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### **Individual differences in prophetic dream belief and experience**

Exploring demographic and sleep-related correlates

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6

## 7 **Individual differences in prophetic dream** 8 **belief and experience**

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19

## Abstract

20 A large proportion of the general population believes that dreams can provide  
21 information about future events that could not have been obtained by any known means. The  
22 present study identifies several factors associated with prophetic (precognitive) dream belief  
23 and experience. Participants ( $N = 672$ ) were measured on demographic variables, sleep  
24 characteristics, and precognitive dream (PD) belief, experience, and frequency. Three ‘sleep  
25 clusters’ were identified based on the analysis of the sleep-related variables. Women were  
26 more likely to believe in PDs as well as experience them. There was a positive relationship of  
27 PD belief and experience with age and a negative one with education. Most notably, we  
28 found that a high frequency of PD experiences was associated with erratic sleep patterns and  
29 sleep medication use. The present study provides a basis for the development of further  
30 models explaining the prevalent phenomena of precognitive dream belief and experience.

31

32 **Keywords:** individual differences; paranormal belief; precognitive dreams; sleep  
33 characteristics.

34

## 35 1. Introduction

36 Recent surveys show that a large proportion of the population believes that dreams can  
37 literally provide information about future events that could not have been obtained by any  
38 known means (e.g., rational inference, intuition) and is not merely coincidental. The belief in  
39 the reality of these so-called precognitive dreams (PD) was espoused by around 55-70% of  
40 participants in three representative samples of Britons, Icelanders, and Swedes, with about  
41 half as many reporting having had such a dream (Haraldsson, 1985). Given the high  
42 prevalence of PD belief and experience coupled with the inconsistent findings from  
43 controlled tests of dream precognition (e.g., Watt, Wiseman, & Vuillaume, in press), it is  
44 important to investigate potential psychological factors that may account for these  
45 phenomena. The present study identifies several such factors.

46 Haraldsson (1985) found that women were more likely to both believe in the reality of  
47 PD and report having experienced them. Others, however, did not find such differences  
48 (Rattet & Bursik, 2001; Schredl, 2009). The present study will look at the relationship  
49 between gender and other demographic variables that have yielded similarly mixed findings  
50 (age, Haraldsson, 1985; Schredl, 2009; and education, see French & Stone, 2014) and PD  
51 belief and experience.

52 Some authors have considered various cognitive factors that might contribute to the  
53 misattribution of normal experiences as 'paranormal' (for a review, see Wiseman & Watt,  
54 2006). Concerning PDs, these include implicit processing of subtle cues from the  
55 environment (Valášek, *et al.*, 2014), selective recall and propensity to perceive  
56 correspondences between randomly-paired stimuli (Watt, Ashley, Gillett, Halewood, &  
57 Hanson, 2014), and the incorporation of unconsciously perceived environmental stimuli into  
58 dreams (Watt *et al.*, in press). For example, if a person falls asleep within earshot of the  
59 television, a news item may get incorporated into the narrative of their dreams. When they

60 later learn the news, they can think that their dream foretold the event in question (Alcock,  
61 1981). Furthermore, both early and late sleep stages have been shown to be permeable to  
62 external stimuli (Hoelscher, Klinger, & Barta, 1981), so it is plausible that the more often one  
63 enters borderline sleep states, the higher the likelihood of putatively PD experiences will be.  
64 This study therefore examines the relationship between precognitive dream experience and  
65 various patterns of sleep-related behaviours (nap-taking, nocturnal wake-ups, dream recall  
66 and overall subjective sleep quality).

67 Closely related to the aforementioned topic is the issue of sleep medication use. Use of  
68 medication alters sleep patterns and certain drugs have been shown to interfere with REM  
69 sleep (Pagel & Parnes, 2001) as well as induce nightmares (Pagel & Helfter, 2003). This  
70 could affect both dream recall and the frequency of borderline sleep states. We thus include a  
71 measure of sleep medication use to explore its potential effects on PD experience.

72 To summarise, given the mixed results of the reviewed research, the study will firstly  
73 investigate the role of demographic variables: we hypothesise an effect of gender (H1), age  
74 (H2), and education (H3) on the belief in and experience of PDs. Secondly, based on the  
75 argument outlined above, we expect to find a relationship between individuals' patterns of  
76 sleep related behaviour characterised by sleep quality, frequency of nocturnal awakening and  
77 diurnal naps, and dream recall and subjective PD experience (H4). And finally, the study will  
78 explore the relationship between sleep medication use and the experience of PDs (H5). Given  
79 the conflicting findings in the literature related to demographic characteristics as well as the  
80 exploratory nature of this study due to a lack of research on sleep behaviour and PDs, all the  
81 hypotheses stated above are non-directional.

