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# THE EFFECTS OF IMAGERY CULTIVATION ON MOOD AND PSI PERFORMANCE

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*ABSTRACT*

Historically, paranormal effects (psi) have been linked to altered states of consciousness (ASCs) (Bem & Honorton, 1994; Luke, 2011), but little is known about the possible mood shifts individuals may experience while in an ASC. The purpose of the present study was to investigate the mood changes that occur as a result of a shamanic-like journeying technique called imagery cultivation (IC) (Storm & Rock, 2009a). One hundred participants were randomly assigned to one of two conditions: either (1) the IC treatment or (2) no treatment (control). Participants in both groups engaged in a psi task—a picture-identification task using randomly generated target sets, following the procedure devised by May et al. (2012). Participants' moods were quantified, before and after these conditions, using the short form of the Profile of Mood States (POMS-SF) (McNair et al., 1992) as a feedback measure of mood change. Paranormal belief and experience (psi belief) were also assessed using the Australian Sheep–Goat Scale (ASGS) (Lange & Thalbourne, 2002), as psi performance can often be predicted by psi belief. Due to the small group sizes, most test results were non-significant, but a few effect sizes (calculated as $z/\sqrt{n}$) replicated past findings for psi-conducive treatments with a relaxation component, such as the ganzfeld procedure and IC. There was some evidence to suggest that mood (especially Tension) can adversely affect psi performance.

## Introduction

Historically, paranormal effects (psi) have been linked to altered states of consciousness (ASCs) (Bem & Honorton, 1994; Luke, 2011). However, little is known about the possible mood shifts individuals may experience while in an ASC. The purpose of the present study was to investigate mood changes and psi enhancement that might occur due to the effects of a shamanic-like journeying technique called imagery cultivation (IC) (Storm & Rock, 2009a). Another aim of the study was to test the influence of paranormal belief on psi outcomes (i.e., the sheep–goat effect).

### *Imagery cultivation*

The IC technique was developed by Storm and Rock (2009a). Essentially, IC is based on shamanic-like journeying practices, which entail "voluntarily entering altered states of consciousness" (Walsh, 1989, p. 5). The link between shamanic

states and psi has been reported extensively in the literature (e.g., Krippner, 1984; Nelson & Radin, 2003; Nelson et al., 1998; Saklani, 1988). To determine the effect of IC treatment, a random number generator is used to generate an array of images, and participants try to select the target image concealed amid decoy images. Participants rank each image, with the expectation that, due to extrasensory perception (ESP), they rank the target image No. 1 (i.e., the participant's first choice = direct hit) more often than can be explained by chance. It is to be noted that Honorton (1985) regards the direct-hit measure as a "conservative" result (p. 54), and its use is easy to grasp intuitively.

Storm and Rock (2009b) and Rock et al. (2012) have demonstrated the effectiveness of the shamanic-like principles underlying IC, finding significant or marginally significant psi effects in their two studies (hit rates of 34.5% and 29.9%; mean chance expectation (MCE) = 25%). The IC technique is similar to the ganzfeld technique, in that they both encourage image formation related to psi targets, and the two hit rates reported by Storm and Rock are comparable to those found in meta-analyses of ganzfeld studies (around 30–31%, MCE = 25%). Specifically, one meta-analysis of 29 four-choice ganzfeld studies (1992–2008) (Storm et al., 2010) found a 30% hit rate, while another of nine four-choice ganzfeld studies (2009–2018) found a 31% hit rate (Storm & Tressoldi, 2020, p. 201). When all four-choice ganzfeld studies dating back to 1974 to 2018 were combined, "there was a total of 3885 trials and 1188 hits, corresponding to a 30.6% hit rate" (p. 209).

In later work, Storm (2019) simplified the original IC procedure by (a) shortening the guided-imagery component to a 9½-minute pre-recorded soundtrack (reduced from 19 minutes), (b) removing the drumming component from the soundtrack, (c) introducing background tonalities, and (d) altering the wording of the guided imagery. These changes were made for the sake of expediency. In addition, the number of images (actual photographs) in the on-screen array was increased from four to five (following the protocol outlined by May et al. (2012)). As hypothesized, Storm found that the direct-hit rate under a pure IC condition was *higher* (23.7%) than for the controls (15%,) where the MCE was now 20%. In a follow-up study using the same design, Storm and Goretzki (2021) reported a significant hit rate of 26% for 200 participants who received IC treatment.

*Mood and the Profile of Mood States*

The IC technique is considered to be an improvement on the ganzfeld protocol, which induces a largely *passive* state of mind, whereas IC induces an *active* state of mind. The *activating component* of IC refers purely to the means by which the target is accessed. Independent of that component, IC also generates an ASC due to the *relaxation component*, and this relaxed state is thought to induce an improved mood (such as reduced Tension). This improved mood state is argued to be psi-conducive.

