

## THE EFFECTS OF EXPERIMENTER-PARTICIPANT INTERACTION QUALITIES IN A GOAL-ORIENTED NONINTENTIONAL PRECOGNITION TASK

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**ABSTRACT:** Several recent studies, inspired by psi theories such as Stanford's psi-mediated instrumental response (PMIR) model, have employed a tacit precognition protocol to test the notion that extrasensory perception may be nonintentional. After remarkable initial success, outcomes have been more inconsistent. One possible reason for the observed variability in results is that the studies were conducted by different experimenters. The current study therefore addressed a number of dimensions regarding participants' interaction with either a male or female experimenter. 52 participants took part in 12 nonintentional precognition trials and a positive or negative outcome task contingent on their performance. The total number of precognitive hits was marginally above mean chance expectation but failed to reach statistical significance. There were significant positive correlations between participants' precognition scores and their ratings of the positivity of their interaction with the experimenter, their rapport with the experimenter, and their level of relaxation. There were also notable differences between the two experimenters with respect to the relationships between their participant-experimenter interaction ratings and participants' tacit precognition scores; all correlations were in the predicted direction for the female experimenter, but in the opposite direction for the male experimenter.

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*Keywords:* extrasensory perception, nonintentional precognition, experimenter-participant interaction

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A number of recent studies (Hitchman, Roe, & Sherwood, 2012, 2015; Hitchman, Sherwood, & Roe, 2015; Luke, Delaney, & Sherwood, 2008; Luke & Morin, 2014; Luke, Roe, & Davison, 2008) have focused on the idea that psi may function unconsciously. Such a notion is consistent with Stanford's (1974, 1977, 1982, 1990) psi-mediated instrumental response model, which frames psi as a process that can serve the best interests of an organism by triggering pre-existing mechanisms in response to threats or opportunities in the environment. Stanford has noted that psi-mediated instrumental responses can occur nonintentionally, and he has claimed that an individual becoming aware of certain need-relevant circumstances or exerting a will to manifest an extrasensory effect may in fact be counterproductive to the psi process. The basic paradigm developed by Luke and colleagues, and modified in subsequent studies to assess further predictions of the PMIR model, involves a picture preference task that serves as a test of nonintentional precognition. In this task, participants are presented with a set of four similar images and asked to choose the one they most prefer. Unbeknown to them, immediately after they make their selection, the computer chooses at random one of the images as a target. Trials in which the participant's selection matches the computer's random choice are scored as hits, whereas all other trials are scored as misses. To capture the goal-oriented nature of psi as proposed by Stanford, the protocol includes a subsequent outcome task that is contingent on the participant's precognitive performance. Those whose total number of hits exceeds mean chance expectation (MCE) are rewarded with a pleasant outcome task that involves viewing pleasant images, whereas those who score below MCE are punished with a negative outcome task that involves either presentation of negative images or a boring number-vigilance exercise. Studies employing this paradigm also have given the researchers opportunities to investigate some of the individual difference factors that are predicted by Stanford to influence the sensitivity of an individual to extrasensory information, and, in turn, their propensity to respond in a need-serving manner.

The results of the studies in which Luke served as the principal investigator were very encouraging. Participants in all four of the studies exhibited hit rates that were above MCE, with three of the four studies producing independently significant evidence of nonintentional psi. Compared with an MCE of 2.50 hits, the combined mean hit rate of participants across all four studies was 2.92 ( $SD = 1.46$ ). This corresponds to an effect size of  $ES(r) = .28$ , which is highly significant,  $t(197) = 4.04$ ,  $p = .00008$ , two-tailed. Please note that throughout this paper, effect sizes for  $t$  tests are calculated according to the following formula:

$$ES(r) = \frac{\sqrt{t^2}}{t^2 + df}$$

However, three subsequent studies by Hitchman and colleagues have been more inconsistent, with none yielding significant evidence of a tacit precognition effect. In their first study, intended primarily as a proof of principle replication, participants achieved a hit rate that was in the predicted direction but did not deviate significantly from MCE, giving an effect size that was somewhat smaller than those observed by Luke and colleagues,  $ES(r) = .16$ ,  $t(49) = 1.14$ ,  $p = .13$ , one-tailed (Hitchman et al., 2012). In their second study, which included more substantial methodological refinements, participants scored slightly fewer hits than the mean chance level on the nonintentional precognition task, with a corresponding effect size of  $ES(r) = -.05$  (Hitchman, Roe, et al., 2015). Participants' performance in a third study was suggestive of a tacit psi effect, with an effect size approaching the combined score reported by Luke and colleagues,  $ES(r) = .23$  vs.  $ES(r) = .28$ , just failing to reach a statistically significant level,  $t(48) = 1.62$ ,  $p = .06$ , one-tailed (Hitchman, Sherwood, et al., 2015). As the core of the experimental protocol was generally consistent throughout all these studies, we speculated that the experimenter may be a key variable to be explored in an effort to explain the differing results obtained by the two primary investigators in Luke's and Hitchman's series.

Evidence of the so-called "experimenter effect" has been widely reported in the parapsychological literature (Kennedy & Taddonio, 1976; White, 1976). Early examples of the contrasting results that have been obtained by different researchers working under equivalent conditions were reported by Nicol and Humphrey (1953), Anderson and White (1956, 1957), Van Busschbach (1956), and Bednarz and Verrier (1969). More recently, a series of collaborative studies by Wiseman and Schlitz (1997, 1999; Watt, Schlitz, Wiseman, & Radin, 2005) provided one of the most striking examples of how different parapsychological researchers have obtained divergent results whilst employing exactly the same experimental protocol. Such findings have led to the view that some experimenters appear to be psi conducive and often obtain significant psi effects in their research, whereas others appear to be psi inhibitory and typically fail to find any evidence of psi (Irwin, 1999; Smith, 2003a). Indeed, Rhine and Pratt stated that the experimenter's role is critical to providing "the psychological conditions under which psi can operate" (Rhine & Pratt, 1957, p. 131, cited in White, 1977, p. 274), whilst Murphy (1949) went so far as to say that there never has been a gifted psi subject; rather, he accredited the success or otherwise of participants in psi research to the experimenter and the way he/she sets up the experimental conditions.

Although a number of factors have been proposed to account for the apparent experimenter effect, including experimenter beliefs (see Parker, 1975; Sharp & Clark, 1937; Smith, 2003b; Watt & Baker, 2002; Watt & Brady, 2002; Watt & Ramakers, 2003) and experimenter psi (e.g., Palmer, 1997; Schmeidler, 1997), it is possible that the effect of the experimenter is psychosocial in nature. According to Woodruff and Dale (1950), a key dimension of this psychosocial influence is the interaction style of the experimenter. Building upon this notion, Harris and Rosenthal (1985) and Rosenthal (1966) suggested that the personality and behaviour of the experimenter may play a role in motivating participants or providing subtle clues about the expected outcomes of the experiment. Evidence for this in a nonexperimental setting was provided by Schmeidler and Maher (1981), who found that when presenting papers at a conference, the body language of researchers considered to be psi conducive was rated by independent judges as being more flexible, enthusiastic, friendly, likeable, and warm and less tense, irritable, and cold than the body language of researchers without a track record of psi-indicative results. Edge and Farkash (1981) conducted a replica-

tion of this study using a larger number of judges and found that, compared to psi-inhibitory researchers, psi-conductive researchers were rated as significantly more active, nervous, and enthusiastic, whilst being considered less poised, egoistic, and cold. Whilst it is possible that researchers may naturally display more positive bodily motions and gestures when presenting the results of successful studies, this report provides an interesting insight into the interpersonal characteristics of successful psi researchers.

To provide a more direct test of this notion in an experimental context, Honorton, Ramsey, and Cabibbo (1975) asked two experimenters to control their interaction style when briefing participants. When dealing with some participants, they were asked to act in a positive, friendly, casual, and supportive manner and take time to establish rapport, whereas when dealing with other participants, they were told to behave in a negative, abrupt, formal, and unfriendly manner. Honorton et al. reported a significant effect of interaction style, with the more positive style being associated with more positive psi scoring. However, this finding was not replicated by Schneider, Binder, and Walach (2000), who manipulated the experimenter's interactions as being "personal" or "neutral."

Two recent studies that assessed more specific properties of the interactions between experimenters and participants as predictors of success in psi tasks were conducted by Roe, Davey, and Stevens (2006) and Roe, Sherwood, Farrell, Savva, and Baker (2007). Drawing on the aforementioned psi-conductive traits identified by Schmeidler and Maher (1981), they developed questionnaires measuring various dimensions of the qualities of experimenter-participant interactions (mood, feeling, optimism, confidence, rapport, warmth, spontaneity, and positivity) that were completed by both experimenters and participants. In each experiment, trials were conducted by two different experimenters (both male in the former study, and one male and one female in the latter).

