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TWEEDLEDUM AND TWEEDLEDEE: ARE PARANORMAL DISBELIEVERS A MIRROR IMAGE OF BELIEVERS?

BY HARVEY J. IRWIN, NEIL DAGNALL, AND KENNETH DRINKWATER

ABSTRACT

This study constitutes an initial exploration of the view that paranormal disbelief is part of the same unidimensional continuum as paranormal belief, at least in regard to people's cognitive predispositions. A convenience sample of 203 British residents was surveyed for their belief in paranormal phenomena and for previously documented cognitive correlates of such belief, namely, thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the "unusual experiences" component of schizotypal tendencies. Based on participants' appraisal of an account of research on a potentially paranormal phenomenon, the sample was then divided into believers and disbelievers. Most of the cognitive variables correlated with intensity of group membership to an equal degree for believers and disbelievers, but with the direction reversed. Implications of these findings are discussed in relation to unidimensionality of a paranormal belief-disbelief continuum and the use of questionnaire measures of paranormal belief that incorporate a bipolar response scale.

INTRODUCTION

Tweedledum and Tweedledee are mirror images of one another... Tweedledee usually addresses the other side of whatever Tweedledum just said.

SparkNotes (2005), on *Through the Looking-Glass*

The objective of this study was to explore some previously identified, conceptually cogent cognitive correlates of the intensity of belief in paranormal phenomena by examining these relationships for believers and for disbelievers in turn. In this respect the paper probes the issue of whether paranormal belief and paranormal disbelief form a unidimensional continuum.

It has long been commonplace for a psychological characteristic of a given person to be represented as a specific point on a bipolar continuum anchored at each extreme by antonymous labels (e.g., 'optimistic' and 'pessimistic'). Not all such psychometric constructs, however, have been conclusively demonstrated to constitute a polarised spectrum. Indeed, some studies of this issue have yielded findings that are not only negative but counterintuitive; for example, masculinity-femininity, intrinsic-extrinsic religiosity, optimism-

pessimism, and pleasant-unpleasant affect seem not to constitute unidimensional continua at all (Hunt & King, 1971; Martin, 1996; Martin-Krumm, 2012; Russell & Carroll, 1999; Sánchez, 2011). These findings should serve as a warning not to embrace bipolar continua simply at face value. This concern warrants critical scrutiny in the specific context of belief in paranormal phenomena.

There is now an impressive quantity of empirical data on the psychological correlates of paranormal beliefs, prompting the formulation of several theories for the development of these beliefs (for a survey see French, 2015; Irwin, 2009). There are, however, two potentially compromising limitations in this database.

First, the substantial majority of these studies correlated psychological dimensions with paranormal beliefs that had been formed at some time in the respondents' past. If theories of paranormal belief are to explain how a person's beliefs originally were generated it is arguably preferable to investigate the impact of psychological factors at the time a paranormal belief was created. The study reported here indexed the intensity of a paranormal belief in real time, that is, when it was actually formed.

Second, most studies in the current database have used a questionnaire measure of paranormal beliefs in which the intensity of each belief had to be rated on a bipolar 5- or 7-point scale anchored at each extreme by such descriptors as 'unreservedly agree' and 'unreservedly disagree'; that is, belief and disbelief in the paranormal are assumed to constitute the two poles of an intrinsically unidimensional continuum. The tenet of continuity is moot in this context because the procedure may unjustifiably conflate the measurement of paranormal belief with that of paranormal disbelief. As Lamont, Coelho, and McKinlay (2009) cogently observe, "after all, 'disbelief' is not the absence of belief, but a belief position in its own right" (p. 544). Lamont et al.'s observation admittedly awaits empirical evaluation, but without an explicit differentiation between paranormal belief and disbelief the interpretation of the resultant correlational data is equivocal — do the reported relationships with respondents' psychological characteristics stem fundamentally from the nature of cognitive processing involved in the formation of paranormal beliefs, or alternatively, from processing involved in the formation of paranormal disbeliefs?

A study by Irwin (2015a) went some way to redressing these potential shortcomings. Survey participants were presented with a summary of past research on dermo-optical perception, that is, the apparent ability of some people to discern the colour of an object purely on the basis of touch, without any visual access to the object. The summary included observations that could be taken to support a paranormal interpretation of the phenomenon, as well as observations that could support a sceptical conclusion based upon allegedly inadequate experimental control (see the Method section of this paper for further details). After excluding participants who previously had encountered reports of dermo-optical perception, the residual sample for analysis comprised people who formed a belief about this phenomenon during the study itself. Among participants who decided it was paranormal there were no significant relationships with thinking style [intuitive-experiential

thinking: $r_s(76) = .11$, $p = .18$, one-tailed; rational-analytical thinking: $r_s(76) = -.06$, $p = .30$, one-tailed]. In the subgroup of disbelievers in dermo-optical perception, on the other hand, the intensity of disbelief was related to thinking style [intuitive-experiential thinking: $r_s(92) = -.18$, $p < .05$, one-tailed; rational-analytical thinking: $r_s(92) = .19$, $p < .05$, one-tailed]. Although all effect sizes were small and the null findings for believers should not be over-interpreted, the observed pattern of findings suggests that past observations of an association between the intensity of paranormal belief and thinking style (documented in some detail below) may well have had more to do with the nature of cognitive processing in disbelievers than with that in believers. At the very minimum, Irwin's (2015a) study encourages further examination of previously reported correlates of paranormal belief but with a specific cognisance of subsamples of believers and disbelievers.