## 82 2. Method

### 83 2.1. Participants

84 Participants were primarily recruited via online social networks and interest groups  
85 dedicated to various topics (psychology, dreams, scepticism, the paranormal). A total of 693  
86 participants completed the study. Ten participants were younger than 18 years and were  
87 excluded from further analysis. Of the remaining participants, 279 were male (41.52%) and  
88 393 (58.48%) female. Eleven participants (1.6%) did not identify as either, and their  
89 exclusion resulted in the final sample of 672 participants ( $M_{\text{age}} = 31.47$  years, range = 18-75,  
90  $SD = 11.74$ ). There was no age difference between genders ( $M_{\text{male}} = 31.45$ ,  $SD = 12.67$ ,  
91  $M_{\text{female}} = 31.48$ ,  $SD = 11.05$ ,  $t(546.21) = 0.032$ ,  $p = .974$ ).

### 92 2.2. Materials

93 A battery of questionnaires was administered in the following order. The wording of the  
94 items can be found in the supplement.

#### 95 2.2.1. Demographic data

96 Standard demographic items including gender (including an additional non-binary  
97 response option), country of origin, age, and years of formal education completed were taken.

#### 98 2.2.2. Sleep characteristics

99 Seven items related to sleep quality addressing usual sleep duration, frequency of day-  
100 time naps and night-time wake-ups, use of sleep medication, history of sleep disorders, usual  
101 dream recall, and overall subjective sleep quality were used. The items were adapted from the  
102 Pittsburg Sleep Quality Index (Buysse, Reynolds, Monk, Berman, & Kupfer, 1989).

103 2.2.3. Precognitive dream belief and experiences

104 Belief in PDs was assessed using a 4-item Likert scale with response options ranging  
105 from 1 (*Completely disagree*) to 7 (*Completely agree*). Internal consistency of this scale was  
106 high,  $\alpha = .92$ .

107 PD experience was measured using two further items. The first was also a 7-point Likert  
108 item worded “I have had at least one dream that came true and which (I believe) was  
109 precognitive.” The second item related to PD frequency (“Approximately how often you have  
110 had a precognitive dream over the last few years?”) was included in the battery. PDs were  
111 defined as “dreams that foretell the future” and Bender’s (1966) criteria for what constitutes a  
112 PD were included before the precognitive dream section of the questionnaire battery.

113 2.3. Procedure

114 The study was approved by [a UK university] Research Ethics Board. The battery of  
115 questionnaires was administered online. Participants read a description of the study and gave  
116 consent by proceeding with filling in the questionnaire. Upon completion, participants were  
117 thanked and debriefed. All analyses were conducted using the R software version 2.15.3 (R  
118 Core Team, 2012).

119 3. Results

120 3.1. Descriptive analysis

121 The mean number of completed years of formal education was 16.45 ( $Mdn = 17, SD =$   
122  $3.35, range = 8-25$ ). The majority of participants reported sleeping on average 7-8 hours a day  
123 (62.7%) with only 4.5% of participants sleeping fewer than 5 or more than 10 hours a day.  
124 The mean overall sleep quality, rated on a 7-point Likert scale from 1 (*Very bad*) to 7 (*Very*

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125 *good*), was 5.1 ( $Mdn = 5$ ,  $MAD^1 = 1.48$ ). Forty-two participants (6.9%) reported having been  
 126 diagnosed with a sleep disorder. Items related to frequencies of daytime naps, night time  
 127 waking up, use of sleep medication and dream recall are summarised in Table 1. Due to  
 128 extremely skewed distribution of responses to the sleep medication item (80.1% reported no  
 129 use), we dichotomised the variable for further analysis.

130

131 Table 1

132 *Descriptive statistics for sleep variables*

Variable	<i>Mdn</i>	Min	Max
Daytime nap frequency	2	0	6
Night time wake-up frequency	3	0	6
Sleep medication use frequency	0	0	6
Dream recall frequency	4	0	7

133

134 The mean score on the PD belief, derived from the four items measuring belief in the  
 135 reality of PDs, was 3.5 ( $Mdn = 3.5$ ,  $SD = 2.01$ ). The median response to the item addressing  
 136 PD experience was 2, with 39.2% of the sample having scored above the mid-point.

137 Furthermore, 56.2% of participants reported no PD experience, 17.8% reported having PDs  
 138 less often than once a year, 6.2% about once a year, 12.1% about once in six months, 5.2%  
 139 reported having PDs about once a month, and 2.5% about once a week. Belief in PDs was  
 140 strongly related to both PD experience ( $r_s = .812$ , 95% CI\* [.780, .841],  $p < 2 \times 10^{-16}$ ) and  
 141 frequency ( $r_s = .730$ , 95% CI\* [.692, .764],  $p < 2 \times 10^{-16}$ ).

