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Paranormal and Religious Believers Are More Prone to Illusory Face Perception than Skeptics and Non-believers

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Summary: Illusory face perception, a tendency to find human-like faces where none are actually present in, for example, artifacts or scenery, is a common phenomenon that occasionally enters the public eye. We used two tests (N = 47) to analyze the relationship between paranormal and religious beliefs and illusory face perception. In a detection task, the participants detected face-like features from pictures of scenery and landscapes with and without face-like areas and, in a rating task, evaluated the face-likeness and emotionality of these areas. Believer groups were better at identifying the previously defined face-like regions in the images but were also prone to false alarms. Signal detection analysis revealed that believers had more liberal answering criteria than skeptics, but the actual detection sensitivity did not differ. The paranormal believers also evaluated the artifact faces as more face-like and emotional than the skeptics, and a similar trend was found between religious and non-religious people.

INTRODUCTION

Every so often, people claim to find the face or figure of a religious character or other important person in peculiar places, for example, on toasted bread. These findings are even reported in the news, and the items are sold on eBay. Although most of us can identify the shapes claimed, reactions vary from serious wonder about the supposed miracle to ignorance of these figures and disbelief in their importance. These intriguing, funny, and often surprising perceptions of human shapes can happen in unexpected situations and have even ended up in a scientific journal, in the case of the face of a sick man peering out of an ultrasound image (Roberts & Touma, 2011). The present study examines the role that religious and other paranormal beliefs may play in illusory face detection.

Research on reports of seeing a face where no face actually exists is scarce. In a recent study, illusory face detection was found to be relatively high even in pure noise images, with face detection rates as high as 41% (Rieth, Lee, Lui, Tian, & Huber, 2011). The same study also suggested that illusory face perception is highly affected by top-down processes (i.e., expectations and previous experiences), not only by bottom-up processes, such as visual input. In another study, two participants tried to detect smiles on faces with mouth areas consisting of white noise (Gosselin & Schyns, 2003). Illusory detection varied from relatively low to high: from 7% to 48%. These studies suggest that even when only noise is present, false perceptions of faces or facial parts are common.

Krummenacher, Mohr, Haker, and Brugger (2010) showed that people who believe in paranormal phenomena erroneously identified faces in scrambled configurations more often than skeptics did. Other studies have also shown that paranormal believers are prone to perceive meaningful patterns in ambiguous stimuli in, for example, semantic or visual tasks (Brugger et al., 1993; Giannotti, Mohr, Pizzagalli, Lehman, & Brugger, 2001). It can thus be expected that illusory face recognition is more typical for paranormal believers than for skeptics.

Illusory face detection can be considered, in a liberal sense, as a form of anthropomorphism. Anthropomorphism, in a strict sense, denotes the belief that nonhuman phenomena have uniquely human properties, such as a sense of humor. However, nowadays the concept is often used more liberally in connection with attributes that may apply to animals as well (e.g., a belief that God is an intentional agent; Boyer, 1996) or without an assumption of a genuine belief ('My computer is grouchy today').

Cognitive scientists of religion have suggested that anthropomorphism explains people's inclination to believe in gods (Barrett, 2000; Guthrie, 1993). The few available studies about the relationship between individual anthropomorphism and religiosity surprisingly propose that this is not the case. Shtulman (2008) found that the more a person believed in a supernatural being, the less it was described with such human attributes as awake, honest, talkative, and skinny. Similarly, perceiving such properties as anger, maliciousness, wisdom, and self-confidence in pictures of a tree and a volcano is not connected to religious beliefs but rather to other paranormal beliefs (Norenzayan, Hanse, & Cady, 2008). Anthropomorphism is characterized as a process where the highly accessible, early developing, and fundamental knowledge about human agents serves as an inductive base that is applied to nonhuman targets (Epley, Waytz, & Cacioppo, 2007; Guthrie, 1993). Therefore, it is possible that an association between religiosity and anthropomorphism is more apparent in basic social processes functional early in development and crucial in dealing with other people, such as face detection (Beauchamp & Anderson, 2010), than in less fundamental and later developing human attributes such as talkativeness and self-confidence.

