88) | 1–5 |
| B_EarthAlive | 3.96(1.26) | 1–5 |
| B_YinYang | 3.89(1.13) | 1–5 |
| B_AnimalsRespond | 3.63(1.14) | 1–5 |
| B_NatureSoul | 3.60(1.28) | 1–5 |
| B_Forces | 3.32(1.35) | 1–5 |
| B_NatureRespond | 3.23(1.11) | 1–5 |
| B_HigherPower | 2.67(1.39) | 1–5 |
| B_Supernaturals | 2.52(1.35) | 1–5 |
| B_Spirits | 2.37(1.35) | 1–5 |
| B_CreationPassive | 2.29(1.19) | 1–5 |
| B_CreationActive | 2.21(1.23) | 1–5 |
| **CINS** | 61% (21%) | 0–100% |

folk religious supernatural practices and believed in supernatural agents, endorsing the presence of ancestors and, most especially, agency in nature. In regard to the participants' scientific understanding as measured by CINS questions, their knowledge of natural selection was average ($M$ = 61%, $SD$ = 21%) (see Järnefelt et al., 2015, for similar results).

## Relationship between design bias, cultural beliefs and practices, and scientific understanding

To further understand participants' rather high tendency to endorse natural entities as designed, we explored the relationships between these endorsements and participants' personal beliefs and practices as well as their scientific understanding of natural selection.

### Practice and beliefs factors

Given the high number of personal beliefs probed, we first conducted a factor analysis to explore whether participants' responses across the three groups of survey questions loaded together due to one or more latent variables. A principal components analysis with varimax rotation was used first. Such exploratory factor analysis is appropriate to determine the number of factors involved and to identify key items before engaging in confirmatory factor analysis (Joreskog, 1978; Tabachnick & Fidell, 2001). This initial analysis revealed six independent factors with subsequent evaluation using confirmatory factor analysis under maximum likelihood estimation indicating that a nested, three-factor model fit the data better than the six-factor model. This more parsimonious model also showed acceptable fit overall (RMSEA = .08), and thus these three factors were used in the subsequent analyses reported here (see Appendix C for the factor loadings and list of items per factor).

The first factor, "Explicit Supernatural and Religious Beliefs" (13 items; $\alpha$ = .85), included several belief items that are culturally regarded as religious or supernatural. The belief items referred to various types of supernatural and superhuman agents, such as the beliefs in some kind of higher power (e.g., God, local gods, Buddha, or Old Heavenly Grandfather), beliefs in the divine creation of the Earth as well as beliefs in ghosts, ancestral spirits, and demons, and some people having inborn supernatural abilities (e.g., ability to see the future or read other people's minds). This factor also included beliefs in different kinds of supernatural forces and principles, which included fate, fortune, qi, and tao, as well as the existence of souls. The explicitly religious practice of praying, meditating, or reciting mantras was also included, as well as two items regarding the effects of belief in supernatural forces (i.e., violating feng shui), though these final two items had low explanatory value.

The second factor, "Beliefs about the Efficacy of Supernatural Practices" (14 items; $\alpha$ = .82), consisted solely of the practice-effect items, which tapped a large range of beliefs about the positive or negative cosmic consequences of participation or failed participation in various rituals or practices. This means that, in contrast to representing the participants' frequency of practice, all items in this factor tapped their belief in the impact of the various practices, such as following the teachings of religious texts, attending religious services, making offerings to gods and ancestors, or praying to a god for a better performance in an exam.

Items that loaded on the third factor, "Active Engagement in Supernatural Practices" (10 items; $\alpha$ = .78), captured the practice frequency of actions that related to supernatural agents and rituals that are characteristic and interwoven in Chinese everyday life. Examples included making offerings to and venerating ancestors, wearing talismans, having one's fortune or fate read, determining lucky days, and using feng shui to improve one's fortune. Consistent with the idea that there are close connections between conceptions of Earth's vitality and various Chinese folk practices (e.g., Paper, 2008; Paton, 2007), the third factor also included a belief in Nature's agency.

Interestingly, due to participants' consistently high level of endorsement, items tapping Gaia beliefs in "Nature as a powerful being" and "Earth as alive" did not load onto any factor. That is, because almost all participants strongly endorsed these beliefs, there was insufficient variability to differentiate participants or to lead these items to load onto a specific latent variable. As described

earlier, attention to Nature and natural order are acknowledged features of Chinese cultural beliefs. The current findings suggest that even as animistic or agentive connotations to such nature-focused cultural beliefs are generally not highlighted or discussed, they are likely to be present and to represent a potentially significant conceptual component.

