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## PRECOGNITIVE DREAMING: INVESTIGATING ANOMALOUS COGNITION AND PSYCHOLOGICAL FACTORS<sup>1</sup>

BY CAROLINE WATT

**ABSTRACT:** This online dream precognition study examined variables, both psychological and parapsychological, that have been proposed to contribute to precognitive dream experiences. 50 participants each contributed four trials, where the task was to dream about a video clip that they would later view. Independent judges were used to score the correspondence between dreams and the target pool. No support was found for the hypothesis that individuals who are intolerant of ambiguity would report greater correspondence between their dreams and subsequently viewed target video clips. A relationship was found between the participants' prior confidence that their dreams would relate to the future target and actual perceived similarity between the target and dreams; however, there was no relationship between perceived similarity and judges' actual hit rates or similarity ratings. The test of the precognition hypothesis obtained above-chance scoring (32% hit rate) on the planned direct hits measure. Obvious methodological artifacts are ruled out, and the discussion concludes with an exploration of whether the judges' ratings also support the dream precognition hypothesis.

*Keywords:* precognitive dreaming, precognition, precognitive dream experiences, ambiguity tolerance

Surveys of the general population show that reports of psi-related experiences such as apparent clairvoyance, telepathy, and precognition are common throughout the world. For example, a 1987 survey published by the University of Chicago's National Opinion Research Center canvassed nearly 1,500 adult Americans, of whom 67% claimed psi-related experiences (Greeley, 1987). Precognition—seemingly knowing about an event that has yet to take place—was reported by approximately one third of respondents in a recent survey of 1000 Britons (Pechey & Halligan, 2012).

Dreams seem to play a particularly important role in precognitive experiences. A review of the various surveys of spontaneous GESP experiences concludes that, if only precognitive cases are considered, around 60% involve dreams, with a further 10% involving “borderland” states (Van de Castle, 1977). Therefore, the vast majority of spontaneous precognitive experiences involve dreams or sleep-related states. Death is a predominant theme in precognitive dreams, followed by accident and injury; percipients are predominantly female (e.g., Green, 1960; Saltmarsh, 1934), although reporting bias may account for both of these trends.

When considering possible explanations for spontaneous paranormal experiences, researchers often either consider a paranormal interpretation, or one of several possible psychological explanations, although these are not mutually exclusive categories.

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<sup>1</sup> An earlier version of this paper was presented at the 2011 Conference of the Society for Psychical Research in Edinburgh, September 3–5.

Researchers tend to turn to controlled laboratory settings to test the psi hypothesis. Only a minority of laboratory dream ESP studies have investigated precognition, which is perhaps odd given the prevalence with which spontaneous dream precognition experiences are reported. Controlled laboratory studies of dream ESP took off from 1962, after psychiatrist Montague Ullman established a dream laboratory at the Maimonides Medical Center in Brooklyn, New York (Krippner, 1993; Ullman et al., 1973, 1989). Thirteen formal dream ESP studies (11 telepathy, 2 precognition) were conducted at the lab before it closed in 1978, the majority of which obtained medium to large positive effect sizes (Sherwood & Roe, 2003). A review of the 21 post-Maimonides dream ESP studies identified that, for the majority of them, the research environment had moved from the relatively expensive and time-consuming sleep laboratory to participants' own homes (Sherwood & Roe, 2003). The studies had a modest combined effect size ( $r = .14$ )—significantly less than for the Maimonides studies, but still regarded as “successful” by Sherwood and Roe, who expressed the hope that dream ESP research would be “re-awakened.”

