



## Group differences in Internet superstition: Negative relationship with neuroticism

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### ABSTRACT

Scientific interest in the relationship between analytical thinking and paranormal beliefs has increased in recent times. However, due to cultural differences, research in this area has been limited to the consideration of paranormal and religious beliefs. Moreover, few studies have explored the relationship between different types of superstitions and analytical thinking. We hypothesized that analytical thinking promotes distrust of Internet superstition which is a kind of superstition conveyed via the internet and a new form of superstition and that individual differences in the tendency to analytically override initially flawed intuitions are associated with decreased Internet superstition. Participants were classified into an Internet superstition group and a control group. We examined the associations between Internet superstition, traditional superstition, neuroticism, and analytical thinking. We found that analytical thinking negatively predicted both Internet and traditional superstition. Participants who were more willing to engage in analytical thinking were less likely to endorse Internet superstition. Further, Internet superstition has negative relationship with neuroticism.

### 1. Introduction

Superstition exists in all human beings in different forms (Zuckerman, 2007). For example, more than 40% of Americans believe in spiritual healing, ghosts, and extra-sensory perceptions (National Science Foundation, 2002; Rice, 2010). Although, there is no unified definition of superstition, some researchers have defined the concept as denoting irrational or false beliefs (Jahoda, 1969; Vyse, 1997) that are related to controlling good or bad luck (Kramer & Block, 2011). Further, the American Heritage Dictionary (Superstition, 2015) defined superstition as “irrational beliefs that an object, action, or situations not logically related to the process of events influences its results.”

Superstitions are often complex and determined by several factors, and analytical thinking is one such factor. Dual-process theory distinguishes between two fundamental types of thought processes (Evans & Stanovich, 2013). Type 1 processes are intuitive and autonomously cued, whereas Type 2 processes are reflective and require working memory. Research shows that the propensity to engage in analytical reasoning can predict disbelief of superstitions (Cheyne & Pennycook, 2013; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012) and the acceptance of science (Gervais, 2015; Shtulman & Mccallum, 2014).

Superstitions are good examples of “being of two minds” (Sloman, 2014; Sloman & Steven, 1996). When there is an ominous sign, such as a broken mirror, the intuitive mind signals danger, whereas analytical reasoning insists that this belief is unfounded (Risen & Jane, 2016). Superstitions, therefore, seem to exist in intuition and can be weakened by rational thinking. From the perspective of dual-process theory, intuition promotes religious cognition. In contrast, those who are good at utilizing analytical thinking are less superstitious (Gervais & Norrenzayan, 2012).

Most studies on superstition have measured superstitious beliefs using the Paranormal Belief Scale (PBS; Tobacyk, Nagot, & Miller, 1988). The PBS scale comprises various items, including considering the number “13” as unlucky. This item can be classified as a “negative” superstitious belief; that is, it reflects the notion that certain behaviors or omens are magically associated with bad luck and have potentially harmful consequences (Wiseman & Watt, 2004). Studies have found that negative superstitions reflect relatively poor psychological adjustment, including low self-efficacy (Tobacyk & Shrader, 1991), high trait anxiety (Uwe & Wolfradt, 1997), and external locus of control (Dag, 1999; Tobacyk, Nagot, & Miller, 1988). Nevertheless, certain superstitions reflect a desire to cause beneficial results by actively pursuing good luck

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or, at least, avoiding bad luck, such as carrying a lucky charm, crossing fingers, or touching wood. Wiseman & Watt (2004) studied the difference between positive superstition and negative superstition in terms of neuroticism and found that people with high neuroticism endorsed both types of superstition more strongly than did those with low neuroticism. Furthermore, the group with low neuroticism was more willing to choose positive rather than negative superstition. Therefore, these two different superstitions may have different psychological mechanisms.

