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Psychological factors in precognitive dream experiences: The role of paranormal belief, selective recall and propensity to find correspondences

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Summary

We report two studies into psychological factors that have been proposed to contribute to the claim of having experienced a precognitive dream. Study 1 investigated the role of selective recall in precognitive dream experiences. Participants read two diaries, one purporting to be a dream diary, and one purporting to be a diary of events in the dreamer's life. The events either confirmed or disconfirmed the reported dreams. As predicted, a significantly greater number of confirmed than disconfirmed dream-event pairs were recalled. Study 1 also investigated whether paranormal belief moderated the selective recall effect, but no relationship was found. Study 2 tested the hypothesis that paranormal beliefs may in part arise from a propensity to associate unrelated events. Participants undertook two tasks. For the 'contextual' task, participants were asked to find correspondences between randomly-paired news articles and dream reports. The 'neutral' task invited participants to produce a noun that would provide an associative connection between two unrelated nouns. As predicted, paranormal belief and precognitive dream belief were found to correlate significantly with ability to find correspondences between dreams and news event pairs. Contrary to prediction, no relationship was found between belief and performance on the neutral association task. Together, these studies illustrate the operation of mechanisms that, when present in individuals having dreams and experiencing subsequent events, would tend to lead to an increase in the number of experiences of a seeming coincidence between dreams and events that can be interpreted as precognitive.

Keywords: precognitive dreaming; psychological factors

1. Introduction

Precognition – literally fore-knowing – has been described in accounts of prophetic dreams from the earliest writings of humankind. Representative surveys show that around one quarter of the population believes in the ability to foretell the future (Moore, 2005) and about one third report precognitive experiences (Pechey & Halligan, 2011). So while these beliefs and experiences concern so-called 'anomalous' phenomena, their frequency in the general population is actually rather common. Case collections indicate that dreams play a particularly important role in spontaneous precognitive experiences (Green, 1960; Gurney, Myers, & Podmore, 1886; Rhine, 1954; Van de Castle, 1977).

Researchers draw a distinction between reports of spontaneous precognitive dream experiences and laboratory-based tests of dream precognition. The latter allow a controlled test of the hypothesis that a person's dreams can include information about a randomly-selected future target that could not have been obtained through other sensory or inferential means. The early controlled tests of dream precognition, conducted in a sleep laboratory (Krippner, Ullman, & Honorton, 1971; Krippner, Honorton, & Ullman 1972), obtained moderate to large effect sizes. More recent studies, where the participants primarily slept in their own homes, have found more mixed results (e.g., Schredl, Götz, & Ehrhardt-Knutsen, 2010; Sherwood & Roe, 2003; Watt & Valášek, in press). However the database of controlled precognitive dream research is small and the methodologies used have been rather variable, so it would be premature to draw conclusions about the evidence for precognition from this body of work.

Controlling for sensory factors and chance coincidence is impracticable with spontaneous reports of dream precognition, and efforts to ascertain whether there is any genuine anomalous information transfer in these cases have unsurprisingly often proven inconclusive. For example, if precognitive dreams contain useful information, it might be possible to warn the public of forthcoming disasters or even to prevent them from occurring. Following the Aberfan disaster the British Premonitions Bureau was set up in London (Barker, 1967) and in the USA the Central Premonitions Registry was established (Nelson, 1970). There is little recorded information about how these registries fared, but they both faltered apparently in part due to an insufficient number of predictions that could be related to specific incidents (MacKenzie, 1974).

Aside from these registries, there has not been a great deal of systematic prospective research into the frequency with which spontaneous dreams are later confirmed. Besterman (1933) conducted three series in which individuals were asked to document their dreams upon awakening and to mail a copy to the researcher. The percipient was asked to notify Besterman if they noticed any events occurring that corresponded to their dreams. In the first series, it was judged that only two out of 265 dreams (over an 8-week period) appeared 'moderately' precognitive. The second series collected 148 dreams, of which only 12 were 'apparent' precognitions, including two 'good' ones. J. W. Dunne served as the percipient in the third series, providing only 17 dreams over a four-month period, four of which Besterman felt contained 'fair or moderate' precognitive material.