Turning to possible psychological factors underlying paranormal experiences, Blackmore and Moore (1994) proposed that paranormal believers and disbelievers might have different cognitive styles. They tested this idea by presenting participants with ambiguous pictures and found that believers guessed the identity of the picture earlier than disbelievers, though the believers were more often incorrect in these guesses. In this study, therefore, believers tended to rapidly evaluate the ambiguous stimuli and, compared to disbelievers, set a lower criterion for identifying these patterns. This propensity seems related to intolerance of ambiguity, which is conceptualised as a form of premature closure achieved through a tendency to resort to clear-cut solutions in ambiguous situations (Frenkel-Brunswick, 1949). Houran and Williams (1998) explored the relation between ambiguity tolerance and specific paranormal experiences using Kumar, Pekala and Gallagher's (1994) Anomalous Experiences Inventory and MacDonald's (1970) Ambiguity Tolerance scale. They reported that there was a small but *positive* correlation between experiences involving internal or physiological experiences, such as precognitive dreams, visual apparitions, and out-of-body experiences, and tolerance for ambiguity. This finding seems to be inconsistent with Blackmore and Moore's (1994) conclusion, leading Houran and Williams (1998) to suggest that variability in the measures used across different studies may contribute to the equivocal association between ambiguity tolerance and paranormal beliefs and experiences. They called for further work on this question.

The present paper describes work that answers colleagues' calls and build upon both of these lines of investigation. Researchers are now able to present stimuli and collect data rapidly from participants online, something that is particularly practical when investigating dream precognition. Sleeping in their own homes, the participants kept dream diaries and used a website to complete questionnaires and submit dream summaries and ratings at times that were convenient to them. Email was used to coordinate and communicate with participants; target feedback was rapidly given via YouTube. Participants were asked to complete questionnaire measures concerning their precognitive dream experience, dream recall, and tolerance of ambiguity. Their task was then to dream about a target video clip that would subsequently be sent to them. They submitted a weekly dream summary that was rated for similarity with randomly-chosen

target pools by independent blind judges. Independent judges were used because if participants were to be judges, they would see all target possibilities; therefore, their dreams could in theory precognise one of the decoy targets. Having participants only view their designated target video was, one felt, a way to “focus” any precognition on the target. After the judges had made their ratings, a target video clip was randomly selected and sent to participants, who were not informed of the judges’ ratings. After viewing the target clip, participants were asked to rate it for similarity with their dreams.

Two hypotheses were proposed. First, to test the idea that dreams can contain unpredictable information about future events, it was hypothesised that there would be significantly more direct hits than chance, based on the independent judges' ranks of the target and three decoy clips. Second, to explore the psychological factor of ambiguity tolerance, which has been proposed to contribute to precognitive dream experiences (Blackmore & Moore, 1994), it was hypothesized that there would be a negative correlation between ambiguity tolerance and the participants' target clip similarity ratings.

### **Method**

The study was approved by the University of Edinburgh's Psychology Department ethics panel.

#### **Participants**

Participants were recruited through posts on Twitter, by email sent to former participants of an online parapsychology course led by CW, through the KPU website, from amongst acquaintances of the authors, and by word of mouth. Individuals were invited to volunteer if they were interested in their dreams (precognitive or otherwise) and able to recall their dreams. The co-experimenter (MV) sent participants detailed information on the study prepared by CW. Volunteers received no financial reward for participating in the study.

#### **Independent Judges**

Two individuals who had an interest in parapsychology (a psychology PhD student and a psychology undergraduate student) acted as independent judges. They were each paid for their work as judges. Because they had no previous experience in judging, they were given guidelines on free-response ESP judging (Delanoy, Morris, & Watt, 2004).

#### **Materials**

Participants provided three types of information via online questionnaires: demographics, beliefs, and ambiguity tolerance measures; a dream summary and confidence ratings; and similarity ratings.