The correlates of paranormal belief investigated here were chosen for their conceptual significance for the explanation of the development of a person's paranormal beliefs. More specifically, the choice of potential correlates was made in light of growing indications that in part the formation of paranormal beliefs in the general population has something in common with the mental processes that underlie the creation of clinically defined delusory beliefs (e.g., Irwin, 2014; Irwin, Dagnall, & Drinkwater, 2012a, 2012b; Irwin, Drinkwater, & Dagnall, 2014). It must be strongly stressed at the outset, however, that under this perspective paranormal beliefs are not construed as necessarily false beliefs¹ — clinical delusions are no longer defined in terms of their falsity, but rather are beliefs founded on an insufficiently rigorous scrutiny of supportive evidence, persistently held in the face of conflicting evidence, and they are accepted more for their emotional appeal than for their logical cogency (American Psychiatric Association, 2013). The latter technical definition of delusions potentially could accommodate paranormal beliefs among most members of the general population, and to this extent it is legitimate to explore empirically the possibility that the cognitive processes underlying the formation of clinically defined delusions have some bearing on the formation of paranormal beliefs in the nonclinical population. At the same time we readily acknowledge that other approaches may be necessary to account for paranormal beliefs and disbeliefs in people who have critically examined the empirical literature of parapsychological research.

The psychological factors included in the study were thinking style; aberrant salience; emotion-based reasoning; reality testing; and the "unusual experiences" component of schizotypal tendencies. The nature of each factor and some of the evidence for their relationship to the intensity of paranormal beliefs will now be described in turn.

Thinking Style

Two habitual styles of thinking have been delineated by cognitive scientists (e.g., Stanovich & Toplak, 2012). The intuitive-experiential mode is a rapid,

¹ The *validity* of paranormal beliefs, or the ontological status of paranormal processes such as ESP and PK, is not at issue here and indeed, it the subject of an entirely different body of research (Irwin & Watt, 2007).

holistic, automatic, heuristic, typically unconscious or preconscious style of processing that is relatively undemanding of cognitive capacity; the rational-analytical mode, on the other hand, is a relatively slow, analytic, typically conscious style of processing that demands cognitive capacity (Pacini & Epstein, 1999; Stanovich & Toplak, 2012). In a substantial number of empirical studies the intensity of paranormal beliefs has been found to correlate positively with a preference to rely habitually on the intuitive-experiential mode of information processing (e.g., Aarnio & Lindeman, 2005; Irwin & Marks, 2013; Irwin & Young, 2002; Marks, Hine, Blore, & Phillips, 2008; Sadler-Smith, 2011). In addition, a distinctly smaller and *negative* correlation has sometimes been found between paranormal belief and a preference for the rational-analytical thinking style (Aarnio & Lindeman, 2005; Irwin & Young, 2002; Marks et al., 2008), although several null results also have been reported (Bainton, 2010; de Vasconcelos & Tróccoli, 2004; Irwin & Marks, 2013; Genovese, 2005; Sadler-Smith, 2011).

As mentioned above, Irwin (2015a) used the task of appraising dermo-optical perception to discern participants who formed a belief in the paranormality of dermo-optical perception during the survey and participants who rejected this view. In contrast to previous research, the paranormal believers showed no significant trend for reliance on habitual thinking styles [intuitive-experiential thinking: $r_s(76) = .11$, $p = .18$, one-tailed; rational-analytical thinking: $r_s(76) = -.06$, $p = .30$, one-tailed], but the intensity of paranormal disbelievers' belief was positively correlated with a preference for a rational-analytical thinking style, $r_s(92) = .19$, $p < .05$, (one-tailed) and negatively related with a preference for an intuitive-experiential thinking style, $r_s(92) = -.18$, $p < .05$ (one-tailed). Irwin (2015a) tentatively suggested that the different pattern of results across subgroups may indicate that previous findings on the role of thinking style were due more to the nature of processing in the formation of paranormal disbeliefs than to that associated with the formation of paranormal beliefs. This finding raises a difficulty for the view that paranormal belief and paranormal disbelief anchor a unidimensional continuum. Irwin's study therefore warrants replication, and so the factor of thinking style was included in the investigation reported here.