Some parapsychological research has been conducted on moods. For example, Carpenter (1991) found that ESP effects were associated with assertiveness, agreeability, physical/emotional experience, anxiety and unhappy adjustment (Carpenter, 2001; see also Crandall, 1985; Schmeidler, 1988). It is possible that the reason why there are no recent studies on mood is that most parapsychologists tend to concentrate on the broader issues of psi-modifying effects of attitude and personality (see the review by Palmer, 1977), or the psychopathological aspects of paranormal belief and experience (see the review by Irwin, 2009). However, it follows that a participant's enthusiasm and motivation for a psi outcome is bound to be reflected in their mood, and parapsychologists have acknowledged this relationship (Carpenter, 1991; Stanford, 1977). Stanford (1977) noted that the issue is complicated by psychophysiological factors such as "emotional arousal" and "attention-focusing" (p. 842). Carpenter (1991), however, saw no difficulty in measuring mood. He found that psi-hitting was associated with moods, whereby the participant felt strong willed, detached and agreeable, whereas psi-missing was associated with anxiety. He also found that a large run-score variance was associated with carefree moods, whereas a small variance was related to annoyance.

McNair et al. (1971) have shown that the Profile of Mood States (POMS) is a reliable measure of seven mood states: Tension, Depression, Anger, Vigour, Fatigue and Confusion, plus the aggregate state Total Mood Disturbance (the combined score of five scales minus the score for Vigour). POMS is one of the most widely used instruments for assessing mood states. The POMS-SF (McNair et al., 1992) is a shortened version of the original 65-item POMS, and provides a "rapid, economical method of identifying and assessing transient, fluctuating affective states" (Chen et al., 2002, p. 619). Although the POMS-SF is applied mostly in clinical and therapeutic situations, it is suitable for use in research where mood changes need to be assessed in order to understand the nature of the experimental effects and manipulations under investigation. In the present study, interest lies in the effects that the IC technique may have on moods, and whether these moods affect psi performance.

As far as POMS correlates are concerned, only one parapsychological study has specifically employed the scale. Storm et al. (2013) found that pre-test scores on Tension and Confusion correlated positively with psi-hitting in a ball selection task. It was assumed that "participants had doubts, expressed as tension and confusion, as to what was expected of them during the experiment" (p. 431). The present study extends that type of research.

*The sheep–goat effect*

Schmeidler (1943, 1945) categorized participants in paranormal experiments into two groups: those who think that ESP is possible under a given experimental condition (sheep), and those who reject this possibility (goats). Paranormal belief, as measured on sheep–goat scales, tends to be a

predictor of psi outcomes, with sheep often producing significant hit rates (i.e., psi-hitting) and goats often producing chance scoring or significant miss rates (i.e., psi-missing). The sheep–goat effect has been confirmed in two meta-analyses (Lawrence, 1993; Storm & Tressoldi, 2017). Therefore, psi belief can be considered an often-reliable psi-conducive measure, and its effects (the so-called "sheep–goat effect") are always worth testing, as was done in the present study.

### *Study design and hypotheses*

The relationship between psi and mood is not well understood, and it is not known what influence IC has on mood. However, positive (i.e., favourable) shifts in mood are expected due to the relaxation component of the IC treatment, and the other component of IC (guided imagery) may be conducive to psi. Therefore, the following hypotheses were proposed in the present study (Hypotheses 1 and 2 are parapsychological; Hypothesis 3 is psychological):

- *Hypothesis 1*. Psi-scoring (direct hitting) is higher for (i) the IC group compared to controls, and (ii) sheep compared to goats.
- *Hypothesis 2*. Pre/post-intervention POMS-SF difference scores (for Tension, Depression, Anger, Vigour, Fatigue and Confusion, plus Total Mood Disturbance) correlate positively with direct hitting).
- *Hypothesis 3*. The mood changes (pre/post-intervention POMS difference scores for Tension, Depression, Anger, Vigour, Fatigue and Confusion, plus Total Mood Disturbance) are larger and positive for (i) the IC group compared to controls, and (ii) sheep compared to goats.

## Method

### *Participants*

The sample mainly comprised first-year psychology students from the University of Adelaide, South Australia, plus students who signed up via a ballot box on campus ($N$ = 100). First-year psychology students participated for course credit. Participants were 'unselected', with the aim of recruiting an approximately even number of sheep and goats. The mean age was 23 years (standard deviation ($SD$) = 7 years); 73% ($n$ = 73) of the sample were female (males: $n$ = 27, 27%).

### *Measures*

Information, Consent and Demographics pages, plus the following two scales described below, were presented on screen on a computer in the author/experimenter's (L.S.) office/laboratory).

- *Australian Sheep–Goat Scale (ASGS)* (Thalbourne, 1995): an 18-item scale measuring belief and alleged experience of paranormal phenomena (items score 0, 1 or 2 for False, Uncertain or True, respectively). The raw range is 0 to 36; the raw mean is 18. In the

Rasch-scaled version of the ASGS (RASGS), the raw data are top-down purified to eliminate age and gender bias (Lange & Thalbourne, 2002). The RASGS uses only 16 items (the two afterlife items are removed). This procedure alters the scoring range and mean (standardized mean = 25, *SD* = 5). RASGS scores range from 8.13 to 43.39. Cronbach's α (alpha) coefficient ranges between 0.91 and 0.95 (Billows & Storm, 2015; Storm & Thalbourne, 2005).