**Questionnaire 1: Initial questionnaire.** The initial questionnaire consisted of two parts. In the first, demographic, part the participants indicated:

1. Age and sex.
2. Frequency of dream recall: “How often have you recalled your dreams recently (in the past several months)?” Response options for the latter were “never,” “less than once a month,” “about once a month,” “two or three times a month,” “about once a week,” “several times a week” and “almost every morning.” This scale was developed by Schredl (2004), who reports a high test-retest reliability over approximately 70 days,  $r(196) = .85$ . Scores could range from 0 to 6, with higher scores denoting more frequent dream recall.
3. Belief in precognitive dreaming: “Do you believe that some individuals have dreams that predict future events, and that are not just coincidence?” Bender’s (1966) five criteria for judging a dream as precognitive were provided to participants, along with parenthetical explanations where appropriate, in order to ensure conceptual clarity: (a) the dream must be recounted or recorded before its fulfilment (e.g., was it written down or described to another person before it “came true?”); (b) the dream must include enough details to render chance coincidence unlikely; (c) the possibility of inference from actual knowledge must be excluded (i.e., the dream must refer to an unexpected or unpredictable event); (d) self-fulfilling prophecies must be excluded (i.e., you could not make the dream “come true” through your own actions after the dream); and (e) telepathic influences should not be able to explain the occurrence of the precognitive dream (i.e., no one else could know the information in the dream at the time that you had the dream). The response options were “yes,” “no,” and “unsure.”
4. Frequency of precognitive dream experience: “Based on the five criteria above, please indicate approximately how often you have had a precognitive dream over the last few years.” Response options were “never,” “less than once a year,” “about once a year,” “about once in six months,” “about once a month,” and “about once a week.” Scores could range from 0 to 5, with higher scores denoting more frequent experiences.

The second part of the initial questionnaire consisted of the Revised Scale for Ambiguity Tolerance (AT-20; MacDonald, 1970). It is a 20-item first-person statement inventory. A sample item is: “A problem has little attraction for me if I don’t think it has a solution,” with “true” and “false” as response options. The scale includes 15 reverse-scored items. Scores on this scale can in theory range from 0 to 20, with higher scores indicating higher tolerance for ambiguity. MacDonald reports high internal consistency of .86, adequate test-retest reliability ( $r = .73$ ), and satisfactory stability over six months ( $r = .63$ ). However, in the present sample the internal consistency of the scale was somewhat lower ( $\alpha = .66$ ). After the exclusion of three negatively or weakly correlated items (items 4, 5 and 7), the internal consistency rose to  $\alpha = .72$ . This trimmed version of the scale was used for further analysis.

At the conclusion of the initial questionnaire, participants were instructed to take note of their dreams over the following 5 mornings. They were informed that after 5 days they would be sent a link to a questionnaire asking for an anonymous summary of their week’s dreams. They were reminded that: “after we have received your dream

summary you will be sent a ‘target’ video clip to view. Every night, before you go to sleep, please take a few moments just to gently remind yourself that your dreams during the night will be linked to the target clip you are going to watch after we have received your dream summary.”

**Questionnaire 2: Dream summary form.** This form, which participants were provided with after 5 days, consisted of three items:

1. Participants’ weekly dream report: “Please type in the space below an anonymous summary (max 300 words) of your remembered dreams over the past 5 days. Include not only descriptions of main content and themes that emerged in your dreams, but details such as emotional tone and the impact of the dream. You do not need to write anything that you would find embarrassing or that would make you uncomfortable to write. Please don't provide any personally identifying details.”
2. Confidence rating: “Please rate how confident you are that your dreams over the past 5 days will relate to the target video clip that you will shortly be sent.” Response options were “not at all confident,” “not very confident,” “somewhat confident,” “very confident,” and “completely confident.” Scores could range from 1–5, with higher ratings denoting higher confidence. Participants were also asked to explain why they chose their particular confidence rating.

**Questionnaire 3: Similarity rating form.** After participants had been sent a link to their target video, they were asked to “indicate how much similarity you feel there is between your submitted dream summary for this week and your target video clip for this week. Please bear in mind not just dream content, but associated themes and emotions.” Participants typed in a number between 1 and 100, where 1 = no similarity and 100 = complete similarity.