Roe et al. (2006) reported a number of significant correlations which suggest that the experimenters' mood and levels of relaxation as well as their expectations regarding how the participant would perform are related to participants' actual performance on both ESP and PK tasks. Furthermore, Roe et al. (2007) reported three significant correlates of psi scoring that all related to the mood of the experimenters and participants. A similar study by Sherwood, Roe, Holt, and Wilson (2005) found evidence of consistent patterns in the data, with results varying depending on the experimenter. Whilst the majority of effects reported were small and nonsignificant, there were a few significant correlations between success in a ganzfeld task and sender mood ( $r_s = -.34$ ), sender optimism ( $r_s = .43$ ) and confidence of success ( $r_s = .40$ ). Taken together, the research that has assessed the nature of interactions between experimenters and participants suggests that the style of experimenter-participant interactions and the resulting mood, relaxation, and expectancy levels may play a key role in determining the outcomes of psi studies. However, the inconsistent findings and the number of analyses carried out across these studies raise some concerns about the potential for Type I errors, and it is therefore necessary to collect further data in order to draw more reliable conclusions about these proposed relationships.

In discussing experimenter effects, researchers typically devote little attention to the gender of the experimenter. It is possible that the gender effects reported by Hitchman et al. (2012) were, in part, influenced by the exclusive use of a male experimenter. There is precedent for this in the ganzfeld literature, namely that cross-sex experimenter-participant pairings as well as cross-sex sender-receiver pairings sometimes yield stronger psi effects than same-sex pairings, although the findings are far from conclusive (Dalton, 1994; Dalton & Utts, 1995; Roberts & Hume, 2010). Whether these gender-pairing effects are due to general underlying properties associated with gender roles, or to the rapport and situational tensions or feelings of ease that result from certain qualities and styles of interaction, has not been thoroughly studied. Consequently, we were particularly interested in the present study to explore whether gender may be a mediating factor in experimenter effects.

The present study provided an opportunity to explore gender- and interaction-based psychosocial dimensions of experimenter effects in the context of a nonintentional psi paradigm. One of the only studies to have previously considered the role of the experimenter in a tacit psi scenario was carried out by Rao and Davis (1978), who asked a limited sample of 11 female participants to complete both intentional and nonintentional psi tasks. The intentional psi task consisted of a word-based ESP test in which participants

were asked to explicitly guess a series of English and Telugu (an unfamiliar language to the participants) target words that were concealed from their conventional sensory faculties. The nonintentional psi task required participants to rank 40 items from a mood adjective check list on a 4-point scale, with responses being scored by comparing them against a list of randomly generated target numbers. The results revealed a differential language effect in the intentional psi task, with participants scoring significantly higher on English words than on Telugu words, but only for one of the experimenters. For the nonintentional psi task, although the main nonintentional psi hypothesis was not supported, it was found that participants who gave different mood ranks in the second of two experimental sessions scored significantly higher than those who gave the same ranks. Furthermore, the number of mood items checked differently across the two nonintentional psi task sessions was found to correlate significantly with the differences between scores for the two languages on the intentional psi task. These findings seem to indicate not only a potential experimenter effect, but also a relationship between participants' performance in intentional and nonintentional psi tasks.

The present study was based on the protocol used by Hitchman, Sherwood, et al. (2015) with the following refinements. Firstly, rather than presenting two mirrored images (similar to those employed by Bem, 2011) to ensure the aesthetic equivalence of stimuli in the image preference task, the present study employed images that could be rotated 90, 180, and 270 degrees without appearing in any way to be incorrectly or unusually oriented. This meant that participants were highly unlikely to have a clear visual preference for any of the stimuli in each array, whilst having the probability of scoring a hit on each trial reduced from .50 to .25. Secondly, following the hypothesis that some participants may be primarily motivated to avoid the negative outcome task, the contingent reward criteria were set more stringently than in the Hitchman, Sherwood, et al. (2015) study, such that participants needed to score at least one hit above MCE to avoid the negative contingent task and enter the positive outcome condition.

Thirdly, in order to overcome potential response biases associated with the position of the mouse on the pad, the use of the mouse was eliminated during nonintentional precognition trials. Instead, participants indicated their preferred target images by pressing one of four correspondingly numbered keys on a keyboard. This also ensured that measures of reaction times were more reliable. We predicted that those exhibiting faster responses would perform better on the nonintentional precognition task than those whose reaction times were slower, on the assumption that a delayed response may be representative of conscious cognitive activities that are potentially counterproductive to the PMIR process. However, with respect to response times, Stanford (1974) specified an unconscious timing mechanism as a means by which psi-mediated instrumental responses could manifest, and this notion was supported by one of his own studies (Stanford & Thompson, 1973). However, more recently Anderson (2010) failed to obtain evidence that the timing of a behaviour can be instrumental in determining the favourability of its outcome. This raises the issue that there are at least two possible mechanisms through which the timing of a response could influence the outcome of a trial. Firstly, it could be that internal ruminations (indicated by a slower response) could overpower a psi-mediated bias to select a specific target. Alternatively, the timing of the response could be related to the system's selection of the target in a manner that coincides with the participant's selection. The latter possibility, that the exquisite timing of button presses could account for psi-mediated instrumental responses, fits well with decision augmentation theory (DAT; May, Utts, & Spottiswoode, 1995). This theory was supported by May, Spottiswoode, Utts, and James (1995), who found that the timing mechanism accounts better for an experimental database than an alternative psychokinetic explanation that the data were originally thought to support. Further evidence for the concept behind DAT has been provided by Palmer (2009) who reported that a subset of participants scored significantly more hits than chance in a temporally dependent computer-based ESP task. The new preference indication method developed for the present study is thought to be useful in helping to provide a more reliable means by which to further test these predictions.

In summary, the primary goal of this study was to consider the roles of properties of the experimenter-participant interaction. The primary hypothesis predicted that performance on the implicit precognition task would exceed mean chance expectation. On an exploratory basis, it was hypothesised that participants

working with an experimenter of the opposite sex and maintaining a positive mood and interaction style would achieve more hits on the precognition task. Note that this study also explored the relationships between participants' sensitivities to rewards and punishments and their precognitive performance. However, a discussion of this element of the study is beyond the scope of this article. Details are available from the authors on request.

## Method

### Design

This study employed a quasi-experimental design in which participants completed a 12-trial, forced-choice, nonintentional precognition task. The dependent variable was the number of direct hits they scored on the task. A contingent reward manipulation was subsequently administered, with participants who scored four hits or more receiving a positive reward of seeing images from sets they had previously rated as being preferred, whereas those who scored less than four hits were given a negative reward of seeing pictures from sets they had rated as their least preferred. In order to explore potential covariates of precognitive performance, questionnaire and performance measures were used to collect data on individual differences in sensitivity to rewards and punishments, openness to experience, emotional reactivity, and decision lability. To explore the influence of participant-experimenter interaction, participants' and experimenters' genders were also recorded, along with their ratings of their mood and level of relaxation, the warmth, spontaneity, and positivity of their interaction with their experimental counterpart, their rapport with their experimental counterpart, and their confidence in the participant's ability to contribute to the success of the experiment. For exploratory analysis, participants' reaction times during the covert precognition task were also measured.

### Participants

Twenty-six male and 26 female participants (mean age = 35.38 years;  $SD = 19.63$ ) were recruited by opportunity sampling from friends, colleagues, associates, and students from the University of Northampton. Participant numbers were prespecified in order to avoid optional stopping. The sample was divided equally by gender between a male and a female experimenter. Each experimenter was responsible for recruiting their own participants, but they used equivalent recruitment methods and materials. The experimenters recruited the majority of participants from the same source. However, for logistical reasons, 15 of the female experimenter's participants were recruited in Würzburg, Germany. Participants were not offered any incentives for taking part.

The principal experimenter in this study, GH, was a 28-year-old doctoral candidate at the University of Northampton. The co-experimenter, CP, was a 22-year-old female undergraduate psychology student from the University of Würzburg, Germany. Both experimenters were open to the psi hypothesis, very enthusiastic about parapsychological research, and considered themselves not to have frequent psi experiences. Efforts were made to ensure that CP was involved in the design of the study from an early stage, and several of her ideas were incorporated into the protocol to encourage a degree of co-ownership of the project.