Aberrant Salience

A behavioural characteristic identified as a key marker of proneness to clinically-defined delusions is known as *aberrant salience*. A section of the cerebral cortex dubbed the "salience network" (comprising the bilateral insula and anterior cingulate) has been found to play a role in activating relevant brain regions in readiness for processing sensory inputs. When an anomalous experience occurs a dysfunction in the brain's dopamine system appears to make even a small amount of evidence for an inference about the experience seem unusually salient, leading to premature conclusions and instigating anomalous perceptions and beliefs (Kapur, 2003; Lau, Wang, Hsu, & Liu, 2013; Winton-Brown, Fusar-Poli, Ungless, & Howes, 2014). Aberrant salience thereby plays an important mediational role in the development of psychosis and other conditions in which delusions are

predominant (e.g., Balzan, Delfabbro, Galletly, & Woodward, 2013; Cicero et al., 2013). This mechanism reportedly is entailed also in the formation of subclinical delusional beliefs (Balog, Somlai, & Kéri, 2013).

A recent study by Irwin, Schofield, and Baker (2014) reported a positive correlation [$r_s(305) = .34, p < .001$] between aberrant salience and an inclination to attribute anomalous experiences to paranormal factors, a behaviour which closely implicates belief in the paranormal. Subsequently Irwin (2014) established a positive relationship between aberrant salience and the intensity of paranormal beliefs, $r_s(102) = .37, p < .01$. On these grounds the present study included aberrant salience as a potential correlate of paranormal belief.

Emotion-Based Reasoning

One influential theoretical account of clinically-defined delusions proposes that these beliefs arise from a faulty interpretation of anomalous experiences or events (e.g., Garety & Freeman, 1999). Beck and his colleagues have identified several of these cognitive distortions among delusional patients and report some success in correcting the distortions through cognitive behaviour therapy (Beck & Rector, 2002; Beck, Rector, Stolar, & Grant, 2008). One of the cognitive distortions implicated in the formation and maintenance of delusions is termed emotion-based reasoning; under this distortion decisions are reached largely on the basis of their emotional rather than rational appeal.

In a study of schizotypal cognitive distortions and paranormal belief Irwin, Dagnall, and Drinkwater (2012a) found several cognitive distortions to correlate positively with the intensity of paranormal beliefs, and one of these predictive factors was emotion-based reasoning, $r(248) = .30, p < .01$. Proneness to this schizotypal cognitive distortion therefore was included among the present study's cognitive variables.

Reality Testing

The formation and maintenance of clinically-diagnosed delusions stem substantially from a failure to subject these notions to appropriate critical scrutiny or "reality testing" (APA, 2013; Garety & Freeman, 1999). A similar tendency has been observed among paranormal believers. In several studies the intensity of paranormal beliefs is reported to be positively correlated with poor reality testing (Dagnall, Drinkwater, Denovan, & Parker, 2015: $r[178] = .37, p < .01$; Dagnall, Drinkwater, Parker, & Munley, 2010: $r[153] = .40, p < .01$; Dagnall, Drinkwater, Parker, & Rowley, 2014: $r[303] = .47, p < .01$; Dagnall, Munley, Parker, & Drinkwater, 2010: $r[318] = .42, p < .001$; Drinkwater, Dagnall, & Parker, 2012: $r[134] = .48, p < .01$; Irwin, 2003: $r_s[191] = .45, p < .001$; Irwin, 2004: $r_s[159] = .54, p < .001$; Irwin, Dagnall, & Drinkwater, 2015, study 2: $r_s[532] = .48, p < .001$; Irwin & Marks, 2013: $r_s[234] = .27, p < .01$). In this respect a weakness in reality testing represents one of the strongest and most replicable correlates of paranormal belief documented in the literature. A measure of reality testing deficits therefore was included in the set of cognitive variables for the current study.

Unusual Experiences

The psychological dimension of schizotypy refers broadly to the presence of various subclinical schizophrenic-like behaviours (Claridge, 1997) among the general population. Schizotypy occurs in a mild or benign form in many people, and only at extreme levels may it be implicated in a full-blown psychotic disorder. Numerous studies have identified a positive relationship between (benign) schizotypy and the strength of paranormal beliefs (e.g., Gouling, 2005; Holt, Simmonds-Moore, & Moore, 2008; Irwin & Green, 1998-1999; Thalbourne, 1985; Williams & Irwin, 1991). The domain of schizotypy, however, is multifactorial, and several investigations have found the cognitive-perceptual component of schizotypy (“unusual experiences and beliefs”) to be particularly important as a correlate of paranormal belief (Bouvet et al., 2014: $r[311] = .57, p < .01$; Hergovitch et al., 2008: $r[569] = .41, p < .001$; Houran, Irwin, & Lange, 2001: $r_s[114] = .45, p < .01$; Irwin & Green, 1998-1999: $r[192] = .35, p < .001$). Perhaps this relationship is not surprising, given that some of the items in the subscale indexing the cognitive-perceptual component address transpersonal experiences. The factor of “unusual experiences” therefore was included in the present study with scores computed both with and without the items with a potentially parapsychological theme.

