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FINAL SCIENTIFIC REPORT TO THE BIAL FOUNDATION

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PROJECT: "ATTITUDES AND BELIEFS AS PREDICTORS OF PSI EFFECTS IN A PSEUDO-GAMBLING TASK"

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The Bial Foundation has financially supported me, Dr. Lance Storm (principal investigator), over the course of the experiment, January 1, 2022 to December 31, 2022. All laboratory work was completed (as planned, number of participants tested = 120). The School of Psychology, University of Adelaide, provided amenities for the conduct of this research.

The following report describes the experimental and analytical work carried out for the project.

This final report includes:

1. A report of the research describing background to the study, methods, results, and discussion (pp. 2–11, plus Appendix, pp. 11–12). This report is a reduced version of the final draft of the paper that has been submitted to the *Journal of Parapsychology*. The draft is to be uploaded to the Bial Foundation website. The submission to the journal duly acknowledges the Bial Foundation's financial support.

2. A table highlighting the differences between expected and achieved output indicators and publications so far though further indications are expected (p. 13).

3. A template with information to be posted on the Bial Foundation web page concerning the final results of the project (p. 14).

Attitudes and Beliefs as Predictors of Psi Effects in a Pseudo-Gambling Task

by Lance Storm

Background and Objectives

It is understood that believers in psi ('sheep') will use psi to hit a target, but as far as non-believers ('goats') are concerned, the conventional understanding is that they will inadvertently use psi to avoid the target. In other words, goats do not tend to psi-hit; they tend only to score at chance or occasionally psi-miss, and since the sheep-goat effect is sufficiently demonstrated when sheep score significantly higher than goats, little thought is given to the fact that goats are never specifically asked (or given the suggestion to) psi-miss. The present study looked at the sheep-goat effect in the context of compliance from sheep and noncompliance from goats.

The advantage to process oriented parapsychology of the present study is that: (i) it caters to a participant's goal orientation, whether the individual is a sheep or a goat, and (ii) compliance in sheep and noncompliance in goats can be tested at more than one level for both, thus attaining evidence of sheep-goat effects in both *degree* (along a continuum of psi-hitting) and *kind* (approach vs. avoidance). These effects are differentiated in a card-guessing experiment by a simultaneous two-task test that has two corresponding psi-outcomes of interest: spade-hitting (an 'approach' task primarily for sheep) and club-hitting (an 'avoidance' task primarily for goats). Thus the experiment caters to sheep and goats by testing compliance and noncompliance, respectively, but it is also conducted in the context of a gambling situation, so it may encourage psi. Therefore, gambling outcomes, gambling attitudes, and various beliefs were measured as possible psychological and parapsychological correlates.

Since Storm and Thalbourne (2005) considered compliance and noncompliance as pivotal concepts related to gambling outcomes, instructions to participants were twofold: to target Ace-of-Spades cards, and simultaneously to avoid Ace-of-Clubs cards. Storm and Thalbourne found the number of Aces of Spades was slightly above chance as hypothesized, thus suggesting participants were compliant with the experimenter's instructions. However, the number of Aces of Clubs was also slightly above chance, which suggested noncompliance.

Originally, the aim of the authors (Storm & Thalbourne, 2005) was to demonstrate compliance as Ace-of-Clubs avoidance (i.e., participants will avoid clubs if they are asked to avoid clubs), so the authors hypothesized that club-hitting should be *below* chance. On the one hand, from a theoretical perspective, the slightly-above-chance finding was serendipitous because it implied noncompliance from some noncompliant sub-group (perhaps mainly goats). On the other hand, compliance may have been coming largely from sheep. Unfortunately, Storm and Thalbourne did not measure the sheep-goat (paranormal belief) variable in order to confirm these assumptions. Therefore, the present study looks at the sheep-goat effect in the context of compliance (from sheep) and noncompliance (from goats).

Method

Participants
Mainly First-Year Psychology students (University of Adelaide). Total planned and tested, $N = 120$.