- *Profile of Mood States—Short Form (POMS-SF)* (McNair et al., 1971): a 30-item self-report measure of positive and negative mood states. Each item represents an affective state, and scores are produced for six mood variables: Tension/Anxiety, Depression/Dejection, Anger/Hostility, Vigour/Activity, Fatigue/Inertia and Confusion/Bewilderment. In addition, a score for Total Mood Disturbance is produced by summing the six subscale scores (weighting Vigour/Activity negatively). Respondents indicate how much each item represents their present state on a scale from 0 = "Not at all" to 4 = "Extremely". The POMS-SF has good internal consistency; Cronbach's α for the six mood states ranges from 0.73 to 0.89 (Jette et al., 1996).

*Apparatus*

- A gallery of 300 photographs (May et al., 2012): 12 groups × 5 categories × 5 photographs.
- A true-noise random number generator (RNG) (Schmidt, 1970, 1973).

*Procedure*

- *Step 1*. All participation was on an individual basis; there was no cooperation and no collusion. The participant was assigned to a computer that had been set up expressly for participants. On the screen, the participant read the following text:

  > The purpose of this exercise is to investigate mood changes and picture-identifying capability after a relaxation technique called Imagery Cultivation (IC). IC involves listening to 9½ minutes of relaxing music with some verbal instructions, but you may or may not receive this treatment. You will be required to complete a few questionnaires. This should take no longer than 30 minutes.

  After reading the preliminary pages (including requests for demographic details), the participant completes the ASGS and the POMS-SF.
- *Step 2*. Via an on-screen message:
  (i) 51 participants, selected at random, were informed that they would undergo the IC procedure (duration: 9½ minutes), and 49 control participants were instructed to go to Step 3.

(ii) Participants in the IC group were then asked to relax in their chair, start the pre-recorded instructions, close their eyes, and listen to the instructions

> Now visualise a photographic image before you … Remember this information for later.

The full instructions (adapted from Harner (1990)) are given in the Appendix). After IC, participants make notes (mentation) about impressions of the future target.

- *Step 3*: Target selection was done following May et al.'s (2012) recommendation. The RNG was used to select one group of five different categories of photos at random from the 12 available, followed by one photograph from each of the five categories in that group, from the fuzzy-set encoded target pool. The RNG lights were numbered on two templates: (i) 1 to 12 for the group, and (ii) 1 to 5 (twice) for the category. These six randomly generated numbers (one for the group, plus five for the categories) were entered by the participant into the computer, and the program drew out the identified (numbered) set of five photos, and displayed them on-screen for ranking (target selection was not performed until Step 5).
- *Step 4*. Once the set of five photos were displayed on the screen, the experimenter instructed the participant to rank the five photographs from 1 to 5 (1 = "most likely" photograph the RNG will select, to 5 = "least likely"). Those in the IC group ranked the photos according to mentation. Control participants were instructed to rank the photos in accordance with whatever feelings or thoughts they had about the target photograph to be generated by the RNG in Step 5.
- *Step 5*. All participants completed the POMS-SF for a second time. Using the same category procedure as in Step 3, the target photograph was randomly selected by the RNG. The target was one of the five already selected and ranked together with the decoys (i.e., MCE = 20%). The participant entered the RNG number into the computer, and the target photograph and the participant's ranking for that photograph were presented on the screen. The participant was debriefed.

*Data analyses*

The analytical components of this study involved statistically testing for:

- IC/control group differences on paranormal performance (direct hitting)
- sheep–goat differences on direct hitting
- POMS-SF/direct hitting relationships, and
- POMS-SF differences between groups

in accordance with the hypotheses given above.

The post hoc analytical components of this study involved statistically testing for

- IC/control group differences on paranormal performance (mean rank score and sum of ranks)
- sheep–goat differences on mean rank score and sum of ranks
- an interaction effect.

The IBM SPSS (Version 28) statistical package was used for all statistical analyses, except for the exact binomial statistics[1] and Cohen's *d* effects,[2] which were calculated using online calculators.

## Results

### *Descriptive statistics*

Direct hitting for the whole sample was 23 hits out of 100 (23%; MCE = 20%). This result is not significant (exact binomial $z = 0.63; p = 0.261$ (one-tailed)). The mean rank score for the whole sample was 2.78 (MCE = 3.00; median = 3.00). This result is marginally significant, $t(99) = -1.50, p = 0.069$ (one-tailed). The ranks applied by all the participants are listed in Table 1.

The sum of ranks test was applied using the sum of ordinal weighted ranks (see Solfvin et al., 1978, pp. 97–99). In this test a score (or "weight") is assigned to each rank (e.g., a rank of 1 scores 1, etc.), and then a total of all the scores is calculated.[3] An ordering of observed distributions is therefore obtained. For the full sample ($N = 100$), the sum-of-ranks statistic was not significant, $z = -0.68$, $p = 0.248$ (one-tailed).

Table 1.