Regarding positive superstition, “Koi” is considered a lucky charm. Koi is a kind of a communication symbol with profound cultural connotations, which symbolizes auspiciousness and luck. In recent years, reposting Koi for good luck and success has become increasingly popular on the Internet. In contrast to superstitious people in the past, persons who engage in “Koi reposting” are typically young, with high levels of education. Indeed, more than 85% of users who engage in Koi reposting are between the ages of 12 and 34 (Li, 2019). This phenomenon reflects the need for emotional support in contemporary youth on the Internet and demonstrates the anxiety and confusion in youth (Ma, 2019). When people are faced with negative events, superstitious rituals are widely used. Studies have found that people use rituals, such as knocking on wood, sprinkling salt, and spitting, to eliminate bad luck. Although these rituals do not change the objective possibility of negative results, they help reduce the perceived possibility of negative results caused by bad luck (Zhang, Risen, & Hoseney, 2014). Therefore, “Koi reposting” is used as a superstitious ceremony. Compared to its actual effect, Koi reposting brings a sense of spiritual comfort to the individual; it is not time- and labor-consuming, as the user only needs to click to repost the Koi, to expect good luck.

Based on the literature reviewed above, there is a negative relationship between the propensity for analytical thinking and religious beliefs. Moreover, compared with negative superstitions that reflect relatively poor psychological adjustment, positive superstitions may be related to people's positive qualities. Therefore, this study considered the positive superstition of Koi reposting. The following hypotheses were proposed:

**H1.** Analytical thinking would negatively predict Internet superstition.

**H2.** The neuroticism score of the Internet superstition group would be lower than that of the control group.

## 2. Method

### 2.1. Participants

In this Internet-based study of superstitious beliefs, 335 participants were recruited through the Internet and completed an online questionnaire. A total of 74 participants were excluded as they did not meet the inclusion criteria. Participants were divided into two groups—an Internet superstition group and a control group—to explore differences between their scores on analytical thinking and neuroticism. The former comprised comment reposters on the microblog “King of Koi”; they are known as “iron fans” (in the preceding 30 days, if interacted with bloggers for 5 days or more, they were automatically designated iron fans). For the Internet superstition group, we used the microblogging platform to send private messages to the iron fans. Because netizens are more alert to unfamiliar private messages, many private messages cannot be answered, only 112 valid questionnaires were collected after more than 3 months of private online chats. In the control group, there were a total of 149 participants. The study was approved by the local ethics committee of Shanghai Normal University, and the participation was voluntary. After the completion of the questionnaire will be 3–6 Yuan of money compensation.

### 2.2. Procedure

The online questionnaire comprised 47 items, which were presented

in a fixed order using Questionnaire Star Surveys. Participants were first asked to provide basic demographic information, after which they were assessed on two different measures of analytic cognitive style (ACS): the Cognitive Reflection Test (CRT; Shane & Frederick, 2005) and the Base-Rate Conflict (BRC) problems (De Neys & Glumicic, 2008). Finally, the participants were asked to complete the Internet superstition Questionnaire (IS), the Traditional Superstition Questionnaire (Li, 2006), and the Neuroticism Scale (EPQ-R; Eysenck & Eysenck, 1991).

#### 2.2.1. Measures of analytic cognitive style

ACS reflects cognitive ability and cognitive style, which were assessed via the CRT and the BRC problems. The CRT consists of three quasi-mathematical problems that can generate implicit misleading intuitions (Toplak, West & Stanovich, 2011). For example, “A bat and a ball cost \$1.10 in total; the bat costs \$1.00 more than the ball. How much does the ball cost?” To this question, most people would readily answer “10 cents” instead of the correct answer of “5 cents” because they intuitively parse the \$1.10 into \$1 and 10 cents (Neys & Pennycook, 2019).

In contrast, the BRC problems contain conflicts between a salient stereotype and more analytical probabilistic information (De Neys & Glumicic, 2008). For example, “1000 people were tested in a study. Among the participants, there were 995 nurses and 5 doctors. Jake is a randomly chosen participant of this study. He is 34 years old, lives in a beautiful home in a posh suburb. He is well-spoken and very interested in politics. He also invests a lot of time in his career. What is more likely? (a) Jake is a nurse, (b) Jake is a doctor.”

