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Personality and Individual Differences 38 (2005) 1805–1812

PERSONALITY AND  
INDIVIDUAL DIFFERENCES

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# Critical thinking ability and belief in the paranormal

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Received 10 March 2004; received in revised form 30 September 2004; accepted 1 November 2004  
Available online 2 February 2005

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## Abstract

A study was conducted to assess the relationship between critical thinking and belief in the paranormal. 180 students from three departments (psychology, arts, computer science) completed one measure of reasoning, the Paranormal Belief Scale (Tobacyk & Milford, 1983), and a scale of paranormal experiences. Half of the subjects filled out the Cornell Critical Thinking Test (Ennis & Millmann, 1985) and the Watson–Glaser Critical Thinking Appraisal (Watson & Glaser, 2002), respectively. The results show no significant correlations between critical thinking and paranormal belief or experiences. Reasoning ability, however, had a significant effect on paranormal belief scores, but not on paranormal experiences. Subjects with lower reasoning ability scored higher on Traditional Paranormal Belief and New Age Philosophy than did subjects with higher reasoning abilities. Results suggest that those who have better reasoning abilities scrutinise to a greater extent whether their experiences are sufficient justification for belief in the reality of these phenomena.

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*Keywords:* Critical thinking ability; Paranormal belief; Paranormal experiences; Reasoning ability

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## 1. Introduction

The relationship between critical thinking ability and belief in the paranormal has been examined extensively in the past. On the whole, the relationship consistently tended in the direction that

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believers in psi have lower critical thinking ability, but only with moderate effect size, depending on measures and conceptual foundation.

Wierzbicki (1985) already reported a significant correlation between paranormal belief and the number of errors made on a syllogistic reasoning task, suggesting that believers in psi generally have lower cognitive ability. In line with this research, Tobacyk (1984), as well as Messer and Griggs (1989) found that college students with better marks exhibited less belief in the paranormal. For a sample of 129 students, Musch and Ehrenberg (2002) reported a correlation of .50 between the last grade completed of secondary school and paranormal belief. However, according to Irwin (1993) the cognitive deficits hypothesis, which ascribes general lower cognitive ability to believers in psi, is not well-founded. In his own study (1991) he could not find differences between believers in psi and sceptics in a reasoning task. In one study (Jones, Russel, & Nickel, 1977), there was even a positive correlation reported between paranormal belief and intelligence.

Besides the consideration of general cognitive ability, some studies indicate a relationship between paranormal belief and low probabilistic reasoning skills (e.g. Blackmore & Troscianko, 1985; Brugger, Landis, & Regard, 1990; Musch & Ehrenberg, 2002), although several studies have failed to find such a relationship (Blackmore, 1997; Matthews & Blackmore, 1995) and Bressan (2002) could only establish this kind of relationship for non-students. According to the results of Musch and Ehrenberg (2002), general cognitive ability accounted for the relationship between paranormal belief and probabilistic reasoning. In their sample, the correlation between probability misjudgement and belief in the paranormal disappeared when cognitive ability was controlled, whereas the aforementioned relationship between general cognitive ability (as measured by last school grade completed) and belief in the paranormal was still very high when probabilistic reasoning skills were controlled ( $r = .47$ ).

Cognitive ability and probabilistic reasoning certainly contribute to critical thinking ability, but are not equivalent to critical thinking ability per se. Critical thinking not only describes the ability to think in accordance with the rules of logic and probability, but also the ability to apply these skills to real-life problems, which are not content-independent. Alcock and Otis (1980), for example, found, based on a very small sample that sceptics did better on the Watson–Glaser Critical Thinking Appraisal. Morgan and Morgan (1998) also provided their subjects with the Watson–Glaser Critical Thinking Appraisal, but found only partial support for the thesis of lower critical thinking ability of believers in psi. Traditional religious belief, superstitious belief and spiritualism thus correlated slightly negatively with one single sub-scale of the Watson–Glaser test. In the study of Gray and Mill (1990) the subjects (students of Biology and English) had the task of reading one of three articles that made a particular claim. The articles differed in apparent scientific relevance, but had in common that they did not contain the crucial control-type information. For example, in one story it was reported that after the introduction of fluoride tablets for children a 50% reduction in caries resulted over a 23-year period. In this article, there is no information concerning changes in caries in populations in which fluoride tablets were not provided to children during this period. As a result, Gray and Mill (1990) found that the number of cues subjects needed to recognise that relevant information was missing correlated to a level of .33 with belief in paranormal phenomena. Roe (1999) criticised this study because of a possible confusion between varying exposure to scientific principles for believers and non-believers. In his own study, he found no differences between believers and non-believers in their ratings of the quality of two experimental reports concerning positive or negative results in an extrasensory perception experi-

ment. However, the objection could be made that believers in psi indeed know more about extra-sensory perception, so that it is easier for them to critically assess a paper on this topic than it is for sceptics, regardless of whether the results are positive or negative.