*Ranks Assigned by All Participants (*N = *100)*

| Rank | Frequency | % |
|---|---|---|
| 1 | 23 | 23.0 |
| 2 | 26 | 26.0 |
| 3 | 20 | 20.0 |
| 4 | 13 | 13.0 |
| 5 | 18 | 18.0 |
| Total | 100 | 100.0 |

[1] Binomial probabilities: http://www.vassarstats.net/binomialX.html

[2] Effect size calculator for *T*-test: https://www.socscistatistics.com/effectsize/default3.aspx

[3] Level of scoring is determined from the sum of ranks *Z* score and the corresponding *Z* score. $Z = (M - U_M \pm 0.5)/\sigma_M$, where $M$ is the observed sum-of-ranks, $U_M = N(R + 1)/2$, and $\sigma_M = N(R - 1)/12$. The 0.5 is the usual continuity correction and has sign opposite to that of $(M - U_M)$ (Solfvin et al., 1978, p. 99). Psi hitting is indicated by a significant sum of ranks score.

*Rasch-scaled Australian Sheep–Goat Scale (RASGS)*. The mean score for the raw-score version of the ASGS was 11.51 (*SD* = 8.33). The distribution of scores was significantly right skewed (skew = 0.62, standard error (*SE*) = 0.24). The mean score for the Rasch-scaled version of the ASGS (i.e., RASGS) was 20.21 (*SD* = 6.95). The skew was not significant (skew = 0.14, *SE* = 0.24). The reliability of the RASGS was high (Cronbach's $\alpha = 0.93$). The RASGS mean scores were 19.66 (*SD* = 5.87), for the control group and 20.74 (*SD* = 7.87) for the IC group. The difference between the RASGS mean scores for the two groups was not significant, $t(98) = -0.77$, $p = 0.443$ (two-tailed).

The median score (21.10) was used as the cut-off point to demarcate between sheep and goats, with goats scoring below 21.10 ($n = 47$) and sheep scoring at or above 21.10 ($n = 53$). The RASGS mean score was 14.57 (*SD* = 4.59) for the goats and 25.21 (*SD* = 4.37) for the sheep. The difference between the RASGS mean scores for the two groups was significant, $t(98) = -11.88$, $p < 0.001$ (two-tailed). Of three demographic variables, age, education and sex, only age and education correlated significantly with the RASGS mean scores (for age, $r(98) = 0.30$, $p = 0.003$ (two-tailed); for education, $r(98) = 0.43$, $p < 0.001$ (two-tailed)). These results indicate that there is a tendency for paranormal belief to increase with age and education.

*Profile of Mood States—Short Form (POMS-SF)*. The POMS-SF was administered before and after IC treatment and/or the picture-identification psi task. The means and *SD*s for the POMS-SF subscales are listed in Table 2. Note that the scores on all seven measures decreased from pre- to post-testing, and the differences were mostly significant (only marginally for Vigour). These statistics are reported as a matter of course, but it must be noted that half the sample did not receive the IC treatment, so IC alone does not completely explain

TABLE 2.

*Descriptive Statistics: Mean and* SD *Values for the POMS-SF Subscales for All Participants (*N = *100)*

| Variable | Mean (*SD*) | | *t*(1, 99) | *p* (two-tailed) |
|---|---|---|---|---|
| | Before | After | | |
| Tension | 3.98 (3.31) | 2.37 (2.85) | 6.00 | <0.001 |
| Depression | 3.43 (3.69) | 2.07 (2.77) | 6.16 | <0.001 |
| Anger | 1.16 (1.83) | 0.45 (1.31) | 5.72 | <0.001 |
| Vigour | 6.23 (3.64) | 5.75 (3.82) | 1.93 | 0.057 |
| Fatigue | 6.62 (4.44) | 4.95 (4.07) | 6.63 | <0.001 |
| Confusion | 5.47 (2.59) | 4.93 (2.19) | 2.64 | 0.010 |
| Total Mood Disturbance | 14.43 (13.05) | 9.02 (11.44) | 5.84 | <0.001 |

the decrease in the values for the various moods. It is possible that the psi task itself also had an effect on mood, as the POMS was administered for the second time *after* the task. The actual causal relationship between the mood changes and the IC treatment alone is addressed in the discussion on Hypothesis 3 in the following section.

*Planned analyses*

*Hypothesis 1. Psi-scoring (direct hitting) is higher for (i) the IC group compared to controls, and (ii) sheep compared to goats*. Assignment of participants to the two groups was random and data collection ceased at 100 subjects, as planned. Hence, $n = 49$ for the control group, and $n = 51$ for the IC group.

(i) *IC group compared to controls*. Psi-scoring was higher for the IC group (Table 3), as hypothesized. This group scored 13 hits out of 51 (25.5%), which is *above* chance, and therefore in the right direction. However, the hit rate was not significant (exact binomial $z = 0.81$, $p = 0.207$ (one-tailed), effect size ($ES$) = 0.11). In the control group there were 10 hits out of 49 (20.4%), which is only slightly above chance (MCE = 20%). The hit rate was not significant (exact binomial $z = 0.11$, $p = 0.528$ (one-tailed), $ES = z/\sqrt{n} = 0.02$). IC had no significant effect on direct hitting, $F(1, 96) = 0.31$, $p = 0.291$ (one-tailed). A Mann–Whitney test indicated that the difference between the hit rates for the IC and control groups was not significant, $U = 1186.00$, $p = 0.358$ (one-tailed); Cohen's $d = 0.12$.