There are two items with conflicting information in the situation, namely, the diagnostic information, which can cue an intuitive response based on stereotypical beliefs about doctors and nurses (i.e., that Jake is a doctor) and the base-rate probability of group membership (i.e., a 99.5% chance that Jake is a nurse). Many people will react intuitively and neglect or undervalue the base-rate information (Barbey & Sloman, 2007; De Neys & Glumicic, 2008). However, those with better cognitive ability and greater willingness (cognitive style) to engage in analytical processing are less likely to choose the intuitive response (Stanovich, 2009; Stanovich & West, 2000).

#### 2.2.2. Measure of Internet superstition

To measure Internet superstition, this study first investigated its prevalence among 51 participants (17 males). And We found that Koi reposting and horoscopes were the most representative of Internet superstitions. Owing to the convenience and low cost of Koi reposting, we chose to explore this as an example of Internet superstition.

The Internet Superstition Questionnaire (IS) was adapted from three sources: The Superstition Questionnaire of College Students (Chen, 2008), the Religious Engagement (RE) Scale (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012), and the Intuitive Religious Beliefs scale (Gervais & Norenzayan, 2012), to which a self-evaluation component was added. For the Superstition Questionnaire of College Students, items were modified to suit the research context; for example, “a black cat can bring bad luck to people” was changed to “Koi reposting can bring good luck.” There were 11 items in total, which addressed three aspects of superstition: belief, motivation, and behavior.

The RE Scale measures religious engagement via three questions relating to church attendance, the importance of religion, and prayer frequency. Items were compiled according to the degree of belief, frequency, and importance of Koi reposting: 1) “Do you believe that reposting Koi can bring good luck?”; 2) “What is your reposting frequency?”; and 3) “Do you think it is important for you to repost Koi?”

Next, we adapted the questions of the Intuitive Religious Beliefs to suit the current study. For example, “I believe in God” was changed to “I believe in Koi reposting.” Finally, a self-assessment question was added to the Internet Superstition Questionnaire: “Do you think you are a person who believes that Koi reposting and praying can bring good luck?” After deleting duplicate items, 19 items were included in the

internet superstition Questionnaire. The reliability coefficients of each subscale are shown in Table 1.

2.2.3. Measures of traditional superstition

To verify whether the participants had the same level of belief in traditional and Internet superstitions, we selected four representative questions from the Superstition Scale of College Students (Li, 2006), which is a Chinese version of the PBS (Tobacyk, Nagot, & Miller, 1988; Tobacyk & Milford, 1983), The Traditional Superstition Questionnaire (TS) comprises four representative superstition questions and a self-assessment question.

2.2.4. Measures of neuroticism

The neuroticism scale was extracted from the 48-item Revised Eysenck Personality Questionnaire Short Scale (EPQ-R; Eysenck & Eysenck, 1991), which included 12 items that assess neuroticism. High scores indicate high neuroticism.

3. Results

3.1. Demographic variables

The demographic variables were as follows among the total sample: 28.7% males, 71.3% females; 16.5% aged 15–19 years, 56.3% aged 20–24 years, 22.2% aged 25–29 years, 4.6% aged 30–34 years, 0.40% aged 35–39 years; and 0.8% with some high school or less, 7.7% with high school education, 14.9% with technical, trade, or vocational training, 52.1% with a college degree, 23.8% with a master's degree, and 0.8% with a doctoral degree.

In the Internet superstition group, most participants were female (79.5%) and aged between 15 and 29 (92.8%), consistent with previous research. That is, there was clear age differentiation in the population involved in Koi reposting, with more than 85% of users being 12–34 years old, and the highest proportion of participants being young people (Li, 2019). The Internet superstition group was relatively highly educated, with 80.3% having a bachelor's degree or above.