Measures
Four measures are to be used in the study:

1. Rasch-scaled *Australian Sheep-Goat Scale* (RASGS; Thalbourne, 1995): an 18-item scale, each item scoring 0 (false), or 1 (uncertain), or 2 (true). ASGS data are top-down purified (Rasch-scaled) to eliminate age and gender bias from the scale (Lange & Thalbourne, 2002);

2. *Belief in Good Luck Scale* (BIGL; Darke & Freedman, 1997): a 12-item scale (scored on 5-point Likert scales; 1= 'strongly disagree' to 5 = 'strongly agree') designed to measure the level of belief in the concept of good luck;

3. *Questionnaire of Beliefs about Luck* (QBL; Luke, Roe, & Davison, 2008): a 21-item questionnaire scored on 7-point Likert scales ('strongly disagree' to 'strongly agree'). There are four polar concepts of 5 items each (Luck, Chance, Providence, and Fortune), and a one-item Perceived Personal Luckiness measure (though Luke et al., 2008, p. 138 advise against its use);

4. *Gambling Attitude Scales* (GAS; Kassinove, 1998): comprises four subscales measuring attitude towards gambling in 'general', 'casino', 'horse-races', and 'lotteries' (9 items per subscale; Total: 36);

5. *Attitudes Towards Gambling Scale* (ATGS-8; Canale et al., 2016): Comprises eight items that measure general attitude to gambling, not subject to "specific gambling activity" (p. 71). Scored using a Likert scale: 1 = 'strongly disagree' to 5 = 'strongly agree'. The sum of eight items forms a total ATGS-8 score (range 8–40).

Materials

Computer program containing Information and Consent pages (i.e., screens), plus separate pages for each of the measures listed above. Also presented are five trials consisting of five playing cards (face-down) presented on-screen.

Procedure

Instructions outlining the experiment are presented on-screen. Participants provide demographics details, and complete the RASGS, BIGL, QBL, GAS, and ATGS-8. They then complete five on-screen card-guessing trials (five cards in each trial). A detailed outline of the procedures is given in the Appendix (pp. 10-11).

Hypotheses

There are *confirmatory* and *exploratory* hypotheses. The *confirmatory* hypotheses are H1a, H2, and H4a (horse-races/club-hitting). All other hypotheses are *exploratory*. All hypotheses are directional and all tests are one-tailed (unless specified otherwise). The level of significance is set at $\alpha = .05$. Data was not transformed, permutated, or boot-strapped. There can be no excluded (e.g., missing) data as the online pages do not permit continuation to another questionnaire page unless and until all items are answered.

H1a. For the *whole sample*, the spade-hitting and club-hitting effects will replicate those found in Storm and Thalbourne (2005, pp. 36, 42), which were both above chance (not significantly). The differences are not expected to range far from ES = 0.008 for spade-hitting, and ES = 0.028 for club-hitting (see Storm & Thalbourne, p. 42).

H1b. The number of correctly identified Aces of Spades (spade-hitting) is above chance *for sheep* ($P_{MCE} = 1.00$), and the number of correctly identified Aces of Clubs (club-hitting) is above chance *for goats* ($P_{MCE} = 1.00$).

H1c. A sheep-goat effect is expected for spade-hitting as performance differences (expressed as critical ratios, CR) both (i) *within the data of the present study*, and (ii) *as replications of past findings* (reported in Storm & Tressoldi, 2017): "CR(z) = 0.40" (p. 89).

H2. There is a negative relationship between spade-hitting and club-hitting.

H3. Scores on the RASGS scale correlate (i) positively with spade-hitting, and (ii) negatively with club-hitting.

H4. Scores on (i) the four GAS subscales (General, Lottery, Horse-races, Casino), and (ii) the ATGS-8, correlate positively with spade-hitting, and negatively with club-hitting.

H5. Scores on the BIGL scale correlate positively with spade-hitting, and negatively with club-hitting.

H6. Scores on three QBL measures (Luck, Providence, Fortune) correlate (i) positively with spade-hitting, and (ii) negatively with club-hitting (NB: the two relationships are reversed in direction for the Chance measure; see Luke et al., 2008, pp. 201-202).

H7. RASGS, BIGL, QBL subscales, GAS subscales, and ATGS-8 (+ Sex and Age) predict spade-hitting.

