Study Registration for the KPU Study Registry

1. The title or name of the experiment (for listing the experiment in the registry).
Correlational Matrix Replication study

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.
The purpose of the present experiment is to replicate the correlation matrix experiment theorised by Walter von Lucadou (1987) and followed by von Lucadou, Walach and Romer (2007).
The experiment examines whether human intention operates on a random number generator (RNG). The aim of the original experiment was to compare the number of significant correlations between physical variables (RNG behaviour) and psychological variables (participant key-pressing behaviour) in a matrix with the number of correlations appearing in a control matrix.
The experiment set-up is intended to capture generalised non-local correlations and has been reported to be replicable in previous studies.
The same psychological and physical variables used in previous studies will be employed in the present study.
Participants will try to mentally influence a fractal appearing on the computer screen to “shrink”, “grow” or “leave” it stable according to the instructions. The instructions to influence the fractal to right, left or centre are called trials, 80 trials make one sub-run and three set of 80 trials complete one run. Three repeated runs are one session. Each session should take between 10 and 20 minutes.
After each session the computer will run a new session without participants to simulate the behaviour of the system during the experiment. The psychological variables from the participant are used together in the empty run to construct the control session.
In previous studies, the psychological and physical variables are all entered into the matrix and a $Z_{Difference}$ binomial analysis is used to compare the number of significant correlations in the experimental matrix with the number in the control matrix. However, because the participant receives feedback on RNG performance, this method of analysis may incorporate causal correlations (i.e. psychological artifacts that should be excluded when testing for psi) for those parts of the matrix where the psychological data is correlated with previously collected physical data. This is because the feedback on
RNG behaviour may influence the participant's subsequent behaviour. It is also preferable to employ a simulation or permutation method rather than $Z_{\text{Difference}}$ to generate a distribution of scores against which the experimental distribution may be compared to obtain a $p$-value. $Z_{\text{Difference}}$ was developed for cases when the theoretical $P$ for the binomial distribution is known and not for cases when $P$ is being estimated from a sample of data (which is normally handled with a $2 \times 2$ analysis). Also $Z_{\text{Difference}}$ and $2 \times 2$ analyses are based on the assumption that each event (correlation) is independent, which is not true for these studies. The effects of dependencies are difficult to predict, but one of the most common effects is increased variance relative to the assumption of independence - which makes an outcome appear more significant than is actually the case. Simulations or permutation analyses are the safest and most convincing approach for situations like this.

Data will be collected by the researcher and by (2-3) undergraduate students who will receive the required training.

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

Hypothesis 1 replicates the method of analysis employed by Walach and von Lucadou. Hypothesis 2 explores an alternative method of analysis that is applied to the section of the data that is not susceptible to causal correlation from RNG feedback influencing the psychological data.

H1- Exploratory hypothesis: the original $Z_{\text{Difference}}$ analysis method as used by Walach and von Lucadou will be applied to the full matrix, and it is predicted that this method of analysis will yield greater proportion of significant correlations compared to the control sessions.

H2 - Exploratory hypothesis: it is hypothesised that the number of significant correlations in the above-diagonal part of the matrix (the part where the psychological data have been collected prior to the physical data) will be significantly greater than the number expected by chance. This analysis will be conducted using a permutation or simulation analysis.

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

The planned number of sessions (as defined in section 3 above) is 220 or the number reached when data collection ends on 30th April 2016, whichever comes first. As in the original study, participants may contribute more than one session.

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.

I confirm that this registration is submitted prior to testing participants.
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.)

The study has 5 physical measures:
1- TR: the number of times the output of the Markov-chain RNG yields “1” during one run.
2- DT: the number of steps the fractal display deviated from the optimum in either direction or from the central position.
3- KR: deviation of the actual physical output of the Markov chain from the ideal Markov-chain.
4- ZT: mean voltage output at the fourth channel out of eight
5- ZV: standard deviation of this voltage output at channel 4

Each of the 5 physical measures will be found for each of the 9 sub-runs in a session which gives 45 physical data points for a session.

Similarly, there are 5 psychological measures describing the behaviour of the participant:
1- T1: number of right shift-key presses
2- T2: number of left shift-key presses
3- T3: number of double presses
4- DR: mean time between key presses
5- DV: variance of time between key presses

Each of the 5 psychological measures will be found for each of the 9 sub-runs in a session, which gives 45 psychological data points for a session. The correlation matrix will be generated by correlating each of the 45 physical variables with each of the 45 psychological variables (2025 total correlations) using the session as the unit of analysis. The pure psi correlations that cannot be contaminated by feedback about
previous trials are the 990 correlations above the diagonal of the matrix. These are correlation between psychological variables and future physical (RNG) variables and exclude correlations with past physical variables for which the participant received feedback. The control correlations are generated by correlating the observed psychological data with the control physical data.

I will calculate non-parametric correlations using Spearman coefficient with alpha set at a two-tailed p-value of 0.1 for the main analysis and a p ≤ .05 for sensitivity analysis. The formula for $Z_{\text{Difference}}$ used in the previous studies is:

$$Z = (\text{CE} - \text{CD})/\sqrt{2\cdot\text{CD} \cdot (1-\text{CD}/\text{NC})}$$

with $\text{CE}$ = number of significant correlations in experimental condition
$\text{CD}$ = number of significant correlation in control condition
$\text{NC}$ = number of correlations in correlation matrix

The specific methods for conducting the permutation or simulation analysis are not pre-specified for this initial exploratory study. All raw data will be deposited with a third party (Dr. Caroline Watt) and the analyses only start after all data has been collected.

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

This line of research is investigating a theory that makes traditional analyses of effect size and statistical power not applicable for typical psi experiments. The planned sample size is based on previous experiments in this line of research and the recommendations of those developing the theory (von Lucadou recommends 220 sessions minimum).


The RNG is the same as used in Walach’s experiments and was built by the workshop of the University Hospital in Freiburg according von Lucadou’s specifications. As in all previous experiments the RNG output is smoothed by a Markov-chain window with lag 1 that makes the appearance of the output look more like a natural process and slows the change process. The noise-current of a Zener-diode is used as the random source. The equivalent voltage of the noise-current is amplified and is measured by an analogue-digital converter, which is read out by the USB-Interface of the computer. To produce the Markov-chain the momentary 12-bit number (voltage) $R_{i+1}$ is compared with the previous one $R_i$. A decrease of the momentary voltage is indicated as a "1" and an increase as a "0". If no change of the decay rate occurred the event is omitted.

10. A detailed description of the experimental procedure.

Participants are seated in front of a computer that displays a fractal curve that is either growing or shrinking. The participants receive a written standardized instruction, similar
to experimental conditions used previously giving instructions to intentionally attempt the curve to shrink, to grow or to be kept stable, in accordance with instructions that will appear on the computer screen. On the top of the screen an arrow points to the left, right or centre indicating the direction toward which the participant should try to influence the fractal.

Participants are also told they may press the shift keys on the computer keyboard in any order they want and that the use of the keys will progress the experiment.

The computer used for the experiment will be disconnected from the internet while the experiment is conducted.

References:
