

Study Registration for the KPU Study Registry

The registration information for the study is given below. Each section can be expanded as needed.

1. The title or name of the experiment (for listing the experiment in the registry).

Retroactive priming of a compound remote associates task (CRAT) using pre-selected participants.

2. The name, affiliation, and email address for the lead experimenter(s) for the study.

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3. A short description or abstract of the purpose and design of the experiment.

Retroactive priming refers to the idea that current performance on a task may be facilitated by repetitive exposure to the target or task at a *future* date (see e.g., Bem, 2011; Maier et al., 2014; Vernon, 2015, 2018). For example, Vernon (2015) utilised a modified repetition priming paradigm, with repeated exposure to the target occurring *after* the test and found that participants were more accurate to respond to material they were primed with in the future. A similar pattern was found when participants practiced recalling images in the future (Vernon, 2018). However, attempts to extend this research by focusing on such retroactive effects using emotive images

(Vernon, 2017b), and those with high levels of belief in psi failed to produce any effects (Vernon, 2017a). Such negative findings are consistent with the attempts of others to elicit precognitive based effects (see e.g., Galak, LeBouf, Nelson, & Simmons, 2012; Ritchie, Wiseman, & French, 2012).

One possibility for the inconsistent pattern of data across the studies may be the reliance on opportunity sampling. For instance, in the above studies the participants taking part were simply those available at the time who were willing to participate. It may be that pre-selecting participants based on prior performance, demonstrating retroactive priming effects, would lead to more robust findings. Indeed, there is suggestive evidence that selectively recruiting individuals with prior experience and/or prior test performance indicative of a precognitive effect can be useful (Haraldsson, 1970; Honorton & Ferrari, 1989), though not all have found this (Rabeyron, 2014). Hence the aim of this study is to address this issue by conducting a two-stage online experiment. The first stage will be an online retroactive priming task, after Vernon (2018), and this will be used as a *Screening* mechanism to identify participants who recall more images that are practiced in the future compared to images not repeated, as well as assessing their levels of belief in psi and cognitive thinking styles. Participants that exhibit a retroactive priming effect will be asked if they are willing to return at a later date to complete the second *Main* online stage of the experiment. This stage will examine potential retroactive facilitation effects using a creative insight task called a compound remote associates task (Bowden & Jung-Beeman, 2003). A creative insight task was chosen as the literature suggests that psi-type performance may rely on intuitive thinking processes (Mossbridge & Radin, 2018) and be directly related to an individual's level of creativity (Roe, Anowarun, & McKenzie, 2001).

The compound remote associates task (CRAT) is a standard cognitive task for measuring insight and creativity. It involves presenting the participant with three words, e.g., *cake/swiss/cottage* and asking them to come up with a fourth word that is associated with all three, in this instance the answer would be *cheese* (Bowden & Jung-Beeman, 2003). The new word can pair either before (e.g. cheesecake) or after (e.g. cottage cheese) the three words.

Hence, the main aim of this study is to test whether retroactively priming pre-selected participants, by having them repeatedly complete a CRAT *after* they have initially completed it, helps them solve the task more accurately compared to items not repeated in the future.

Materials

Both the initial *Screening* study and the following *Main* study will be conducted online using Qualtrics software to present material online and a standard keyboard for entering responses.

The *Screening* study will present three standard questionnaires, including the 44-item Belief in the Supernatural Scale (BitSS) (Schofield, Baker, Staples, & Sheffield, 2018), the 40-item Rational-Experiential Inventory (Pacini & Epstein, 1999) and the 3-item Cognitive Reflection Test (CRT) (Frederick, 2005). The software will then present a diffuse star field image along with a 1-minute clip of new-age type music called 'Stargazing' to create the relaxation induction. The retroactive

priming stimuli will consist of two main lists of 10 arousing images from the International Affective Picture Systems (IAPS) database (Lang, Bradley, & Cuthbert, 1997). One list contains positively arousing images and the other negatively arousing images. Whilst the images have been matched for mean arousal level (Positive: 6.53; Negative: 6.23; $t(18)1.51$, $p=0.149$) they differ significantly in terms of valence (Positive: 7.36; Negative: 2.32; $t(18)29.27$, $p=0.001$). These 2 main lists have been further divided to produce 8 sub-lists each containing 10 images (5 positive and 5 negative) with each sub-list matched for mean valence and arousal levels.

For the *Main* study the stimuli will consist of 2 example compound remote associates and three main lists each containing 15 compound remote associates from the normative database produced by Bowden and Jung-Beeman (2003). Each of the main lists will be matched for the mean % of participants able to solve them in 15 seconds.

4. A statement or list of the specific hypothesis or hypotheses being tested, and whether each hypothesis is confirmatory or exploratory. ([confirm/explore guidance](#))

There are two confirmatory and four exploratory hypotheses:

Confirmatory hypotheses

1. The level of accuracy for the CRAT items in phase 1 that are later repeated (i.e., retroactively primed) will be significantly greater than those not repeated.
2. The level of accuracy for the CRAT items in phase 2 that were *previously* presented (i.e., implicit priming effect) will be greater than those items not previously seen.