(ii) *Sheep compared to goats*. The results obtained for this comparison (Table 4) go against the usual findings reported in the literature, as direct hitting was highest for goats (not sheep). This result is supported by the *negative* RASGS/direct hitting correlation

TABLE 3.

*Rank Scores: Control and IC Groups*

| Control group | | | IC group | | |
|---|---|---|---|---|---|
| Rank score | Frequency | % | Rank score | Frequency | % |
| 1 | 10 | 20.4 | 1 | 13 | 25.5 |
| 2 | 9 | 18.4 | 2 | 17 | 33.3 |
| 3 | 14 | 28.6 | 3 | 6 | 11.8 |
| 4 | 8 | 16.3 | 4 | 5 | 9.8 |
| 5 | 8 | 15.3 | 5 | 10 | 19.6 |
| Total | 49 | 100.0 | Total | 51 | 100.0 |

TABLE 4.

*Rank Scores: Sheep* (n = *53) and Goats* (n = *47)*

| Sheep | | | Goats | | |
|---|---|---|---|---|---|
| Rank score | Frequency | % | Rank score | Frequency | % |
| 1 | 11 | 20.8 | 1 | 12 | 25.5 |
| 2 | 14 | 26.4 | 2 | 12 | 25.5 |
| 3 | 9 | 17.0 | 3 | 11 | 23.4 |
| 4 | 6 | 11.3 | 4 | 7 | 14.9 |
| 5 | 13 | 24.5 | 5 | 5 | 10.6 |
| Total | 53 | 100.0 | Total | 47 | 100.0 |

approaching significance, $r(98) = -0.15$, $p = 0.068$, suggesting a slight tendency for psi performance to decline as paranormal belief increases. Direct hitting for goats was 12 hits out of 47 (25.5%), which is *above* chance (MCE = 20%), and therefore not in the direction hypothesized. The hit rate was not significant, exact binomial $z = 0.77$, $p = 0.217$ (one-tailed), $ES = 0.11$. Direct hitting for sheep was 11 hits out of 53 (20.8%), which is only slightly above chance, but in the right direction. The hit rate was not significant, exact binomial $z = 0.03$, $p = 0.500$ (one-tailed), $ES = 0.004$. A Mann–Whitney test indicated that the difference was not significant, ($U = 1186.00$, $p = 0.371$ (one-tailed); Cohen's $d = 0.12$).

*Hypothesis 2. Pre / post-intervention POMS-SF difference scores (for Tension, Depression, Anger, Vigour, Fatigue and Confusion, plus Total Mood Disturbance) correlate positively with direct hitting*. All seven correlations were very weak, and none were significant. Only three correlations (for Tension, Depression and Anger) were positive. Note that the correlation for Vigour was *negative*, which is preferred (the general wording of the hypothesis does not differentiate the fact that a negative correlation means hitting is more likely if the *difference* score for Vigour is small, not large).

These tests were re-run for the IC and control groups separately to determine the actual effect of IC on the hit rate, as this technique has a relaxation component and it putatively induces an ASC. The controls were considered not to be in any induced state, either *relaxed*, or *altered* in some other way by the guided imagery component. For the controls, once again the seven correlations were all very weak and none were significant. Only three were positive (for Tension, Depression and Total Mood Disturbance). For the IC group also, the seven correlations were all very weak and none were significant. Only one correlation was positive (for Anger).

*Hypothesis 3. The mood changes (pre/post-intervention POMS difference scores for Tension, Depression, Anger, Vigour, Fatigue and Confusion, plus Total Mood Disturbance) are larger and positive for (i) the IC group compared to controls, and (ii) sheep compared to goats.*

(i) IC group compared to controls. The POMS-SF difference scores for the controls and the IC group are presented in Table 5. The MANOVA test was used. Mood changes were all positive (i.e., moods improved) such that there were reductions in Tension, Depression, etc., and these effects were *larger* for the IC group (theoretically attributable to the relaxation component of IC, which the controls did not receive). However, most difference scores were not significant; only that for Tension was marginally significant. (Note: Though not significantly different, the difference score for Vigour was favourably *smaller* for the IC group, potentially validating the IC treatment, as it indicates that the IC group's Vigour had not decreased as much as the controls. See the Discussion section for details.)

(ii) *Sheep compared to goats*. Sheep were differentiated from goats by a median split of the RASGS scores (see the Descriptive Statistics section). The POMS-SF difference scores for sheep and goats are presented in Table 6. The mood changes were all positive, and *mostly* larger for the sheep, the exceptions being Tension, Fatigue and Confusion (theoretically, the reduced Vigour for sheep is in the right direction). Only one difference (for Anger) was highly significant, but this did not remain significant after Bonferroni correction (done by dividing the critical $p$ value ($\alpha \leq 0.05$) by the number of tests (7): new critical $p = 0.05/7 = 0.007$.)

TABLE 5.