Based on these factor analytic results, we formed three mean variables representing each factor, and explored their relationship to the measure of scientific understanding (CINS) and performance on the Speeded Design task. First, we conducted partial correlations that controlled for the effects of speed on the being-made and human-made groups separately (see Table 3). These analyses revealed that design endorsement in the being-made condition was systematically related to the "Active Engagement in Supernatural Practices" factor, which included practices involving Chinese folk religious concepts as well as a belief in Nature's agency. No other correlations were found with the Speeded Design task.

To further explore the influence of individual difference factors on performance in the Speeded Design task, we regressed participants' intentional design endorsement in the being-made group and human-made group onto the CINS scores and three practice and belief factors while controlling for Speed. In the being-made group, participants' creation endorsement was predicted by Speed and marginally by the Active Engagement in Supernatural Practices factor, $R^2 = .085$, $F(5, 132) = 2.5$, $p < .05$. In the human-made group, creation endorsement was predicted by Speed, and negatively predicted by both natural selection understanding and Active Engagement in Supernatural Practices. Thus, higher understanding of natural selection and stronger Active Engagement in Supernatural Practices independently predicted *lower* endorsement of the idea that people make natural phenomena, $R^2 = .125$, $F(5, 102) = 2.9$, $p < .05$ (see Table 4).

## Discussion

This study explored adults' intuitions about the origins of natural phenomena. It examined whether Chinese adults, who live in a non-Western, non-Abrahamic culture marked by self-identified atheism and a rejection of creationism, have a tendency to view natural phenomena as agentively caused, particularly when reasoning automatically. Our results suggest that they do. Chinese participants defaulted to the notion that both living and non-living natural phenomena were made by someone, especially when forced to rely on their gut intuitions under speeded conditions. This finding is consistent with previous findings of a design bias in Western samples (Järnefelt, 2013; Järnefelt et al., 2015). It also aligns with prior research on Western and non-Western adults' teleological tendency to ascribe functions to nature (Kelemen et al., 2013; Kelemen & Rosset, 2009; Rottman et al., 2017).

In order to examine what kinds of cultural conceptions – beyond creationist and monotheistic belief – relate to tendencies to view natural phenomena as caused by someone, we designed a survey that tracked participants' supernatural beliefs and practices within the broader framework of Chinese

**Table 3.** Partial correlations between the Speeded Design task, personal belief and practice factors, and natural selection understanding (CINS).

| Variable | 1. | 2. | 3. | 4. | 5. |
|---|---|---|---|---|---|
| Being-made group | | | | | |
| 1. Speeded Design task | – | | | | |
| 2. Explicit Supernatural and Religious Beliefs | .07 | – | | | |
| 3. Beliefs about the Efficacy of Supernatural Practices | .06 | .17* | – | | |
| 4. Active Engagement in Supernatural Practices | .17* | .56*** | .14 | – | |
| 5. CINS | −.10 | −.07 | −.02 | −.02 | – |
| Human-made group | | | | | |
| 1. Speeded Design task | – | | | | |
| 2. Explicit Supernatural and Religious Beliefs | .10 | – | | | |
| 3. Beliefs about the Efficacy of Supernatural Practices | .08 | .52*** | – | | |
| 4. Active Engagement in Supernatural Practices | −.08 | .39*** | .38*** | – | |
| 5. CINS | .03 | .14 | −.14 | −.16 | – |

*$p < .05$; **$p < .01$; ***$p < .001$.

**Table 4.** Linear regressions predicting test item endorsement in the Speeded Design task.

| | B | *SE* B | *β* |
|---|---|---|---|
| Being-made group | | | |
| Explicit Supernatural and Religious Beliefs | −.03 | .05 | −.05 |
| Beliefs about the Efficacy of Supernatural Practices | .04 | .08 | .04 |
| Active Engagement in Supernatural Practices | .09 | .05 | .19† |
| CINS | −.15 | .13 | −.10 |
| Speed | −.13 | .05 | −.21* |
| Human-made group | | | |
| Explicit Supernatural and Religious Beliefs | .04 | .04 | .11 |
| Beliefs about the Efficacy of Supernatural Practices | .10 | .09 | .13 |
| Active Engagement in Supernatural Practices | −.09 | .05 | −.20† |
| CINS (Conceptual Inventory of Natural Selection) | −.23 | .11 | −.20* |
| Speed | −.12 | .05 | −.25* |