There seems to be a disconnect between the relatively frequent reports of spontaneous precognitive dream experiences, which can be powerful and convincing for the experient, and the less persuasive results of prospective studies that have attempted to document the dream before the confirming events occur. This has led

several researchers to suggest that psychological factors may lead to an inflated number of precognitive dream experiences. The present studies investigate two of these proposed factors: selective recall (study 1), and propensity to find correspondences (study 2).

2. Study 1: Selective recall

Our first study looks at whether selective recall could be a factor in leading people to conclude they have experienced a precognitive dream. Selective recall in this context is defined as a systematic tendency to recall a particular subset of dream-event pairs. Thus far the link between memory and extraordinary beliefs and experiences has been under-researched (David, Lynn, & Ellis, 2010), though Wilson and French (2006) have studied false memory in this context, and have reviewed research into cognitive factors and paranormal experiences (French & Wilson, 2007). However, little work has been conducted on memory and precognitive dreaming. One exception to this is research by Madey & Gilovich (1993; see also Madey, 1993), who investigated memory for confirming versus disconfirming information as a possible explanation for what they term 'folk beliefs' (e.g., it always rains after you wash the car) that seem to persist despite disconfirming information. This series of studies is particularly relevant to precognitive dreaming because the researchers presented participants with prophetic statements (purportedly from a dream diary written by an undergraduate student) and with daily event diaries (purportedly from the same author) each of which contained one event that either confirmed or disconfirmed the prophetic dream. The diaries were constructed so as to resemble student life. As an example of a confirming entry, "I had an ominous dream of terrible failure" was paired with "I managed to ask this guy that I've been interested in for a date and he flatly refused," while the paired disconfirming event was "I received a tremendous thrill when I asked this guy that I've been interested in for a date and he said yes." Confirming dream-event pairs therefore resemble a precognitive dream experience, and disconfirming pairs simulate the experience of a dream that is apparently not precognitive. After a short distractor task, participants were asked to remember as many dream-event pairs as possible. Madey and Gilovich's studies consistently found a recall bias, with participants remembering two or three times as more confirmed dream-event pairs than disconfirmed pairs.

Madey and Gilovich (1993) also investigated the role of paranormal belief in selective recall. They hypothesised that believers might be more likely than disbelievers to selectively remember confirming dream-event pairs because this would be consistent with their beliefs. However, they did not find a significant effect of belief, perhaps in part because the majority of participants fell into the 'agnostic' category, with only 15% being categorised as believers. Another possible limitation was that Madey and Gilovich created their own two-item paranormal belief scale (belief in ESP, and belief that dreams are prophetic), which may have been unreliable. Madey and Gilovich (1993) described the findings of their paranormal belief analyses as "variable and uninformative" (p.461). The present study attempts to replicate and extend upon this work by using what we feel may be a more informative measure of paranormal belief that will allow comparison with other research into the psychology of paranormal belief. Most of the work into the psychology of paranormal belief has used Tobacyk's (2004) 7-factor Revised Paranormal Belief Scale (RPBS) (Goulding & Parker, 2001). However, Lange, Irwin, and Houran (2000) suggest that this scale suffers from differential item functioning,

and instead recommend using a two-factor 'purified' version. Therefore our primary measure of paranormal belief is the New Age Philosophy (NAP) sub-scale of Lange et al.'s purified RPBS, which contains items about belief in paranormal abilities including precognition. As a second, more narrowly-focused measure of belief in precognition, we will use the Precognition subscale from the original 7-factor RPBS (Tobacyk, 2004).

2.1. Hypotheses

Participants will recall more confirming dream-event pairs than disconfirming pairs, and this effect of selective recall will be greater for believer participants compared to disbelievers. The study's procedures were approved by the University of Edinburgh's ethics committee.

3. Method

3.1. Participants

There were 85 participants (55 female, 30 male, mean age = 23.3 years, $SD = 0.66$) recruited by email. Most (77%) were undergraduate students.