*Descriptive Statistics: Mean and* SD *Values for the POMS-SF Subscales for All Participants (*N = *100)*

| Variable | Mean difference score (*SD*) | | | $F(1, 96)$ | $p$ (one-tailed) |
|---|---|---|---|---|---|
| | Full sample | Controls | IC group | | |
| Tension | 1.61 (2.68) | 1.14 (2.09) | 2.06 (3.10) | 2.64 | 0.054 |
| Depression | 1.36 (2.21) | 1.24 (1.61) | 1.47 (2.67) | 0.27 | 0.302 |
| Anger | 0.71 (1.24) | 0.65 (1.11) | 0.76 (1.37) | 0.29 | 0.295 |
| Vigour | 0.48 (2.49) | 0.63 (1.90) | 0.33 (2.96) | 0.34 | 0.281 |
| Fatigue | 1.67 (2.52) | 1.41 (2.22) | 1.92 (2.78) | 0.85 | 0.180 |
| Confusion | 0.54 (2.04) | 0.27 (2.10) | 0.80 (1.97) | 1.57 | 0.107 |
| Total Mood Disturbance | 5.41 (9.26) | 4.08 (6.08) | 6.69 (11.45) | 1.81 | 0.091 |

TABLE 6.

*POMS-SF Mean Difference Scores and* SDs*: Goats* (n = *47) and Sheep* (n = *53)*

| Variable | Mean (*SD*) | | *t*(1, 96) | *p* (one-tailed)* |
|---|---|---|---|---|
| | Goats | Sheep | | |
| Tension | 1.64 (2.47) | 1.58 (2.88) | 0.02 | 0.446 |
| Depression | 1.13 (2.35) | 1.57 (2.08) | 0.97 | 0.163 |
| Anger | 0.40 (1.04) | 0.98 (1.35) | 5.75 | 0.009 |
| Vigour | 0.51 (2.21) | 0.45 (2.74) | 0.01 | 0.456 |
| Fatigue | 1.72 (2.69) | 1.62 (2.38) | 0.05 | 0.409 |
| Confusion | 0.62 (1.92) | 0.47 (2.16) | 0.14 | 0.355 |
| Total Mood Disturbance | 5.00 (9.07) | 5.77 (9.50) | 0.16 | 0.346 |

* Tests were two-tailed for Tension, Fatigue and Confusion.

*Post hoc analyses*

*Hypothesis 1b*. Hypothesis 1 was re-tested using mean rank scores and sum-of-ranks statistics instead of direct hitting to compare (i) the IC group and controls, and (ii) sheep and goats.

(i) The mean rank score for the IC group was 2.65 (MCE = 3.00), which is better than the score for the controls (2.90). Ranks for both groups are listed in Table 3. A Mann–Whitney test indicated that the difference was not significant, $U = 1102.50$, exact binomial $p = 0.152$ (one-tailed); Cohen's $d = 0.18$.

The sum-of-ranks statistic for the IC group was $z = -1.03$ ($p = 0.152$; $ES = 0.14$), but for the controls it was only $z = -0.28$ ($p = 0.390$; $ES = 0.04$). The scores were not significant for either group, and the $z$-score difference ($0.75/\sqrt{2} = 0.53$) between the two groups was not significant ($p > 0.05$).

(ii) Contrary to expectations once again, the mean rank score for the sheep (2.92) was larger than that for the goats (2.60). The ranks for both groups are listed in Table 4. A Mann–Whitney test indicated that the difference was not significant, $U = 1098.00$, exact binomial $p = 0.150$ (one-tailed); Cohen's $d = 0.23$.

For the sheep, the sum-of-ranks statistic was $z = -0.20$ ($p = 0.421$; $ES = 0.03$), but for the goats the statistic was $z = -1.18$ ($p = 0.119$; $ES = 0.17$). The scores for the two groups were not significant, and the $z$-score difference ($0.98/\sqrt{2} = 0.69$) between the two groups was not significant ($p > 0.05$).

*Hypothesis 2b*. Hypothesis 2 was re-tested by determining whether the POMS-SF difference scores were correlates of the rank scores. There was a

significant correlation between the Tension difference and the rank scores, $r(98) = -0.18$, $p = 0.040$ (one-tailed). The correlation indicates that larger reductions in Tension tend to be associated with lower (better) rank scores. Rank score therefore proved to be a more sensitive measure than direct hitting (see the results for Hypothesis 2 in the Planned Analyses section).

*Hypothesis 3b*. A marginally significant interaction effect was observed between IC /control groups and sheep/goats, $F(1, 96) = 3.37$, $p = 0.069$ (two-tailed). Though not hypothesized, the effect shown in Figure 1 suggests that sheep benefit from IC (with reduced Tension), whereas goats do not (see the Discussion for details).

*Pre-test scores*. Since Storm et al. (2013) found that pre-test scores on Tension and Confusion correlated positively and significantly ($p < 0.01$) with psi-hitting in their ball selection task (0.29 and 0.33, respectively), the same tests were run again to see if these correlations would be replicated. (Note: The Storm et al. sample was a conflation of control participants with reactance-treated participants.) In the present study (full sample), only the correlation between Confusion and direct hitting was marginally significant, $r(98) = -0.14$, $p = 0.088$ (one-tailed). No other POMS-SF measure, pre- or post-test, correlated significantly with direct hitting in two-tailed tests, although the correlation between post-test Tension and direct hitting was marginally significant, $r(98) = -0.17$, $p = 0.087$ (two-tailed).