H8. RASGS, BIGL, QBL subscales, GAS subscales, and ATGS-8 (+ Sex and Age) predict club-hitting.

Results

Preliminary Findings

Sample = 120 participants; mean Age = 22 years (*SD* = 6 years); 38 males (mean Age = 22 years; *SD* = 4 years) and 82 females (mean Age = 22 years; *SD* = 7 years). Age correlated positively and significantly with education, $r(118) = .50$, $p < .001$ (two-tailed), indicating that older participants tended to have tertiary-level qualifications.

Sex correlated positively and significantly with RASGS scores, $r(118) = .32$, $p < .001$ (two-tailed), indicating that females (mean RASGS = 21.80, *SD* = 6.72) tended to score higher on paranormal belief than males (mean RASGS = 16.99, *SD* = 6.57), $t(118) = 3.68$, $p < .001$ (two-tailed).

For the whole sample (N = 120), hit rates on Spades, Clubs, and Kings, are given in Table 1. The hit rate was below chance for Spades, at chance for Clubs, and above chance for Kings.

Table 1
Card Hit Rates (Spades, Clubs, and Kings)

Card Type	Hits (MCE)	Observed %	z	p
Spades (Tests Psi Hitting)	110 (P_{MCE} = 20%)	18.3	-0.97	.858
Clubs (Tests Psi Missing)	120 (P_{MCE} = 20%)	20.0	0.00	.516
Kings (Tests Displacement)	370 (P_{MCE} = 60%)	61.7	0.79	.215
Total	600	100.0		

Note: Sample (N = 120); Five trials per participant: 120 × 5 = 600 trials. Binomial test is one-tailed

The median RASGS score (21.45) was used as the cut-off point to demarcate sheep from goats, with goats scoring below 21.45 (n = 60), and sheep scoring at or above 21.45 (n = 60). Statistics for the scales and subscales are given in Table 2, which also shows results of a MANOVA to assess differences between sheep and goats. Rows in **bold** indicate significant differences. Five comparisons were significantly different (See the **Discussion** section below for comments.)

Table 2
Descriptives and Differences: Five Questionnaires, Mean Scores and *SD*s (N = 120)

Variable	Full Sample (*SD*)	Sheep (*SD*)	Goats (*SD*)	$F(1, 118)$	p (2t)
1. RASGS	**20.28 (7.01)**	**25.95 (3.45)**	**14.61 (4.68)**	**228.31**	**< .001**
2. BIGL	**32.43 (7.81)**	**34.30 (7.21)**	**30.83 (8.11)**	**5.22**	**.024**
3a. QBL—Luck	**21.26 (5.80)**	**22.58 (5.40)**	**19.93 (5.93)**	**6.55**	**.012**
3b. QBL—Chance	**26.31 (5.20)**	**24.83 (5.59)**	**27.78 (4.33)**	**10.44**	**.002**
3c. QBL—Providence	**15.81 (7.04)**	**18.23 (6.82)**	**13.38 (6.45)**	**16.03**	**< .001**
3d. QBL—Fortune	18.02 (5.93)	17.80 (5.41)	18.25 (6.46)	0.17	.680
4a. GAS—General	26.93 (7.79)	26.40 (7.52)	27.45 (8.08)	0.54	.463
4b. GAS—Lotteries	31.28 (7.21)	32.55 (6.22)	30.02 (7.93)	3.79	.054
4c. GAS—Horse-Races	20.12 (8.55)	19.78 (8.46)	20.45 (8.69)	0.18	.671
4d. GAS—Casino	30.60 (8.29)	30.45 (7.39)	30.75 (9.16)	0.04	.844
5. ATGS-8	20.69 (4.69)	20.40 (4.65)	20.98 (4.76)	0.46	.498

Notes. RASGS = Rasch-Scaled Australian Sheep-Goat Scale; BIGL = Belief in Good Luck Scale; QBL = Questionnaire of Beliefs about Luck; GAS = Gambling Attitude Scales; ATGS-8 = Attitudes Towards Gambling Scale.