### Individual Difference Measures

The following questionnaires were administered:

**Behavioural Inhibition System/Behavioural Activation System scales (BIS/BAS; Carver & White, 1994).** A four-scale questionnaire consisting of 20 items designed to assess individual differences in people's BIS and BAS systems was administered (Gray, 1981, 1982). The BIS scale consists of seven items that address an individual's concerns relating to potential bad occurrences and their sensitivity to negative

outcomes (e.g., “Even if something bad is about to happen to me, I rarely experience fear or nervousness”). The BAS is assessed via three intercorrelated subscales: Reward Responsiveness (five items), Drive (four items) and Fun Seeking (four items). Participants respond to a series of statements (e.g., “I go out of my way to get things I want”) on a 4-point scale ranging from “very true for me” to “very false for me.” Scores on the BAS Drive and BAS Fun Seeking scales can range from 4 to 16, whereas scores on the BAS Reward Responsiveness scale can range from 5 to 20 and on the BIS scale from 7 to 28. In a scale development study, each subscale was found to have an acceptable level of internal reliability, with coefficient alphas ranging from .66 to .76. Carver and White’s (1994) factor analysis suggested that items from the four respective scales load on the appropriate factors, although Cogswell, Alloy, van Dulmen, and Fresco’s (2006) confirmatory factor analysis raised some concerns. However, Beck, Smits, Claes, Vandereycken, and Bijttebier (2009) reported an adequate fit.

**Sensitivity to Punishment and Sensitivity to Reward Questionnaire (SPSRQ; Torrubia et al., 2001).** A 48-item questionnaire designed to assess individuals’ sensitivities to punishments (SP) and rewards (SR) based on the BIS and BAS systems, respectively, was administered. Twenty-four items relate to SP and 24 relate to SR. Each item is scored on a yes/no basis, yielding a total score that can range from 0 to 24 for both SP and SR. Initial validation studies of the questionnaire divided respondents by gender, and acceptable levels of reliability were found in each case, with coefficient alphas ranging from .75 to .83. Test-retest reliabilities after three months were .89 and .87 for males and females, respectively, and declined to .57 and .61 after three years. In a similar analysis to that used for the BIS/BAS scales, Cogswell et al. (2006) found a relatively poor fit of the items to the factor structure in a confirmatory factor analysis, whereas Beck et al. (2009) reported no such problems.

**Demographic questionnaire.** This two-item questionnaire asked about participants’ age and gender.

**Participant/Experimenter Interaction Questionnaire.** A seven-item questionnaire completed by both experimenters (see Appendix) and participants addressed respondents’ mood and level of relaxation as well as the properties (warmth, spontaneity, positivity, rapport) of their interaction with their experimental counterpart. A final item was used to assess the respondent’s confidence in the participant’s ability to contribute to the success of the experiment. Each item is scored on a 7-point scale and scores can therefore range from 1 to 7. These questions were based largely upon those developed by Roe et al. (2006) and were adapted only slightly to avoid compromising the nonintentional nature of the psi task.

**Openness to Experience scale (OE; Goldberg, 1999).** This 20-item questionnaire addresses an individual’s openness to new experiences. Participants respond to statements such as “believe in the importance of art” and “have a rich vocabulary” by indicating the extent to which each statement is an accurate description of themselves. Each item is rated on a 5-point Likert scale from “very inaccurate” to “very accurate,” yielding a score that can range from 0 to 80. Coefficient alphas for the subscales range from .77 to .86 (Goldberg, 1999), and scores have been found to correlate with scores on the equivalent scale of the NEO personality inventory ( $r = .56$ ; Gow, Whiteman, Pattie, & Deary, 2005).

**Emotional reactivity items (Bem, 2003).** Two items addressed participants’ awareness of their emotional reactivity to violent, scary, or gruesome content in photographs, movies, and videos. Participants respond on a scale from 1 (“not at all intensely aware”) to 5 (“very intensely aware”). Bem (2003) advises the use of mean scores for correlational analysis, which can range from 1 to 5.

**Research impressions items.** These two items were included to assess whether participants were aware of the researcher’s interests in psi phenomena and whether the study involved a covert precognition task. The first item read “Do you have any idea what the experimenter’s main research interests are? If yes, please describe them briefly below.” The second item read “Do you have any ideas of the predictions being explored in this experiment? If yes, please describe them briefly below.”

## Materials for Test Session

**PMIR Visual Basic program.** A software program was developed specifically for this experiment

by the first author. The program was based largely on the software used in the Hitchman, Sherwood, et al., (2015) study but adapted to reflect new design elements for the present study. The program was used to present images from the following set.

**International Affective Picture System (IAPS; Lang & Greenwald, 1993).** The IAPS is a large set of emotive colour photographs, the contents of which span numerous semantic categories including awe, excitement, contentment, amusement, fear, sadness, disgust, and anger. During the development of the IAPS, all images were rated by a large number of independent judges using self-assessment manikins (SAMs) for their perceived valence, arousal, and dominance, enabling them to be categorised according to a number of criteria. These ratings were used to sort the images into five categories: “very pleasant” ( $9 \geq \text{pleasantness} > 6.5$ ), “mildly pleasant” ( $6.5 \geq \text{pleasantness} > 5.5$ ), “neutral” ( $5.5 \geq \text{pleasantness} > 4.5$ ), “mildly unpleasant” ( $4.5 \geq \text{pleasantness} > 3.5$ ) and “very unpleasant” ( $3.5 \geq \text{pleasantness} > 0.0$ ). For each of these categories, eight pictures were then selected that, in the opinion of the authors, best conform to similar semantic themes. The final picture sets, each consisting of eight images, thus consisted of the following: very pleasant pictures—animals; mildly pleasant pictures—relaxed city scenes; neutral pictures—household tools/utensils; mildly unpleasant pictures—broken/decaying items/landscapes; very unpleasant pictures—dead/injured/mutilated human bodies. Each set also met the following criteria: (a) their mean arousal ratings were closely matched, and (b) the sum of the standard deviations of the pleasantness and arousal ratings did not exceed 3.5 units (implying that the majority of individuals have similar emotional responses to the images). These five image sets defined the contingent reward conditions.

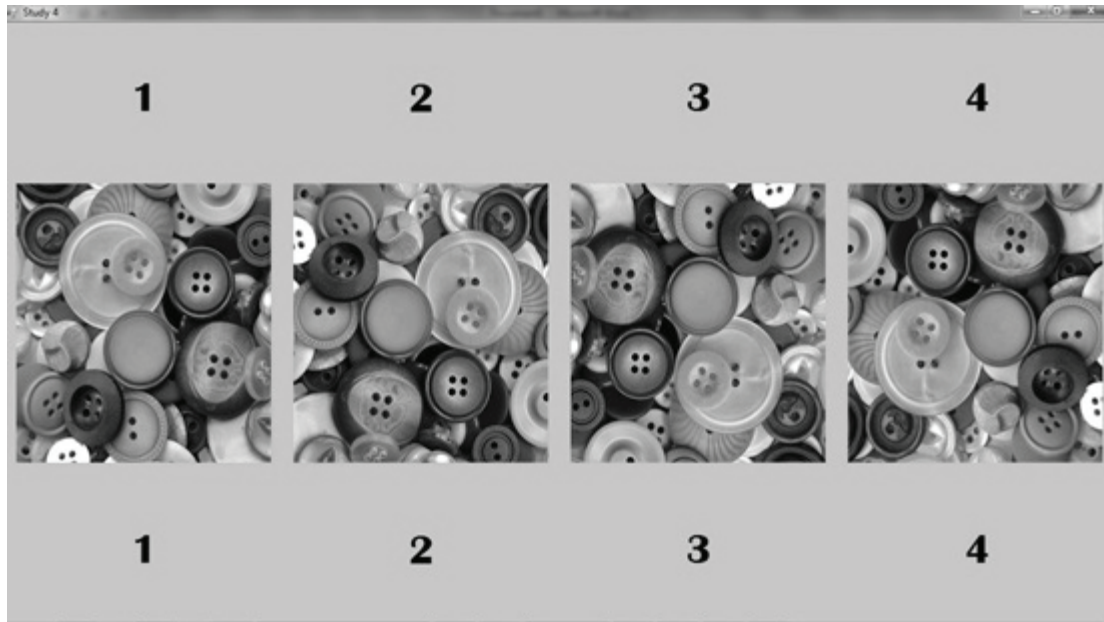
**Target stimuli.** Seventeen royalty-free images that could be rotated such that each orientation appears equally natural were identified specifically for the present study. Some pictures reflect arrangements of natural or everyday objects such as fruit, flowers, and buttons, whereas others reflect abstract artistic patterns. Each image was then rotated through 90, 180 and 270 degrees to yield sets of 4 equivalent images that differed only in their orientation (see Figure 1). Five of these sets were used in practice trials, whereas the remaining 12 were used as target stimuli in the covert precognition task.