We examined illusory face detection with artifact face pictures and non-face pictures. Artifact face pictures are pictures of artifacts and scenes in which face-like features

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such as eyes and a mouth might be perceived even though the picture includes no actual faces or people. The hypotheses were tested with two tasks: the perception of human faces in artifacts and the rating of the face-likeness and emotionality of the faces. Two hypotheses were set: (1) paranormal believers and religious people are more prone to illusory face perception than skeptics and non-religious people are and (2) paranormal believers and religious people rate artifact faces as more face-like and emotional than skeptics and non-religious people do.

METHOD

Participants

A total of 47 (26 women, 21 men, mean age = 31 years, range 20–50 years) healthy participants with normal or corrected to normal vision were included in the study. The participants were recruited from various electronic mailing lists (e.g., university students' lists), internet forums (e.g., a skeptic's association), notice boards (e.g., at an esoteric bookstore), and with the snowball method. The participants had 29 different occupations, and 39% of them either were university students or university graduates. To obtain participants from the opposite ends of the paranormal beliefs continuum, two different advertisements were used. These were otherwise identical, but in the first advertisement we emphasized that we are looking for participants who view the paranormal positively or believe that there is an invisible spiritual world; in the other, we stated that we were looking for participants who are skeptical about the existence of paranormal phenomena. The participants received personal feedback from a questionnaire about their thinking style as a reward. We also asked the participants whether they were familiar with the idea of artifact faces and if they had, for example, visited internet pages dedicated to the phenomena. Familiarity did not predict performance in any of the tasks (all p's $> .50$).

Originally 73 people were recruited for the study. The distribution of paranormal and religious beliefs was found to be strongly skewed, which was probably due to the emphasis on skepticism or paranormal beliefs in the recruitment process. Only those belonging to the upper and lower quartiles (25%) were included in the analyses: paranormal believers ($N = 19$, mean age = 34 years) and skeptics ($N = 20$, mean age = 28 years); religious people ($N = 20$, mean age = 34 years) and non-religious people ($N = 19$, mean age = 27 years). We focused on the more extreme groups to avoid a possible qualitative difference between mild and strong believers: believers who hold mild or medium strength beliefs may be habitual believers, not true believers or skeptics (Vyse, 1997). Paranormal beliefs and religiousness correlated strongly with each other, $r = .84$, $p < .001$, and 30 participants who were categorized either as paranormal believers or as skeptics were also categorized as religious and non-religious, respectively. Thus, even though we speak separately about paranormal and religious believers (or skeptics and non-believers), the groups overlapped.

Religious and paranormal beliefs were assessed with Tobacyk's (2004) Revised Paranormal Belief Scale. The scale includes 26 items. The four items that measure traditional religious beliefs (e.g., 'I believe in God') were used to measure *religiosity* (Cronbach's $\alpha = .85$). Twenty items addressing beliefs in psi, superstition, spiritualism, extraordinary life forms, and precognition were used to measure non-religious *paranormal beliefs* ($\alpha = .96$; e.g., 'Astrology is a way to accurately predict the future', 'A person's thoughts can influence the movement of a physical object'). The questions were answered with a five-point scale (1 = *strongly disagree*, 5 = *strongly agree*). Two items concerning the possibility of extraterrestrial life and witches were removed because several participants reported interpreting them in a non-paranormal way. The questionnaire was completed after the experimental part of the study. Prior to the experiment, the participants signed an informed consent form and were given a short briefing about the study, including information regarding ethical issues and the flow of the study. A longer description of the study was given at the end.