The RASGS correlated significantly with BIGL and three of the four QBL subscales (Luck, Chance, and Providence). All test were two-tailed:

- RASGS × BIGL, $r(118) = .31$, $p = .001$;
- RASGS × QBL-Luck, $r(118) = .31$, $p = .001$;
- RASGS × QBL-Chance, $r(118) = -0.37$, $p < .001$;
- RASGS × QBL-Providence, $r(118) = .43$, $p < .001$.

The RASGS did not correlate significantly with any of the four GAS subscales or the ATGS-8.

The BIGL correlated significantly with the four QBL subscales (Luck, Chance, Providence, and Fortune), the ATGS-8, and GAS-Lotteries. All test were two-tailed:

- BIGL × QBL-Luck, $r(118) = .45$, $p < .001$;
- BIGL × QBL-Chance, $r(118) = -0.32$, $p < .001$;
- BIGL × QBL-Providence, $r(118) = .38$, $p < .001$;
- BIGL × QBL-Fortune, $r(118) = .27$, $p = .002$;
- BIGL × ATGS-8, $r(118) = .22$, $p = .016$;
- BIGL × GAS-Lotteries, $r(118) = .18$, $p = .050$.

Most of the four QBL subscales correlated significantly with each other (see Table 3).

Table 3
Pearson's Correlations: Beliefs About Luck (QBL).

Variable	1	2	3
1. QBL—Luck	–		
2. QBL—Chance	-.29*	–	
3. QBL—Providence	.41**	.43**	–
4. QBL—Fortune	.37**	.04	.17

Notes. df = 118; * p = .002; ** p < .001.

All four GAS subscales correlated significantly with each other and the ATGS-8 (see Table 4).

Table 4
Pearson's Correlations: Attitudes Towards Gambling (GAS & ATGS-8).

Variable	1	2	3	4
1. GAS—General	–			
2. GAS—Lotteries	.47**	–		
3. GAS—Horse-Races	.49**	.23*	–	
4. GAS—Casino	.78**	.51**	.40**	–
5. ATGS-8	.64**	.54**	.42**	.66**

Notes. df = 118; * p =. 011; ** p < .001; GAS = Gambling Attitude Scales; ATGS-8 = Attitudes Towards Gambling Scale.

Planned Analyses

H1a. For the *whole sample*, the spade-hitting and club-hitting effects will replicate those found in Storm and Thalbourne (2005, pp. 36, 42), which were both above chance (not significantly).

Participants as Unit of Analysis. The mean number of Aces of Spades was slightly below chance (M_{spades} = 0.92, SD = .80), and not significant, t(119) = -1.15, p = .253 (two-tailed). The mean number of Aces of Clubs was at chance (M_{clubs} = 1.00, SD = .79), and not significant, t(119) = 0.00, p = 1.00 (two-tailed).

Trials as Unit of Analysis. From Table 1, the count of Aces of Spades was below chance (N_{spades} = 110), and not significant, Exact Binomial z = -0.97, p = .858. The number of Aces of Clubs was at chance (N_{clubs} = 120), and not significant, Exact Binomial z = 0.00, p = .516.

When z scores were converted to ES values, the differences were not expected to be different from ES = 0.008 (for spade-hitting) and ES = 0.028 (for club-hitting), which were calculated from the data collected by Storm and Thalbourne (2005). Table 5 lists the trial and hit counts for spade-hitting and club-hitting for the two studies. Respective ESs were compared using the VassarStats online calculator (Lowry, 2001-2021: http://vassarstats.net/rdiff.html). The programme compares r values; Rosenthal (1986, p. 319) equates ES with r by using the same formula used in many parapsychological meta-analyses (i.e., ES = $r = z/\sqrt{n}$).

For the two studies, the Ace-of-Spades ES difference between .008 and -0.004 is not significant, z = 0.20, p = .842 (two-tailed). The Ace-of-Clubs ES difference between .028 and .000 is not significant, z = 0.46, p = .646 (two-tailed). Though effects are very much weaker in the present study, they can be taken as replications, for as Rosenthal notes (1986): "A replication is successful to the degree that the second study obtains an effect size similar to the effect size of the first study" (p. 334).