Our study was designed to compare the critical thinking abilities of believers in and sceptics of paranormal phenomena. Possible influences on reasoning ability were controlled and the subject of study was systematically varied. The general hypothesis was that sceptics would exhibit higher critical thinking scores than would believers in paranormal phenomena. Secondly, in line with [Musch and Ehrenberg \(2002\)](#), it was assumed that if there are any differences between believers and non-believers, these differences can be ascribed to reasoning ability to a substantial extent.

## 2. Methods

### 2.1. Sample

The sample comprised 180 subjects, all of them students from three university departments in Austria. One-third were students of psychology ( $n = 60$ ) at the University of Vienna, one-third were art students ( $n = 60$ ), the majority of whom were studying at the University of Art in Vienna and one-third attended the Technical College for Multimedia in Salzburg, or were students of computer science at the University of Vienna ( $n = 60$ ). 107 subjects were female (59.4%) and 73 (40.6%) male. The age range was 18–37 with a mean age of 24.54 ( $SD = 3.61$ ).

### 2.2. Procedure

First, all subjects completed a measure of critical thinking (for half of the subjects, i.e. 30 psychology students, 30 art students and 30 computer science students, this was the Cornell Critical Thinking Test (CCTT, [Ennis & Millmann, 1985](#)), for the other half the measure of critical thinking was the Watson–Glaser Critical Thinking Appraisal (WGCTA, [Watson & Glaser, 2002](#))) in German. Each subject in each group was randomly assigned to one of the two conditions. Afterwards, all subjects completed one intelligence test, the Wiener Matrizen-Test (WMT, [Formann & Pischwanger, 1979](#)), an adapted version of the Raven progressive matrices which conforms to the Rasch model ([Rasch, 1960](#)). Finally, all participants answered one questionnaire concerning their paranormal experience (a shortened and slightly modified version of the [Aubeck, 1989](#)) and the Paranormal Belief Scale (PBS, originally from [Tobacyk & Milford, 1983](#)) in revised form and in German ([Tobacyk, 1988](#)). From the PBS, the item “Big Foot exists” was replaced by “Extra-terrestrial life forms do exist”, because “Big Foot” is not very well-known in Austrian culture.

### 2.3. Results

Reliabilities (Cronbach Alpha coefficients) were calculated for all scales. Alpha was .61 for the CCTT, .78 for the WGCTA, .84 for the WMT, .61 for the scale of paranormal experiences and .89 for the PBS. The scores on the paranormal belief scale were also recorded according to the suggestions of [Lange, Irwin, and Houran \(2000\)](#), who applied Rasch scaling to Tobacyk’s PBS and thus came up with two scales, “New Age Philosophy” and “Traditional Paranormal Beliefs”.

These scales are population-independent measures on an interval level which are not susceptible to differential item functioning, meaning that extraneous factors such as age or gender have no differential effect on the responses on the paranormal belief items. However, as a supplement, we will also provide results with respect to the total score of the paranormal belief score and on one point also results referring to the original seven sub-scales of the PBS. The descriptive statistics of all measures can be seen in Table 1. Although our sample consisted of college students only, the values are distributed over a broad range.

For the sample which completed the CCTT, the correlations between critical thinking and the paranormal belief scores were very low and not significant. These results are pretty much the same for the sample which completed the WGCTA (Table 2). Although lower critical thinking ability thus seems to be related to higher paranormal belief, especially traditional paranormal belief (which consists of items from the original PBS sub-scales traditional religiosity, witchcraft and precognition), the coefficients are too small to justify further interpretation. Interestingly, paranormal experiences do not fall under this pattern.