In summary, when proneness to believe in the paranormal is indexed by a set of questionnaire items coded on a bipolar response scale, paranormal beliefs have been found to correlate positively with an intuitive-experiential thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the “unusual experiences” component of schizotypy. In some instances paranormal beliefs have also been observed to correlate negatively with a rational-analytical thinking style. We emphatically reiterate that these findings do not “pathologise” paranormal believers but rather, they indicate the involvement in the formation of paranormal beliefs of a specific cognitive style that is widely utilised in the nonclinical population. The fact remains, however, that the above findings do not make clear if any or all of the underlying relationships stem from cognitive characteristics of paranormal believers, or from cognitive characteristics of paranormal disbelievers, or from both. A general working hypothesis of our study, therefore, was that when the ‘belief’ half of the paranormal belief-disbelief response continuum is considered in its own right, the intensity of paranormal belief at the time of its formation is positively correlated with an intuitive-experiential thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the “unusual experiences” component of schizotypy, and negatively correlated with a rational-analytical thinking style. Conversely, when the ‘disbelief’ half of the paranormal belief-disbelief response continuum is taken in isolation, the intensity of paranormal disbelief at the time of its formation is negatively correlated with an intuitive-experiential thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the “unusual experiences” component of schizotypy, and positively correlated with a rational-analytical thinking style.

METHOD

The project was a correlational study conducted as an online questionnaire survey. The design of the study conformed to the host university's ethical requirements.

Participants

A convenience sample of 203 people participated in the study. There were 53 males and 150 females. The mean age was 26.93 years ($SD = 10.67$) with a range of 19–69 years. Participants included undergraduates and employees from the host university, alumni and similar associates of the university.

Materials

The study was undertaken as an online survey. The survey inventory began by soliciting basic demographic information (age and gender), followed immediately by Irwin's (2015a) Dermo-Optical Perception exercise. In turn this was followed, in a counterbalanced order, by questionnaire measures of the five focal cognitive variables, namely, thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the "unusual experiences" component of schizotypy. Subsequently a questionnaire measure of proneness to paranormal belief was presented. Each of the measures now will be described.

Dermo-Optical Perception exercise

In Irwin's (2015a) Dermo-Optical Perception (DOP) exercise participants are given an account of past research into dermo-optical perception. The account contained suggestions that DOP could be a paranormal phenomenon like ESP, as well as suggestions that experimental participants may have used fraudulent means to correctly name the colours of the objects presented to them by the experimenters. All descriptions of research studies in the summary, however, are factual. The research summary read as follows (Irwin, 2015a).

This page provides a brief summary of psychological research into a phenomenon popularly known as *dermo-optical perception* (DOP), the apparent ability to discern the colour of an object purely on the basis of touch, that is, without an opportunity to see the object. Please read the following account carefully, as you will later be asked some questions about it.

Cases of apparent dermo-optical perception have long been reported, but the modern experimental study of DOP dates from the early 1960s. A Russian woman, Rosa Kuleshova, was reported to be able to discern colours simply by 'feeling' them, and eventually she was tested formally at the Biophysics Institute of the Soviet Academy in Moscow. Accounts of these observations appeared in popular magazines in the West, and soon many people came forward to assert that they, too, had the ability of DOP.

Some of these claimants proved to be frauds, and one commentator even claimed that 'successful' DOP performance was due to nothing more than the experimenter's use of poorly fitting blindfolds and a 'peek down the nose' by participants. In later years, however, a number of people were tested for DOP under increasingly rigorous experimental conditions; for example, participants have been screened from the coloured objects, have been allowed to touch the objects only through sleeves

elasticised at the wrist, or have had their head enclosed in a box; see illustrative examples in the photographs below.

[At this point in the online presentation participants were shown two photographs of the apparatus used by Yvonne Duplessis (1975) in her investigations of DOP²².]

In these methodologically improved studies some participants were still found to show accurate tactile identification of colours well beyond that expected simply by guessing. Practical applications of DOP for blind people have even been mooted.

Although a growing number of psychologists now concede there is a phenomenon here to be explained, there remains a lack of consensus on the actual nature of DOP. Successful DOP performance has been observed even when participants are kept in complete darkness, so it would seem the effect is not mediated by radiation within the normal visible spectrum. Some investigators have noted, however, that coloured objects may differ in the amount of infra-red radiation they emit and thus it is possible people may learn to use temperature sensors in their fingers to distinguish different colours by touch; indeed, some experimental evidence has been published in support of this infra-red theory. On the other hand, DOP has also been found even when the target objects are enclosed in a cardboard or aluminium-foil envelope and the participant can only lay a hand over the envelope. Some writers therefore have proposed that DOP is a paranormal phenomenon akin to extrasensory perception. The theory that DOP is a paranormal phenomenon is consistent with the characteristics of the phenomenon observed in experiments to date, and it can be experimentally tested further through the application of procedural safeguards that rule out alternative explanations.