†$p < .10$; *$p < .05$.

folk culture. Results from this measure showed that, despite their marked tendency to identify as atheists, all participants endorsed some or many supernatural beliefs and practices – a finding that converges with other culturally sensitive surveys among groups that do not have predominantly Abrahamic beliefs and practices (Gries et al., 2012; Hu, 2016; Wenfang, 2014; Yang & Hu, 2012). Our results further revealed that rather than being related to monotheistic creation belief (see Explicit Supernatural and Religious Beliefs factor), Chinese adults' design bias was related to an animistic folk belief in Nature as a need-responsive agent and to actions invoking ancestors, local gods, luck, fate, and fortune (i.e., Active Engagement in Supernatural Practices factor). Notably, however, this latter Active Engagement in Supernatural Practices factor was only a marginally significant predictor in our model – a pattern that may have resulted because a grouping of certain beliefs was almost entirely not included in this or any other factor: Specifically, almost all the informal beliefs reflecting ideas about Nature's and Earth's imminent agency (i.e., those tapping the folk concept of "Gaia") were, unexpectedly, so invariantly and strongly endorsed by Chinese adults that they did not load with any other variables. Because of the lack of variance, it was also not possible to isolate a sizeable group of Gaia non-endorsers for purposes of separate analyses or to explore the association between these animistic intuitions and Chinese adults' rather marked intuitions about intentional origins in nature (see Järnefelt et al., 2015, for relationship in secular Western samples; also Kelemen & Rosset, 2009; Kelemen et al., 2013).

Although more research is needed on culture-specific factors, overall our findings are consistent with the view that a design bias is a general feature of adult mentality that is independent of explicit creationist or Abrahamic monotheistic belief, despite frequent assumptions that such beliefs are its source. By contrast, it would seem that intuitions about design and intentional origins relate to a wide array of agency concepts (Järnefelt, 2013; Järnefelt et al., 2015; Kelemen et al., 2013; Kelemen & Rosset, 2009; see also Banerjee & Bloom, 2014; Willard & Norenzayan, 2017). Furthermore, patterns involving the Active Engagement in Supernatural Practices factor provide additional insights into the dynamics of design intuitions not revealed in earlier research. Specifically, they suggest that, while often under-documented, the practice of simply engaging in culturally normative ritualistic actions (e.g., making offerings to ancestors) might help foster design intuitions even in individuals who reject a formal religious identity and view themselves as "non-religious." This finding lends weight to recent calls for a greater focus on practices in research on religion (e.g., Sosis & Kiper, 2014), given the potential cognitive implications that such behaviors and their associated contexts may have (see also Liénard, 2006; Sebestény & Emmons, 2017).

In addition to findings from the being-made group, interesting patterns of response in the human-made group emerged. In contrast to previous studies with Western adults, Chinese participants were more willing to endorse the notion that people design living and non-living natural phenomena. But while this finding might suggest that Chinese adults were therefore blurring a distinction between human and supernatural creative agency, several findings mitigate this interpretation. First, while

Chinese adults' endorsements in the human-made condition were relatively high, they were far lower than in the being-made condition. Second, although endorsements in the being-made condition were positively predicted by Active Engagement in Supernatural Practices, the same factor negatively predicted these endorsements in the human-made condition, which were instead predicted by poor scientific knowledge. This differential pattern suggests that judgments in the human-made condition therefore truly reflected artificialist ideas about the ability of human agents to control and create nature. In the future, more research is needed to understand the cultural factors promoting these artificialist beliefs. It is possible that culturally important myths and narratives that emphasize human abilities to tame natural events (e.g., the story of Great Yu controlling the waters or Old Man Yu Gong moving the mountain), as well as explicitly taught Maoist cultural ideas that "Humans must conquer nature," might play a role (see, e.g., Grumbine & Xu, 2011; McNeal, 2012; Shapiro, 2001).