Exploratory hypotheses

1. The possible relationship between retroactive priming and belief in psi will be examined using the Belief in the Supernatural Scale (BitSS) (Schofield et al., 2018).
2. The possible relationship between retroactive priming and intuitive thinking style will be examined using the Rational-Experiential Inventory (REI) (Pacini & Epstein, 1999).
3. The possible relationship between retroactive priming and reflective cognitive thinking style will be examined using the Cognitive Reflection Test (CRT) (Frederick, 2005).
4. The possible relationship between belief in psi and intuitive/cognitive thinking will be examined using the BitSS, the REI and CRT.

5. The planned number of participants and the number of trials per participant.

Links to the initial *Screening* study will be made available to undergraduate students from both academic institutions (i.e., Canterbury and Derby) and posted on internet sites of organisations with special interests in the field of parapsychology (e.g., Society for Psychical Research and Parapsychological Association). Hence, the *Screening* study will rely on opportunity sampling from undergraduate students and interested members of the public.

Participants will continue to be *Screened* until 106 have been identified as showing evidence of retroactive priming and confirm a willingness to complete the *Main* study. The *Screening* process will require each participant to complete a total of 40 trials. This is made up of the 20 trials in the main recall task (10 of which will represent the ‘to be repeated’ items and 10 of which represent the ‘control items’) and a further 10 trials in the post-recall practise phase which is repeated twice (total of 20 trials).

The *Main* study will be based on 106 participants selected from the *Screening* stage who show evidence of a retroactive priming effect (i.e., greater recall score for images practised after the test compared to those not practised). Each of these participants will complete a total of 60 trials. This is made up of the 30 trials in phase 1 (15 primed and 15 unprimed) followed by 30 trials in phase 2 (15 primed and 15 new-unprimed).

6. A statement that the registration is submitted prior to testing the first participant, or indicating the number of participants tested when the registration (or revision to the registration) was submitted.

This study has yet to be started.

The following additional information is needed for studies that include confirmatory analyses:

7. Specification of all analysis decisions that could affect the confirmatory results, including: the specific statistical test for each confirmatory hypothesis, whether the test is one-sided or two-sided, the criterion for acceptable evidence, any transformations or adjustments to the data, any criteria for excluding or deleting data, and any corrections for multiple analyses. Checklists and examples for registering classical analyses, permutation and bootstrap analyses, Bayesian analyses, and classification analyses are provided in the [statistics registration document](#). (This information can be included in section 4 above for simple experiments.)

Only data from participants who meet the criteria of being a native English speaker, complete all phases of the compound remote associates task and pay full attention to the study throughout (as monitored by the attention check questions) will be included in the main analysis.

The main dependent measure is ‘level of accuracy’, which will be counted as the number of items from the compound remote associate task (CRAT) correctly answered within 15 seconds. The correct answer will be taken as the ‘solution’ provided by Bowden and Jung-Beeman (2003). The level of accuracy for correctly completed compound remote associates that are primed will be compared to the level of accuracy for those that are not primed using a repeated measures t test with 2 conditions: primed CRAT vs. unprimed CRAT.

The statistics test will be 2-tailed to allow for the possibility that post-completion repetition of the solutions *could* impair performance (see, Ritchie et al., 2012) and utilise a p value of 0.05, including 95% confidence intervals and Cohen's effect sizes.

Given the emphasis on a timed response and the requirement for participants to type in their answer to each CRAT they may incorrectly spell the solution and/or only partially enter a solution or enter an incorrect solution.

The following procedure will be maintained in each case respectively:

All incorrectly spelled items will be viewed by two external judges, blind to the aims of the study, to ascertain whether they sufficiently identify the appropriate solution.

Any partial input will also be assessed by two external judges, blind to the aims of the study, to ascertain whether they sufficiently identify the appropriate solution.

In both of the above cases the criterion for judging whether a solution is correct is that there is a *50% or more* level of mapping between the letters and placements of the incorrectly spelled/partially typed input and the given solution of the CRAT by Bowden and Jung-Beeman (2003). Hence, if the level of mapping is below 50% the response will be classified as incorrect.

If, in either of the above cases, the two external judges cannot agree on a classification of correct/incorrect then a third independent judge will act as arbiter and classification will be based on the majority view (i.e., 2 out of 3).

Incorrect solutions will not be included in the analysis.