When you have finished reading this review and are ready to answer some questions about it, please continue.

Participants then were asked to indicate how they interpreted the phenomenon of dermo-optical perception, using a 7-point Likert-type scale (“Unreservedly accept paranormal interpretation” to “Unreservedly reject paranormal interpretation”). The exercise in appraising DOP research was concluded with a query about whether the participant had “had any views about this phenomenon before today”. The latter item was used to identify participants who had not formed their initial view of DOP until undertaking this survey; these participants could then be categorised as having generated either a belief or a disbelief in DOP during the test session.

Thinking Style

The *Rational-Experiential Inventory* (REI; Pacini & Epstein, 1999) is a widely-used index of thinking styles and comprises 40 items relating to habits and preferences in regard to the application of reasoning and judgement. Half of the items tap Type 1 processes or intuitive-experiential engagement and perceived ability (e.g., “I like to rely on my intuitive impressions”); the remainder index Type 2 processes or rational engagement and ability (e.g., “I enjoy solving problems that require hard thinking”). On the advice of the designer of the REI (S. Epstein, personal communication, September 22, 2011), the scale used in the present study included only the 20 items for engagement and not those for ability, as the latter are reported to incorporate an element of self-esteem. Responses to REI items are made on a

²² See <http://thegiarettas.blogspot.com.au/2011/10/susan-macwilliam-dermo-optics-2006.html>

5-point scale (1 = Definitely false, to 5 = Definitely true). A score for an Intuitive-Experiential thinking style and one for a Rational-Analytical style are computed as the sum of responses over the respective items, and thus on the short form each of these scores potentially may range from 10 to 50. The psychometric characteristics of the REI have been independently ascertained (Handley, Newstead & Wright, 2000; Witteman, van den Bercken, Claes, & Godoy, 2009) and are acceptable.

Aberrant Salience

Proneness to aberrant salience was assessed with the *Aberrant Salience Inventory* (ASI; Cicero, Kerns, & McCarthy, 2010). The ASI has 29 dichotomous (Yes/No) items surveying experiences of aberrant salience (e.g., “Do normally trivial observations sometimes take on an ominous significance?”). A total ASI score is computed as the total number of affirmative responses over the 29 items. Cicero et al. (2010) report the scale has satisfactory convergent and discriminative validity, as well as high internal consistency.

Emotion-Based Reasoning

The *Cognitive Biases Questionnaire* (Peters et al., 2010) is a self-report measure of reasoning biases known to be associated with the formation of psychotic delusions. One of the questionnaire’s five subscales comprises six items indexing Emotion-Based Reasoning (EBR). For each item of the EBR a short vignette is presented and the respondent is asked to choose the one of three options that best describes how they would feel about the situation. Each response is rated on a 3-point scale (1 = absence of bias; 2 = presence of bias with some qualification; and 3 = presence of bias). Scores on the EBR subscale are computed as the sum of ratings on items in that subscale and therefore may potentially range from 6 to 18. Peters et al. (2010) report the complete *Cognitive Biases Questionnaire* has good psychometric properties (Cronbach’s alpha = .89, test-retest reliability $r = .92$), but no data for the individual EBR subscale are reported. In the study by Irwin et al. (2012a) Cronbach’s alpha for the EBR subscale was .56; this value is not strong but may be expected for a scale comprising only six items. In any event, the subscale has proved effective in discriminating levels of paranormal belief (Irwin et al., 2012a) and therefore inclusion in the present project seemed justified.

Reality Testing Deficits

The 20-item Reality Testing subscale of the *Inventory of Personality Organization* (IPO-RT; Lenzenweger et al., 2001) was chosen to assess reality testing deficits. Examples of IPO-RT items are “I can’t tell whether certain physical sensations I’m having are real, or whether I am imagining them”, and “When I’m nervous or confused, it seems like the things in the outside world don’t make sense either”. Responses to the IPO-RT are made on a 5-point scale (1 = never true, to 5 = always true), and a total score on the scale is computed as the sum of responses over the 20 items; that is, IPO-RT scores may range from 20 to 100. The psychometric characteristics of the scale are satisfactory (Cronbach’s alpha = .88; test-retest $r = .73$), and scores

have been found to correlate with measures of proneness to psychosis by Lenzenweger et al. (2001), who also report that scores do not vary across gender.