## Conclusion

The present results provide evidence of culturally recurrent and potentially universal cognitive tendencies to construe natural phenomena as purposefully made by an agent. They demonstrate that intuitions about intentional origins exist independent of Western cultural constructs, most especially monotheistic beliefs in a creator God. The present results also broaden our understanding of the way various cultural beliefs and practices relate to this type of design intuition and reveal that an array of cultural expressions may be associated. In the future, more research is needed to broaden investigations of the relationship between automatic intuitions about intentional origins and different types of culture-specific or potentially pan-cultural agency or supernatural agency ideas, especially given the unexpectedly marked pervasiveness of some of them. An examination of interconnections to other spontaneous cognitive biases such as the teleological tendency to assume function would also be beneficial (e.g., Rottman et al., 2017). Such research will require increased interdisciplinary collaboration between researchers across the humanities, social, behavioral and natural sciences, as well as mixed methodological solutions that allow the assessment of people's reasoning and beliefs beyond one-dimensional and often Abrahamic or Christocentric polling and surveying approaches (see Cadge, Levitt, & Smilde, 2011; Pyysiäinen, 2012; Slingerland, 2008, 2013; Slingerland & Collard, 2012).

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# Appendices

## *Appendix A. Instructions of the Speeded Design task (being-made group; speeded condition)*

在这项任务中，你会看到不同事物的图片。你也会看到多彩的形状。
*In this task you will see pictures of different kinds of things. You will also see colorful shapes.*

请看图片中的东西，并指出是某个时刻有个“主体”（比如人，外星人，神，精神力量,等）有意地创造了图片中这个物品， 还是说该物品（或它的前身）自行出现（因此并非由任何“主体”创造）。也就是说，作答时请考虑以下问题：是有个“主体”有意创造了该物品吗？请回答“是”或“否”。
*When you see a picture of a thing, your task is to identify if any subject purposefully created the item at some point in time or whether the item (or a precursor) just happened and was therefore not made by any being. That is, when prompted to give a response, please consider the question “did any subject purposefully make this,” and respond either “YES” or “NO.”*

重要的是请注意，我们使用的术语“主体”是故意没有特指的。对于我们来说，“主体”的意思很广泛，所指的可以是任何有能力故意创造事情的东西,比如： 一个人， 自然的力量，一个外星人，一个动物， 上帝，一个神秘的力量，一个精神力量，等等
*It is important for you to note that by using the term “subject” we are deliberately non-specific. For us, “subject” might refer to any kind of being who makes things deliberately. Some possibilities that you might draw upon are: a human, Mother Nature, an alien, an animal, God, a mystical power, a spiritual force, etc.*

对于我们而言，“主体”的具体身份是不重要的并且可以对于不同的物品是不同的，所以请不要局限只考虑一种“主体”（如人类）。因此，对于一些物品，你可能会认为“主体”是人类。 对于其他物品是一个动物，再对于其他物品，为更抽象的一个超能力。不管谁或什么，重要的事是你判断是否任何种类的“主体”都考虑到了。也就是说，请考虑是否有些“主体”/任何主“主体”制造了物品（或其前身）。
*For our purposes, the specific identity of the “subject” is unimportant and can vary across items so please do not feel restricted to considering only one kind of being (e.g., human) for everything. Thus, for some items, you might think the “being” is a human, for other items an animal, and for others that it is a more abstract higher power. Regardless of who/what it is, all that matters is that you judge whether ANY kind of being was involved. That is, please consider whether some being/any being made the item (or its precursors) or not.*

当你看到图片，请决定是否有“主体”故意地制造图片里的东西。
请用电脑健作答：
在你的观点中，有“主体”故意地制造了图片中的东西吗？是或者否
有时候仅仅有一个多彩的形状出现。如果是这样的话，请总是按否。
在计算机的键盘上：
如果是请按字母D
如果否请按字母J

*When you see the picture, decide whether or not some subject purposefully made the thing in the picture. Please respond using the computer keyboard. In your opinion, did any subject purposefully make the thing in the picture? YES or NO. Sometimes only a colorful shape appears. If so, please always press NO.*

*On the computer keyboard:*
*If YES press letter D.*
*If NO press letter J.*

你有非常有限的时间来评价图片里的东西。请保持警觉因为图片会变化的很快。
*You will have very limited time to evaluate the thing in the picture. Be alert because the pictures will change quickly.*

这个不是对知识的检验。 我们对答案是否正确不感兴趣 – 我们仅仅对你对我们提供的事物起源的想法感兴趣。
*This is not a test of knowledge. We are not interested in whether the answers are right or wrong – we are simply interested in your thinking about the origins of the items we present.*