8. The power analysis or other justification for the number of participants and trials.

Bem (2011) reported on two retroactive priming/facilitation tasks (Experiments 8 and 9) which produced a combined average effect size of $d = 0.31$. Adopting the standard alpha criterion of 0.05 (two-tailed), coupled with a test that has the statistical power of 0.9, the required sample size can be calculated the calculation from Howell (1992)of:

$$N = \left[\frac{\delta}{d} \right]^2$$

where power of 0.9 as a function of significance at 0.05 (two-tailed) translates into a δ score of 3.20 (Appendix Power Tables, Howell, 1992, p. 644). Hence, $N = (3.20/0.31)^2$ gives: 10.32^2 which equates to a total sample size of 106.

9. The methods for randomization in the experiment. If a pseudorandom generator is used, specify how and when the seed(s) will be obtained.

Once participants access the initial welcome screen the Qualtrics software will pseudo-randomly allocate them to one of the experimental pathways, using an inbuilt Mersenne Twister pseudorandom number generator (PRNG), with the proviso that the PRNG evenly select the pathways. The PRNG uses the Unix timestamp, counted in milliseconds, as the seed for the random number generator.

10. A detailed description of the experimental procedure.

Both stages of the experiment will be conducted online with the second stage (i.e., the *Main* study) completed sometime after the first (i.e., the *Screening* study). Consistent with previous work all participants will be made aware that the experiment tests for ESP, although precisely how it tests for this will not explained until they have completed the relevant stage of the experiment.

The *Screening Study* will begin by initially presenting an information page on screen informing the participant they are about to take part in a study that tests for extra sensory perception (ESP) and that to take part they need to be a native English speaker and they may be invited back to take part in a follow up study afterwards. Once participants have read through the information page, confirmed that they are a native English speaker and provided informed consent they will progress to the information capture page and enter demographic information and complete the three main questionnaires (i.e., the BitSS, REI and CRT) with questionnaire order counterbalanced. Participants will then be informed that they will see an image of stars and hear some music for 1-minute and that the aim of this is to help them relax. At the end of this they will be presented with a new screen with the message: ‘You will now be presented with a selection of both positive and negative images. Each image will remain on screen for 3.5 seconds. Please attend to the images’. The instructions end by stating that the participant should ‘Press the arrow key’ to begin. Each participant will then be presented with 20 trials of images in a random sequence with each trial image shown on screen for 3500ms along with its identifying label in font Ariel size 36pt. Once all images have been shown a surprise recall instruction screen will appear saying ‘Your task now is to recall as many of the images you have just seen and write their names down in the text box below. You have 3 minutes to do this. You can write them in any order and spelling doesn’t matter’. Participants will then be given 3 minutes to type in as many words relating to the images they have just seen as they can remember. At the end of the 3 minutes the computer will sound a tone and instruct the participant to stop writing. They will then be told to click on the arrow key to continue to the next screen which will inform them that they will now see a subset of images they just saw. Again, each image will remain on screen for 3.5 seconds and they will be asked to attend to the images. Once participants click on the arrow key they will be shown a practise list of 10 images (5 positive and 5 negative). After this, participants will be asked to recall the 10 images

just seen by writing down their names in the text box provided. They will be given 2 minutes to do this and at the end of this time the computer will sound a prompt and instruct them to stop writing. The same 10 images will then be presented again followed by another recall test using the same procedure as before. Participants will then complete an ‘attention check’ screen which will ask them if at any time during the study they shifted screens to check emails, looked away from their PC, or were distracted by something else going on around them. Finally, participants will be presented with a debrief information screen explaining the aims of the study and providing contact details of the Principal Investigator (PI) should they wish to obtain more information.

Those who complete all aspects of the *Screening* study, and whose recall score for the repeated images is higher than that of the non-repeated images will be invited to take part in the *Main* study at a later date.

The *Main Study* will begin with an information screen informing them that they are about to take part in a study that tests for extra sensory perception (ESP) using a compound remote associates task. It will stress that in order to take part in the study they need to be a native English speaker. They will then be presented with an explanation of the CRAT, which will point out that compound-remote-associates problem consists of three words (e.g., cottage, swiss, cake) and that their task is to come up with a fourth word that can form a compound and/or is semantically related with each of the three problem words (e.g., cheese can join with cottage, swiss and cake to form cottage cheese, swiss cheese and cheesecake). To help them understand this they will be given two example CRAT’s to complete before moving on. Once completed they will move on to *Phase 1* during which they will be presented with 30 CRAT items (15-primed and 15-unprimed) in a random sequence. Each CRAT trial will be presented for 15 seconds, during which participants will be required to enter the ‘solution’ to the item by typing the answer into a text box using the keyboard. After they have completed all 30 trials the computer will move them onto the next phase. In *Phase 2* they will again be shown 30 CRAT items (15-primed and 15-new unprimed) randomly presented one at a time and be required to type the answer to each one into a text box. Once completed all participants will complete an ‘attention check’ screen which will ask them if at any time during the study they shifted screens to check emails, looked away from their PC, or were distracted by something else going on around them. Finally, participants will be presented with a debrief information screen explaining the aims of the study and providing contact details of the Principal Investigator (PI) should they wish to obtain more information.

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