## Procedure

Participants were briefed either by a male (GH) or a female (CP) experimenter. The majority of briefings took place in a private office at the University of Northampton. However, for logistical reasons, 15 of the female experimenter’s participants were briefed and tested in a private room on the campus of the University of Würzburg, Germany. Each experimenter provided a standardised briefing but inevitably differed in their natural personal interaction style. Both experimenters maintained their ordinary demeanour with no unnatural efforts to appear more warm or friendly than they would under normal circumstances. During the briefing, participants were informed that the study was exploring individuals’ preferences for specific images and how these relate to some of their individual characteristics. They were fully informed about what they would be required to do in each part of the experiment, but at no point was it mentioned to them that the experiment had anything to do with a test of precognition or psychic ability. Both experimenters allowed ample opportunity for participants to ask any questions, and those who were willing to take part were directed toward the automated experimental program on a laptop computer.

Participants were left alone to complete all of the tasks, but the experimenter remained available in a nearby room in case participants had any problems or questions. During this time, experimenters completed a participant-experimenter interaction questionnaire, providing ratings of their mood, level of relaxation, and various aspects of the quality of their interaction with the participant. Finally, they indicated how confident they were that the participant would contribute towards the success of the experiment.

The computer program displayed instructions to guide participants through the first image rating task (Figure 2). Participants were asked to look briefly at a series of pictures and indicate how pleasant they found each one on a scale ranging from 1 (“extremely unpleasant”) to 10 (“extremely pleasant”). Participants rated two randomly selected images from each of five subsets, the order of presentation of all 10 images also being randomised.



*Figure 1.* Image preference task 1 (tacit psi task)

The pictures within each of the subsets were the same as those employed by Hitchman, Sherwood, et al. (2015). Each subset was internally homogeneous, containing pictures of similar content, pleasantness, and arousal according to the IAPS rating data, whilst being superficially heterogeneous, with each subset representing distinctly different semantic categories and ranging in pleasantness from very pleasant animal images to very unpleasant pictures showing dead/injured/mutilated human bodies. The participants' ratings were used to calibrate the image sets so that the subsequent positive or negative contingent reward stimuli could be tailored to each participant's idiosyncratic preferences.

Participants then proceeded to the tacit psi task. The on-screen instructions for this task explained to them that they would be shown a series of sets of four images that would appear to look identical but differ in their orientation. Each image was numbered from 1 (leftmost) to 4 (rightmost). Numbered stickers were placed on the Q (1), W (2), O (3) and P (4) keys on the computer's keyboard, and participants were asked to indicate which of the four images they most preferred by pressing the correspondingly numbered button. The instructions reminded participants to be spontaneous in making their choices.

Participants were then shown 17 sets of four pictures displayed in a horizontal line across the screen (Figure 1). The pictures within each set were identical but rotated 90, 180, or 270 degrees. The order in which the pictures in each set were displayed on the screen was randomised for each trial. The first five trials were dummy trials intended to allow participants to familiarise themselves with the procedure, in order to ensure that the measures of response time were not distorted by an initial learning curve. The following 12 trials constituted the nonintentional precognition task. For each trial, immediately after the participants chose their favourite image from the target set, the computer chose one of the images as the target image. Trials in which participants' selection matched the computer's selection were scored as hits, otherwise they were scored as misses. Participants' button presses also initiated the display of the next set of stimuli, with no temporal spacing between trials. The order in which the picture sets were presented across trials was randomised separately for each participant.

Randomisation of the image array positions and computer target selections was achieved using the random number generation function of VB.NET, which is seeded by the CPU timer. A 1 x 4 chi-square analysis indicated there were no systematic patterns in the computer's selection of the targets,  $\chi^2(3, N = 624) = 4.74, p = .19$ . Furthermore, a 1 x 24 chi-square test did not reveal a bias in the positioning of targets in the arrays presented to participants,  $\chi^2(23, N = 624) = 29.15, p = .18$ .





Figure 2. Image rating task 1 (pre-rating task)<sup>1</sup>

After the 17th trial (12th nonintentional precognition trial), the program administered a second image rating task that was contingent upon participants' tacit precognition scores. This task was identical to the initial image rating task, but this time with 10 images being selected from the remaining unrated images of the five aforementioned subsets. Participants who scored four hits or more ( $MCE = 3$ ) were rewarded by being able to rate images from amongst their three most preferred subsets, whereas participants who scored three hits or fewer were negatively rewarded by being asked to rate images from their three least preferred subsets. The exact composition of images for the final task was determined according to the criteria specified in Table 1.

Table 1  
*Composition of Contingent Reward Pictures by Nonintentional Precognition Score*

Psi score	Number of images from each subset rank				
	1st	2nd	3rd	4th	5th
$\geq 10$	6	4	0	0	0
8 or 9	6	2	2	0	0
6 or 7	2	6	2	0	0
4 or 5	2	2	6	0	0
2 or 3	0	0	2	6	2
0 or 1	0	0	2	2	6

After the final experimental task had been completed, the program informed participants that they had completed all the experimental tasks and were ready to move on to the questionnaire battery. Participants were then guided through a battery of questionnaires in the following order: demographic question-

<sup>1</sup>For contractual reasons, IAPS images are not permitted to be displayed in journal publications. Indicative images are therefore displayed in all the figures rather than the genuine IAPS pictures that were used in the present study.

naire, emotional reactivity items, BIS/BAS scales, SPSRQ, and Openness to Experience questionnaire. Next came the Participant/Experimenter Interaction Questionnaire. Given that participants may have been reluctant to provide sincere answers if they felt they would be seen by the experimenter, in addition to being told so during the briefing, they were reminded by the on-screen instructions that their answers would be analysed by an independent researcher and not seen by anyone else. Participants were then requested to answer the two research impression items regarding their awareness of the experimenter's research interests and the experimental hypotheses, in order to verify that they were not aware of the true nature of the tacit psi task.

The final screen displayed the participant's cumulative score on the nonintentional psi task, which aided the researcher in providing a full debrief. This included an explanation that the image preference task was, in fact, a covert psi task and the reasons for the mild deception. During this time, participants were asked not to discuss the nature of the experiment with other potential participants.

### **Ethics**

The project was designed to adhere to the British Psychological Society's Code of Ethics and Conduct (BPS, 2009) and received ethical approval from the University of Northampton Research Ethics Committee. Participants were briefed prior to giving their informed consent as part of the program. In particular, participants were forewarned that they may see images of a violent, gruesome, or scary nature during the experiment. All data were collected anonymously and participants were made aware of their right to withdraw from the experiment at any time without having to provide a reason. To ensure that participants did not feel uncomfortable when rating the properties of their interaction with the experimenters, neither experimenter saw the raw data. Instead, these data were written to a separate data file that was stored in an alternate location on the computer's disk drive. Instructions that described to an independent researcher how to retrieve and delete the data and how to conduct the planned analyses were prepared in advance.

### **Results**

The total number of hits on the nonintentional psi task was recorded along with scores on the performance- and questionnaire-based individual difference measures. Seven of the 52 participants chose not to answer one or more of the questionnaire items. In instances where the omitted items amounted to less than 10% of all the items on the respective measure, a median substitution was applied; otherwise, all the data for that questionnaire were excluded from the analyses.

### **Manipulation Checks**

Regarding the efficacy of the experimental manipulation of assigning participants to positive and negative contingent reward conditions, Table 2 shows that, as expected, those in the positive reward condition generally rated the contingent task images as significantly more pleasant than those in the negative reward condition (positive condition mean = 5.97, negative condition mean = 3.60;  $t(50) = 9.08$ ,  $p = 2 \times 10^{-12}$ , one-tailed).

Table 2  
*Means and Standard Deviations of Participants' Subjective Ratings of the Pleasantness of the Contingent Task by Task Type*

Reward condition	<i>N</i>	<i>M</i>	<i>SD</i>
Positive	15	5.97	0.96
Negative	37	3.60	0.81

In order to validate the sensitivity of the ordinally scaled contingent rewards, Spearman correlations were calculated between the severity rank of punishment or reward and participants' subjective ratings of the pleasantness of the outcome task. Because of Hitchman et al.'s (2012) concern about the relationship potentially being nonlinear, participants were classified by reward type (positive or negative). For those who received a positive reward, there was a medium-sized positive correlation between their psi scores and their ratings of the contingent reward images, but the relationship just failed to reach statistical significance,  $r_s(14) = .41, p = .06$ , one-tailed. For those who received a negative reward, there was also a medium-sized positive correlation between their psi scores and their ratings of the contingent reward images, and the relationship was statistically significant,  $r_s(36) = .36, p = .01$ , one-tailed. Given that the effect sizes of both relationships are similar, it is likely that the sample size determined the significance of the observed effects.