3.2. Materials, tasks and procedure

Belief questionnaires. The Revised Paranormal Belief Scale (RPBS; Tobacyk, 2004) requires participants to state their level of agreement with 26 items on a seven-point Likert-type scale (Strongly Disagree to Strongly Agree). Our analysis focused on the NAP sub-scale (11 items; Lange, Irwin, & Houran, 2000), and the Precognition subscale (4 items). Three of the Precognition subscale items are included in the NAP scale, and one is not ("Some people have an unexplained ability to predict the future"). We found good internal consistency for both measures ($\alpha = .89$ for NAP, and $.83$ for the Precognition sub-scale.)

Diary. Aside from minor changes to adapt the terminology and locations to the local context, the diary content was exactly the same as the original created by Madey (1993)². The diary was kept as close to original in content as possible to be sure that the confirming and disconfirming events were equally memorable and vivid, as established by pilot work described in Madey and Gilovich (1993). There were 10 entries, with dreams being reported on 8 days. The diary entries about daily events contained events typical of an undergraduate's life (e.g., discussions of coursework, meals, social events). Each dream was paired with an event that either confirmed or disconfirmed the dream content. Of the eight dream prophecies, four were paired with confirming events and four with disconfirming events. The order of presentation of the dream-event pairs was random. The dream was presented at the beginning of each entry, but the confirming or disconfirming target events were embedded amongst the text for that day to avoid primacy or recency effects.

Distractor task. The distractor task was a word association task in which the participant is given a letter of the alphabet and says as quickly as they can all the

² We are grateful to Richard Madey for generously granting us permission to use and adapt his original study materials.

words they can think of beginning with that letter. One minute was allowed for each letter, and the task duration was five minutes.

Recall Task. The recall task consists of the following instructions: "You will recall that the author of the diary documented her dreams over several days. What we would like you to do is try to recall each dream and any event that was relevant to the dream. You do not have to recall them in any particular order, but keep the particular dream and event together. It is okay if you cannot recall any relevant events; however it is important that you try to remember as many dreams as you can. Finally be as specific and as detailed as you can when you write down the dream and its corresponding event." The recall sheet was made up of the above instructions and two empty columns, one headed 'Dreams' and the other 'Events'; there were 8 rows for the 8 possible dream-event pairs.

Procedure. Participants, who were tested individually, first completed demographic and belief questionnaires. Next, they were presented with the diary with the following instructions: "The following are excerpts from the diary of an undergraduate student. The student began writing the diary as a participant of a study that looked at the relationship between personality and hand-writing. Please read all of the information below and pay equal attention to all parts of the diary. You will be asked about what you remember from the diary at the end of the experiment. As you'll see from reading the diary, the student reports her dreams and the events of the day. We would like you to consider both parts of the diary entry and consider if there is any relationship between the two."

Participants read the diary at their own pace then completed the distractor task, after which they read the instructions and completed the recall task in their own time.

3.3. Results

3.4. Descriptive statistics

As can be seen from Table 1, the average response to items in the NAP cluster was 2.86, while average reported belief in precognition was slightly higher at 3.18. Mean scores could range from 1 (low belief) to 7 (high belief) so average scores were just below the mid-point of the scale (4 = uncertain). A preliminary inspection of the data indicates that the results were as predicted for recall of event type, with participants recalling more than twice as many confirming dream-event pairs as disconfirming pairs, as shown in the table. Tables 2 and 3 show, respectively, the descriptive statistics for NAP and Precognition belief when participants are split into three equal groups according to their scores on these measures. This was done in order to allow an initial impression of whether, in relative terms (i.e., for the spread of scores obtained with our particular sample of participants), high, medium and low belief scores were associated with any differences in mean recall. We use the terms 'Believer' 'Agnostic' and 'Skeptic' in the table, however this is to avoid the cumbersome terminology 'Relative Believer' etc. It can be seen from the tables that there is no obvious difference between the belief groups on recall of the different event types, contrary to expectation; in all cases more confirming than disconfirming pairs are recalled.