最后澄清， 请不要评价照片是否是被处理过的或者经过图像软件修改过的。我们感兴趣的是你对照片所描述的事物的想法，并不是图片本身。
*As a final clarification, please don’t assess if the picture was manipulated or photo-shopped. We are interested in your opinion about the thing depicted in the picture, not the picture itself.*

你会接到8个练习试验来感受一下任务。在主要的任务中，你会在每24个物品后得到短暂的休息。
*You will first receive eight practice trials so you can get a feel for the task. In the main task, you will also get a break after every 24 items.*

如果你准备好进行到练习阶段，请按空白健。
*If you are ready to proceed to the practice phase, please press the SPACE bar.*

请记得要尽快地回答。
*PLEASE REMEMBER TO ANSWER AS QUICKLY AS YOU CAN.*

## *Appendix B. Chinese practices and beliefs survey*

*Practice frequency*
On a scale of 1–5 how often do you do the following?
请用1–5的评分级别回答你做以下事情的频率

1 = rarely or never, 5 = often or always
1 = 几乎从不，5 = 经常或常常

1. meditate/pray/recite mantras **[PF_Mantras]**
1. 冥想/祈祷/诵经

2. read religious texts (such as the Bible, sutras, the Torah, the Koran, Taoist texts, etc.) **[PF_Texts]**
2. 阅读宗教性书籍（比如圣经、佛经、犹太律法书、可兰经、道德经等）

3. attend religious services at a shrine/temple/church/mosque, etc. **[PF_Services]**
3. 参加祠堂、寺庙、教堂、清真寺等场所举行的宗教活动

4. make offerings/burn incense for local gods or ancestors **[PF_Offerings]**
4. 给神明或祖宗上供或焚香

5. venerate ancestors at home, in the temple, at their graves **[PF_Venerate]**
5.在家里、寺庙或墓地祭拜祖宗

6. wear talismans (crucifix, rosary, prayer beads, objects for good fortune, zodiac symbols, etc.) **[PF_Talismans]**
6. 佩戴护身符（十字架、念珠、佛珠、带来好运的物品、生肖饰品等等）

7. had your fortune or fate read (e.g., checking your 八字, numerologist, astrologer, face reader, palm reader, etc.) **[PF_Fortune]**
7.预测你的运气或命运（比如检查你的生辰八字、研究数字命理学、占星术、看面相和手相等等）

8. followed the advice of a fortune teller (e.g., changing your name or appearance or customs) **[PF_FollowedFortune]**
8. 听从算命者的建议（比如更改你的名字、相貌或习惯）

9. hired someone (a chiomancer) or used an almanac to determine lucky days **[PF_LuckyDays]**
9. 雇佣别人（算命者）或者使用黄历来决定吉日

10. used feng shui or displayed objects in your home to improve your fortune **[PF_FengShui]**
10.在你的家里利用风水或摆设物体来提高你的运气

11. wear red clothing on certain holidays **[PF_Red]**
11. 在特定的节日穿红色的衣服

12. practice tai chi chuan or qi gong **[PF_Tai Chi]**
12. 练习太极拳或者气功

*Practice-effects*
What would happen if you:
什么事情会发生

Assess the outcome of the following actions on a scale of 1 to 5
请用1–5的评分级别评估以下行为造成的效果

1 = negative outcome, 3 = no difference, 5 = positive outcome
1 = 消极效果， 3 = 没有差别， 5 = 积极效果
1. praying, meditating, or reciting mantras regularly **[PE_Praying]**
1. 如果你有规律地祈祷、冥想或诵经

2. not praying, meditating, or reciting mantras **[PE_NotPraying]**
2. 如果你不祈祷、冥想或诵经

3. not following the teachings of the Bible/Koran/Torah/sutras etc. **[PE_NotFollowing]**
3. 如果你不遵循圣经、可兰经、犹太律法书或者是佛经的教导

4. regularly attending religious services at a church/temple/shrine/mosque **[PE_Services]**
4. 如果你有规律地参加祠堂、寺庙、教堂、清真寺里举行的宗教活动

5. not regularly attending religious services at a church/temple/shrine/mosque **[PE_NoServices]**
5. 如果你不能有规律地参加祠堂、寺庙、教堂、清真寺里举行的宗教活动