<sup>1</sup> Median absolute deviation.



## 142 3.2. Hypothesis testing

## 143 3.2.1. Demographic variables and PD belief and experience

144 First, we explored the role of demographic variables in PD belief and experience (H1). A  
 145 multiple linear regression predicting PD belief with gender, age and years of formal  
 146 education was conducted<sup>2</sup> to assess the individual contributions of the predictor variables.  
 147 The model accounted for 22.5% of the variance in precognitive dream experience, with all  
 148 variables having a significant effect on PD belief (Table 2). This result was supportive of H1,  
 149 H2, and H3: men exhibited lower PD belief, while age was positively related to the outcome  
 150 variable. Furthermore, PD belief diminished with increasing number of years of formal  
 151 education completed. Comparable results were obtained from a multiple ordinal regression of  
 152 PD experience on the same predictor variables (see Table S1).

153

## 154 Table 2

155 *Summary of the multiple linear regression model predicting PD belief*

Predictor	<i>b</i>	$\beta$ [95% CI*]	<i>t</i>	<i>p</i>
Gender	-0.449	-0.109 [-0.174, -0.039]	-3.203	.001
Age	0.072	0.416 [0.350, 0.475]	12.169	$< 2 \times 10^{-16}$
Education	-0.139	-0.230 [-0.291, -0.162]	-6.745	$3 \times 10^{-11}$

156

157 In order to explore the effect of demographic variables on the unique variance of PD  
 158 belief and PD experience respectively, we added each variable in the model predicting the  
 159 other. This resulted in age being the only significant predictor of PD belief,  $b = 0.029$ ,  $SE =$   
 160  $0.004$ ,  $\beta = 0.047$ , 95% CI\* [0.033, 0.062],  $p = 2 \times 10^{-12}$ ,  $\Delta R^2 = .022$ , and education being the

<sup>2</sup> Predictors were added simultaneously in all regression models reported in this paper.

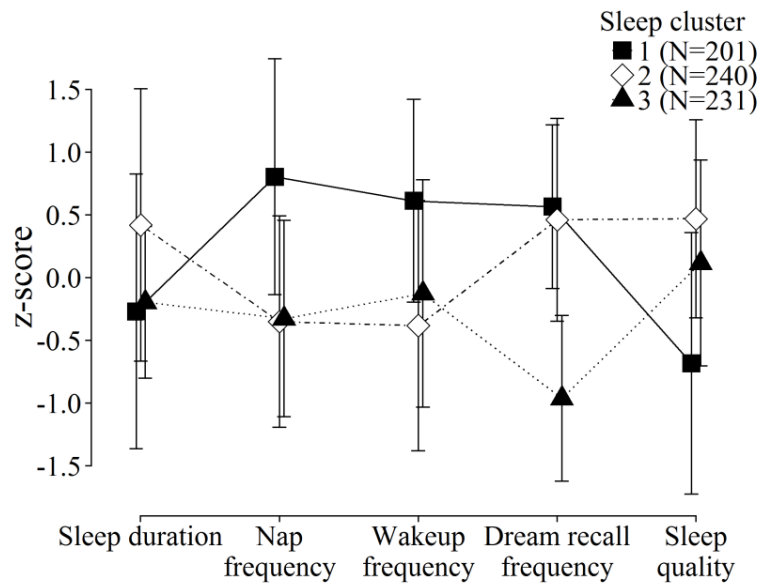
161 only significant predictor of PD experience,  $b = -0.088$ ,  $SE = 0.027$ ,  $OR = 0.92$ , 95% CI  
162  $[0.87, 0.96]$ ,  $p < .001$ .