Table 2 shows the correlations among Internet superstition (Is) and cognitive variables, along with neuroticism and traditional superstition. Traditional superstition was significantly positively correlated with Internet superstition. Consistent with previous studies, the propensity to engage in analytical reasoning predicted paranormal disbeliefs (Gervais & Norenzayan, 2012; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012). Correlations of all cognitive variables (BRC and CRT) with traditional superstition were negative and significant. Regarding the relationship between Internet superstition and analytical thinking, BRC negatively predicted Internet superstition, whereas CRT had no significant negative correlation with Internet superstition. However, CRT had a significant negative correlation with its subscale. Moreover, neuroticism was significantly negatively correlated with two forms of superstition.

**Table 1**  
Reliability coefficients (Cronbach's alpha) for the Internet superstition scale and each subscale.

Dimension	Alpha ( $\alpha$ )	Items
Koi superstition (Ks)	0.92	11
Belief	0.94	2
Behavior	0.81	2
Motivation	0.84	7
Koi engagement (Ke)	0.90	3
Koi intuition (Ki)	0.69	4
Internet superstition (Is)	0.94	19

Note. Koi superstition (Ks) is changed by the Superstition Questionnaire of College Students, which including three subscales: superstitious belief, superstitious motivation, and superstitious behavior. It is abbreviated as belief, motivation, and behavior here.

As can be seen in Table 3, significant gender differences were found in the scores for traditional superstition, Internet superstition, and the Neuroticism Scale. For traditional superstition, females (M = 3.00, SD = 0.61) had higher scores than males (M = 2.70, SD = 0.74;  $p < 0.01$ ), as was the case for Internet superstition (M = 3.18, SD = 0.73 vs. M = 2.86, SD = 0.79;  $p < 0.01$ ). For the Neuroticism Scale, male students (M = 18.20, SD = 4.44) had higher scores than female students (M = 16.98, SD = 3.87;  $p < 0.05$ ).

In line with findings of previous studies (Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016), an age difference in CRT was found. Those aged 15–19 years (M = 0.39, SD = 0.34) scored significantly lower than those aged 30–34 years (M = 0.67, SD = 0.40;  $p < 0.01$ ). The results indicate that younger participants gave more heuristic responses than did older participants (Table 4). In addition, there were significant differences in CRT scores according to the participants' levels of education: CRT scores increased with increasing education level (Table 5).

There were significant differences in the scores for traditional superstition, Internet superstition, and neuroticism between the control group and the Internet superstition group (Table 6). Specifically, the scores for traditional superstition and Koi reposting in the control group were lower than those of the Internet superstition group, thus verifying the division of the sample. In addition, the scores for neuroticism in the control group were higher than those in the Internet superstition group. Regarding neuroticism differences, the control group (M = 17.91, SD = 3.93) scored significantly higher than the Internet superstition group (M = 15.56, SD = 4.15;  $t = 2.67$ ,  $p < 0.01$ ).

4. Discussion

The collected data supported our hypotheses: an analytical cognitive style, defined as a type of analytical thinking with effortful reasoning, was associated with a tendency against Internet superstition. That is, for the two types of reasoning problems, participants who were prone to reject an intuitive response were more inclined to reject Internet superstition and supernatural beliefs. Additionally, although Internet superstition is an irrational belief, positive Internet superstition, such as Koi reposting had a significant negative correlation with neuroticism. Finally, we also found that Internet superstition was significantly positively correlated with traditional superstition, indicating that people may have the same tendency to believe in traditional superstition and Internet superstition.

Secondary findings involving the demographic variables were generally consistent with previous studies. Women generated higher scores on religiosity (Hanford, Batson, Schoenrade, & Ventis, 1994), females score higher than men on both traditional and Internet superstitions. Further, the effects of education and age on analytical thinking were also consistent with previous studies (Primi, Morsanyi, Chiesi, Donati, & Hamilton, 2016). The correlations between education, age, and cognitive variables were strong: older, more highly educated individuals consistently scored higher on measures of cognitive ability and analytical thinking style.