6. making offerings every day to gods or ancestors **[PE_Offerings]**
6. 如果你每天给神明或祖宗上供或焚香

7. not making routine offerings to gods or ancestors **[PE_NoOfferings]**
7. 如果你没有每天给神明或祖宗上供或焚香

8. not making offerings on special occasions (holidays, grave-cleaning days, etc.) to gods or ancestors **[PE_NoSpecialOfferings]**
8. 如果你在特别的场合（节日、清明等等），不给神明或祖宗上供

9. praying to a god for better performance in an exam in addition to studying **[PE_PrayStudying]**
9. 如果你除了学习之外，向神明祈祷考试可以有好成绩

10. not praying to a god for better performance in an exam in addition to studying **[PE_NotPrayStudying]**
10. 如果你除了学习，没有向神明祈祷考试可以有好成绩

11. if you were told which days were lucky and unlucky for an important event and choose to have it on an unlucky day **[PE_UnluckyDay]**
11.如果对于一件重要的事情，在你被告知有些日子是吉日有些日子不是的前提下，把那件事情安排在了不吉利的日子

12. going out at night on ghost days **[PE_GhostDays]**
12. 如果你在鬼节的晚上出门

13. getting advice from a fortune teller and choosing not to follow it **[PE_IgnoreFortune]**
13. 如果你从算命先生那里得到建议并且没有按照建议做

14. if you forget your lucky talisman at home or don't wear it **[PE_ForgotTalisman]**
14. 如果你把护身符忘在了家里或者没有佩戴它

15. violating principles of feng shui (e.g., sleeping with your head in the wrong direction) **[PE_ViolateFengShui]**
15. 如果你违背了风水（比如睡觉的时候头朝向了错误的方向）

16. not wearing red on the New Year **[PE_RedNewYear]**
16. 如果你过新年的时候没有穿红色

17. the effect on your health if you regularly practice tai chi chuan/qi gong **[PE_TaiChiHealth]**
17. 如果你有规律地练习太极拳/气功，对你的健康造成的影响

18. the effect on your qi if you regularly practice tai chi chuan/qi gong **[PE_TaiChiQi]**
18. 如果你有规律地练习太极拳/气功，对你的 "气" 造成的影响

*Beliefs*
Please rate on the scale below how much you agree or disagree with the following statements:
Strongly disagree 1-----2-----3-----4-----5 Strongly agree

请用量表来标识你对于每个句子同意或者不同意的程度。

非常不同意1-----2-----3-----4-----5非常同意

1. I believe in the existence of some kind of higher power or being such as God, gods, local gods, the Buddha, (Old Heavenly Grandfather), etc. **[B_HigherPower]**
1. 我相信有某种神（上帝、神仙、神明、佛祖、菩萨、老天爷）的存在。

2. I believe in the existence of spirits such as ghosts, ancestral spirits, demons, etc. **[B_Spirits]**
2. 我相信灵界（鬼魂、祖宗灵魂、妖魔）的存在。

3. I believe in the existence of forces that are beyond natural laws, such as fate, fortune, karma, reincarnation, qi, tao, etc. **[B_Forces]**
3. 我相信某种超出自然定律的力量（命运、运气、因果、轮回、气、道）的存在。

4. I believe that some kind of higher powers/spirits/forces created the Earth and living things (animals, plants) but does not currently have any influence on them. **[B_CreationPassive]**
4.我相信某种神/灵界/超然规律最初创造了地球和生物（动物、植物），但是目前并不影响他们。

5. I believe that some kind of higher powers/spirits/forces created the Earth and living things (animals, plants) and continues/continue to have an influence on them. **[B_CreationActive]**
5.我相信某种我相信某种神/灵界/超然规律最初创造了地球和生物（动物、植物）并且继续影响他们。

6. I believe some people are born with supernatural abilities, such as the ability to see the future, interpret dreams, read other people's minds, etc. **[B_Supernaturals]**
6. 我相信有的人生来就有特异功能和能力，比如预知未来、解梦、读心术等等。