### 163 3.2.2. PD frequency and sleep characteristics

164 To ascertain the relationship between PD experience and sleep characteristics (H3), a  
165 hierarchical cluster analysis using Ward's minimum variance method (Ward, 1963) was first  
166 conducted on the five standardised sleep variables (sleep duration, frequency of nocturnal  
167 awakenings and diurnal naps, dream recall frequency, and subjective overall sleep quality).  
168 Due to extremely small variance of the sleep medication variable as well as the binary nature  
169 of the sleep disorder variable, these were excluded from the cluster-analysed set. The aim of  
170 this analysis was to identify different sleep patterns in the sample. Three clusters of similar  
171 sizes were identified. The individual "sleep profiles" of these clusters are depicted in Fig. 1.  
172 Cluster 1 was characterised by an erratic sleep pattern with high frequency of both nocturnal  
173 awakenings and diurnal naps, high dream recall and a low subjective overall sleep quality.  
174 Cluster 2 differed from Cluster 3 most markedly in terms of sleep duration and dream recall.  
175 Thus, these two clusters were interpreted as representing high and low dream recallers  
176 respectively. Table 3 shows the descriptive statistics for the measured variables with respect  
177 to the three sleep clusters as well as tests of differences between the clusters. There were no  
178 significant differences between the sizes of the clusters,  $\chi^2(2) = 3.723$ ,  $p = .155$ , however,  
179 there was a preponderance of men in Cluster 3 compared to Cluster 2,  $\chi^2(2) = 7.790$ ,  $p =$   
180  $.020$ . The mean age of Cluster 1 was furthermore significantly higher in comparison to the  
181 other two clusters, Mean diff<sub>2-1</sub> =  $-3.29$ , 95% CI\*  $[-5.90, -0.69]$ ,  $p = 0.009$ ; Mean diff<sub>3-1</sub> =  
182  $-4.37$ , 95% CI\*  $[-7.00, -1.74]$ ,  $p = 3 \times 10^{-4}$ . Importantly, the three clusters also differed  
183 significantly from one another in the proportion of participants who have used sleep  
184 medication, with Cluster 1 having the highest and Cluster 3 the lowest proportion,  $\chi^2(2) =$   
185  $28.396$ ,  $p = 7 \times 10^{-7}$ . To see if this relationship remained significant after controlling for age,

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186 the variables were entered into a logistic regression with age and sleep clusters as predictors  
 187 and sleep medication use as a binary outcome. As shown in Table 4, participants in Cluster 2  
 188 were 58% less likely to have used sleep medication than Cluster 1 participants. Those in  
 189 Cluster 3 were 67% less likely to report sleep medication use compared to Cluster 1.  
 190 However, there was no significant difference between Clusters 2 and 3 (Table S2).



191

192 Figure 1. Sleep variable profiles of three identified sleep clusters. Error bars represent  $\pm 1 SD$ .

193

194 Next, we investigated the relationship between sleep patterns and PD frequency. As  
 195 reported in Table 3, there was a significant difference in PD frequency between each pair of  
 196 sleep clusters. Table 5 shows a more detailed breakdown of proportion of responses on the  
 197 PD frequency item within individual clusters.

198

199 Table 3

200 *Descriptive statistics and test of between group differences for measured variables with*  
 201 *respect to sleep clusters*

Variable	Cluster 1	Cluster 2	Cluster 3	$\chi^2 (2)$
----------	-----------	-----------	-----------	--------------

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<i>N</i> (%)	201 (29.9)	240 (35.7)	231 (34.4)	3.723
Gender (% male)	42.3	35.0 <sup>3</sup>	47.6 <sup>2</sup>	7.790*
Sleep meds (% use)	32.3 <sup>2,3</sup>	16.3 <sup>1,3</sup>	13.0 <sup>1,2</sup>	28.396***
Sleep disorder (%)	11.00 <sup>2,3</sup>	4.6 <sup>1</sup>	4.3 <sup>1</sup>	9.910**
	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>M</i> ( <i>SD</i> )	<i>F</i> (2,669)
Age	34.14 (13.22) <sup>2,3</sup>	30.85 (11.02) <sup>1</sup>	29.77 (10.7) <sup>1</sup>	8.125***
Years of education	16.31 (3.39)	16.39 (3.47)	16.64 (3.20)	0.564
PD belief	4.17 (2.02) <sup>3</sup>	3.76 (2.05) <sup>3</sup>	3.27 (1.90) <sup>1,2</sup>	10.990***
	<i>Mdn</i> ( <i>MAD</i> )	<i>Mdn</i> ( <i>MAD</i> )	<i>Mdn</i> ( <i>MAD</i> )	<i>H</i> (2) <sup>†</sup>
Sleep duration	3 (0.00) <sup>2</sup>	3 (0.00) <sup>3</sup>	3 (0.00) <sup>1,2</sup>	65.313***
Nap frequency	5 (1.48) <sup>2,3</sup>	2 (1.48) <sup>1</sup>	2 (1.48) <sup>1</sup>	168.269***
Wakeup frequency	6 (1.48) <sup>2,3</sup>	4 (2.97) <sup>1,3</sup>	4 (2.97) <sup>1,2</sup>	114.984***
Dream recall	6 (1.48) <sup>3</sup>	6 (1.48) <sup>3</sup>	4 (1.48) <sup>1,2</sup>	333.306***
Sleep quality	4 (1.48) <sup>2,3</sup>	6 (1.48) <sup>1,3</sup>	5 (1.48) <sup>1,2</sup>	139.745***
PD experience	5 (2.97) <sup>2,3</sup>	3 (2.97) <sup>1</sup>	2 (1.48) <sup>1</sup>	25.631***
PD frequency	2 (1.48) <sup>2,3</sup>	1 (0.00) <sup>1,3</sup>	1 (0.00) <sup>1,2</sup>	40.407***

*Note.* Superscripts in individual cells indicate a significant difference from given cluster according to Tukey HSD-corrected *t*-test for continuous variables and Bonferroni corrected Mann-Whitney *U*-test for ordinal variables.