“Unusual Experiences”

The cognitive-perceptual component of schizotypy was indexed by the “Unusual Experiences” (UE) subscale of the *Oxford-Liverpool Inventory of Feelings and Experiences (Short Form)* (O-LIFE: Mason, Linney, & Claridge, 2005), a subscale comprising twelve binary (Yes/No) items (e.g., “Are your thoughts sometimes so strong that you can almost hear them?”). The UE score is computed as the number of items on which the respondent checks the aberrant option, and thus the score may vary from 0 to 12. Psychometric properties are well documented (e.g., Cronbach’s $\alpha = .80$ to $.85$; Fonseca-Pedrero, Ortuño-Sierra, Mason, & Muñiz, 2015; Mason, Linney, & Claridge, 2005). As four of the items address transpersonal experiences (e.g., “Do you think that you could learn to read other’s minds if you wanted to?”) there could be a potential confound in correlating UE scores with paranormal beliefs; a revised score (revUE) therefore was also computed from the remaining eight items, yielding a total revUE score from 0 to 8.

Proneness to Paranormal Belief

The *Survey of Scientifically Unsubstantiated Beliefs* (SSUB; Irwin & Marks, 2013), labelled the “Survey of Popular Beliefs” for general use, is a 20-item self-report interval-level measure of the intensity of paranormal and related beliefs. Responses to the SSUB items are made on a 5-point scale (1 = Strongly disagree, to 5 = Strongly agree). The SSUB comprises two scales denoted New Age Beliefs (NAB, 15 items) and Traditional Religious Beliefs (5 items), but only the former items were processed here. The NAB encompasses such New Age beliefs as telepathy, astral projection, fortune telling, psychokinesis, astrology, crop circles, haunted houses, shamanism, and the like. Scores on the NAB scale are computed as the sum of responses to the constituent items and then converted to scores with interval-level (Rasch scale) measurement using the conversion table provided by Irwin and Marks (2013, Appendix 3). Scores for NAB may range from 13.37 to 36.53. The Rasch measure for the NAB scale has been standardized with a mean of 25 and a standard deviation of 5. Irwin and Marks (2013) have documented the dimensional purity and other psychometric characteristics of the SSUB, and generally these appear satisfactory. For example, the strong internal reliability of NAB scores is attested by Irwin and Marks (2013; Cronbach’s $\alpha = .92$), Irwin, Dagnall, and Drinkwater (2015; Cronbach’s $\alpha = .89$), Irwin (2015a; Cronbach’s $\alpha = .93$), and Irwin (2015b; Cronbach’s $\alpha = .91$). The NAB is currently one of the few available interval-level measures of paranormal belief.

Procedure

The project was administered as an online study compiled using *Qualtrics™ Survey Software* (Qualtrics Labs Inc., Provo, UT; see <http://www.qualtrics.com>). An invitation to participate was distributed via the host

university’s internal email system and also via a list of alumni and other associates of the university. The stated aim of the project was “to survey various popular beliefs and relate them to aspects of psychological style”. People aged at least 18 years were said to be eligible to take part and they were assured their participation was anonymous and completely voluntary, with withdrawal from the exercise permitted at any time. The need for frankness in responding was stressed. The system automatically prevented participation more than once by the same person. Recruitment was terminated shortly after the target of 200 completions had been achieved.

RESULTS

Preliminary Assessment of Sample Characteristics

Descriptive statistics for the principal variables of the study are given in Table 1, together with correlations between paranormal belief (NAB) and the cognitive variables of thinking style (REI), aberrant salience (ASI), emotion-based reasoning (EBR), reality testing deficits (IPO-RT), and the “unusual experiences” component of schizotypy (O-LIFE). NAB scores were slightly skewed, so Spearman correlations were used for these calculations. Probability values are for one-tailed tests after Bonferroni corrections.

Table 1

Descriptive statistics for and Spearman correlations between paranormal beliefs and psychological factors

Variable	M	SD	Range	Skewness	Spearman rho with NAB
<i>Paranormal Beliefs (NAB)</i>	22.20	3.51	13.37–31.94	-.52***	
<i>Thinking Style (REI)</i>					
Intuitive-Experiential	31.37	5.38	16–45	-.25	.32***
Rational-Analytic	36.16	6.27	15–49	-.31	-.10
<i>Aberrant Salience (ASI)</i>	13.32	6.71	2–29	.33	.36***
<i>Emotion-Based Reasoning (EBR)</i>	8.20	2.06	6–15	.88***	.46***
<i>Reality Testing Deficits (IPO-RT)</i>	41.78	12.56	21–88	.76***	.48***
<i>Unusual Experiences (O-LIFE)</i>					
UE	48.60	35.71	0–144	.48***	.44***
revUE	25.44	17.73	0–64	.30	.35***