Furthermore, in response to the research impression items, none of the participants indicated any awareness of the experimenters' main research interests or the predictions being explored in the experiment. Before being debriefed, participants therefore appeared to be unaware that they had taken part in a psi study that involved a covert precognition task. Similarly, after being informed of the nature of the study during the debriefing, none of the participants indicated that they had surmised the nature of the study.

### Nonintentional Precognition

The primary hypothesis predicted a nonintentional precognition effect. Fifty-two participants each completed 12 tacit precognition trials with an associated probability of correctly selecting the target image of .25. Thus, with a total of 624 trials, MCE was 156, whereas the actual number of hits was 160. The mean number of hits was 3.08 hits ( $SD = 1.72$ ) per participant, marginally above the MCE of 3.00 ( $SD = 1.50$ ). Figure 3 shows that the distribution of individual scores was positively skewed, and the extent of the skewness was found to be statistically significant ( $IS = 1.09, z = 3.23, p = .001$ , two-tailed). For consistency and comparison with previous studies, results of untransformed parametric tests are included in this report for reference only. Given the distribution of the data, readers are advised to interpret the nonparametric test results reported where appropriate as the more reliable. The results of a one-sample  $t$  test indicate that participants did not score significantly more hits during the nonintentional precognition task than would be expected by chance,  $t(51) = .32, p = .37$ , one-tailed,  $ES(r) = .04$ . A nonparametric trial-by-trial binomial analysis yielded a similar result,  $z = .32, p = .37, ES(r) = .03$ .

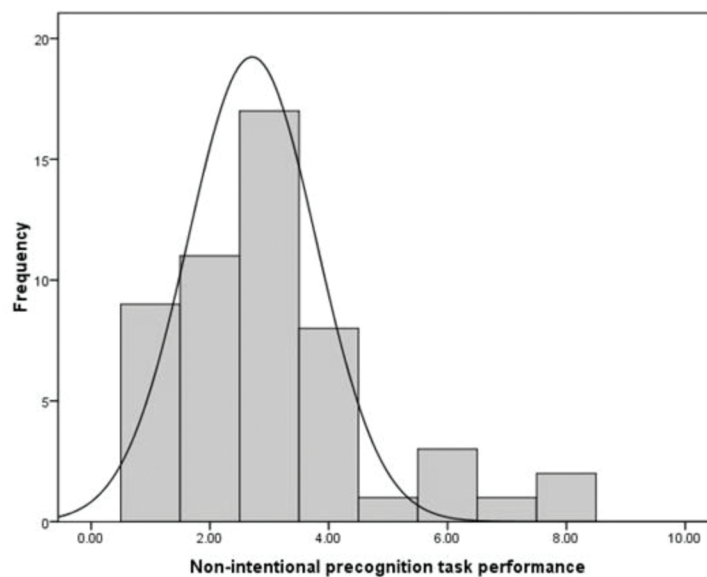


Figure 3. Histogram showing the frequency distribution of scores on the nonintentional precognition task ( $N = 52$ )

### Experimenter Effects: Sex Pairing

In order to test whether there was a classical experimenter effect and/or effects of gender and experimenter-participant sex pairing, a 2 x 2 ANOVA with experimenter (GH vs. CP) and gender (male vs. female) as between-subjects factors was carried out. The results reveal that although CP's participants generally performed better than GH's (mean precognition score = 3.38 vs. 2.77), there was no significant main effect of experimenter,  $F(1,48) = 1.74, p = .19$ , or of gender,  $F(1,48) = 3.92, p = .05$ , and no significant interaction between experimenter and gender,  $F(1,48) = 0.00, p = 1.00$ . Table 3 presents the means, medians, and standard deviations of participants' scores by experimenter and gender, and Table 4 shows the means, medians, and standard deviations of hit rates by sex pairing. The mean hit rate for opposite sex gender pairings ( $M = 3.08, SD = 1.62$ ) was similar to that of same sex gender pairings ( $M = 3.08, SD = 1.85$ ), with the median scores being the same in each case (3.00). The results of a Mann-Whitney  $U$  test indicate that there was no statistically significant difference in precognitive performance between gender pairings,  $U = 331.00, p = .45$ , one-tailed.

Table 3  
*Means, Medians, and Standard Deviations of Participants' Nonintentional Precognition Task Scores by Experimenter and Gender*

		Overall	Male	Female
<i>N</i>		26	13	13
GH	Mean precognition score	2.77	2.31	3.23
	Median	2.50	2.00	3.00
	Standard deviation	1.73	0.95	2.20
CP	Mean precognition score	3.38	2.92	3.85
	Median	3.00	3.00	3.00
	Standard deviation	1.80	1.50	1.82

Table 4  
*Means, Medians, and Standard Deviations of Hit Rates for the Precognition Task When Participants Were Paired With an Experimenter of the Same or Opposite Gender*

Gender pairing	<i>N</i>	<i>M</i>	<i>Mdn</i>	<i>SD</i>
Same gender	26	3.08	3.00	1.62
Opposite gender	26	3.08	3.00	1.85

### Experimenter Effects: Participant-Experimenter Interactions

Hypotheses in relation to the experimenter-participant interaction variables predicted that the number of hits participants would score in the covert precognition task would be positively related to their rating of: (a) their mood, (b) their level of relaxation, (c) the warmth of their interaction with the experimenter, (d) the spontaneity of their interaction with the experimenter, (e) the positivity of their interaction with the experimenter, (f) their rapport with the experimenter, and (g) their confidence in their ability to contribute to

the success of the experiment. Both the participants and the experimenters rated these dimensions on scales ranging from 1 to 7. Table 5 shows that participant ratings of their rapport with the experimenter were well above the midpoint for both experimenters (GH mean rapport = 5.68,  $SD = 1.17$ ; CP mean rapport = 5.58,  $SD = 1.03$ ).

Table 5  
Means and Standard Deviations of Participants' and Experimenters'  
Experimenter-Participant Interaction Ratings

Question	Participant ratings				Experimenter ratings			
	GH ( $N = 26$ )		CP ( $N = 26$ )		GH ( $N = 26$ )		CP ( $N = 26$ )	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Mood	4.46	1.30	6.00	0.89	5.46	1.03	4.31	1.12
Relaxation	3.69	1.46	2.38	1.75	4.69	1.44	3.92	1.13
Warmth	5.58	0.76	5.46	1.17	5.62	0.98	4.85	0.92
Spontaneity	5.31	1.09	5.19	1.55	5.35	1.02	4.50	1.39
Positivity	5.24	0.88	5.46	1.07	5.69	1.05	4.88	1.03
Rapport	5.68	1.03	5.58	1.17	5.38	1.10	4.88	1.07
Confidence	4.80	1.08	5.35	1.02	4.50	1.36	4.62	1.27

Correlation analysis was used here, as the data do not meet a number of the criteria recommended by Tabachnick and Fidell (2001) for binary logistic regression analysis. Table 6 shows that there were significant positive correlations between participants' nonintentional precognition task scores and their ratings of the positivity of their interaction with the experimenter,  $r_s(51) = .25, p = .04$ , one-tailed, their rapport with the experimenter,  $r_s(51) = .27, p = .03$ , one-tailed, and their level of relaxation,  $r_s(51) = .27, p = .03$ , one-tailed. There was also a suggestive positive correlation between participants' nonintentional precognition task scores and their ratings of the warmth of their interaction with the experimenter,  $r_s(51) = .22, p = .06$ , one-tailed.

Table 6 shows that when results were classified by experimenter, there were small-to-medium sized positive correlations between GH's participants' nonintentional precognition scores and their ratings of their level of relaxation,  $r_s(25) = .31, p = .06$ , one-tailed, the warmth of their interaction with GH,  $r_s(25) = .22, p = .14$ , one-tailed, the positivity of their interaction with GH,  $r_s(25) = .31, p = .06$ , one-tailed, and their confidence in their ability to perform well in the experiment,  $r_s(25) = .20, p = .16$ , one-tailed. However, none of these relationships achieved statistical significance, although the relatively small sample size may have precluded the detection of possibly genuine effects. For the female experimenter (CP), there was a significant positive correlation between her participants' psi scores and their ratings of the experimenter-participant rapport,  $r_s(25) = .51, p = .01$ , one-tailed. There were also small-to-medium-sized positive correlations between CP's participants' tacit precognition scores and their ratings of the warmth and positivity of their interaction with CP: warmth:  $r_s(25) = .21, p = .16$ ; positivity:  $r_s(25) = .27, p = .10$ , both one-tailed, as well as their confidence in their ability to perform well in the experiment,  $r_s(25) = .23, p = .13$ , one-tailed. However, possibly due to the relatively small sample size, none of these relationships achieved statistical significance. All other correlations were small and nonsignificant.