Storm et al. (2013) also compared the pre-test scores of sheep and goats, and found no significant differences. Similarly in the present study, there were no significant differences between sheep and goats.

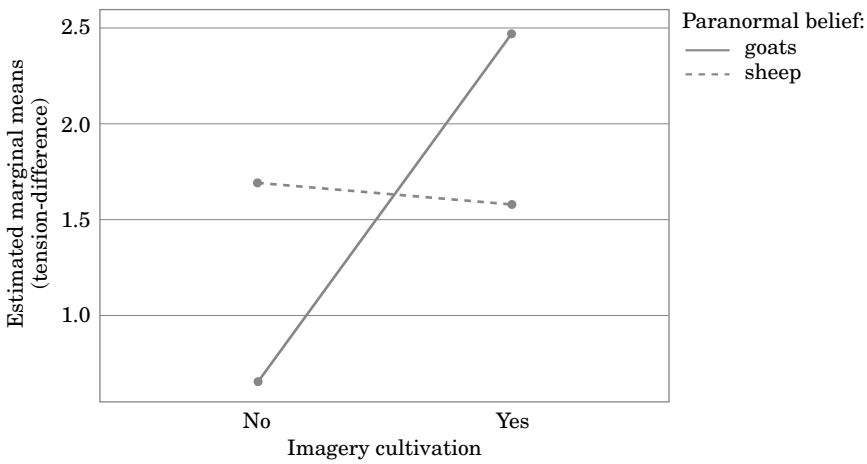


*Figure 1. IC had little effect on goats in terms of reduced Tension, whereas sheep responded favourably, with reductions in Tension*

## Discussion

The testing of IC, a technique designed to elicit relaxation and to increase psi effects, produced encouraging results in the present study, but there were too few significant effects to allow firm conclusions to be drawn. Significance testing aside, however, some effects are on par with the effects reported in the literature for other techniques (Storm & Goretzki, 2021; Storm & Tressoldi, 2020), so IC may be regarded as a comparable and viable psi-conducive treatment. The present study also sought insight into the differences in psi performance between sheep and goats, and the influence of moods, as evaluated using the POMS-SF score, on psi performance (McNair et al., 1992).

The full sample ($N = 100$) produced a hit rate of 23%, which is not significant but is nevertheless above the MCE of 20%. The mean rank score (2.78) was also greater than chance (MCE = 3.00), which is therefore in the right direction but it is only marginally significant ($p = 0.069$). The sum-of-ranks was a successful measure in a past study of IC (see Storm & Goretzki, 2021), but the present study yielded a non-significant $z$ score. In their study, however, Storm and Goretzki found a slightly higher hit rate of 25%, plus their study involved a much larger sample size ($N = 200$), which may account for their significant $p$ value. In addition, all their 200 participants underwent IC, whereas in the present study only half the sample ($n = 51$) did so. Nevertheless, the mean rank score obtained in the present study (2.78) was still better than the significant mean rank score 2.84 reported by Storm and Goretzki.

A positive and significant correlation was found in the present study between education and RASGS. I draw attention to this finding because it suggests a tendency for paranormal belief to *increase* with a higher level of education. However, under the cognitive deficits hypothesis, paranormal belief is the result of poor education, and believers in the paranormal are said to have uncritical, naïve and irrational thought processes due to deficits in education, lower average levels of intelligence and poor reasoning skills. That said, evidence supporting the cognitive deficits hypothesis is inconclusive at this stage, and this hypothesis is even thought by some to be "rather more successful as a polemical device for sceptical commentators than as an empirically grounded theory of paranormal belief" (Irwin, 2009, p. 90).

Outcomes for Hypothesis 1 with regard to differences between the IC group and controls were in the hypothesized directions for direct hitting (25.5% for the IC group, 20.4% for controls; MCE = 20%). Also, post hoc, the mean rank score was better for the IC group (2.65) than the controls (2.90), and the sum-of-ranks was better for the IC group (IC group, $ES = 0.14$; controls $ES = 0.04$). Once again, the mean rank score of 2.65 obtained in this study is better than one (2.84) reported previously by Storm and Goretzki (2021), but the both the hit rate *and* the *ES* for the IC group are effectively equal to those reported in the same study (p. 49). In addition, the *ES* of 0.14 obtained for the control group

is comparable to the value (mean $ES = 0.15$) reported in a recent meta-analysis of 117 ganzfeld studies (Storm & Tressoldi, 2020, p. 209).

When it came to testing the sheep–goat effect, however, there was an unexpected turnaround; the goats performed better than the sheep on direct hitting. The goats produced a high hit rate of 25.5% (equivalent to the hit rate for the IC group), whereas the sheep produced a low hit rate (20.8%), but the difference between these rates was not significant. Post hoc testing using mean rank scores and sum-of-ranks produced similar results indicating that goats had better psi performance than sheep.

Hypothesis 2 looked for correlations between direct hitting and difference scores for each of the six POMS-SF subscales (Tension, Depression, Anger, Vigour, Fatigue and Confusion) and the global scale of Total Mood Disturbance. It was hypothesized that improved mood might induce better performance on the psi task, and that the IC group would perform better than controls. However, no correlation was significant, and only three were positive (for Tension, Depression and Anger). However, the post hoc test using rank scores instead of direct hitting, produced one significant correlate—as Tension reduced, the rank score tended to improve—although by chance alone we might expect one significant correlation out of seven tests.