Stimuli

The stimuli pictures were chosen in several steps. First, 28 color photographs were chosen from existing private photographs of the authors that fit the requirements for the stimuli. Then, we took additional photographs to complete a set of 150 color photographs of artifact faces and 100 non-face pictures. All of the artifact face pictures had a face-like area where, at the minimum, eyes and a mouth could be perceived. The faces in the pictures were evenly distributed to different areas of the photographs. Some of the artifact pictures were staged, such as office tools arranged on a table, whereas others were natural, such as a rock wall. The pictures depicted items, objects, and places such as furniture, rooms, buildings, and landscapes. No humans or animals were in the pictures. When possible, the artifact face picture had a control non-face picture with the same setting, theme, and light, taken by the same camera (see Figure 1 for examples). In the non-face pictures, there were no face-like areas. To keep the pictures as natural as possible, they were not converted or adjusted in any way except for resizing them to 640×640 pixels.

Next, four people rated whether they were able to detect faces in the artifact face pictures and in the non-face pictures. If three raters agreed upon the same face area, the picture was added to the artifact face set. Also, to define the artifact face areas in the pictures, all of the raters estimated the opposite top and bottom corners of the perceived face area, and the box calculated from the average of these values was then used as a hit box area for the face in the detection task. If any of the raters reported a face-like area in a non-face picture, the picture was discarded. A total of 124 artifact face pictures and 99 non-face pictures were chosen to pilot the study.

A pilot test with 10 participants (mean age 32 years, seven women) was conducted to test and choose the pictures for the main study. Half of the participants took the test in a laboratory and the rest with a laptop computer in various places using the same procedure as in the main study, which is described in the succeeding text. Thirty-eight pictures in which everyone had perceived an artifact face were excluded along with one picture in which no one had perceived a face.

Figure 1. Artifact faces. Two pictures of artifact faces (first row) and control pictures (second row)

Twelve non-face pictures were rejected because of ambiguities. The rest of the 98 artifact face pictures were used in the detection and rating task along with the 87 non-face pictures in the detection task.

The detection task

The detection task was done in a dimmed laboratory with a PC and a Samsung 22" 1440x 900 LCD screen. The stimuli were presented with Neurobehavioral Systems Inc.'s PRESENTATION® 14.1 software. The participants sat 60 cm from the screen. The viewing angle was not restricted, and answering was done with a mouse. The background color of the screen was gray throughout the study.

The participants read the instructions for the study from a computer screen. The test started with practice sections that taught the answering method and the idea of artifact faces. Because of the rapid pace of the test, participants were instructed to be fast but as precise as possible. The first practice section consisted of six small green squares. The participants had to point to each square and click on it as quickly and precisely as possible, after which the next one would be shown. In the second part, the six squares were shown again but now only for 1000 ms each, and the participants had to point to and click on the area in which they had seen the square.

In the third section, six artifact faces and two non-face pictures were used. To exemplify a range of artifact faces, pictures were chosen from the pilot study on the basis of their relative difficulty, from easy to difficult. The participants were instructed to try to find a face-like area in the pictures. If they found one, they were to point with the mouse to the approximate location of the middle of the face, that is, the nose, and press the left mouse button. If there was no face-like area, they were instructed to press the right mouse button. The answering time was not restricted, and the pictures were presented one by one. To give feedback to the participants, the target picture was presented again after every answer, for both right and wrong answers, with the face-like area circled or with an X in the middle of the picture for non-face pictures. The fourth practice section used the same procedure and instructions as the main task, which is described next, but like the third section had only two non-face pictures and six artifact face pictures.

In the main experiment, the participants were instructed to try to find face-like areas from randomly shown 98 artifact face pictures and 87 non-face pictures. If they found one, they were to point with the mouse to the approximate location of the middle of the face and press the left mouse button. If there was no face-like area, they were instructed to press the right mouse button. The main task proceeded in the following way. First, a fixation cross was shown for 1000 ms. Second, a picture was shown for 1000 ms. Third, a mouse cursor appeared on the screen to be used for answering with an answering time of 4000 ms. Because the pictures were smaller than the whole screen, mouse clicks were made on a highlighted gray area that replaced the area of the pictures, as the picture was not shown during the time given for answering. After the answer was given or if the participant did not answer within the given answering time, the test continued automatically to the next fixation cross.