<sup>†</sup> Kruskal-Wallis ANOVA due to ordinal variable.

\* < .05; \*\* < .01; \*\*\* < .001

202

203 Table 4

204 *Summary of logistic regression predicting sleep medication use*

Predictor	<i>b</i>	<i>SE</i>	<i>p</i>	OR [95% CI]
Age	0.012	0.01	.118	1.01 [1.00, 1.03]
Cluster 2	-0.862	0.23	2 × 10 <sup>-4</sup>	0.42 [0.27, 0.66]

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Cluster 3    -1.112    0.25     $8 \times 10^{-6}$     0.33 [0.20, 0.53]

---

205

206 Table 5

207 *Proportion of PD frequency levels by sleep clusters and sleep medication use categories*

---

Sleep cluster	PD frequency (%)					
	0	1	2	3	4	5
1	36.82	19.40	7.46	20.90	9.45	5.97
2	51.88	16.74	3.77	14.23	8.79	4.60
3	62.77	18.61	8.66	7.36	1.73	0.87
Sleep medication use						
No	54.56	17.69	6.7	12.1	5.77	3.17
Yes	37.31	20.15	5.97	20.9	9.7	5.97

---

*Note.* Columns within rows add up to 100%.

208

209 In order to control for demographic variables, a multiple ordinal regression model was fit

210 with PD frequency as outcome and demographic variables and sleep cluster as predictors.

211 The results are summarised in Table 6. Sleep cluster remained a significant predictor even

212 after accounting for the significant effects of age and education. Furthermore, there was also

213 a significant difference between Clusters 2 and 3,  $b = 0.580$ ,  $SE = 0.19$ ,  $p = .002$ ,  $OR = 1.79$ ,

214 95% CI [1.24, 2.58] (Table S3).

215 The relationship between the presence of a sleep disorder diagnosis and PD frequency

216 was investigated using another multiple ordinal regression with a categorised PD frequency

217 (“Never”, “Once a year or less often”, “More often than once a year”) as outcome variable.

218 The reason for this treatment of the variable was the small number of participants who

219 reported having been diagnosed with a sleep disorder. Reducing the number of outcome

220 variable categories thus increases the number of cases per cell. Sleep disorder was a

221 significant predictor of PD frequency category, even after accounting for the effects of  
 222 demographic variables and sleep cluster,  $b = 0.752$ ,  $SE = 0.33$ ,  $p = .021$ ,  $OR = 2.12$ , 95% CI  
 223 [1.12, 4.04]. This result provides further support for H4 that sleep patterns are related to  
 224 experience of precognitive dreams.

225

226 Table 6 *Summary of ordinal regression of demographic variables, sleep cluster and sleep*  
 227 *medication use on PD frequency*

Predictor	$b$	$SE$	$p$	OR [95% CI]
Gender	-0.169	0.16	.279	0.84 [0.62, 1.15]
Age	0.041	0.01	$2 \times 10^{-11}$	1.04 [1.03, 1.06]
Education	-0.163	0.02	$10^{-12}$	0.85 [0.81, 0.89]
Cluster 2	-0.393	0.18	.033	0.68 [0.47, 0.97]
Cluster 3	-0.973	0.19	$4 \times 10^{-7}$	0.38 [0.26, 0.55]
Sleep meds	0.446	0.19	.016	1.56 [1.08, 2.24]

228

### 229 3.2.3. PD frequency and sleep medication

230 Finally, we investigated the role of sleep medication in PD experience (H5). Firstly, we  
 231 compared the distributions of responses on the PD frequency variable between those who  
 232 reported having used sleep medication and those who did not. The distributions differed  
 233 significantly,  $\chi^2(5) = 17.454$ ,  $p = .003$ . Table 5 shows the proportions of responses within the  
 234 individual sleep medication use groups.

235 Secondly, we controlled for the effects of demographic variables and sleep cluster by  
 236 including them, along with the binary sleep medication variable into a multiple ordinal  
 237 regression with PD frequency included in the model as outcome. As shown in Table 6, the

238 effect of sleep medication, as well as sleep cluster, on PD frequency remained significant.

239 This result was consistent with H5.

#### 240 4. Discussion

241 The present study investigated the relationships between belief in, and experience of,  
242 putatively precognitive dreams and various demographic and sleep-related variables. Five  
243 hypotheses were tested.