With Bonferroni correction, $df = 201$, one-tailed tests: *** $p < .001$

As Table 1 demonstrates, the sample presented with significant positive correlations between proneness to paranormal belief and each of the variables intuitive-experiential thinking style, aberrant salience, emotion-based reasoning, reality testing deficits, and the “unusual experiences” component of schizotypy. These data and the associated effect sizes conform fully to the

previously established patterns of findings surveyed in the Introduction. The sole non-significant finding was for the relationship between paranormal beliefs and the rational-analytical thinking style ($r_s[201] = -.10, p = .134$), and as noted earlier, null results often are reported for this correlation (Bainton, 2010; de Vasconcelos & Tróccoli, 2004; Genovese, 2005; Irwin & Marks, 2013; Sadler-Smith, 2011). On these grounds further statistical analyses may now be undertaken in the confidence that the sample does not appear in any way atypical as far as this project’s objectives are concerned.

Principal Statistical Analyses

Of the 203 participants, only 21 acknowledged having previously heard of the phenomenon of dermo-optical perception, of whom 7 had concluded DOP was a paranormal phenomenon. The remaining 182 people in the sample therefore generated a belief or disbelief in DOP within the context of the present study, and were the focus of subsequent analyses.

Table 2

Interpretations of DOP elicited by research summary

Interpretation	Frequency
Unreservedly accept paranormal interpretation	1
Strongly accept paranormal interpretation	7
Moderately accept paranormal interpretation	42
Neither accept nor reject paranormal interpretation	59
Moderately reject paranormal interpretation	36
Strongly reject paranormal interpretation	31
Unreservedly reject paranormal interpretation	6

Table 2 summarises the distribution of interpretations of DOP generated among the subset. It may be noted that the Spearman correlation between the distribution of DOP interpretations and NAB scores was $r_s(180) = .59, p < .00001$ (one-tailed), supporting the assumption that DOP interpretations are akin to paranormal beliefs more generally, and confirming the original finding reported by Irwin (2015a; $r_s[121] = .55, p < .001$).

The key objective of the present study, however, was to examine the relationships between paranormal beliefs and each of the study’s cognitive variables in the context of DOP believers and of DOP disbelievers in their right. To this end people in the top four categories of Table 2 were classified as *believers* (recoded as 1 = “Neither accept nor reject paranormal interpretation”, to 4 = “Unreservedly accept paranormal interpretation”. Similarly, people in the bottom four categories of Table 2 were classified as *disbelievers* (1 = “Neither accept nor reject paranormal interpretation”, to 4 = “Unreservedly reject paranormal interpretation”, so as to be a direct measure rather than inverse measure of disbelief). This strategy then permits an assessment of the cognitive variables in relation to beliefs or disbeliefs formed during the survey session itself. Note that the inclusion of the “neither

accept nor reject” subgroup in the sample of believers and in the sample of disbelievers effectively provides a “zero” reference point for both samples. This strategy admittedly rules out any direct statistical comparison between the performance of believers and that of disbelievers, given that these two samples are neither independent nor matched, but as the study was designed to address statistical relationships within believers and relationships within disbelievers this procedure for forming experimental groups did not represent a serious limitation for the analyses.

Table 3

Spearman Correlations between Intensity of DOP Belief or Disbelief and the Psychological Factors

Psychological Factor	DOP Group Membership	
	Believers (N = 109)	Disbelievers (N= 132)
<i>Thinking Style (REI)</i>		
Intuitive-Experiential	.17*	-.25**
Rational-Analytic	-.06	.01
<i>Aberrant Salience (ASI)</i>		
	.17*	-.14
<i>Emotion-Based Reasoning (EBR)</i>		
	.22*	-.23**
<i>Reality Testing Deficits (IPO-RT)</i>		
	.15	-.18*
<i>Unusual Experiences (O-LIFE)</i>		
UE	.25**	-.14
revUE	.26**	-.06

With Bonferroni correction, one-tailed tests: * $p < .05$; ** $p < .01$

Table 3 presents the Spearman correlations between DOP belief intensity and each of the five cognitive variables. Bonferroni adjustment to significance levels are properly made on a hypothesis by hypothesis basis (Abramson et al., 1999; Shaffer, 1995); in the present context this amounts to making the adjustment for each group within each cognitive variable, and this correction has been implemented. One-tailed tests were applied on the grounds that the relationship of each predictor to the intensity of paranormal beliefs as a whole has previously been documented. Note that the difference in direction of correlations between the two columns (positive in the first column, negative in the second) is simply a consequence of the fact that the second column lists relationships to the intensity of disbelief rather than belief.

DISCUSSION

The observed relationships with the intensity of DOP belief (Table 3) are generally consistent with those previously reported for questionnaire measures of paranormal belief. Even the null results associated with the

rational-analytic thinking style accords with findings that often this style fails to show a link with paranormal belief. An advantage of the present study, however, is that the cognitive processes associated with the predictive variables have been shown here to govern the intensity of a paranormal belief at the very time that belief is formed; that is, these factors are not involved solely in the assimilation of a belief endorsed at some earlier time. This finding may have implications for the formulation of new cognitive theories of the development of paranormal beliefs.