### **Target Pool**

The stimulus pool consisted of 68 short (around 1 min) video clips divided into 17 target pools of four orthogonal videos, each uploaded to YouTube. The target clips were digitized from a pool used in KPU ganzfeld-ESP research that had obtained positive psi results (e.g., Dalton, 1997; Morris, Dalton, Delaney, & Watt, 1995). The pool included scenes from films, nature documentaries, and music videos. There had originally been 18 target pools (i.e., 72 video clips), but one was withdrawn prior to the commencement of the study after a copyright query was raised by YouTube.

### **Random Number Generator**

For random selection of the target pools and targets an RNG function from the website RANDOM.ORG was used. It generates numbers based on atmospheric noise and is therefore a true random source. It is more appropriate for a precognition study than a pseudo-random source, because it rules out the possibility of clairvoyance.

## Procedure

The initial questionnaire, along with the two forms, was published online using the Google Forms service. Participants could therefore complete the online questionnaire and forms after being sent the appropriate URL. The target pool was uploaded to a YouTube channel and marked as unlisted, so that targets were accessible only via a particular URL.

The experimenters and judges took part in pilot trials to refine and test the protocol. The results of the pilot trials are not included in this report.

The study consisted of 200 trials (preplanned as four trials each from 50 participants). For security reasons, the target for any one trial was randomly selected and sent to participants only *after* the independent blind judge had submitted his rating of the four randomly chosen target pool videos against the dream summary for that trial. Therefore, there could be no leakage of target information, either from the randomiser to the judges or from the participants to the judges.

Each participant was assigned by MV to one of the two judges and was sent a hyperlink to the initial questionnaire. Participants had no contact with the judges, nor were they aware of the judges' identity; likewise, the judges were unaware of the participants' identities. After completing and submitting the initial questionnaire, the participants were informed that their 5-day dream collection period had commenced. On the fifth night they were sent an email informing them that the dream collection period was about to end and that their first dream summary was due the next morning. They were also sent a hyperlink to the dream summary form. Upon receiving the dream summary from a participant, MV randomly selected a target pool for that participant (one of the 17) and sent the anonymised dream report along with the URLs of the target pool videos to the judge. Within each target pool, the number of the clip determined the position in which its URL would be presented to the independent judges. So, for target pool 1, clip 1-1 would be first in the list of four URLs, clip 1-2 second, 1-3 third, and 1-4 fourth. Judges could (and did) review the four clips in whatever order they chose, and could (and did) view the clips more than once during the judging process for any particular trial.

The judges were instructed to provide a percentage rating of the similarity between each of the four videos in a given target pool and the contents of the dream summary, as well as a ranking of the videos based on these ratings (rank 1 = greatest similarity, rank 4 = least similarity). No tied ratings were permitted, and a hit was defined as a rank of 1 corresponding to the designated target. They subsequently emailed their judgements to MV in an attached file. MV then, without viewing the judgements, randomly selected a target video from the given pool and sent its URL to the participant via email. The participants were also instructed to follow a hyperlink to the dream similarity rating form upon viewing the target videos.

Two to 3 days after receiving the participants' similarity rating, MV informed the participants by email that the second dream collection period was commencing and the procedure repeated itself. Altogether, for each participant, four trials were conducted over approximately a 4-week period. Throughout the study, the participants were

thanked for their involvement and indirectly encouraged to continue. Participants who failed to submit either of the forms were sent a gentle reminder to do so.

At the conclusion of the study, as soon as data had been checked and analyses had been completed, participants were sent a short summary of the overall study results. They were not informed of the outcome of their judge's ratings while the study was underway.

## Results

A total of 99 volunteers were sent the link to the initial questionnaire. Twenty-two of them did not return a completed questionnaire so did not proceed with the study. Recruitment continued until 50 participants (20 males, 30 females; mean age 42.8, range 21–82 years,  $SD = 14.41$ ) had completed four trials each. Twenty-one others dropped out of the study before completing four trials; 6 completed four trials after the pre-planned  $N$  of 50 participants had been reached. Data for these 27 participants are not included in this report. Prior to analysis, the scoring of the questionnaire measures was independently checked for possible errors, as was the recording of the study's psi results (both the judges' ratings and rankings, and the subsequent assignment of each trial as a hit or miss).