244 The first three hypotheses postulated a relationship between gender, age, and years of  
245 completed formal education on the one hand and PD belief and experience on the other.  
246 Consistent with previous literature (Haraldsson, 1985), women were more likely to believe in  
247 the reality of PDs as well as to report a first-hand experience of them than men. Furthermore,  
248 contrary to some previous findings (Schredl, 2009), both PD belief and experience were  
249 positively related to age. It could be argued that a longer life means a greater chance of  
250 having a subjectively precognitive dream and thus a greater likelihood of espousing PD  
251 belief. However, this interpretation does not account for the positive relationship between age  
252 and reported PD frequency, unless this kind of self-report is at least partly driven by belief.  
253 Since attitudes have been shown to inflate self-reported dream recall frequency (Beaulieu-  
254 Prévost, & Zadra, 2005), this is certainly a possibility. Further research should address this  
255 issue. We also found that the number of completed years of education was negatively related  
256 to both PD belief and experience. However, when predicting only the variance not shared  
257 between PD belief and experience, gender and education were not related to the former, while  
258 gender and age were not predictive of the latter. This suggests that the detected gender  
259 differences lie in the overlap of PD belief and experience, while age is primarily related to  
260 PD belief and education primarily to PD experience. These findings demonstrate the value of

261 treating paranormal belief and experience as separate constructs with their own respective  
262 underlying factors.

263 In the light of the cognitive deficit hypothesis of paranormal belief (Alcock, 1981), the  
264 relationship between education and PD experience may be taken to suggest that more  
265 educated people are more likely to scrutinise their experiences. This is certainly plausible;  
266 cognitive ability has been shown to correlate positively to critical thinking and negatively to  
267 biases in probability judgement (Liberali, Reyna, Furlan, Stein, & Pardo, 2012; West, Toplak,  
268 & Stanovich, 2008; but see Stanovich & West, 2008) and education has been shown to  
269 correlate with general cognitive ability (Ritchie, Bates, Der, Starr, & Deary 2013). On the  
270 other hand, using formal education as a proxy for cognitive/critical thinking ability is  
271 potentially problematic (Deary & Johnson, 2010). Therefore this result should be treated with  
272 caution when used as support for the cognitive deficit hypothesis. It nevertheless provides a  
273 good basis and rationale for future research using more direct measures of cognitive ability  
274 and critical thinking. Future investigation of the relationship between these variables and  
275 specific paranormal experiences may help to resolve the inconclusive results obtained from  
276 studying the conceptually ill-differentiated composite of general paranormal belief and  
277 experience (French & Wilson, 2007).

278 We also hypothesised a relationship between the frequency of PD experience and  
279 patterns of sleep-related behaviour. We identified three clusters of participants based on their  
280 responses on sleep-related variables. One exhibited a somewhat erratic sleep pattern with a  
281 relatively high frequency of nocturnal awakenings and diurnal naps and a lower overall sleep  
282 quality. This cluster also reported a high dream recall frequency. Dream recall was also a  
283 main characteristic that distinguished the other two clusters, although there were smaller yet  
284 statistically significant differences in most of the measured sleep variables. The results  
285 showed that, controlling for demographic variables, participants in the “erratic” cluster



286 reported the highest PD frequency and those in the low dream recall cluster reported having  
287 PDs least often. This was further supported by the finding that the presence of a sleep  
288 disorder diagnosis was a significant predictor of PD frequency.

289 Finally, we hypothesised a relationship between PD experience and sleep medication  
290 use. We found that participants who used sleep medication in the past reported a higher  
291 frequency of PDs than those who never used it. Furthermore, those in the “erratic” sleep  
292 cluster were more likely to have used sleep medication than participants in the other two  
293 clusters. This validates our interpretation of the extracted clusters since it can be expected  
294 that people with disturbed sleep are more likely to use sleep medication. However, the  
295 findings suggest that sleep medication use has an additive effect beyond that of the sleep  
296 clusters.

297 These results are consistent with the hypothesis that PD experience may arise as a result  
298 of an individual’s processing of external stimuli during borderline sleep states (Alcock,  
299 1981). An erratic sleep pattern and associated increased likelihood of sleep medication use  
300 means more frequent hypnagogic and hypnopompic states and thereby a heightened  
301 likelihood of external stimuli being processed. Such stimuli can then figure in the narrative of  
302 one’s dreams. If one is then confronted again with the same stimuli after awakening, this can  
303 lead to the impression of precognition.