Table 6  
*Spearman Correlations Between Psi Task Scores and Participants' Experimenter-Participant Interaction Ratings and One-Tailed Significance Values*

	Overall ( $N = 52$ )		GH ( $N = 26$ )		CP ( $N = 26$ )	
	$r_s$	$p$	$r_s$	$p$	$r_s$	$p$
Mood	-.16	-	-.08	-	.11	.29
Relaxation	.27	<b>.03</b>	.31	.06	.05	.40
Warmth	.22	.06	.22	.14	.21	.16
Spontaneity	-.01	-	.04	.42	-.14	-
Positivity	.25	<b>.04</b>	.31	.06	.27	.10
Rapport	.27	<b>.03</b>	.07	.37	.51	<b>.01</b>
Confidence	.13	.18	.20	.16	.23	.13

Similar predictions were made in regard to the experimenters' ratings of the experimenter-participant interaction variables. Table 7 shows that in the overall database, none of the relationships was statistically significant. It is interesting to note that when the results were divided between the two experimenters, the majority of GH's correlations were negative, whereas CP's correlations were all in the predicted direction. However, it should be noted that there were large intercorrelations between both experimenters' interaction ratings (mean GH  $r_s = .52$ ; mean CP  $r_s = .56$ ). Among these correlations, there were small-to-medium-sized negative correlations between GH's participants' nonintentional precognition scores and his ratings of the spontaneity and positivity of his interactions with them: spontaneity:  $r_s(25) = -.33$ ; positivity:  $r_s(25) = -.25$ , and a small-to-medium sized correlation between CP's evaluations of her mood and her participants' nonintentional precognition scores,  $r_s(25) = .28$ ,  $p = .08$ , one-tailed. All other relationships were small and nonsignificant. These findings may suggest a subtle underlying difference between the two experimenters with respect to the predictive power of their ratings of the participant-experimenter interaction variables that was not sufficiently highlighted by the limited sample size.

Table 7  
*Spearman Correlations Between Psi Task Scores and Experimenters' Experimenter-Participant Interaction Ratings and One-Tailed Significance Values*

	Overall ( $N = 52$ )		GH ( $N = 26$ )		CP ( $N = 26$ )	
	$r_s$	$p$	$r_s$	$p$	$r_s$	$p$
Mood	.16	.13	-.04	-	.28	.08
Relaxation	.07	.31	-.11	-	.09	.34
Warmth	.03	.42	-.17	-	.07	.38
Spontaneity	-.07	-	-.33	-	.10	.32
Positivity	.04	.39	-.25	-	.16	.21
Rapport	.11	.23	-.04	-	.18	.19
Confidence	.02	.44	.00	.50	.07	.38

## Reaction Times

Turning to participants' reaction times, it was predicted that their reactions would be faster on trials in which they scored a hit relative to those in which they scored a miss. Table 8 shows that mean response times were shorter on trials in which participants scored a hit compared with those on which they scored a miss (mean response time = 5.18 s vs. 5.31 s). The distribution of reaction times for hit trials was found to be positively skewed,  $IS = 1.67$ ,  $z = 4.93$ ,  $p = 4 \times 10^{-7}$ , so consequently a nonparametric statistical test was employed. The median reaction times were 4.44 s for hit trials and 5.31 s for miss trials. The result of a Wilcoxon signed ranks test indicated that reaction times for trials in which participants scored a hit were significantly lower than those for trials in which participants scored a miss,  $z = 2.14$ ,  $p = .02$ , one-tailed.

Table 8  
*Means, Medians, and Standard Deviations of Participants' Reaction Times (Seconds) by Outcome of Trial (N = 52)*

	<i>M</i>	<i>SD</i>	<i>Mdn</i>
Hit	5.18	3.49	4.44
Miss	5.31	2.80	5.31

## Openness to Experience and Emotional Reactivity

Previous studies have indicated interesting relationships between tacit precognition scores and scores on the Openness to Experience scale (Goldberg, 1999) and emotional reactivity items (Bem, 2003). Table 9 displays the means and standard deviations for participants' scores on each measure in the present study. Participants' Openness to Experience scores were marginally lower than those in previous studies ( $M = 53.90$ ,  $SD = 9.46$ ); Hitchman, Roe, et al., (2012):  $M = 62.00$ ,  $SD = 7.70$ ; Hitchman, Roe, et al. (2015):  $M = 54.54$ ,  $SD = 12.50$ ; Hitchman, Sherwood, et al. (2015):  $M = 55.18$ ,  $SD = 8.85$ . On the other hand, participants generally rated their emotional reactivity to violent, scary, or gruesome material slightly higher than those in previous samples, with a mean score of 3.75 ( $SD = 0.88$ ) compared with a mean of 3.44 ( $SD = 0.87$ ) in Hitchman, Roe, et al., (2015) and 3.55 ( $SD = 0.90$ ) in Hitchman, Sherwood, et al., (2015). Table 10 indicates that the correlation between participants' Openness to Experience scores and their scores on the nonintentional precognition task was close to zero,  $r(51) = .06$ ,  $p = .34$ , one-tailed. Spearman nonparametric analysis yielded a similar result,  $r_s(51) = .08$ ,  $p = .28$ , one-tailed. Meanwhile, as expected, there was a significant positive correlation between scores on the tacit precognition task and emotional reactivity ratings,  $r(51) = .29$ ,  $p = .02$ , one-tailed. Spearman analysis yielded a similar result,  $r_s(51) = .30$ ,  $p = .02$ , one-tailed.

Table 9  
*Means and Standard Deviations of Individual Difference Measures*

Measure	<i>N</i>	<i>M</i>	<i>SD</i>
Openness to Experience	52	53.90	9.46
Emotional Reactivity	52	3.75	0.88
BAS Drive	51	10.61	1.84
BAS Fun Seeking	52	11.54	2.26
BAS Reward Responsiveness	52	16.44	2.19
BIS	50	20.44	3.28
Sensitivity to Punishment	51	13.08	4.89

Table 10  
*Spearman and Pearson Correlations Between Psi Task Scores and Individual Difference Measures and One-Tailed Significance Values*

	<i>N</i>	<i>r<sub>s</sub></i>	<i>p</i>	<i>r</i>	<i>p</i>
Openness to Experience	52	.08	.28	.06	.34
Emotional Reactivity	52	.30	<b>.02</b>	.29	<b>.02</b>
BAS Drive	51	.01	.48	-.04	-
BAS Fun Seeking	52	.01	.48	-.05	-
BAS Reward Responsiveness	52	.11	.21	.14	.16
BIS	50	.19	.09	.11	.22
Sensitivity to Punishment	51	-.19	-	-.21	-
Sensitivity to Reward	51	-.05	-	.00	.49

Consistent with previous studies, multiple statistical tests are reported without a correction applied to the alpha levels for multiple analyses. Milton and Wiseman (1997) have noted that the standard Bonferroni adjustment should be considered conservative, whilst Abdi (2007) claims the Bonferroni correction is not appropriate when the inferential tests conducted are not entirely independent. Readers are advised to treat the results reported with caution, as the chance of a Type 1 error is increased as a consequence of the multiple analyses carried out.

### Discussion

In an effort to demonstrate a reliable nonintentional precognition effect, this study aimed to further refine the protocol developed by Luke and colleagues (Luke, Delanoy, et al., 2008) which had been demonstrated and successfully replicated by Luke, Roe, et al. (2008), but the outcomes of three attempted replications by Hitchman and colleagues (Hitchman et al. 2012; Hitchman, Roe, et al., 2015; Hitchman, Sherwood, et al., 2015) have been more inconsistent. To explore the reasons for this inconsistency, this study had a further focus of evaluating experimenter-participant interaction qualities, which were expected to be predictive of participants' success.

Overall, participants in this study scored only marginally more hits (3.08) than MCE (3.00). However, the distribution of these scores was positively skewed, indicating that the majority of participants (71%) scored either at or below MCE. Only 29% managed to avoid the negative reward, whereas 35% would be expected to by chance. The overall effect size of  $ES(r) = .04$  was the second lowest observed across the four studies by the present research team: Study 1:  $ES(r) = .16$ ; Study 2:  $ES(r) = -.02$ ; Study 3:  $ES(r) = .23$ .