Table 1. Descriptive Statistics ($N = 85$)

Recall for Confirming Dream-Event Pairs (N pairs)	Recall for Disconfirming Dream-Event Pairs (N pairs)	New Age Philosophy Belief	Precognition Belief
$M = 2.09$ ($SD = 1.08$)	$M = 0.86$ ($SD = 0.89$)	$M = 2.86$ ($SD = 1.21$)	$M = 3.18$ ($SD = 1.724$)

Table 2. NAP belief group and event type

NAP Belief Group	Recall for Confirming Dream-Event Pairs (N pairs)	Recall for Disconfirming Dream-Event Pairs (N pairs)
Believer ¹ ($N = 28$)	$M = 1.82$ ($SD = 0.95$)	$M = 0.64$ ($SD = 0.78$)
Agnostic ² ($N = 29$)	$M = 2.34$ ($SD = 1.08$)	$M = 1.21$ ($SD = 1.05$)
Disbeliever ³ ($N = 28$)	$M = 2.11$ ($SD = 1.17$)	$M = 0.71$ ($SD = 0.81$)

¹Believer M (belief score) = 4.28, $SD = 0.58$; ²Agnostic $M = 2.77$, $SD = 0.48$;

³Disbeliever $M = 1.54$, $SD = 0.29$

Table 3. Precognition belief group and event type

Precognition Belief Group	Recall for Confirming Dream-Event Pairs (N pairs)	Recall for Disconfirming Dream-Event Pairs (N pairs)
Believer ¹ ($N = 28$)	$M = 2.07$ ($SD = 1.05$)	$M = 0.82$ ($SD = 0.72$)
Agnostic ² ($N = 29$)	$M = 2.21$ ($SD = 1.10$)	$M = 0.86$ ($SD = 1.01$)
Disbeliever ³ ($N = 28$)	$M = 2.00$ ($SD = 1.10$)	$M = 0.89$ ($SD = 0.94$)

¹Believer M (belief score) = 5.11, $SD = 0.94$; ²Agnostic $M = 3.20$, $SD = 0.68$;

³Disbeliever $M = 1.23$, $SD = 0.38$

3.5. Recall of event type, and paranormal belief

Two ANCOVAs were conducted to test the three experimental hypotheses. The first looked at event type (within subjects factor: confirming; disconfirming) with NAP belief as covariate, and confirmed the expected main effect of event type: $F(1,83) = 16.477$, $p < .001$, partial $\eta^2 = 0.17$. However there was no significant effect of the

covariate: $F(1,83) = 0.123, p = .73$. The second ANCOVA looked at event type with Precognition belief as covariate. This again confirmed a main effect of event type $F(1,83) = 18.507, p < .001$, partial $\eta^2 = 0.18$, but found no significant effect of the covariate: $F(1,83) = 0.027, p = .87$.

Thus, our hypothesis that more confirming than disconfirming dream-event pairs would be remembered, was supported. However, our hypothesis that paranormal believers would recall more confirming pairs than disbelievers, was not supported.

4. Study 1 discussion

This study attempted to replicate previous work by Madey and Gilovich (1993), and to extend upon an "uninformative" aspect of the earlier work by applying a more widely used measure of paranormal belief. As predicted, our participants demonstrated significantly greater recall of dream-event pairs where the event confirmed the dream's prediction compared to pairs where the dream's predictions were disconfirmed. These findings replicate the pattern of results reported by Madey and Gilovich.

Madey and Gilovich felt that their investigation of the role of belief in selective recall was "uninformative" because only 15% of their participants were categorised as believers. Also, they used only a two-item belief scale. Madey and Gilovich do not provide the data to allow a more exact comparison, but as we were able to categorise one third of our participants as believers (mean scores above the mid-point of the scale), we feel we have been able to conduct a more informative investigation of this question. Contrary to prediction (but again consistent with Madey and Gilovich's findings) we found no evidence that this effect was stronger for those who believed in paranormal ability or specifically in precognition. Rather, the increased recall of confirming dream-event pairs, relative to disconfirming dream-event pairs, was consistently found across all groups of participants: believers, agnostics, and disbelievers. This suggests that the selective recall of confirming dream-event pairs is a pervasive cognitive bias that affects individuals irrespective of their beliefs.

Our first study has found evidence in support of the idea that selective recall is one psychological factor that can lead to an increased frequency of reported precognitive dream experiences, because dreams that are not confirmed are less likely to be remembered. Our second study turns attention to another psychological factor that has been proposed to contribute to an increased frequency of paranormal experiences: propensity to see correspondences.