304 Alternatively, given that the present study employs self-report measures, it is also  
305 possible that these results reflect a tendency of certain people to exaggerate their sleep  
306 difficulties and over-report extraordinary experience. If so, one would expect to find a  
307 relationship between PD experience and variables such as anxiety, depression, or narcissism.  
308 To the best of our knowledge, there has been only one study into the role of neuroticism in  
309 PD frequency and it did not find a significant result (Schredl, 2009). As for the other traits,  
310 there appears to be no research linking them to PD experience. More research on this topic is

311 therefore needed. Exploring the aforementioned variables could help to adjudicate between  
312 the two interpretations of the link between PD experience and sleep characteristics.

313       There are some limitations to our findings. Firstly, the sample used in the study may not  
314 be representative of the general population and was not obtained using random sampling.  
315 However, an effort was made to recruit a broad range of participants of differing backgrounds  
316 and beliefs. However, the sample may nevertheless have been biased. There was, for  
317 instance, a preponderance of males in one of the sleep clusters, despite males being slightly  
318 underrepresented in the sample as a whole. Since the cluster in question included the most  
319 disbelievers in PDs, this gender distribution may reflect the fact that some of the strong  
320 disbelievers were recruited via online forums dedicated to scepticism. These forums tend, in  
321 general, to be rather male-dominated. Moreover, using online forums and interest groups  
322 dedicated to the paranormal may have led to overrepresentation of PD believers/experiencers  
323 in comparison to the general population. Thus, the frequency of PD belief and experience in  
324 our sample should not be viewed as representative of the distribution of these variables in the  
325 general population.

326       As noted above, there are relationships between PD belief, experience and their  
327 correlates, whose nature remains unclear. Further research should clarify the issues identified  
328 here. Especially welcome would be the employment of longitudinal design and the inclusion  
329 of personality and psychopathology measures. Exploring differences in individuals' attitudes  
330 towards their PD experiences could also provide novel insights into the psychology of these  
331 experiences.

332       In conclusion, the present study identified several correlates of PD belief and  
333 experiences, some of which had not been previously explored. The main findings are that PD  
334 experience is negatively related to education and that a higher frequency of PDs is associated  
335 with somewhat erratic sleep patterns and a heightened likelihood of sleep medication use.

336 Further research in this field is highly encouraged since, in light of the often inconclusive  
 337 findings in the area of psychology of extraordinary beliefs and experiences, exploring the  
 338 underlying mechanisms of specific phenomena seems to be the conceptually strongest  
 339 strategy to elucidate why these kinds of beliefs and experiences remain so prevalent in the  
 340 general population.

## 341 5. References

- 342 Agorastos, A., Metscher, T., Huber, C. G., Jelinek, L., Vitzthum, F., Muhtz, C., ... & Moritz,  
 343 S. (2012). Religiosity, magical ideation, and paranormal beliefs in anxiety disorders and  
 344 obsessive-compulsive disorder: a cross-sectional study. *The Journal of Nervous and*  
 345 *Mental Disease, 200*(10), 876-884.
- 346 Alcock, J. E. (1981). *Parapsychology: Science or Magic?* Oxford: Pergamon.
- 347 Auton, H. R., Pope, J., & Seeger, G. (2003). It isn't that strange: Paranormal belief and  
 348 personality traits. *Social Behavior and Personality: an international journal, 31*(7),  
 349 711-719.
- 350 Beaulieu-Prévost, D., & Zadra, A. (2005). Dream recall frequency and attitude towards  
 351 dreams: a reinterpretation of the relation. *Personality and Individual Differences, 38*(4),  
 352 919-927.
- 353 Bender, H. (1966). The Gotenhafen case of correspondence between dreams and future  
 354 events: A study of motivation. *International Journal of Neuropsychiatry, 2*, 398-407.
- 355 Buysse, D. J., Reynolds III, C. F., Monk, T. H., Berman, S. R., & Kupfer, D. J. (1989). The  
 356 Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research.  
 357 *Psychiatry Research, 28*(2), 193-213.