In conclusion, this research replicated and extended the reported relationship between the analytical cognitive style and paranormal beliefs (Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012), using Koi reposting as representative of Internet superstition. Moreover, our results are consistent with those of previous research (Gervais & Norenzayan, 2012; Pennycook, Cheyne, Seli, Koehler, & Fugelsang, 2012; Shenhav, Rand, & Greene, 2012), in which more intuitive participants were found to be significantly more superstitious. Superstition and paranormal belief are multi-determined and culturally shaped phenomena; further, dual-process theory suggests that analytical thinking may be a factor in paranormal beliefs. Recent evidence supports this notion (Shenhav, Rand, & Greene, 2012), whereby participants who relied on intuitive thinking tended to have a greater belief in God. Thus, religious belief may emerge through a converging series of intuitive processes; moreover, if analytical processing can override intuitive

**Table 2**  
Pearson product-moment correlations among major variables.

	Ts	Is	Ks	Belief	Behavior	Motivation	Ke	Ki	CRT	BRC
Ts	1									
Is	0.47**	1								
Ks	0.46**	0.96**	1							
Belief	0.46**	0.90**	0.87**	1						
Behavior	0.43**	0.89**	0.89**	0.80**	1					
Motivation	0.42**	0.89**	0.96**	0.74**	0.76**	1				
Ke	0.50**	0.92**	0.83**	0.83**	0.78**	0.74**	1			
Ki	0.17**	0.71**	0.51**	0.59**	0.55**	0.39**	0.65**	1		
CRT	-0.13*	-0.11	-0.12	-0.14*	-0.06	-0.11	-0.13*	-0.02	1	
BRC	-0.13*	-0.15*	-0.13*	-0.14*	-0.14*	-0.11	-0.15*	-0.1	0.16**	1
Ne	-0.14*	-0.15*	-0.1	-0.07	-0.15*	-0.08	-0.19**	-0.19**	0.15*	0.03

Note. Ts = Traditional superstition, Is = Internet superstition, Ks = Koi superstition, Ke = Koi engagement, Ki = Koi intuitive, NE = Neuroticism, CRT = Cognitive reflection test, BRC = Base-rate conflict. N = 261.

Koi superstition (Ks) is changed by the Superstition Questionnaire of College Students, which including three levels aspects of superstition: superstitious belief, superstitious motivation, and superstitious behavior. It is abbreviated as belief, motivation, and behavior here.

**Table 3**  
Gender differences (Mean ± SD).

	Male	Female	t	p
Ts	2.70 ± 0.74	3.00 ± 0.61	-3.41	0.01
Is	2.86 ± 0.79	3.18 ± 0.73	-3.13	0.01
Ne	18.20 ± 4.44	16.98 ± 3.87	2.09	0.04

Note. Ts = Traditional superstition, Is = Internet superstition, Ne = Neuroticism. N = 261.

**Table 4**  
Age differences (Mean ± SD).

	15-19	20-24	25-29	30-34	35-39	F	p
CRT	0.39 ± 0.34	0.58 ± 0.36	0.61 ± 0.36	0.67 ± 0.40	0.00 ± 0.0	3.81	0.01
Ke	2.71 ± 0.95	2.66 ± 0.99	3.11 ± 1.10	3.14 ± 1.00	3.33 ± 0.0	2.56	0.04
Ki	3.14 ± 0.56	2.84 ± 0.76	3.24 ± 0.89	2.94 ± 0.61	3.00 ± 0.0	3.40	0.01

Note. CRT = Cognitive Reflection Test, Ke = Koi engagement, Ki = Koi intuitive. N = 261.

processing, then analytical thinking may undermine religious belief. In addition, Pennycook, Cheyne, Barr, Koehler, and Fugelsang (2014) proposed that conflict detection is the basic mechanism underlying this relationship. Specifically, participants with a less analytical cognitive style are more likely to be superstitious as they are less efficient at detecting and reacting to conflicts when reasoning about beliefs. Although forms of superstitions change with time and culture, participants' analytical thinking tendencies can still negatively predict irrational beliefs. Therefore, we suggest that individuals who are characterized by analytical thinking have decreased levels of Internet superstition because they are more likely to scrutinize ideas, detect violations, and doubt information presented.