Since all subjects of the total sample ( $n = 180$ ) completed the WMT, it is possible to relate these scores to the belief scores for all subjects. The WMT as a content-independent measure of reasoning correlates rather highly with the CCTT ( $r = .53$ ), as well as with the WGCTA ( $r = .47$ ). As can be seen in Table 3, reasoning as measured using the WMT correlates significantly and negatively with Traditional Paranormal Belief. This means the higher the reasoning ability, the lower Traditional Paranormal Belief and vice versa. With respect to the original sub-scales from the PBS, we see that traditional religiosity and superstition correlate significantly with reasoning ability. If one analyses the content of these items, these two sub-scales do not assess belief in paranormal phe-

Table 1  
Descriptive statistics

	Mean	SD	Min	Max
CCTT	28.07	5.12	15.00	40.00
WGCTA	52.60	8.17	31.00	67.00
WMT	19.57	4.05	2.00	24.00
PE	18.83	2.16	13.00	24.00
PBS	83.12	23.92	26.00	151.00

Remarks: CCTA, Cornell Critical Thinking Test; WGCTA, Watson–Glaser Critical Thinking Appraisal; WMT, Wiener Matrizen-Test; PE, Paranormal Experiences; PBS, Paranormal Belief Scale.

Table 2  
Correlations between Critical Thinking and Paranormal Belief/Experiences Scores

	PBS	Tradit. Para	New Age Phil.	Paranorm. Exper.
CCTT ( $n = 90$ )	-.13	-.14	-.08	.14
WGCTA ( $n = 90$ )	-.12	-.15	-.01	.11

Remarks: CCTA, Cornell Critical Thinking Test; WGCTA, Watson–Glaser Critical Thinking Appraisal; PBS, Paranormal Belief Scale.

Table 3

Correlations between Reasoning and Belief/Experiences Scores (total sample:  $n = 180$ )

	Reasoning
PE	.06
TPB	-.22**
NAP	-.05
PBS-Score	-.17
Trad. Religiosity	-.23**
Psi	-.07
Witchcraft	-.09
Superstition	-.23**
Spiritualism	-.11
Extraord. Life	.00
Precognition	-.09

Remarks: TPB, Traditional Paranormal Belief; NAP, New Age Philosophy; PE, Paranormal Experiences.

\*\*  $p < .01$ .

Table 4

Effects of Reasoning Ability on Paranormal Belief/Experiences

Reasoning ability	Cell means		Univariate tests		
	Low	High	<i>F</i>	df	<i>p</i>
TPB	26.33	24.82	8.62	1, 166	<.01
NAP	26.74	25.02	6.35	1, 166	<.05
PE	18.73	18.80	.04	1, 166	>.05

Remarks: TPB, Traditional Paranormal Belief; NAP, New Age Philosophy; PE, Paranormal Experiences.

nomena (psi-phenomena) as examined and defined by parapsychologists (Irwin, 1999), but popular convictions about assumed outer forces that may have an influence on our life.

For the total sample, a  $3 \times 2 \times 2$  MANOVA using the factors subject (Psychology/Arts/Computer Science), reasoning ability (low/high values in the WMT, according to the median), and critical thinking ability (median-partition according to the scores on the CCTT or WGCTA) and the dependent variables Traditional Paranormal Belief, New Age Philosophy and Paranormal Experiences was conducted. This analysis revealed only significant multivariate effects of reasoning ability, ( $F(3, 164) = 3.94$ ,  $p < 0.01$ ). At the univariate level, the effect of reasoning ability emerged for the variables Traditional Paranormal Belief as well as New Age Philosophy (Table 4). Subjects with lower reasoning ability had higher belief scores in both measures, although the effect on Traditional Paranormal Belief was stronger. The influence of subject of study (multivariate  $F(6, 330) = .86$ ,  $p > .05$ ) and critical thinking ability (multivariate  $F(3, 164) = 2.15$ ,  $p > .05$ ) had no effect. No interactions reached significance.

### 3. Discussion

The results show that critical thinking ability does not differ significantly between believers in psi and non-believers. However, reasoning ability per se has a moderate influence on belief in

paranormal phenomena. This is in line with the cognitive deficits hypothesis. Why is it that we were able to establish an effect for reasoning but not for critical thinking? The most obvious differences between our measures of critical thinking and reasoning are that the measure of reasoning not only has a power component but also a speed component and that the reasoning measure assesses reasoning on purely formal grounds without any content that may provide one solution with more or less plausibility. The critical thinking tests further measure not only deductive thinking, but also inductive and probabilistic thinking. Thus, those people who are not as good at reasoning under time pressure may equalise their performance on items requiring induction or allowing enough time to solve the problem correctly. However, empirically it is unclear whether critical thinking and reasoning really do measure different constructs. Although the retest-reliability of the WMT according to several studies is close to 1 (Formann & Piswanger, 1979), values from the CCTT (Ennis & Millmann, 1985) and the WGCTA (Watson & Glaser, 2002) are not available. Thus the discriminate validity of critical thinking with respect to reasoning could not be evaluated, leaving the possibility that the correlation of .50 between the constructs underestimates the actual relationship.