On the other hand an immediately obvious difference between the correlations in Table 3 and the corresponding statistics in Table 1 is that the former are distinctly weaker. This may be the case for any one or more of several reasons. The correlations in Table 3 are based on much smaller subgroups (109 and 132) than those in Table 1 for the entire sample (203). More importantly, the Table 3 data for the categories of belief in DOP were generated by a single response (paranormal/not paranormal), whereas the Table 1 data are based on an aggregate of 15 questionnaire responses; the former therefore are likely to be less statistically powerful. This issue perhaps is most evident in relation to the factor of reality testing deficits. Another potentially crucial difference between the two measures of proneness to paranormal belief is that the Table 1 correlations index long held beliefs and those in Table 3 tap a belief still in its formative stages. The stronger relationships in Table 1 therefore may be due to the ongoing involvement of the specified cognitive processes well after the initial formulation of paranormal beliefs. Further research could usefully explore this suggestion concerning the range of cognitive processes implicated in the assimilation and the maintenance of paranormal beliefs, that is, processes that take place some time after the initial mental representation of the beliefs (see also Connors & Halligan, 2015).

Part of the rationale for the present study was Irwin's (2015a) observation that questionnaire measures of paranormal belief may erroneously conflate the measurement of paranormal belief with that of paranormal disbelief; the bipolar response scale intrinsic to these questionnaires implicitly assumes that key cognitive processes underlying paranormal disbeliefs are simply the mirror image of those implicated in paranormal beliefs. The data in Table 3, on the other hand, may serve as some assurance that this common tacit assumption is indeed reasonable and is unlikely to have compromised the existing extensive database for paranormal beliefs. For the most part the correlations in Table 3 are remarkably symmetrical, that is, for each of the cognitive variables the (absolute) sizes of the correlations for believers and for disbelievers are essentially equal. This outcome is precisely what might have been expected if paranormal belief and paranormal disbelief were part of a unidimensional continuum, at least as far as the operation of delusion-related cognitive processes is concerned. Indeed, these findings may even encourage the view that the formation of beliefs and that of disbeliefs involve much the same sequence of cognitive processes and differ only in the output of the processes. In this respect researchers' reliance on paranormal belief questionnaires with a bipolar response scale therefore may well be appropriate for general purposes.

Nevertheless, caution should be exercised before embracing the universality of this conclusion. For example, although the present study failed to replicate Irwin's (2015a) finding that a rational-analytical thinking style is of specific importance to the formation of paranormal disbelief, further investigation is warranted on the issue of a possible discrepancy between belief formation and disbelief formation in this respect. Additionally, the striking symmetry of the columns in Table 3 evidently did not apply in the case of the "unusual experiences" component of schizotypy; this predisposition seems specifically operative in the formation of beliefs rather than disbeliefs. The contrast between this finding and those showing symmetry across the belief continuum is intriguing and if replicated, could have some implications for cognitive models of paranormal belief. At present, however, speculation on such matters should await further empirical investigations.

Broadly speaking, the findings of the study support the utility of including both a questionnaire measure and a single-item index of belief and disbelief in future investigations of the bases of paranormal beliefs. Compared to the questionnaire measure the single-item index is more suited to an assessment of whether a predictive variable is symmetrical in its consequences for belief and for disbelief; and the single-item index can also be framed so as to address the creation of a paranormal belief in real time. The design of the DOP appraisal task was intended to engage a range of cognitive analyses in the formation of an attitude to the paranormal, but in some contexts researchers could consider the utility of a simple direct one-item query (e.g., "Generally speaking, do you believe paranormal phenomena are genuine?") based on a 5- or 7-point response scale ("Unreservedly agree" to "Unreservedly disagree"). Such an item would at least permit a check on the symmetry of correlations for believers and disbelievers.

Finally, an acknowledgment of the study's limitations is appropriate. The effect sizes documented in Tables 1 and 3 are not large, so an account of paranormal beliefs in terms of processes associated with the formation of nonclinical delusions should not neglect the additional contributions by other cognitive factors. Again, the DOP task addresses only one potentially paranormal phenomenon. The generality of the study's findings therefore needs to be assessed with the construction of a research summary of other such phenomena. The design of the study also was correlational, so the imputation of causal processes must necessarily be tentative. Again, the search for a cognitive model of the development of paranormal beliefs may need to take greater account of the diversity of these beliefs (Irwin, 2009); different beliefs may well engage subtly different sequences of cognitive processing. In conclusion, it remains to be shown how inclusive the "mirror image" metaphor can be; in addition to cognitive predispositions to delusions, other characterological dimensions such as personality and motivation warrant investigation in groups of believers and disbelievers.

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