Table 5
Trials, Hit-Rates, Trial-Based *Z* Scores, and ES Scores for Spade Hitting and Club Hitting

Study	Variable	Total Trials	Total Hits	Proportion	*Z* Score	ES
Study 1	Aces of Spades	500	102	.204	0.170	.008
	Aces of Clubs	500	106	.212	0.615	.028
Study 2	Aces of Spades	600	110	.183	-0.970	-.004
	Aces of Clubs	600	120	.200	0.000	.000

Notes. Study 1 = Storm and Thalbourne (2005); Study 2 = Present Study.

H1b. Spade-hitting for sheep was not above chance (MCE = 1.00), M_{spades} = 0.93 (*SD* = .73), and not significant, $t(59) = -0.60$, $p = .551$ (two-tailed). Club-hitting for goats was not above chance, M_{clubs} = 0.98 (*SD* = .79), and not significant, $t(59) = -0.16$, $p = .871$ (two-tailed).

H1c: A *sheep-goat effect* is expected for spade-hitting as performance differences both (i) ***within the data of the present study***, and (ii) as ***replications of past findings*** (reported in Storm & Tressoldi, 2017, p. 89). For both (i) and (ii), the sheep-goat difference is expressed as a critical ratio (CR) given by Formula #10 in Palmer (1986, p. 154; also used by Lawrence, 1993, p. 76; and Storm & Tressoldi, p. 106) for change in scoring as hit totals of two groups of trials:

$$CR(z) = \frac{(H_1/n_1) - (H_2/n_2) \pm 0.5(1/n_1 + 1/n_2)}{\sqrt{[(pq/n_1) + (pq/n_2)]}}$$

where CR(*z*) is the critical ratio of the difference as a *z* score, H_1 and H_2 are the total number of hits in each group, n_1 and n_2 are the corresponding numbers of trials, p = chance probability of a hit (the reciprocal of the number of target alternatives), q = chance probability of a miss (i.e., $1 - p$), and ± 0.5 means adjust towards zero. A significant CR(*z*) indicates a sheep-goat effect..

For (i), scoring was in the direction expected: sheep (with 56 Spades) scored slightly higher than goats (54 Spades). However, CR(*z*) = 0.11, $p = .456$. The sheep-goat effect is not significant.

Out of interest, the club-hitting difference was checked. Scoring was not in the direction expected: goats (with 59 Clubs) scored slightly lower than sheep (61 Clubs), though the difference was not significant, CR(*z*) = 0.08, $p = .468$. King-hitting was also checked: sheep scored 183 Kings, and goats scored 187 Kings; the difference was not significant, CR(*z*) = 0.24, $p = .404$.

For (ii), CR(*z*) calculated in the present study is compared to the CR(*z*) in the Storm and Tressoldi (2017) sub-sample of studies with actual sheep and goat trials. The past (earlier) value determined from this data is: "CR(*z*) = 0.40" (p. 89). The two CR(*z*) values can be tested against each other to determine replication using Rosenthal's (1986, p. 317) formula for a *z*-score difference $(z_1 - z_2)/\sqrt{2}$. The difference between the two *z* values 0.40 and 0.11 is not significant, $z = .21$, $p = .417$. The second value from the present study can be taken as a replication of the first.

H2. The relationship between spade-hitting and club-hitting was negative and significant, $r(118) = -0.15$, $p = .05$. The hypothesis was supported. This effect replicates the Storm and Thalbourne (2005, p. 36) finding ($r[98] = -0.23$). The difference between -0.15 and -0.23 is not significant, $z = .60$, $p = .275$ (one-tailed).

H3. Scores on the RASGS scale did not correlate positively with spade-hitting, $r(188) = -0.05$, $p = .564$ (two-tailed); and did not correlate negatively with club-hitting, $r(118) = -0.05$, $p = .568$ (two-tailed). The two-part hypothesis was not supported.