### Descriptive Statistics

Table 1 shows  $M$ ,  $SD$ ,  $N$  and range of scores on the principal questionnaire measures.

**Dream recall.** A large proportion of participants (50%) reported that they recalled their dreams several times a week, followed by almost every morning (28%), about once a week (10%), two or three times a month (8%), once a month (2%), and less than once a month (2%). As participants needed to be able to remember their dreams to successfully participate in the study, it was reassuring that the majority (88%) remembered their dreams at least once per week.

**Precognitive dream belief.** Having been asked to use Bender's (1966) criteria for evidentiality, most participants (66%) expressed a belief that individuals could have precognitive dreams, 26% were unsure, and 8% did not believe in precognitive dreams. Thus, the sample was skewed towards individuals believing in precognitive dreams. Because there were so few disbelievers in the sample (4 out of 50), no attempt was made to compare disbelievers and believers on the other study measures.

**Precognitive dream experience.** Twenty-eight percent of participants indicated that they had never had a precognitive dream experience (again, as defined by Bender's criteria), 26% less than once a year, 14% about once a year, 16% about once in 6 months, 12% about once per month, and 4% about once a week. Thus, the majority of participants (72%) reported having had at least one prior precognitive dream experience that would be considered evidential.

**Confidence ratings.** Participants were not particularly confident that their dream summaries would relate to the future target video (mean rating 2.04 on a scale from 1–5). Participants who gave low confidence ratings reported that they did so either because they did not believe in dream precognition, or because their own precognitive dreams were more personal and they did not think their dream would relate to a randomly selected target video.

**Similarity ratings.** Following feedback about the target video identity, participants' similarity ratings suggested that they saw little similarity between their dream summaries and the target videos (mean rating 15.15 on a 1–100 scale).

## Main Analyses

**Dream precognition (Hypothesis 1).** Direct hits analysis was planned (rather than, for instance, sum-of-ranks, binary hits where rankings or ratings in the top half = binary hit and in the bottom half = binary miss, or  $z$ -score based on judges' ratings), firstly because Child's (1985) meta-analysis of Maimonides dream-ESP studies used direct-hits outcome measure to allow comparison between studies, and secondly because participants only viewed the target videos so it was predicted that any precognitive dream content would focus on these videos. As it turns out, the decision to base analyses on hits rather than ratings did not disadvantage the psi hypothesis: judges' ratings of the targets and decoys did not show elevated ratings for the target video clips relative to decoy clips, Mann-Whitney  $U = 56073.5$ ,  $p = .16$ , two-tailed. Sixty-four hits were obtained out of 200 trials, giving a 32% hit rate. Using an exact binomial test, this result is significant,  $z = 2.21$ ,  $p = .015$ , one-tailed,  $ES (z/N^{1/2}) = 0.16$ . Thus, Hypothesis 1 was supported.

**Ambiguity tolerance and similarity ratings (Hypothesis 2).** The Mean AT score was 11.02, range = 3–17,  $SD = 3.57$ . Contrary to expectation, there was no significant relationship between AT and participants' mean similarity ratings; indeed, the correlation was in the direction opposite to that predicted,  $r_s(48) = .158$ ,  $p = .27$ , two-tailed. Therefore, Hypothesis 2 was not supported.

## Exploratory Analyses

**Independent judges.** There was little difference between the hit rates obtained by the two judges (Judge 1, 26 hits out of 84 trials, 31.0%; Judge 2, 38 hits out of 116 trials, 32.8%), as confirmed by an independent groups  $t$  test comparing the judges' mean numbers of hits per participant,  $t(48) = 0.32$ ,  $p = .75$ , two-tailed.