7. I believe that everything in nature is balanced between yin and yang. **[B_YinYang]**
7. 我相信自然界中的所有事物是阴阳平衡的。

8. I believe that Earth is alive. **[B_EarthAlive]**
8. 我相信地球是有生命的。

9. I believe that Nature is a powerful being (existence). **[B_NaturePowerful]**
9. 我相信大自然是一个很强大的存在。

10. I believe that everything in Nature (da ziran) has its own soul. **[B_NatureSoul]**
10. 我相信大自然中的每个事物都有自己的灵魂。

11. I believe that Nature responds to the needs of animals to help them survive. **[B_NatureRespond]**
11. 我相信自然回应动物的需要来帮助他们生存。

12. I believe that animals have the power to change their own biological traits in order to survive. **[B_AnimalsRespond]**
12. 我相信动物有能力为了生存而改变他们的生理特征。

## *Appendix C. Factor loadings and uniqueness for confirmatory factor model of personal practices and beliefs*

| | Explicit Supernatural and Religious Beliefs | | | Beliefs about the Efficacy of Supernatural Practices | | | Active Engagement in Supernatural Practices | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized |
| I believe in the existence of some kind of higher power or being such as God, gods, local gods, the Buddha, (Old Heavenly Grandfather), etc. [B_HigherPower] | 1.00 | – | – | | | | | | |
| I believe in the existence of spirits such as ghosts, ancestral spirits, demons, etc. [B_Spirits] | .91 | .05 | 18.18 | | | | | | |
| I believe in the existence of forces that are beyond natural laws, such as fate, fortune, karma, reincarnation, qi, tao, etc. [B_Forces] | .84 | .05 | 15.38 | | | | | | |
| I believe that some kind of higher powers/spirits/forces created the Earth and living things (animals, plants) and continues/continue to have an influence on them. [B_CreationActive] | .73 | .05 | 15.73 | | | | | | |
| I believe that some kind of higher powers/spirits/forces created the Earth and living things (animals, plants) but does not currently have any influence on them. [B_CreationPassive] | .71 | .05 | 14.99 | | | | | | |
| I believe some people are born with supernatural abilities, such as the ability to see the future, interpret dreams, read other people's minds, etc. [B_Supernaturals] | .65 | .06 | 11.24 | | | | | | |
| I meditate/pray/recite mantras. [PF_Mantras] | .44 | .06 | 7.90 | | | | | | |
| I believe that everything in Nature (da ziran) has its own soul. [B_NatureSoul] | .40 | .06 | 6.86 | | | | | | |
| I attend religious services at a shrine/temple/church/mosque, etc. [PF_Services] | .33 | .04 | 7.90 | | | | | | |
| I read religious texts (such as the Bible, sutras, the Torah, the Koran, Taoist texts, etc.) [PF_Texts] | .30 | .04 | 7.28 | | | | | | |
| I believe that everything in nature is balanced between yin and yang. [B_YinYang] | .25 | .05 | 4.88 | | | | | | |
| [I believe in negative/positive outcome] if one would violate principles of feng shui (e.g., sleeping with your head in the wrong direction). [PE_ViolateFengShui] | .15 | .03 | 5.00 | | | | | | |

(*Continued*)

Continued.

| | Explicit Supernatural and Religious Beliefs | | | Beliefs about the Efficacy of Supernatural Practices | | | Active Engagement in Supernatural Practices | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized |
| [I believe in negative/positive outcome] if you were told which days were lucky and unlucky for an important event and choose to have it on an unlucky day. [PE_UnluckyDay] | .14 | .03 | 4.43 | | | | | | |
| [I believe in negative/positive outcome] if I regularly attend religious services at a church/temple/shrine/mosque. [PE_Services] | | | | 1.06 | .11 | 9.75 | | | |
| [I believe in negative/positive outcome] if I make offerings every day to gods or ancestors. [PE_Offerings] | | | | 1.05 | .11 | 9.90 | | | |
| [I believe in negative/positive outcome] if I do not follow the teachings of the Bible/Koran/Torah/sutras etc. [PE_NotFollowing] | | | | 1.04 | .10 | 10.22 | | | |
| [I believe in negative/positive outcome] if I do not regularly attend religious services at a church/temple/shrine/mosque. [PE_NoServices] | | | | 1.03 | .09 | 11.57 | | | |
| [I believe in negative/positive outcome] if I do not make routine offerings to gods or ancestors. PE_NoOfferings] | | | | 1.01 | .09 | 11.42 | | | |
| [I believe in negative/positive outcome] if I do not pray, meditate or recite mantras. [PE_NotPraying] | | | | 1.00 | – | – | | | |
| [I believe in negative/positive outcome] if I pray to a god for better performance in an exam in addition to studying. [PE_PrayStudying] | | | | .97 | .11 | 8.75 | | | |
| [I believe in negative/positive outcome] if I do not make offerings on special occasions (holidays, grave-cleaning days, etc.) to gods or ancestors. [PE_NoSpecialOfferings] | | | | .93 | .12 | 7.94 | | | |
| [I believe in negative/positive outcome] if I pray, meditate, or recite mantras regularly. [PE_Praying] | | | | .90 | .12 | 7.75 | | | |
| [I believe in negative/positive outcome] if I do not pray to a god for better performance in an exam in addition to studying. [PE_NotPrayStudying] | | | | .89 | .09 | 10.31 | | | |