5. Study 2: Propensity to find correspondences

Mednick (1962) defined the creative thinking process as "the forming of associative elements into new combinations which either meet specified requirements or are in some way useful" (p. 221), and Krippner (1963) suggested an association between psychic experiences and the creative personality. Several researchers have observed a connection between a propensity to link unrelated events, and paranormal beliefs and experiences (e.g., Brugger, 1997; Brugger & Graves, 1997). Mohr et al. (2001) asked participants to judge the semantic distance between unrelated words that had been randomly paired. It was found that participants reporting greater Magical Ideation (MI: Eckblad & Chapman, 1983) judged unrelated words as more closely associated than participants reporting lower MI. They

suggested that this propensity to see associations was an important aspect of creative thinking and schizotypy as well as being integral to the formation of paranormal beliefs. Gianotti et al. (2001) replicated these findings by looking at how associative processing differed in paranormal believers and non-believers using a new measure called the Bridge-the-Associative-Gap (BAG) task. Participants had to make word associations to link pairs of words that were either indirectly related or unrelated to each other. Word responses were then split into 3 groups - Unique associations, Rare associations, and Common associations. Magical Ideation was used as an index of paranormal belief. Overall, paranormal believers made significantly more Rare associations between the unrelated word pairs than disbelievers, which led the authors to conclude that believers in the paranormal are more creative and are therefore more likely to make associations or connections between two unrelated items. Similar findings were obtained by Duchêne, Graves and Brugger (1998). However, both these studies found no significant difference between the number of Unique associations made by believers and disbelievers. Gianotti et al. (2001) note that this may have been due to the experimenters' inability to differentiate between creative unique word associations and associations that are completely personal to the participant.

The association tasks used in the studies reviewed above have been rather abstract or 'neutral' in context, and so far none of this research has been explicitly linked to the experience of precognitive dreams. Our Study 2 therefore considered whether the general relationship that has been reported between paranormal beliefs and propensity to find correspondences in a neutral task would also be found specifically with a task designed to more closely match the context of precognitive dream experience.

As with Study 1, we used two indicators of belief. The first is the broad measure of NAP belief from the RPBS. Study 1 also had a four-item scale of belief in precognition. However, in order to have a more focused measure of precognitive *dream* belief that included personal experience of precognitive dreaming, and that gave a well-specified definition of precognitive dreaming based on Bender's (1966) criteria, a new three-item scale was devised, as described below.

We also used two measures of the propensity to see correspondences, one 'neutral' and one 'contextual'. The neutral measure was the BAG task, whose validity we attempted to improve by asking participants to avoid producing any associations that are personal to them. Our contextual task provided participants with extracts from a dream diary that had been randomly paired with world news events, and asked them to find connections between the pairs.

5.1 Hypotheses

Participants who report greater levels of belief in paranormal ability and precognitive dreaming will find greater numbers of correspondences on the neutral and contextual association tasks than participants reporting lower levels of belief. The study's procedures were approved by the University of Edinburgh's ethics committee.

6. Method

6.1. Participants

Fifty undergraduate participants (27 female, 23 male) from the University of Edinburgh took part in the study. All were proficient English speakers and none had any reading difficulties. All were aged between 18-24 years.

6.2. Materials, tasks, and procedure

Demographic questions. Participants were asked to indicate their gender and age, with the latter in four categories: under 18, 18-24, 25-32, over 32 years.

Neutral association task. The Bridge-the-Associative-Gap (BAG) task (Gianotti et al., 2001) was used as a neutral measure of associative creativity. It consisted of 40 pairs of nouns, half of which were semantically indirectly related to each other (e.g., leg-shoe) and half of which were semantically unrelated to each other (e.g., corn-helmet). Word pairs were presented at 5-second intervals on a computer screen. Participants were told to read aloud both of the words that appeared on screen and to then say a noun that they semantically associated with both of them. In line with Gianotti et al. (2001) participants were told to try to avoid the use of proper nouns and non-nouns, and that if they couldn't think of a word to say nothing. The present study also asked participants to try and avoid personal associations. Participants' associative responses were noted by the experimenter. Associations that were produced after the 5-second interval were not recorded.