As proposed in Hypothesis 3(i), the mood changes of all participants were positive (i.e., moods improved). The changes were larger (but not significant) for the IC group, which is theoretically attributable to the relaxation component of IC, which controls did not receive. The pre/post-intervention difference for Tension was marginally significant (the difference for Total Mood Disturbance only approached significance). The general wording of the hypothesis does not cover Vigour, which is the only subscale antithetical to the other moods. However, the pre/post-intervention difference for Vigour is favourably *smaller* for the IC group. This validates the IC treatment, as it indicates that the Vigour of the IC group did not decrease as much as the controls.

With regard to Hypothesis 3(ii), all mood changes were positive, and were *mostly* larger for the sheep—the exceptions being Tension, Fatigue and Confusion. (Vigour is excluded, as it is in the right direction, there being a smaller decrease in Vigour for the sheep.) Only one difference (for Anger) was highly significant, which may arguably be due to chance after Bonferroni correction. If, however, the result is taken seriously, it is difficult to understand why anger might dissipate so much for sheep. Noting that there was no significant pre-test difference on Anger between sheep and goats (see also Storm et al., 2013, p. 431), it is probably not sheep but goats who should be the focus of our attention. It might be that goats are fearful (angry?) of getting too close to a "proof-of-psi" scenario, and the POMS-SF was readministered right after the photograph ranking but just before the final RNG trial that determined the psi target. This assumption is based on the findings that anger

and fear are quite strongly correlated (e.g., Wollebæk et al., 2019), and that fear can induce anger (Zhan, et al., 2018).

Recall that in Hypothesis 2 the correlation between the pre/post-intervention difference in Tension and direct hitting was only marginally significant, but the post hoc (Hypothesis 2b) correlation between the pre/post-intervention difference in Tension and the rank-score was significant. This indicates that reduced tension tends to improve psi scoring. In addition, the post hoc interaction effect between IC-group/controls and sheep/goats suggests that sheep benefit from IC more than goats. Taken together, these results suggest that sheep whose Tension is reduced by IC treatment would tend to do better in a psi task than goats, who do not seem to benefit from IC treatment.

The significant correlation between Confusion and psi-hitting reported by Storm et al. (2013) was effectively replicated in this study, where the correlation between Confusion and direct hitting approached significance (though we are comparing a forced-choice task (ball selection) with a free-response task (picture identification)). If there is any merit in the assumption made by Storm et al. that "participants had doubts, expressed as tension and confusion, as to what was expected of them during the experiment" (p. 431), the same assumption might be made for Confusion in the present study. From the findings of the present study, we cannot say with certainty that moods such as Confusion (or the other six PMS-SF variables) adversely affect psi performance. However, the post hoc tests do seem to indicate some benefit of the IC treatment in reducing Tension, and this may be reflected in a tendency for the participants who received IC to show improved psi performance. This conclusion holds despite the fact that the psi performance of the goats was better (not significantly) than that of the sheep.

The results of the experiment conducted in this study have helped to answer the questions posed: Does IC affect mood? Do IC and mood affect psi performance? Are sheep more prone than goats to mood change? Do sheep perform better than goats on psi tasks? The answer is "Yes" to all these questions except the last one, although it is more often reported that sheep perform better than goats (Storm & Tressoldi, 2017).

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# APPENDIX

Pre-recorded instructions, adapted from Harner (1990):

*[Relaxing background tones for the entire 9 minutes and 35 seconds]*

- Visualize an opening into the earth that you remember from some time in your life.
- It can be an opening that you remember from your childhood, or one you saw last week, or even today.
- Any kind of entry into the ground will do. It may be a hole made by a burrowing animal, a cave, a hollow tree stump, a spring, or even a swamp.
- It can even be a man-made opening.
- The right opening is one that really feels comfortable to you, and one that you can visualize.
- Spend a couple of minutes seeing the hole without going in it. Note its details clearly.

*[2 minutes with continued background tones; no voice]*

- Visualize your opening into the earth … [5 second pause] … enter it … [5 second pause] … and begin the journey. Are you ready? OK, here we go.
- Go down through the opening and enter the tunnel … [5 second pause] … At first the tunnel may be dark and dim … [5 second pause] … It usually goes underground at a slight angle, but occasionally it descends steeply … [5 second pause] … The tunnel often bends … [5 second pause] … Now continue this journey down the tunnel until I give you further instructions.

*[3 minutes with continued background tones; no voice]*

- You are now reaching the end of the tunnel … [10 second pause] … you will see a set of doors … [10 second pause] … now visualize the doors in front of you … [10 second pause] … Now push open the doors … [10 second pause] … Now visualize a photographic image before you … one that you will see later on the computer monitor [20 second pause] … Imagine the photograph appearing on the computer monitor … [20 second pause] … Study the photograph in all its detail … [20 second pause] … Remember this information for later.
- The journey is now almost over … [10 second pause] … come back up through the tunnel ... [5 second pause] … The session will conclude with a ringing bell sound to signal that the journey is over. [10 second pause] … [bell rings]