The variables for the hit and miss rates for the artifact faces and non-face pictures were calculated in the following way. For the artifact faces, left mouse clicks ('yes, there is a face-like area in the picture') were coded as *hits* if the answer was given in the previously defined face area of the picture, and all right clicks ('no, there is no face-like area') were coded as *misses*. If the area clicked when answering 'yes' was outside the previously defined face area, the answer was coded as *yes-miss*. For the non-face pictures, all left mouse clicks ('yes') were coded as *false alarms* and right mouse clicks ('no') as *correct rejections*. Non-responses for both types of pictures were coded as *non-responses* (no group differences were found, both p's $> .249$). The internal consistency of the test was good for both the artifact faces ($\alpha = .93$) and the non-face pictures ($\alpha = .98$).

The rating task

In the rating task, presented after a short break following the detection task, the participants rated the face-likeness and emotionality of the artifact face pictures using a visual analog scale and a mouse. The instruction was as follows: 'Next you will be shown pictures in which a face-like area can or cannot be found. Rate the possible face-like areas using the following scales.' The participants were asked to indicate how face-like the artifact face was (the left end of the scale = 'not at all', coded as 0; the right end = 'a lot', coded as 170) and how emotional the face was (the left end = negative, coded as −170; the middle = no emotion, coded as 0; the right end = positive, coded as 170). To obtain a score for the perceived strength of the emotion, only the absolute value of the rating was used (0–170). Answering was done by moving the cursor along the visual analogical scale and pressing the left mouse button. If the participant thought that there was no face-like area in the picture, they were instructed to press the right button (this answer was coded as 0). The first picture was a practice picture taken from the detection task's practice section and was not used in the analyses. The artifact face pictures and the setting were the same as in the detection task. The pictures were presented randomly, without a time limit, one by one with the answering scale and the question. Two variables, *face-likeness* ($\alpha = .98$) and *emotionality* ($\alpha = .95$), were formed from the ratings.

RESULTS

We used signal detection analysis (Green & Swets, 1966; Macmillan & Creelman, 2005) to analyze the results of the detection task because it enables the correction of the hit rate with the false-alarm rate, revealing actual detection sensitivity. 'Yes' answers for artifact faces and false-alarm rates for non-face pictures were calculated and used to calculate two variables based on signal detection analysis: sensitivity d' (perceptual sensitivity) and the criterion C (bias towards the answer 'yes'). For all means, see Table 1. Analyses of variances and covariance were conducted between the paranormal believers and skeptics and the religious and non-religious people between all the variables. Age was added as a covariate in the analysis because the paranormal believers were older than the skeptics, $F(1,37) = 6.45$, $p = .015$, $\eta_p^2 = .148$, the religious people were older than the non-religious, $F(1,37) = 10.01$, $p = .003$, $\eta_p^2 = .213$, and because age correlated with *misses* for artifact faces in the fast-paced detection task, $r = .24$, $p = .044$.

The religious people had more false alarms in non-face pictures, $F(1,36) = 6.34$, $p = .016$, $\eta_p^2 = .150$, but also more hits in predetermined face areas in artifact face pictures, $F(1,36) = 10.15$, $p = .003$, $\eta_p^2 = .220$, than the non-religious people had. Similarly, the paranormal believers had more false alarms in non-face pictures, $F(1,36) = 7.95$, $p = .008$, $\eta_p^2 = .181$, and more hits in the predetermined artifact face areas, $F(1,36) = 9.99$, $p = .003$, $\eta_p^2 = .217$, than the skeptics had. Regarding sensitivity d', neither the comparison between the paranormal believers and skeptics nor the comparison between the religious and non-religious people was statistically significant (both p's $> .225$). There were, however, group differences in response criterion C. The paranormal believers had a lower criterion than the skeptics had, $F(1,36) = 11.02$, $p = .002$, $\eta_p^2 = .234$, and the religious believers lower than the non-religious people, $F(1,36) = 6.06$, $p = .019$, $\eta_p^2 = .144$. No group difference was found in the *yes-miss* answers, between the religious and non-religious people, $F(1,36) = 2.93$, $p = .095$, $\eta_p^2 = .075$, nor between the paranormal believers and the skeptics, $F(1,36) = 2.10$, $p = .156$, $\eta_p^2 = .055$. Age had a significant independent effect on the response criterion and hit rate; the older participants had less hits and a lower criterion value than the younger participants had in both group comparisons between the believer groups. Between the religious and non-religious people, the group differences were not statistically significant without controlling for age. Regarding the paranormal believers and skeptics, all statistically significant differences were also significant without controlling for age, except for the hit rate on artifact faces.