H4. (i) Of the four GAS measures—General, Lottery, Horse-races, Casino—three correlated positively with spade-hitting (listed in **bold**), but these were weak and not significant:

- **Spade-hitting × General, $r(118) = .0003$, $p = .499$;**
- **Spade-hitting × Lottery, $r(118) = .04$, $p = .335$;**
- Spade-hitting × Horse Races, $r(118) = -0.03$, $p = .790$ (two-tailed);
- **Spade-hitting × Casino, $r(118) = .02$, $p = .434$.**

Of the four GAS measures, three correlated negatively with club-hitting (listed in **bold**), but these were weak and not significant:

- Club-hitting × General, $r(118) = .003$, $p = .976$;
- **Club-hitting × Lottery, $r(118) = -0.01$, $p = .443$;**
- **Club-hitting × Horse Races, $r(118) = -0.05$, $p = .308$;**
- **Club-hitting × Casino, $r(118) = -0.03$, $p = .364$.**

H4. (ii) The correlation between spade-hitting and ATGS-8 was not positive, $r(118) = -0.06$, $p = .524$ (two-tailed). The correlation between club-hitting and ATGS-8 was not negative, $r(118) = .02$, $p = .824$ (two-tailed). Both correlations were weak and neither was significant. The hypothesis were not supported.

H5. Scores on the BIGL scale did not correlate positively with spade-hitting, $r(118) = -0.05$, $p = .600$ (two-tailed); and did not correlate negatively with club-hitting, $r(118) = .000$, $p = 1.00$ (two-tailed). The hypothesis was not supported.

H6. (i) Of the four QBL measures—Luck, Providence, Fortune, and Chance—two out of four spade-hitting correlations were in the directions hypothesized (listed in **bold**), but none were significant:

- **Spade-hitting × Luck, $r(118) = .07$, $p = .211$;**
- Spade-hitting × Providence, $r(118) = -0.02$, $p = .834$ (two-tailed);
- **Spade-hitting × Fortune, $r(118) = .03$, $p = .362$;**
- Spade-hitting × Chance, $r(118) = .000$, $p = .360$.

H6. (ii) Of the four QBL measures—Luck, Providence, Fortune, and Chance—three out of four club-hitting correlations were in the directions hypothesized (listed in **bold**), but none were significant:

- **Club-hitting × Luck, $r(118) = -0.06$, $p = .249$;**
- Club-hitting × Providence, $r(118) = .08$, $p = .374$ (two-tailed);
- **Club-hitting × Fortune, $r(118) = -0.11$, $p = .117$;**
- **Club-hitting × Chance, $r(118) = -0.02$, $p = .429$**.

For H6, five out of eight correlations in total were in the directions hypothesized, but none were significant.

Discussion

Forced-choice (card-guessing) experiments are known to have weak effects (Cardeña, 2018), but forced-choice designs are the logical option in experiments that test gambling scenarios because the range of target choices is limited and unequivocal (as in poker machines, blackjack, roulette). Since forced-choice effects are weak, gamblers are clearly at a disadvantage if they wish to use psi (see

Radin & Rebman, 1998). However, it is argued in this present study, as was argued by Storm and Thalbourne (2005), that gambling performance (outcomes) may have a psi component, so it is reasonable to assume that beliefs about luck and psi (paranormal influence), and attitudes towards gambling, may play a role in gambling outcomes. In particular, sheep-goat effects may be evident in gambling performance. Thus, a number of relevant measures were used in the present study (see *Measures* above).

Of these measures specifically (not pertaining to psi effects) there were five significant mean differences between sheep and goats out of a possible 11 tests (see Table 1), with four of the five in the directions expected. That is, sheep scored higher than goats on RASGS, BIGL, and two QBL subscales (Luck and Providence). Goats were significantly higher on QBL-Chance, which is understandable as they would be expected to think quite strongly that psi outcomes are the result of mere chance (no luck involved). One marginally significant difference was also in the direction expected (GAS-Lotteries). These differences may have bearing on the sheep-goat psi effect as goats (being non-believers) could be thought of as repudiating the idea that luck and a positive attitude towards gambling can facilitate a successful psi effect (i.e., winning). However, the relevant correlations do not support this supposition (see results for H3 to H6).

As far as gambling attitudes go (as measured on GAS subscales), sheep and goats do not differ generally, and the same applies to ATGS-8 (also an attitude scale). That is, sheep and goats appear to be in agreement. It is not clear whether some degree of sociocultural influence, manifesting as a matter of conscience (e.g., thoughts and concerns about problem gambling), might account for this parity in attitudes.