Accounting for participants' poorer performance is not easy, as the methodological changes introduced for the present study relative to the most recent Hitchman et al. study (Hitchman, Sherwood, et al., 2015)—the most successful of the four—were mostly minor refinements of adaptations that had previously appeared to be effective. The most notable change was the shift from using binary mirrored images as targets/decoys to an array of four equivalent images rotated through different angles. Arrays of four images (albeit fractals, arranged in a square pattern rather than a horizontal line) was also the format employed in Luke and colleagues' successful studies. It therefore seems unlikely that the diminished performance is due to this minor adjustment, and it is possible that the observed differences in results across studies may largely be due to measurement error. Nevertheless, future researchers may wish to systematically manipulate the layout format of images to test whether or not this is a significant issue.

Given that the other elements of the method were broadly the same as those employed in the Hitchman, Sherwood, et al., (2015) study, the explanation for the divergent results may have to do with the



participants. The sample in the present study was considerably more diverse than in the Hitchman, Sherwood, et al. (2015) study. The mean age of participants in this study was 35.38 ( $SD = 19.63$ ), compared with 23.06 ( $SD = 7.00$ ) in the previous study, the difference being statistically significant,  $t(99) = 4.15$ ,  $p = .00007$ . Furthermore, the majority (67%) of participants in the present study were either complete strangers or people with whom the experimenters had only short prior interactions, whereas in the previous study the principal investigator relied more heavily upon personal contacts. Nevertheless, participant ratings of their rapport with the experimenter were well above the midpoint for both experimenters (GH mean rapport = 5.58,  $SD = 1.17$ ; CP mean rapport = 5.68,  $SD = 1.03$ ).

As for the other individual difference characteristics of the participants, the Openness to Experience scale was one of the stronger predictors of precognitive success in the Luke and colleagues studies and the original study of the present team. However, this relationship has proven to be more inconsistent in subsequent studies. The present study yielded no overall relationship between nonintentional psi scores and Openness to Experience scores, raising further doubt over the reliability of the relationship reported in earlier studies. The authors are not aware of any reasons why the minor methodological deviations from the original studies should have caused the apparent lack of similar relationships in more recent studies.

From Hitchman et al.'s second study (Hitchman, Roe, et al., 2015) onwards, emotive images were used in negative reward conditions with the aim of providing a stronger aversive effect from the negative outcome task. Participants with higher levels of emotional reactivity were expected to be more averse to the negative rewards and consequently demonstrate higher precognition scores. This study is broadly supportive of the results of the Hitchman, Roe, et al. (2015) study, in which there was a significant positive correlation between participants' responses to the emotional reactivity items and their nonintentional precognition scores. Results of both studies differed, though, from those of the Hitchman, Sherwood, et al. (2015) study, in which a suggestive *negative* correlation was found between the two variables. Taken together with Bem's (2003) finding of a significant positive correlation between emotional reactivity scores and precognitive avoidance of negative stimuli, it may be that the result of the Hitchman, Sherwood, et al. (2015) study was an anomaly. It is concluded that the measures relating to participants' sensitivities to rewards and punishments did not convey the desired information in relation to the PMIR model and results relating to these metrics will therefore not be discussed.

A main focus of this study was the effect of the interaction between the experimenter and the participant. A female research placement student (CP) ran half of the participants through the experiment, whilst the other half of the sample was tested by the first author (GH). Both experimenters and participants rated their own psychological and physiological states, as well as several qualities (mood, relaxation, warmth, spontaneity, positivity, rapport) of their interaction with their experimental counterpart, and their confidence that the participant would be successful.

It was found that, with the exception of their ratings of their mood and the spontaneity of the interaction, all participants' ratings were positively correlated with their performance on the precognition task, with their ratings of their level of relaxation and the positivity of their interaction and rapport with the experimenter being significant. The direction of the effect was generally consistent for both experimenters. However, only their rapport with CP was significantly related to their tacit psi scores. This correlation was medium sized and was amongst the strongest of all the correlations observed in the study ( $r_s = .51$ ). The predicted relationships involving experimenter ratings were generally modest and nonsignificant.

It is important to note the possibility that participants' responses to all of the questionnaire-based measures were influenced by the fact that they provided them after the experimental tasks. Because each participant encountered a different positive or negative reward that was contingent on their performance on the tacit psi task, and the task itself may have seemed rather puzzling to some participants, the reliability and construct validity of the questionnaire measures may have been compromised. Although this could easily have been avoided by having participants respond to the questionnaires before taking part in the nonintentional psi task, it was felt that this would have been just as likely to influence the outcome of the experimental tasks by causing fatigue, boredom, or some other context effect associated with completing a battery of individual difference measures. Although Krishna and Rao (1991) found no effect of ESP test

feedback on a self-report personality measure, the results reported above should be interpreted with caution as the order effects noted have the potential to cause both Type I and Type II errors.

Furthermore, it should be noted that the manipulation check employed in this study assumed that participants' enjoyment of the experience of completing the contingent positive or negative reward task was consistent with how they rated the images in the task. However, it is possible that participants enjoyed looking at the images they considered to be unpleasant, or did not enjoy looking at the images they found to be intrinsically pleasant, and hence did not necessarily find completing the negative reward task to be a negative experience (and vice versa). Therefore, in addition to participants rating the pleasantness of the images, a more reliable manipulation check would have been to ask participants to rate how pleasant they found the overall experience of completing the contingent task.

In addition, a reviewer pointed out a potential limitation of the procedure used to derive contingent positive or negative reward stimuli that are specifically tailored to the visual preferences of participants. As participants rated sample images from the contingent image subsets before the main psi task, they were necessarily exposed to the type of affect-laden stimuli that they would see in the positive or negative reward task. This therefore has the potential to either sensitise or desensitise participants and consequently alter the nature or magnitude of the effect of the contingent task. In future studies, the differential effect this may have on participants may be explored using the Miller Behavioral Style Scale (MBSS), a personality measure that has been used to predict the extent to which individuals continue to monitor an unpleasant or threatening situation rather than find a way to distract themselves (e.g., Miller, 1987).

Generally, then, the results observed in the present study are not well aligned with those discussed by Sherwood et al. (2005) and Roe et al. (2006, 2007). Sherwood et al.'s findings emphasised the roles of mood, optimism, and confidence and were partially supported by Roe et al.'s two studies, which suggested effects of mood and expectancy on psi task success. However, the results of the present study indicate that other properties of participants' disposition, such as their level of relaxation, as well as their rapport with the experimenter and spontaneity of their interaction with the experimenter, might have had some bearing on psi scoring rates. Overall, these analyses add further to the argument that the experimenter may play a critical role in the success of an experiment, with the mixed pattern of results across different studies implying that experimenters' influence might differ by task type and personal characteristics.

With regard to this experimenter and task specificity, based on results from previous ganzfeld studies (Dalton, 1994; Dalton & Utts, 1995; Roberts & Hume, 2010), a final prediction in the present study was that participants would perform better when they were recruited and briefed by an experimenter of the opposite sex. It was found that participants did perform slightly better when working with an experimenter of the opposite sex, however not to a statistically significant extent. At face value, the lack of effect would seem to imply that the findings from the previous ganzfeld studies, which utilised a very overt form of ESP in conjunction with a mild altered state of consciousness induction, do not necessarily apply to the non-intentional psi paradigm. However, in light of the lack of a clear psi effect in this study overall, this is another finding which remains difficult to evaluate. Only with a more extensive database including more overall successful studies can hypotheses relating to these effects be evaluated with any degree of conviction. Future researchers are therefore encouraged to assemble experimental teams consisting of both male and female investigators and consider mixed-gender experimenter-participant pairings as a potential predictor of success.