To score the BAG task, in line with Gianotti et al. (2001), words were split into 3 groups depending on the frequency with which they were produced amongst the whole sample of participants, for both indirectly related and unrelated word pairs. These groups were unique, rare and common associations, and the number of each was tallied for each participant. A unique association was a word that was produced once out of all of the participants' responses to a particular word pair. Two to three indirectly related associations were classified as rare, and four or more indirectly related associations were classified as common. For unrelated associations, two were classified as rare, and three or more were classified as common. As with Gianotti et al. (2001) the measure of interest is the number of unique and rare associations made between Unrelated word pairs.

Contextual association task. This was a novel method that we created to determine the propensity to connect unrelated events in the context of dream precognition. The task consisted of 40 items, half of which were short news articles from the BBC website from 2000/2001, and half of which were dream diary entries submitted to the website www.dreambank.net³. Articles and diary entries were between 50 and 200 words in length and were screened for potentially distressing content. None of the news articles had any direct connection to the dream diary entries. Each of the twenty news articles and diary entries were numbered from 1 to 20 and were randomly paired for each trial with the use of an online random number generator. This ensured that participants were given two unrelated events for each trial.

Participants were given four sets of news article and dream diary pairs. They were given three minutes to read each pair and then write down as many connections and similarities as they could find between them. Participants were told that if they couldn't find any connections to notify the experimenter, who would then give them the next pair.

³ The world news events were selected from 10 years ago so that they came before the dreambank reports, so it could not be suggested that there was a pre-existing precognitive connection between the dreams and events.

To score the contextual association task, both experimenters independently counted the number of connections each participant made. The experimenters then had to agree on the overall score for each participant. A greater number of connections made suggested a higher propensity to make connections between unrelated events.

Belief questionnaires. To measure belief in paranormal abilities, the NAP subscale of the RPBS was used. Scores on this 11-item subscale could range from 0 to 66, and in Study 2 we again found good internal consistency for this measure: $\alpha = .84$. To measure belief and experience in precognitive dreaming, a three-item scale was devised. The first question (from Schredl, 2004) asked 'how often have you recalled your dreams recently (in the past several months)?' This item was chosen because in order to have a precognitive dream experience one first has to be able to remember one's dreams. A person who remembers their dreams readily will be more likely to experience a coincidental life event than a person who cannot remember their dreams, and research does indeed find a correlation between dream recall and frequency of precognitive dreaming (Schredl, 2009). Response options were 'almost every morning,' 'several times a week,' 'about once a week,' 'two or three times a month,' 'about once a month,' 'less than once a month,' or 'never'. Scores could range from 0 for 'never' to 6 for 'almost every morning.' The second question asked 'do you believe that some individuals have dreams that predict future events and are not just coincidence?' The three response options were 'yes' 'unsure' and 'no', which scored from 2 to 0 points. The third question listed the 5 criteria, as outlined by Bender (1966) which defined whether a dream that has come true is evidential of a precognitive dream, before asking 'based on the five criteria above, please indicate approximately how often you have had a precognitive dream over the last few years.' The six response options were 'about once a day,' 'about once a week,' 'about once a month,' 'about once in 6 months,' 'about once a year,' or 'never'. Scores could range from 5 to 0. Total scores for the precognitive dream questions could therefore range from a minimum of 0 to a maximum of 13⁴.

Procedure. Participants, who were tested individually, first answered the demographic questions and then completed the BAG task followed by the dream and event diary task. Finally, they completed the RPBS and the belief in precognitive dreams questionnaire.

6.3. Results

6.4. Descriptive statistics.

Paranormal belief. The mean NAP belief score was relatively low at 18.56 ($SD = 11.12$), well below the middle of the possible range of scoring (0 - 66). In contrast, mean belief in precognitive dreaming seemed to be stronger at 5.32 ($SD = 2.33$), closer to the midpoint of the possible range of scoring (0 - 13).