Some significant correlations were to be expected. RASGS correlated with BIGL, and three QBL subscales (Luck, Chance, and Providence). Believers (sheep) may be expected to consider that luck, chance, and providence, can be controlled paranormally (i.e., with psi), whereas non-believers (goats) would tend not to hold such beliefs. It is also not surprising that the BIGL correlated with all four QBL subscales as these are all 'luck' measures (and most QBL subscales correlate significantly with each other—see Table 3). These QBL intercorrelations generally replicate those in Luke et al. which "range between .04 and .67" (p. 140).

Also to be expected, the gambling attitude scales (GAS and ATGS-8) all correlate significantly with each other (see Table 4). The GAS inter-correlations replicate the six significant correlations reported in Storm and Thalbourne (2005, Table 2, p. 39). However, only the significant BIGL/GAS-Lotteries correlation above was a replication, whereas the BIGL correlated with all four GAS subscales in Storm and Thalbourne (Table 1, p. 39).

All three parts of H1 (a, b, c) are underpinned by a standard (compliance) protocol; participants were generally expected to *target* Ace-of-Spades (expected effect = spade-hitting), with mostly sheep showing compliance, whereas the non-standard (noncompliance) protocol that runs concurrently (i.e., target avoidance) is expected to engage goats in a noncompliant attitude (expected effect = club-hitting). In H1a, for the whole sample (using participants' individual scores as the unit of analysis), both types of effect were not significant. Using trials as the unit of analysis, total hit counts for spades and clubs were at chance (see Table 1). ES values for spade-hitting and club-hitting were extremely weak, and despite the non-significant differences with respective values reported in Storm and Thalbourne (2005b), these values could be interpreted as replications (see Table 5). Previously, since Storm and Thalbourne did not administer the ASGS, sheep and goat performances could not be tested, but in the present study, there was no significant scoring for sheep on spade-hitting, and no significant scoring for goats on club-hitting (see H1b). The test result for a sheep-goat effect (see H1c) shows that the performance difference between sheep and goats was not significant, which contrasts with findings in the meta-analysis by Storm and Tressoldi (2017) that indicate sheep-goat effects.

The original spade-hitting/club-hitting correlation was negative and significant in the study by Storm and Thalbourne (2005b), r = -0.23 (see H2). This effect was replicated in the present study (r = -0.15), and although weaker, it was not significantly lower. The significant spade-hitting/club-hitting correlation actually suggests that if participants successfully targeted Ace-of-Spades, they tended to avoid Ace-of-Clubs (and *vice versa*), but more is implied—failing in their aim, participants could still avoid *noncompliance* (if they were sheep) or avoid *compliance* (if they were goats) by displacing to King cards because the two tasks are not dependent and so other targets (i.e., Kings) are optional. In fact, there is a slight suggestion of displacement towards Kings (at 61.7% where MCE = 60%; see Table 1). Even though the spade-hitting/club-hitting relationship is semi-independent, the r values so far do not show constancy, and there is much scope for other than negative outcomes. Thus, as Storm and Thalbourne have stated: "… this negative relationship is an important one. It indicates that there may be a negative relationship between compliant psi and noncompliant psi" (p. 44). However, there was no evidence from psi performances for sheep and goats that it was primarily sheep who demonstrated compliance and/or primarily goats who demonstrated noncompliance, but it would seem likely given their characters which would appear to be driven (at least in part) by vindication in psi tests; "sheep and goats are … motivated toward different ends" (see Palmer, 1972, p. 9).

The paranormal belief measure (RASGS) did not correlate significantly with the two psi measures, spade-hitting and club-hitting (H3). Nor were the correlations in the directions expected. However, six of eight GAS correlations (with the two psi measures) were in the directions hypothesized, but again none were significant (see H4). Neither were the two ATGS-8 correlations significant or in the directions hypothesized.

The remaining two hypotheses (H5 to H6), concerning the BIGL and QBL as possible spade-hitting and club-hitting correlates, comprised another ten correlations in total. Though none were significant, five out of six QBL correlations were in the directions hypothesized. Given these results there was no need to run multiple regression analyses (H7 & H8).