To approximate whether the believer groups were better than non-believers at identifying the previously defined face-like regions in the images, analyses of covariance were conducted with age as a covariate. The number of correct location identifications divided by the sum of correct and incorrect location identifications for all trials where participants reported detecting a face was the dependent variable. The results showed that paranormal believers scored higher ($M = 90$) than skeptics did ($M = 87$), $F(1,36) = 6.01$, $p = .019$, $\eta_p^2 = .143$, and that religious people scored higher ($M = 90$) than non-religious people did ($M = 86$), $F(1,36) = 5.26$, $p = .028$, $\eta_p^2 = .127$.

In the rating task, the paranormal believers rated the artifact faces as more face-like, $F(1,37) = 6.25$, $p = .017$, $\eta_p^2 = .145$, and emotional, $F(1,37) = 4.70$, $p = .037$, $\eta_p^2 = .113$,

Table 1. Means and standard deviations of all variables in the different groups

	Paranormal believers	Skeptics	Religious believers	Non-religious people
Hit rates in predetermined artifact face areas	0.52 (0.13)	0.46 (0.12)	0.51 (0.12)	0.48 (0.12)
Yes-miss answers given outside the predetermined artifact face areas	0.05 (0.03)	0.07 (0.05)	0.06 (0.03)	0.08 (0.06)
False alarms for non-face pictures	0.16 (0.10)	0.10 (0.07)	0.15 (0.10)	0.10 (0.07)
Correct rejections for non-face pictures	0.84 (0.10)	0.90 (0.07)	0.85 (0.10)	0.90 (0.07)
Sensitivity d'	1.30 (0.38)	1.45 (0.31)	1.33 (0.36)	1.33 (0.36)
Response criterion C	0.43 (0.34)	0.67 (0.39)	0.47 (0.34)	0.62 (0.38)
Face-likeness in the rating task	110 (50)	72 (44)	101 (51)	79 (39)
Emotionality in the rating task	54 (18)	42 (14)	51 (18)	45 (15)

than the skeptics did. In contrast, the religious people and non-religious people rated the face-likeness of the pictures equally, $F(1,37) = 2.29$, $p = .139$, $\eta_p^2 = .058$, and no difference was found for emotionality ratings either, $F(1,37) = 1.03$, $p = .318$, $\eta_p^2 = .027$.

DISCUSSION

The religious people saw artifact faces in pictures of, for example, rocks, landscapes, and lifeless material objects more often than the non-religious people did. Similarly, the people who believed in other paranormal phenomena (e.g., astrology and telepathy) detected faces in the artifacts more often than the skeptics did. Supporting Hypothesis 2, the paranormal believers also regarded these face-like areas as more face-like than the skeptics did and assigned more extreme emotions to them. A similar trend was found between the religious and non-religious people, but the differences were not significant. Moreover, compared with the non-believers and skeptics, the religious and paranormal believers not only detected faces more often when they were actually present, but in line with Hypothesis 1, they also saw more faces in pictures without any face-like patterns.

Signal detection analysis revealed that the participant groups did not differ in their sensitivity in detecting faces but that the paranormal and religious believers had a reduced criterion for approving the presence of a face, reflected in the low number of misses at the expense of high false alarm rates. The believers' tendency to report seeing faces regardless of whether there were faces or not implies that they were susceptible to the suggestion that faces may be present, on the basis of, for example, a 'yea-saying' tendency, the priming effect of the practice items, or on a confirmation bias, which has been shown to be common among paranormal believers (Hergovich, 2003; Wiseman, Greening, & Smith, 2003). As such, the results are in line with earlier findings that paranormal believers are more prone to find patterns in noisy or ambiguous stimuli than other people are (e.g., Brugger et al., 1993; Giannotti et al., 2001; Krummenacher et al., 2010) and that paranormal beliefs are associated with a tendency to jump to conclusions on the basis of inadequate evidence (Blagrove, French, & Jones, 2006; Brugger & Graves, 1997).