Finally, the methodological development implemented for the present study of allowing participants to indicate their image preferences by means of a keyboard button press rather than a mouse click enabled a more reliable measure of their response times to be recorded. It was found that the response times of trials in which participants scored a hit were significantly lower than those in which they scored a miss. This supported the hypothesis that those employing genuinely spontaneous selection strategies would perform better at the task. Relating this finding back to cases of spontaneous psi on which the PMIR model is largely based, this result would seem to support the idea that in many cases, the need for instinctual choices and time for cognitive deliberation would obviate the gains from the psi-mediated instrumental response. However, it is worthwhile to consider that rapid responses do not necessarily directly imply spontaneity,

and there may also be occasions in which rapid responses do not favour positive psi-mediated outcomes. Indeed, Honorton's (1987) work with a purportedly psi-gifted individual, Malcolm Bessent, revealed that psi-hitting was associated with longer response times than psi-missing in a forced-choice precognition task. Selections on such successful trials were more commonly labelled by Bessent as driven by cognitive impressions rather than by feelings or just being guesses. It can be speculated that in trials with longer response times, Bessent was able to achieve a relatively neutral state of mind that better allowed for psi-mediated impressions to be formed. A similar observation was reported by White (1964) with experienced psi experiencers. However, these findings relate to intentional forms of psi and, unlike the present study, were from experienced or gifted individuals rather than relative novices. Nevertheless, future researchers may wish to consider including a more direct measure of response spontaneity in conjunction with response times as a more comprehensive basis for predicting success in a nonintentional context.

This study is the fourth of its kind in this series that, in combination with other nonintentional precognition studies, provide an evidential basis against which the claims of theories such as Stanford's PMIR model can be evaluated. Despite incorporating a number of further refinements to the successful nonintentional psi protocol developed by Luke, Delanoy, et al. (2008), this study failed to demonstrate an overall nonintentional precognition effect. Nevertheless, a meta-analysis of the eight Luke and colleagues and Hitchman and colleagues studies combined that used this paradigm demonstrates that the overall paradigm still presents significant evidence of tacit psi, with Stouffer  $Z = 3.94$ ,  $p = .00004$  (cf. Rosenthal, 1991, p. 93) and a mean effect size of  $ES(r) = .28$ .

In turn, the lack of an overall psi effect makes interpreting findings in relation to the predictors somewhat problematic. A number of significant relationships were detected between participants' precognition scores and scores on various individual difference measures. In particular, there were significant positive correlations between participants' precognitive performance and their ratings of the positivity of their interaction with the experimenter, their rapport with the experimenter, and their level of relaxation, whilst emotional reactivity scores were once again found to be predictive of precognitive performance. Given the number of comparisons conducted, and the absence of adjustment of alpha levels in light of this, the reader is advised to interpret these effects with a sizeable amount of caution. Nevertheless, they all contribute to the growing database of relationships between psychological variables and nonintentional precognition scores that can be used in subsequent combined analyses.

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**Appendix  
Interaction Questionnaire—Experimenter**

Participant Number:				
Date and Time of Session:				
Experimenter:				
Relationship with Participant:	complete stranger	short prior interaction	acquaintance	friend
	further explanation:			

1. How would you rate your current mood?

1     2     3     4     5     6     7

negative

positive

2. How do you feel at this moment? / How relaxed are you at this moment?

1     2     3     4     5     6     7

tense

relaxed

3. How would you rate the quality of the interaction between you and the participant?

1     2     3     4     5     6     7

very cold

very warm

1     2     3     4     5     6     7

“rehearsed”

spontaneous

1     2     3     4     5     6     7

very negative

very positive

4. How would you describe the quality of rapport that you have with the participant?

1     2     3     4     5     6     7

extremely poor

extremely good

5. How confident are you that the participant will contribute towards the success of this experiment?

1     2     3     4     5     6     7

not at all confident

extremely confident

**Abstracts in Other Languages***Spanish***LOS EFECTOS DE LAS CUALIDADES DE INTERACCIÓN EXPERIMENTADOR-PARTICIPANTE EN UNA TAREA DE PRECOGNICIÓN NO INTENCIONAL ORIENTADA A UN OBJETIVO**

RESUMEN: Varios estudios recientes inspirados en teorías de psi como la de Respuesta Instrumental Mediada por Psi (PMIR) de Stanford han empleado un protocolo de precognición tácito para poner a prueba la idea de que la percepción extrasensorial puede ser no intencional. Después de un notable éxito inicial, los resultados han sido más inconsistentes. Una posible razón de la variabilidad observada en los resultados es que diferentes experimentadores llevaron a cabo los estudios. Por lo tanto, el presente estudio evaluó varias dimensiones sobre la interacción de los participantes con experimentadores hombre o mujer. 52 personas participaron en 12 pruebas no intencionales de precognición y un contingente a la tarea positivo o negativo dependiente del rendimiento. El número total de aciertos precognitivos estuvo ligeramente por encima del azar, pero no alcanzó significación estadística. Hubo correlaciones positivas significativas entre las puntuaciones de los participantes en precognición y sus clasificaciones del agrado de la interacción con el experimentador y su rapport con él/ella, y el nivel de relajación del participante. También hubieron diferencias notables entre los dos experimentadores con respecto a sus puntuaciones sobre la interacción participante-experimentador y las puntuaciones tácitas de precognición de los participantes. Todas las correlaciones fueron en la dirección prevista para la experimentadora, pero en dirección contraria para el experimentador.

*French***LES EFFETS DES QUALITÉS DE L'INTERACTION EXPERIMENTATEUR-PARTICIPANT DANS UNE TÂCHE DE PRÉCOGNITION NON-INTENTIONNELLE ORIENTÉE PAR UN BUT**

RÉSUMÉ : Plusieurs études récentes, inspirées par des théories du psi telles que le modèle de la réaction instrumentale médiatisée par le psi (modèle PMIR de Stanford), ont employé un protocole de précognition tacite pour tester la notion d'une non-intentionnalité de la perception extra-sensorielle. Après un succès initial remarquable, les résultats ont été plus inconsistants. Une des possibles raisons pour la variabilité observée dans les résultats est que ces études furent conduites par des expérimentateurs différents. La présente étude interroge donc de nombreuses dimensions relatives à l'interaction des participants avec soit un expérimentateur mâle ou femelle. 52 participants ont pris part à 12 essais de précognition non-intentionnels et une tâche soit positive, soit négative, contingente à leur performance à la première tâche. Le nombre total de succès précognitifs était marginalement au-dessus de ce qui était attendu du hasard, mais insuffisant pour atteindre la significativité statistique. Il y a eu des corrélations positives significatives entre les scores de précognition des participants et leurs évaluations positives de l'interaction avec l'expérimentateur, de leur rapport avec l'expérimentateur, et de leur niveau de relaxation. Il y a eu également des différences notables entre les deux expérimentateurs par rapport à leurs relations entre leur interaction participant-expérimentateur et les scores de précognition tacite des participants : toutes les corrélations furent dans la direction prédite pour l'expérimentateur femelle, mais dans la direction opposée pour l'expérimentateur mâle.

*German***DIE AUSWIRKUNGEN DER BESCHAFFENHEIT DER EXPERIMENTATOR-TEILNEHMER-INTERAKTION IN EINER ZIELORIENTIERTEN NICHTINTENTIONALEN PRÄKOGNITIONS-AUFGABE**

ZUSAMMENFASSUNG: Mehrere neuere Studien, die durch Psi-Theorien wie Stanfords Psi-vermittelte instrumentelle Reaktion (PVIR) inspiriert wurden, haben das Protokoll einer impliziten Präkognitionsauf-



gabe verwendet, um die Annahme zu testen, daß außersinnliche Wahrnehmung nicht intentionaler Natur sei. Nach anfänglich bemerkenswertem Erfolg, wurden die Ergebnisse uneinheitlicher. Eine mögliche Ursache für die beobachtete Variabilität der Ergebnisse könnte darin liegen, daß die Studien von verschiedenen Experimentatoren durchgeführt wurden. Die vorliegende Studie berücksichtigt eine Anzahl von Dimensionen bezüglich der Interaktion der Versuchsteilnehmer mit einem männlichen oder weiblichen Experimentator. 52 Teilnehmer nahmen an 12 nicht intentionalen Präkognitionsdurchgängen teil und an einer positiven oder negativen Abschlussaufgabe in Abhängigkeit von ihrer Trefferleistung. Die Gesamtzahl der präkognitiven Treffer lag knapp über der mittleren Zufallserwartung, erreichte aber keine statistische Signifikanz. Es zeigten sich signifikante positive Korrelationen zwischen den Präkognitionstreffern der Teilnehmer und der Einschätzung ihrer positiven Interaktion mit dem Experimentator, ihrer Einstellung zum Experimentator und dem Grad ihrer Entspannung. Es zeigten sich auch deutliche Unterschiede zwischen den beiden Experimentatoren in Bezug auf die Zusammenhänge zwischen ihrer Einschätzung der Teilnehmer-Experimentator-Interaktion und den impliziten Präkognitionstreffern der Teilnehmer; beim weiblichen Experimentator fielen alle Korrelationen in der vorausgesagten Richtung aus, beim männlichen Experimentator war es allerdings umgekehrt.