**Prior dream recall, precognitive experience, confidence and similarity ratings.** Older participants tended to report having had more precognitive experiences than younger participants,  $r_s(48) = .29$ ,  $p = .04$ , two-tailed. Also, as one might expect, there was a significant tendency for participants reporting greater numbers of prior precognitive experiences to give higher ratings of confidence that their dream reports would contain material relating to the future target video,  $r_s(48) = .32$ ,  $p = .02$ , two-tailed. However, as these two relationships were not predicted, and as several correlations were

calculated for the psychological variables (see Table 2), it would be wise to regard them as only tentative, in need of replication.

After receiving feedback of the target video's identity and giving it a rating for similarity to their previously-submitted dream report, participants who had previously given higher confidence ratings tended also to give higher similarity ratings,  $r_s(48) = .41$ ,  $p = .003$ , two-tailed. However, there was little relationship between these ratings and actual psi performance: the correlation between confidence ratings and hit rate was slightly negative  $r_s(48) = -.14$ ,  $p = .34$ , two-tailed, and there was no correlation between hit rate and similarity ratings  $r_s(48) = .03$ ,  $p = .86$ , two-tailed.

Self-reported prior dream recall did not significantly correlate with precognitive dream experience, confidence ratings, similarity ratings, or hit rate. Ambiguity Tolerance also did not correlate with any of these variables. Table 2 gives the full matrix of correlations for the variables reported here.

I also explored whether the participants may have given higher similarity ratings to the target clips than the judges, perhaps because the participants were better able to recognise their own dream content in the targets than the judges were. Although participants' mean ratings were slightly higher than those of the judges, this was primarily attributable to a small number of "outlier" similarity ratings above the mid-point of the scale. The vast majority of ratings by judges and participants were strongly skewed towards the bottom end of the 100-point scale (judges' median rating 4.5,  $SD = 12.35$ ; participants' median rating = 5.0,  $SD = 21.67$ ); a weak but significant correlation was also found between judges' and participants' similarity ratings,  $r_s(198) = .14$ ,  $p = .04$ , two-tailed.

## Discussion

The majority of individuals who took part in this study reported that they believed in precognitive dreaming, had experienced an evidential (according to Bender's criteria) precognitive dream personally at least once in their lifetime, and were able to recall their dreams at least once per week. So, on the face of it, this sample would seem to be appropriate for a dream precognition study.

The study hypotheses explored two types of explanation for precognitive dream experiences: psychological and paranormal. For the first type, it has been proposed that individuals who are low in tolerance for ambiguity (AT) will be most likely to report that they have spontaneous precognitive dream experiences. The rationale for this prediction, from Blackmore and Moore (1994), is that these individuals will be more inclined to prematurely judge that there are "matches" between their dreams and subsequent events. This hypothesis was tested by correlating AT with the similarity ratings that participants gave to their dream summaries, having received feedback about the target identity. However, the data did not support the prediction of a negative correlation between AT and similarity ratings. A possible explanation of this null finding, other than the nonexistence of the hypothesised relationship, concerns the low internal consistency of the ambiguity tolerance scale. Although the consistency reported by the authors of the scale is good, applied to the present sample the scale's internal consistency index (Cronbach's  $\alpha$ ) did not reach the conventionally acceptable value of .8, even after the exclusion of negatively and weakly correlated items. The present study's finding is more

consistent with Houran and Williams (1998), who reported a small but positive correlation between AT and paranormal experiences, including precognitive dreams; however, they do not report internal consistency for the AT-20. Lange, Schredl, and Houran (2000) have argued that there is some complexity to the relationship between ambiguity tolerance and precognitive dream experience, and they suggest that a nonlinear model may better describe the relationship. Such a model might therefore help to account for the mixed findings so far.