## INDIVIDUAL DIFFERENCES IN PROPHETIC DREAM BELIEF AND EXPERIENCE

- 358 Deary, I. J., & Johnson, W. (2010). Intelligence and education: causal perceptions drive  
359 analytic processes and therefore conclusions. *International Journal of*  
360 *Epidemiology*, 39(5), 1362-1369.
- 361 Dudley, R. T. (2000). The relationship between negative affect and paranormal  
362 belief. *Personality and Individual Differences*, 28(2), 315-321.
- 363 French, C. C., & Stone, A. (2013). *Anomalistic psychology: Exploring paranormal belief*  
364 *and experience*. Palgrave Macmillan.
- 365 French, C. C., & Wilson, K. (2007). Cognitive factors underlying paranormal beliefs and  
366 experiences. In S. Della Sala (Ed.), *Tall tales about the mind and brain. Separating fact*  
367 *from fiction* (pp. 380-398). Oxford: Oxford University Press.
- 368 Haraldsson, E. (1981). Some determinants of belief in psychical phenomena. *Journal of the*  
369 *American Society for Psychical Research*, 75(4), 297-309.
- 370 Haraldsson, E. (1985). Representative national surveys of psychic phenomena. *Journal of the*  
371 *Society for Psychical Research*, 53, 145-158.
- 372 Hoelscher, T. J., Klinger, E., & Barta, S. G. (1981). Incorporation of concern-and  
373 nonconcern-related verbal stimuli into dream content. *Journal of Abnormal*  
374 *Psychology*, 90(1), 88-91.
- 375 Liberali, J. M., Reyna, V. F., Furlan, S., Stein, L. M., & Pardo, S. T. (2012). Individual  
376 differences in numeracy and cognitive reflection, with implications for biases and  
377 fallacies in probability judgment. *Journal of Behavioral Decision Making*, 25(4), 361-  
378 381.
- 379 Pagel, J. F., & Helfter, P. (2003). Drug induced nightmares—an etiology based  
380 review. *Human Psychopharmacology: Clinical and Experimental*, 18(1), 59-67.

## INDIVIDUAL DIFFERENCES IN PROPHETIC DREAM BELIEF AND EXPERIENCE

- 381 Pagel, J. F., & Parnes, B. L. (2001). Medications for the treatment of sleep disorders: an  
382 overview. *Primary Care Companion to the Journal of Clinical Psychiatry*, 3(3), 118.
- 383 R Core Team (2012). *R: A language and environment for statistical computing*. R Foundation  
384 for Statistical Computing, Vienna, Austria. ISBN 3-900051-07-0, URL [http://www.R-](http://www.R-project.org/)  
385 [project.org/](http://www.R-project.org/).
- 386 Rattet, S. L., & Bursik, K. (2001). Investigating the personality correlates of paranormal  
387 belief and precognitive experience. *Personality and Individual Differences*, 31(3), 433-  
388 444.
- 389 Ritchie, S. J., Bates, T. C., Der, G., Starr, J. M., & Deary, I. J. (2013). Education is associated  
390 with higher later life IQ scores, but not with faster cognitive processing  
391 speed. *Psychology and Aging*, 28(2), 515.
- 392 Roe, C. A., & Morgan, C. L. (2002). Narcissism and belief in the paranormal. *Psychological*  
393 *reports*, 90(2), 405-411.
- 394 Schredl, M. (2009). Frequency of precognitive dreams: Association with dream recall and  
395 personality variables. *Journal of the Society for Psychical Research*, 73(2), 91-90.
- 396 Sharps, M. J., Matthews, J., & Asten, J. (2006). Cognition and belief in paranormal  
397 phenomena: Gestalt/feature-intensive processing theory and tendencies toward ADHD,  
398 depression, and dissociation. *The Journal of Psychology*, 140(6), 579-590.
- 399 Stanovich, K. E., & West, R. F. (2008). On the relative independence of thinking biases and  
400 cognitive ability. *Journal of Personality and Social Psychology*, 94(4), 672.
- 401 Tobacyk, J. J., & Mitchell, T. E. (1987). Out-of-body experience status as a moderator of  
402 effects of narcissism on paranormal beliefs. *Psychological Reports*, 60(2), 440-442.

## INDIVIDUAL DIFFERENCES IN PROPHETIC DREAM BELIEF AND EXPERIENCE

- 403 Valášek, M., Watt, C., Hutton, J., Neill, R., Nuttall, R., & Renwick, G. (2014). Testing the  
404 implicit processing hypothesis of precognitive dream experience. *Consciousness and*  
405 *Cognition*, 28, 113-125.
- 406 Ward, J. H., Jr. (1963). Hierarchical grouping to optimize an objective function. *Journal of*  
407 *the American Statistical Association*, 58, 236–244.
- 408 Watt, C., Ashley, N., Gillett, J., Halewood, M., & Hanson, R. (2014). Psychological factors  
409 in precognitive dream experiences: The role of paranormal belief, selective recall and  
410 propensity to find correspondences. *International Journal of Dream Research*, 7, 1-8.
- 411 Watt, C., Wiseman, R., & Vuillaume, L. (in press). Dream precognition and sensory  
412 Incorporation: A controlled sleep laboratory study. *Journal of Consciousness Studies*.
- 413 West, R. F., Toplak, M. E., & Stanovich, K. E. (2008). Heuristics and biases as measures of  
414 critical thinking: Associations with cognitive ability and thinking dispositions. *Journal*  
415 *of Educational Psychology*, 100(4), 930.
- 416 Wiseman, R., & Watt, C. (2006). Belief in psychic ability and the misattribution hypothesis:  
417 A qualitative review. *British Journal of Psychology*, 97(3), 323-338.