Researchers have found that negative superstition is often related to psychological maladjustment, such as low self-efficacy (Tobacyk & Shrader, 1991), high anxiety (Uwe & Wolfradt, 1997), and external locus of control (Dag, 1999; Tobacyk, Nagot, & Miller, 1988). However,

**Table 5**  
Education differences (Mean ± SD).

	High school or less	High school	Vocational training	College degree	Master's degree	Doctoral degree	F	p
Ts	3.00 ± 0.00	3.06 ± 0.50	2.97 ± 0.59	2.87 ± 0.68	2.92 ± 0.71	3.60 ± 0.85	0.82	0.54
Is	3.18 ± 0.33	3.08 ± 0.58	3.02 ± 0.74	3.16 ± 0.80	2.97 ± 0.76	3.34 ± 0.48	0.61	0.70
CRT	0.33 ± 0.47	0.30 ± 0.32	0.35 ± 0.35	0.61 ± 0.34	0.66 ± 0.36	0.83 ± 0.24	7.11	0.00
Ne	18.50 ± 4.95	16.00 ± 4.48	17.54 ± 4.17	17.37 ± 4.00	17.47 ± 4.02	18.50 ± 7.78	0.53	0.76

Note. Ts = Traditional superstition, Is = Internet superstition, CRT = Cognitive Reflection Test, Ne = Neuroticism. N = 261.

Wiseman and Watt (2004) suggested that positive superstition may serve different psychological functions than negative superstition. In this study, Koi reposting was an example of a positive superstition that is believed to bring good luck. Which have a significant negative correlation between Internet superstition and neuroticism. Additionally, the control group had a higher mean neuroticism score than the Internet superstition group.

Research has shown that neuroticism and psychoticism, as assessed via the EPQ, can explain up to 53% of mental health variations (Cheng & Furnham, 2001). Neuroticism is characterized by emotional instability. People with high scores are often anxious, nervous, and worried. They have large emotional fluctuations and are easily affected by external events. Therefore, persons with a neurotic personality are relatively susceptible to depression and anxiety (Ormel, Oldehinkel, & Brilman, 2001). Gunthert, Cohen, and Armeli (1999) indicated that compared to individuals with low neuroticism, those with high neuroticism exhibit greater negative emotional arousal and more painful feelings when encountering stressful life events. Therefore, neuroticism is directly related to anxiety, depression, and other negative emotions. Generally, individuals with high neuroticism have higher levels of anxiety and depression (Farnam, Farhang, Bakhshipour, & Niknam, 2011; Rosellini & Brown, 2011). However, our results show that Koi reposting can negatively predict neuroticism, thereby indicating that when faced with stressful life events, Those who with a high degree of Internet superstition have a low degree of negative emotions. Nevertheless, Internet superstition is still an irrational belief, which is an expedient in the face of uncontrollable situation.

**Table 6**  
Group differences (Mean ± SD).

	Control group	Internet superstition group	t	p
Ts	2.79 ± 0.68	3.08 ± 0.60	-3.60	0.01
Is	2.68 ± 0.70	3.63 ± 0.41	-13.83	0.01
Ne	17.91 ± 3.93	15.56 ± 4.15	2.67	0.01

Note. Ts = Traditional superstition, Is = Internet superstition, Ne = Neuroticism. N = 261.



## 5. Conclusions

This study expands the literature on forms of superstition to include the positive Internet superstition of Koi reposting, which has not been analyzed previously. Although this form of superstition does not appear to be markedly different from more traditional superstitions in how it is treated by individuals, in terms of the nature of the persons who adopt same, determining that this is the case, is of value. Given the worldwide prominence of the Internet, the role of this system is promulgating superstitions is of great relevance. However, our study has some limitations. Future research should consider causality rather than correlation studies. Additionally, cognitive neuroscience also be considered to enable better understanding of the underlying brain mechanisms.

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## CRedit authorship contribution statement

Jie Liu wrote up the manuscript. Jie Liu, Shasha Li and Bingbing Li collected data and conducted data analysis, Junlong Luo designed the experiment and provided the important suggestions on the final version of the manuscript.

## Declaration of competing interest

The authors have no relevant financial or non-financial interests to disclose.

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