Our results cannot be interpreted as an artefact, as Roe (1999) has argued against the results of Gray and Mill (1990). The argument against Gray and Mill was that their subjects were differentially exposed to scientific principles and these differences were confused with paranormal belief (English students did worse than Biology students on a critical thinking task and showed a higher belief in paranormal phenomena). In our study the subject of study had no effect on the level of belief and there were no differences in reasoning ability among students of different subjects. Thus, the differences in belief scores between subjects with relatively lower and relatively higher reasoning ability cannot be ascribed to different exposure to scientific principles (which is certainly different for students of art and psychology). Nevertheless, it may be that consideration of other University departments (from the natural sciences) would have established such an artefact.

Perhaps it is not exposure to scientific principles per se, but the readiness to adopt a secular world view which explains the effect of reasoning ability on paranormal belief. If one examines the single item level on the correlations between paranormal belief and reasoning ability, only 6 out of 26 items yield coefficients with  $p < .01$  (all coefficients are about .20). The items are “Black cats can bring bad luck”, “There is a devil”, “I believe in God”, “The number 13 is unlucky”, “There is a heaven and hell” and “It is possible to communicate with the dead”. These items measure superstitious thinking and religiosity in a somewhat profane, trivial sense. How many well-educated and religious people really do agree with a sentence such as “There is a heaven and hell” without asking whether this is meant literally or just an analogous figure of speech? In this respect the generalisation of our results to every facet of belief (for example also the belief that scientific studies have proven the reality of psi-phenomena) is disputable, although this post hoc interpretation on individual items must be considered with reservation. On the other hand, reasoning ability clearly also has a small, although significant effect on the factor “New Age Philosophy”, which contains most of the original Psi, Spiritualism and Precognition items.

Interestingly, reasoning ability had no effect on the frequency of paranormal experiences. As it is generally accepted that paranormal experiences are a reason for belief in psi (Irwin, 1991), this suggests that those who have better reasoning abilities scrutinise to a greater extent whether their experiences are really sufficient justification for belief in the reality of these phenomena. This interpretation is in line with the aforementioned greater readiness of subjects with higher reasoning ability to have a greater tendency to adopt a secular world view.

Irwin (1991) suggested that it could also be the case that relatively smarter thinkers in our sample were more likely to be aware of the sceptical attitude of the investigators and may have taken this cue to be reticent about their belief in paranormal phenomena. The null-effect of reasoning abilities on the frequency of reported paranormal experiences makes this interpretation unlikely, because why should there be more reticence concerning paranormal belief than paranormal experiences. Moreover, we were unknown to the participants of the study and provided no statement at all concerning the reality of paranormal phenomena. However, “hard-core parapsychologists” would not accept denial of sceptical intentions as well as attempts to conceal these attitudes, if there are any, because for them a result suggesting deficits of believers per se makes the sceptical intention obvious. They would refer to the experimenter effect (Kennedy & Taddonio, 1976) and stress that even the unconscious wish to obtain a result in line with the cognitive deficits hypothesis may “telepathically” (!) influence the performance of the subjects negatively. But here we quickly reach a point where we need to finish experimental investigations of such questions, because there is no way to prove the opposite. Therefore we suggest that an empirical result (no matter whether it pleads for sceptics or parapsychologists) should not be sufficient reason to assign a sceptical or pro-parapsychological attitude to a researcher.

In sum, the ability to think critically about given contents does not seem to differ between believers and non-believers, whereas reasoning ability does. Certainly, critical thinking and reasoning are not independent from one another (the measures correlated to about .50), and it can thus be expected that in some contexts the ability to apply scientific thinking will be impeded by lower reasoning ability, at least if there are constraints such time pressure or lack of content information. At any rate, reasoning ability does affect paranormal belief, or at least the belief in content which is in contradiction to a secular world view.

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