However, it might be possible that the results are not only due to these factors alone because the way in which the paranormal and religious believers detected faces was not indiscriminate. Whereas in a typical signal detection design, the participants are simply asked to answer yes or no, in the present study they also had to point to the area where the face was. Interestingly, the paranormal and religious believers were more likely to find the face-like areas than the skeptics and non-believers were: the group differences that were found were in these hits, not in the yes answers given outside the predetermined face areas. However, it is possible that the believer groups identified the location of more faces simply because they had the opportunity to do so as they reported detecting faces overall more than non-believers. Therefore, in future studies, believers' detection of face-like pictures should be tested with a design where participants are always asked to make location responses.

As a whole, the results hint at the possibility that the believers may be overly sensitive to social information and that only a small amount of information is sufficient to activate their social information processing. This possibility would be consistent with the arguments that these beliefs, like anthropomorphism, stem from the capacity to recognize and understand human beings (Epley et al., 2007). Theoretical arguments (e.g., Bering, 2006; Bloom, 2007; Kelemen, 2004) and empirical findings (e.g., Lindeman & Aarnio, 2007; Lindeman et al., 2008; Svedholm, Lindeman, & Lipsanen, 2010) suggest that paranormal and religious believers stretch universally and early developing human attributes, such as beliefs, desires, and intentional purpose, to inappropriate realms. It has also been suggested that processing information relating to human beings is a fundamental dimension of domain-specific cognition that comes in degrees in the general population, ranging from underdeveloped to hyperdeveloped (i.e., exaggerated) social cognition (e.g., Baron-Cohen, Knickmeyer, & Belmonte, 2005; Crespi & Badcock, 2008). Considering the theoretically plausible link between social information processing skills and paranormal and religious beliefs, it could be useful to study their association more closely in future studies.

In the introduction, we suggested that detecting faces in artifacts with no face-like patterns is one form of anthropomorphism. For the present, theoretical arguments have mostly focused on anthropomorphism as a determinant of belief in gods and other spirits (Barrett, 2000; Guthrie, 1993), but empirical findings have been rare and inconclusive (e.g., Norenzayan et al., 2008; Shtulman, 2008), most probably because of the myriad of ways the concept of anthropomorphism can be operationalized. Our results suggest that both religiosity and paranormal beliefs are associated with anthropomorphism and that the tendency to attribute human qualities to nonhuman phenomena may extend to face perception as well.

Illusory face perception, a phenomenon often in the public eye, was here studied with as natural stimuli as possible, which has advantages and disadvantages. The pictures were chosen for their naturalness to ensure face validity: we tried to use stimuli as close to real-life situations as possible. On the other hand, this limits control over the images. For example, a more controlled psychophysical approach with an equal number of non-face and face pictures could be used to investigate more precisely where the group differences lie at the perceptional level. Using receiver operating characteristics (see, for example, Macmillan & Creelman, 2005) could further highlight the relation of sensitivity and the response criterion. Also, to rule out a possible response bias in the rating task, a control condition of non-face pictures could be used. It should also be noted that the paranormal believers were here partly the same participants as the religious individuals (or the skeptics and non-religious participants, respectively), and it could be useful to use more diverse groups of paranormal and religious believers in the future.

One thing that we learned during the research was that illusory face perception is a pervasive phenomenon. It was

hard to find pictures of artifact faces that were difficult enough to detect but still realistic because most of the faces were so self-evident. Thus, the line between when a pattern is face-like and when it is not is challenging to draw, and as our results show, that line may be in a different place for different individuals. To conclude, we may all be biased to perceive human characteristics where none exist, but religious and paranormal believers perceive them even more than do others.

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