The study results did suggest the operation of psychological mechanisms that can lead to increased subjective experience of precognitive dreams. Participants who had higher confidence tended to report greater levels of similarity between their dreams and the target video, although perceived similarity was not associated with a higher hit rate or actual similarity ratings. So, prior confidence appears to be associated with perceived correspondences between dreams and subsequent events. Some previous research has suggested that frequency of dream recall is a factor likely to create more opportunities for correspondences between dreams and subsequent events to be noticed (e.g., Lange, Schredl, & Houran, 2000). Contrary to this suggestion, the present study found only a weak positive correlation between reported dream recall and prior precognitive experience that did not reach statistical significance. One referee of this paper commented that there may be difficulties in interpreting participants' responses to the dream recall measure (developed by Schredl, 2004) due to the nature of the question, which required retrospective reflection and self-report from participants (rather than, for instance, having them keep a diary and then count how often they remembered their dreams). However, this kind of self-report measure is common in psychological research despite the response bias that can accompany any such measure. Furthermore, Schredl reports high test-retest reliability, which indicates consistency in responses.

I also conducted a controlled test of the hypothesis that individuals' dreams can contain information about unpredictable future events, in other words, that some form of anomalous cognition can occur. Independent judges rated each participant's dream summary for similarity to the contents of a randomly selected pool of four video clips, and then one of these clips was randomly selected as the target and sent to the participant for feedback. Judges gave the highest similarity ratings to the future target clip significantly more often than would be expected by chance, thus supporting the hypothesis. An above-chance hit rate provides evidence for a psi process only if plausible alternative explanations can be ruled out, so these alternative explanations will now be considered.

### **Consideration of Alternative Explanations for the Significant Hit Rate**

1. *Judges were deliberately or unconsciously biased by the experimenter's knowledge of the selected target.* This explanation does not apply because the experimenter did not select the target until after the judges' ratings were made.
2. *The experimenter's target selection was biased by his knowledge of the judges' ratings.* The experimenter did not view the judges' ratings prior to target selection. Furthermore, target selection was done using an online

- random number generator, which would not under normal circumstances be influenced by the experimenter.
3. *Participants leaked information about the target identity to the judges, for example using online social networking sites.* The judges did not know the identity of the participants and, even if they did, the judging was completed before participants were given feedback about the target identity.
  4. *Participants' dream summaries contained cues as to previous weeks' targets that may have leaked information to the judges about the target identity.* The judges rated each trial on the day that the dream summary was received, so the judging was done in real time. This means that dream summaries could contain only information about previous targets that had already been judged. This information would not be useful for the present trial being judged.
  5. *The coordinating experimenter cheated.* The records for each trial were independently checked and verified after the study was concluded. For cheating to apply, one therefore has to adopt an unfalsifiable conspiracy theory, including fraud by the judges and the principal investigator.

These five points demonstrate that the study design precludes the most obvious methodological flaws that might lead to spuriously significant results. Finally, one must consider whether this study's significant hitting may reasonably be attributed to precognitive dreaming on the part of the study participants, or whether some as yet unexplained alternative form of psi or undetected methodological artifact may be at work.

### **Is a Precognitive Dreaming Interpretation Supported by the Study Data?**

The precognitive dreaming hypothesis requires that judges detect a greater degree of similarity between the participants' dreams and the designated target video clips, compared to decoy clips. If this were the case, then one would expect to see three things in the study data. First, one would expect the target clip to be given the highest ranking to a greater than chance extent. The study design prespecified direct hits (based on ranks) as the outcome measure, and a significant outcome was indeed found. This supports the precognitive dreaming hypothesis. Second, one would expect judges' *ratings* for clips designated as the target to be greater than for clips designated as decoys. This would indicate that judges detected greater similarity between dreams and targets than between dreams and decoys. Third, there should be a difference in target versus decoy ratings for hit trials compared to miss trials, because in the hit trials judges presumably select the target because it is more similar to the dream mentation than the decoy clips. Further exploratory analyses of judges' ratings that address the latter two questions will now be presented.