(*Continued*)

Continued.

| | Explicit Supernatural and Religious Beliefs | | | Beliefs about the Efficacy of Supernatural Practices | | | Active Engagement in Supernatural Practices | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized |
| [I believe in negative/positive outcome] if I get advice from a fortune teller and choose not to follow it. [PE_IgnoreFortune] | | | | .79 | .10 | 8.28 | | | |
| [I believe in negative/positive outcome] if I forget my lucky talisman at home or don't wear it. [PE_ForgotTalisman] | | | | .72 | .09 | 8.42 | | | |
| [I believe in negative/positive outcome] on my qi if I regularly practice tai chi chuan/qi gong. [PE_TaiChiQi] | | | | .52 | .10 | 5.02 | | | |
| [I believe in negative/positive outcome] if I do not wear red on the New Year. [PE_RedNewYear] | | | | .47 | .08 | 5.75 | | | |
| I use feng shui or display objects in my home to improve my fortune. [PF_FengShui] | | | | | | | 1.53 | .18 | 6.00 |
| I have my fortune or fate read (e.g., checking your 八字, numerologist, astrologer, face reader, palm reader, etc.) [PF_Fortune] | | | | | | | 1.43 | .18 | 8.05 |
| I hire someone (a chiomancer) or used an almanac to determine lucky days. [PF_LuckyDays] | | | | | | | 1.42 | .17 | 8.60 |
| I wear talismans (crucifix, rosary, prayer beads, objects for good fortune, zodiac symbols, etc.) [PF_Talismans] | | | | | | | 1.32 | .20 | 6.80 |
| I have followed the advice of a fortune teller (e.g., changing your name or appearance or customs). [PF_FollowedFortune] | | | | | | | 1.28 | .15 | 8.60 |
| I make offerings/burn incense for local gods or ancestors. [PF_Offerings] | | | | | | | 1.00 | – | – |
| I wear red clothing on certain holidays. [PF_Red] | | | | | | | .99 | .16 | 4.27 |
| I venerate ancestors at home, in the temple, at their graves. [PF_Venerate] | | | | | | | .81 | .15 | 5.44 |
| I believe that Nature responds to the needs of animals to help them survive. [B_NatureResponds] | | | | | | | .59 | .13 | 4.61 |

(*Continued*)

Continued.

| | Explicit Supernatural and Religious Beliefs | | | Beliefs about the Efficacy of Supernatural Practices | | | Active Engagement in Supernatural Practices | | |
|---|---|---|---|---|---|---|---|---|---|
| | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized | Unstandardized | SE | Standardized |
| I practice tai chi chuan or qi gong. [PF_TaiChi] | | | | | | | .46 | .11 | 4.27 |
| [I believe in negative/positive] effect on my health if I regularly practice tai chi chuan/qi gong. [PE_TaiChiHealth]† | | | | | | | | | |
| [I believe in negative/positive outcome] if going out at night on ghost days. [PE_GhostDays]† | | | | | | | | | |
| [I believe in negative/positive outcome] if making offerings every day to gods or ancestors. [PE_Offerings]† | | | | | | | | | |
| I believe that Nature is a powerful being (existence). [B_NaturePowerful]† | | | | | | | | | |
| I believe that Earth is alive. [B_EarthAlive]† | | | | | | | | | |
| I believe that animals have the power to change their own biological traits in order to survive. [B_AnimalsRespond]† | | | | | | | | | |

Note: Dashes (–) indicate the standard error was not estimated.
†These items loaded onto separate factors in the original 6-factor model, but were dropped from the more parsimonious 3-factor model, as they did not add to model fit (likely due to invariance in responses).