In conclusion, a few factors need considering before firm statements can be made about the findings in the present study: First, given that a forced-choice study was conducted, it is fair to say the sample size may have been too small (N = 120, accounting for a total of 600 trials). In the sheep-goat forced-choice meta-analysis by Storm and Tressoldi (2017), the majority of studies had trial counts numbering in the thousands and tens of thousands, but only a minority showed significant z scores (around 27%), and there are even fewer (15%) that produced significant psi effects requiring only hundreds of trials or less (see Storm and Tressoldi, Appendix A1, p. 103). Second, participants were primarily psychology students who are notorious for being poorer than other types of participants at producing psi effects. Third, as far as the measures are concerned, the QBL factors are not orthogonal (Luke et al., 2008b), and all the GAS subscales inter-correlate, as has been shown twice by this experimenter (see Table 4; see also, Storm & Thalbourne, 2005b, Table 2, p. 39), so that variance is not necessarily *uniquely* explained, and in the case of this study especially, consistent failure to correlate significantly may be a pattern due to a lack of orthogonality in the subscales. At this stage it looks like beliefs about luck do not appear to influence gambling success paranormally, though the review by Zdrenka and Wilson (2017) suggests otherwise. Attitudes towards gambling (whether positive or negative) seem to have no effect on psi outcomes either. These statements are based mostly on nonsignificant findings but these, and the significant findings, will require future replication.

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APPENDIX

Attitudes and Beliefs as Predictors of Psi Effects in a Pseudo-Gambling Task

PROCEDURE

Stage 1 (Questionnaires): Via on-screen computer monitor, participants were required to complete the five measures (ASGS, BIGL, QBL, GAS, & ATGS-8).

Stage 2 (Gambling Task):
On a computer monitor, five frames are presented one by one, each frame consisting of a row of five (5) playing cards (images drawn from a standard 52-card deck). Each row represents a 'hand' of five concealed

cards comprised of 1 × Ace of Spades, 1 × Ace of Clubs, 3 × Kings—all face-down; each row is a trial (5 rows = 5 trials).

All cards appear face down so that their values are not identifiable. Participants are required to complete the gambling task trial by trial. Participants are required to locate, in each trial, the Ace of Spades in the 'hand' of five cards by using the mouse, placing the cursor over the card of choice, and left-clicking (for each trial, P_{MCE} = .20). An 'Instant Scratchies' ticket (AUD$1.00) of small cash value (but with high potential cash reward) is issued by the experimenter each time the participant finds an Ace of Spades (each participant can win up to five tickets). Targeting this card tests the hypothesis that significant overall success at the paranormal task of identifying Aces of Spades is evidence of a compliant attitude toward winning.

An Ace of Clubs is also concealed in each of the five hands (for each trial, P_{MCE} = .20). Participants are instructed not to target Aces of Clubs. This card is necessary as a test of noncompliance. Should there be a significant number of hits on the Ace of Clubs, then evidence would exist that undermines the assumption of sufficient compliance, by showing that noncompliance can exist during a psi task as well, which can lead to psi-missing. Structured this way, noncompliance in goats is optimized possibly to the same degree that compliance is encouraged in sheep. Thus, this procedure is a more balanced test of the sheep-goat effect.

The participant is free to stop the task at any time and take any winnings accrued at the time of cessation of the task. Structured this way, the 'pseudo-gambling' task approximates the dynamism of real gambling because participants do know full well they are not actually making a personal investment in the task, but they are winning or losing. Additionally, the chance to win does help focus concentration and arguably stimulates the psi function.

Randomization of card-positioning and trial presentation is achieved through the random program in the computer code written by consultant Mark Brown. The experimenter (L.S.) can have no knowledge of the outcomes as they are generated live during each trial. After each trial, the participant is given immediate feedback on the trial page; at the end of up to five trials (which also marks the end of the experiment) a total hit rate is given, so that the participant can receive the correct number of 'Scratchies' tickets. Thus, feedback on trail outcomes is live, but questionnaire feedback will be by e-mail and sent to participants at a later date once questionnaires are scored.