Neutral association task. Proper nouns and non-nouns were removed from the data set. Synonyms were treated as one word (e.g. 'love' and 'adoration') as they were semantically the same. Table 4 shows the data for the number of unique, rare and common associations produced for indirectly related and unrelated word pairs on the BAG task.

⁴ Alpha is not reported for this second measure due to the different response options.

Contextual association task. The mean number of associations reported between dreams and news events for each participant was 11.1 ($SD = 2.33$).

Table 4. Mean and SD of the number of unique, rare and common associations produced on the BAG task for both indirectly related and unrelated word pairs ($N = 50$).

Word pairs	Association	Mean	SD
Indirectly related	Unique	4.42	2.95
	Rare	2.84	1.58
	Common	10.88	3.62
Unrelated	Unique	5.46	2.62
	Rare	2.06	1.27
	Common	7.74	3.10

6.5. Paranormal belief and propensity to find correspondences

Contrary to expectation, belief in paranormal ability (NAP) was not correlated with the number of unique or rare associations made between the Unrelated word pairs on the neutral association (BAG) task, respectively: $r(48) = -.08$, n.s.; $r(48) = -.02$, n.s.). No relationship was found between belief in precognitive dreaming and number of unique or rare associations made between the Unrelated word pairs on the neutral association (BAG) task, respectively: $r(48) = .06$, n.s.; $r(48) = -.15$, n.s.. There was therefore no support for the hypothesis that paranormal belief would be associated with a greater propensity to find correspondences in the neutral association task.

As predicted, there was a significant positive correlation between NAP belief and performance on the contextual association task: $r(48) = .33$, $p = .01$ (1-t). A significant positive correlation was also found between belief in precognitive dreaming and performance on the contextual association task: $r(48) = .34$, $p = .008$ (1-t). Therefore our hypothesis that paranormal belief would be associated with a greater propensity to find correspondences on the contextual association task was supported.

7. Study 2 discussion

Study 2 tested the suggestion that propensity to find correspondences would be related to belief in paranormal ability and belief in precognitive dreaming. Two associative tasks were used, one neutral and one contextual. The neutral BAG task measured the number of unique or rare associations made by participants to pairs of unrelated words. Previously, Gianotti et al. (2001), using the Magical Ideation Scale as an index of belief, had reported that paranormal believers produced more rare (but not more unique) associations to unrelated word pairs than disbelievers. Gianotti et al. had suggested that scoring of their BAG task was complicated by participants possibly giving personal associations, and our study attempted to overcome this problem by asking participants to avoid giving personal associations. However, the present study, using a different measure of belief, did not replicate Gianotti et al.'s

(2001) results. One reason for this lack of replication may be that our participants' scores on the belief measures suggested that they held mainly low to moderate levels of belief in paranormal ability and precognitive dreaming. In contrast, Gianotti et al. selected participants from the upper and lower quartiles of paranormal belief scores, so their analysis was conducted with two distinct groups.

Any comparison between studies may be complicated by the possibility that the BAG task itself is not a particularly sensitive indicator of associative ability. We found it to be difficult to code the words as unique, rare or common, despite following Gianotti et al.'s (2001) criteria. For example, we chose to code pairs of synonyms as the same word because they were semantically related. Gianotti et al. don't give criteria for how synonyms should be coded. Also, we found it difficult to separate idiosyncratic responses from truly creative ones. This might be the case when a unique association was not semantically related but was given due to a personal association. These difficulties might be overcome in future with the development of stricter criteria for what counts as a valid association, or perhaps by using multiple coders.

However, we did find the predicted significant relationship between paranormal belief, belief in precognitive dreaming, and performance on our contextual association task. This provides evidence in support of the suggestion that propensity to find correspondences may lead to increased frequency of experience of seemingly precognitive dreams.

8. General discussion

We have described two studies testing the proposition that the frequency of experience of seemingly precognitive dreams may be increased through the operation of certain cognitive processes. We also investigated whether those reporting higher levels of paranormal belief, as measured broadly by the NAP subscale of the RPBS, and more narrowly by measures of belief in precognition, would more strongly show the hypothesised propensities.