**Analysis of judges' ratings.** The Results section provides a justification for the decision to analyse ranks rather than rating scores (1–100). It also shows that there was no significant difference between the ratings of targets and decoys. However, it could be argued in line with the psi hypothesis that this result could be expected. Even if there was

indeed a communication anomaly, there is no reason to expect all targets to be rated as more similar than decoys; only hits should be particularly salient to judges, due to there being a noticeable similarity between the participant's dream report and the target content. This reasoning, however, is problematic because, by definition, targets have the highest ratings in hit trials. Instead, one can explore the difference between the rating of the videos ranked 1 for hit trials and miss trials. If the saliency hypothesis is true, there should be a difference. However, in the present study, there was no such difference,  $U = 4127.5$ ,  $p = .56$ . Taking this one step further, it could also be argued that it is not the ratings per se that should differ. After all, it is quite possible that salience matters only in the context of other videos in the pool. If all of them are equally similar to the dream, then there is no particular salience for the target, and hence any hits are due to chance. On the other hand, the argument goes, hits obtained due to psi should be characterised by the target standing out from amongst the other video clips in the pool. If this is true, a comparison of the ratio of the rating for the video ranked 1 to the mean rating of the videos ranked 2–4 ( $\text{Rank 1} / \text{mean}(\text{Rank 2} - 4)$ ) between hit and miss trials should reveal a difference. But again, the analysis did not yield significant results,  $U = 4318.5$ ,  $p = .47$ . The analyses reported above suggest that there was nothing qualitatively special about the hits compared to the misses.

In conclusion, on the preplanned direct hits measure, the study outcome is consistent with a precognitive dreaming interpretation. However on the exploratory analyses of ratings, there was no significant difference between the judges' ratings of targets and decoys. Furthermore the ratings for targets that scored a hit were on average no more similar to the dream reports than the ratings for those that did not, whichever way one looks. These latter two observations are inconsistent with an interpretation in terms of precognitive dreaming, and may indicate the presence of nonpsi factors. However at best they can only tentatively qualify the planned outcome measure because (a) they are post hoc, and (b) they may simply indicate that ratings are a less reliable indicator of psi than rankings, for instance because, although they can offer a more fine-grained measure, they may also be more susceptible to extraneous “noisy” influences. As is always the case when a significant outcome is reported in a study using an original method to test the psi hypothesis, this study's findings could be due to chance or an undetected artifact and should therefore be regarded as tentative pending replication.

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Table 1  
*Descriptive Statistics*

	<i>M</i>	<i>SD</i>	Range
Age	42.82 years	14.41	21–82
Dream Recall Frequency (0–6)	4.88	1.10	1–6
Precognitive Dreams Belief (0–2)	1.58	0.64	0–2
Prior Precog. Dream Experience (0–5)	1.70	1.53	0–5
Ambiguity Tolerance (0–20)	11.02	3.57	3–17
Mean Confidence Rating (1–5)	2.04	0.74	1–3.75
Mean Similarity Rating (1–100)	15.15	15.95	0.25–60

*Note.* *N* = 50 in all cases.

INVESTIGATING PRECOGNITIVE DREAMING

Table 2

*Matrix of Spearman Correlations Between Study Variables*

	1	2	3	4	5	6	7
Age	-	-.19	.29*	-.06	-.12	.06	.01
Dream Recall	-.19	-	.16	-.04	.16	-.06	-.07
Precognitive Dream	.29*	.16	-	-.07	-.01	.32*	.07
Experience							
Ambiguity	-.06	-.04	-.07	-	.19	-.04	.16
Tolerance							
Total Hits	-.12	.16	-.01	.19	-	-.14	.03
Mean Confidence	.06	-.06	.32*	-.04	-.14	-	.41**
Mean Similarity	.01	-.07	.07	.16	.03	.41**	-

*Note.*  $N = 50$  in all cases.

\* $p < .05$ , \*\* $p < .01$ , all two-tailed