Study 1 looked at memory processes. It found that, when presented with a dream diary paired with a diary of subsequent life events some of which appeared to confirm or disconfirm the dreams' predictions, participants had a strong propensity to recall the confirming dream-event pairs but to forget the disconfirming pairs. Participants remembered more than twice as many confirming dream-event pairs, a bias that in real-world situations would be likely to lead to an increased frequency of the subjective experience of a dream being confirmed by subsequent events.

We interpret these results in terms of cognitive processes that lead to memory consolidation: when an event appears to confirm a dream, this would be more salient than a disconfirming event. The salient dream-event pairing would therefore receive more processing and be more easily recalled as a result. In comparison, a dream that is not confirmed by subsequent events is perceived as a non-event amongst a large number of possible non-events. These non-events are not noticeable, do not receive much attention, and are therefore less likely to be remembered. Madey and Gilovich (1993) report evidence in support of this interpretation, as they found that participants spent more time scrutinizing confirming dream-event pairs than disconfirming pairs. However like Madey and Gilovich (1993), we did not find any evidence that this memory bias was greater for paranormal believers, suggesting it is a powerful and pervasive cognitive bias.

Our second study investigated the suggestion that paranormal belief and experience may occur when certain individuals have a particular ability to find correspondences between unrelated events. Researchers (e.g., Bressan, 2002; Brugger et al., 1993) have suggested that if an individual subjectively experiences a large number of coincidences then this may lead to them developing paranormal beliefs. We presented participants with two measures of associative ability: a neutral word-association task, and a contextual task in which participants were asked to report correspondences between randomly-paired dream diary entries and world news events. Neither of our paranormal belief measures correlated with neutral task performance, a result that may in part indicate that the BAG task is an unreliable indicator of associative ability given that we did find the predicted significant relationship between paranormal belief and contextual task performance. We suggest ways in which the reliability of the BAG task may be increased. The contextual task was designed to resemble real-world precognitive dream experiences, and it appears to be a useful measure with which researchers might further explore the psychology of precognitive dream experiences. While our task is presented in the guise of pairs of dreams and subsequent events, it could readily be adapted to simulate other kinds of coincidences that resemble psychic experiences, for instance between one person's thoughts and another's.

The psychological literature tends to focus on the implications of paranormal belief (e.g., Russell & Jones, 1980), and there is a need for more research into *disbelief*, which tends to be assumed to equate simply to an absence of belief. We suggest that any cognitive bias associated with 'belief' could potentially cut both ways. Just as a paranormal believer may be inclined to notice associations that are consistent with their beliefs, it is also possible that someone who holds a disbelief in the paranormal may fail to notice associations that are inconsistent with their belief. In this case, the disbeliever may underestimate the frequency with which their dreams appear to be confirmed by subsequent events. This is a question that merits further investigation, and whose ramifications of course extend beyond precognitive dreaming to cognitive biases and scientifically unsubstantiated beliefs more generally.

While a propensity to perceive associations can be pathologically linked to schizophrenic thought disorder, now understood as a disinhibition of the spreading activation in semantic networks (e.g., Spitzer, Braun, Hermle, & Maier, 1993), such tendencies can also be found in quite "normal" individuals who score high in Magical Ideation. Our own study participants, an unselected "normal" student sample, did not report particularly high levels of paranormal belief. Nevertheless belief correlated moderately and significantly with performance on the contextual association task. Mohr et al. (2001) caution against tarring paranormal belief with negative connotations, noting that loosening of associative processes is also positively and adaptively associated with creativity. Rather, they recommend that future research should strive to understand the distinctions between pathological disinhibition of associations, non-pathological paranormal beliefs and experiences, and creative styles of reasoning.

The studies reported here highlight two possible mechanisms that would lead individuals to experience an increased frequency of precognitive dream experiences: selective recall and propensity to find correspondences. Logically, finding evidence in support of these postulated psychological mechanisms does not rule out the possibility of genuinely paranormal connections between dreams and subsequent events, and the present studies do not address the question of the evidentiality of

precognitive dreams. However, our studies may help to explain the discrepancy between the limited findings of prospective spontaneous precognitive dream studies and the rather frequently reported experience of having dreamed about a seemingly unpredictable future event.

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