A fully transparent pre-registered replication study of precognitive detection of reinforcement using an expert consensus design

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Aims: This project aimed to develop methodological tools that facilitate highly credible and rigorous research. Furthermore, we aimed to conduct a multi-site, fully transparent replication of Bem's (2011) Experiment 1 using these credibility-enhancing methodologies. We also seek to disseminate our output in the scientific community via publications, talks, and seminars.

Methods: We conducted a multi-site, fully transparent replication of Bem's (2011) Experiment 1. We developed a study protocol for this replication effort via a Consensus Design Process. During this process more than twenty experts on the field (both proponents and opponents of the original ESP hypothesis) contributed to finalizing the protocol.

The experimental paradigm closely matched the protocol of Bem's (1) Experiment 1. Participants completed 36 trials in a laboratory setting, in each of which they were presented with two curtains on the computer screen, and had to guess which one hides a picture. If the participant chose the correct ('target') curtain, the 'reward image' was revealed, otherwise, a uniform grey background was revealed. Importantly, the target side (left or right) was determined randomly by the computer after the participant's guess. This randomization was done with replacement, so in each trial, the target side was completely random. The reward image for each trial was also determined after the participant's guess by randomly selecting from a pool of 36 reward images without replacement. The pool contained 18 erotic and 18 non-erotic images, resulting in 18 'erotic trials' and 18 'non-erotic trials'. The randomization of the target side and the reward images were independent of each other. The outcome of the trial was whether the participant successfully guessed the target side. The erotic images were selected from the erotic subset of the NAPS image set (28), while the non-erotic images were from the IAPS (29). There were a few deviations from the protocol of the original Bem (1) experiment: Multiple participants could be tested in the same experimental space at the same time; compensation of participants could differ between data collection sites (e.g., sites had the option to offer university credit for participation, monetary compensation, or no compensation at all); and we used a different set of erotic images than in the original study for legal reasons. All of these deviations were accepted by the consensus design panel.

The protocol includes a comprehensive toolkit of safeguards against researcher biases and mistakes that are often thought of as the primary cause for the abundance of non-replicable findings in psychology and biomedicine. The safeguards include radical transparency about the whole research pipeline via Born Open Data, Direct Data Deposition, Real-time Research Reports, automation, trusted third party oversight, tamper evident seals on data and software, documented training, and lab logs.

Results and Discussion: We conducted a pilot study involving two research sites and one hundred eighty-four participants. This pilot study demonstrated the feasibility of our approach, and the adequacy

of the consensus-derived study protocol. During this pilot investigation we observed 49.49% successful guesses (99.5% CI = 47%, 51.9%; posterior mode = 50.6%, posterior 90% HDI = 49.4%, 51.7%).

Following the acceptance of our research protocol as a Stage 1 registered report in *Royal Society Open Science* (RSOS), we started the main study. We have collected data from 2,220 participants at ten research sites worldwide. The data were more consistent with the model assuming that humans' guesses about the future, randomly determined, position of a target do not have a higher than chance success rate, rather than the model assuming that they do.

In the main study, we observed a total of 49.89% successful guesses (99.5% CI = 49.11%, 50.67%); posterior mode = 50.02%, posterior 90% HDI = 49.6%, 50.4%). Observing this percentage of successful guesses is 72 times more likely if the guesses are successful at random than if they have a better than chance success rate. The results proved to be robust to different statistical approaches, increasing our confidence in our inference. Taken at face value, the data provide strong evidence that the probability of successfully guessing later computer-generated random events is not higher than chance level contrary to what was previously reported by Bem (2011) and others (Bem et al., 2016).

The manuscript of the paper about the results of our project has been accepted at RSOS and will be published February 1st, 2023 (Preprint already available: Kekecs, et al., 2023). As stated in our last progress report, we are also preparing a manuscript on the consensus design process used in this project. We aim to publish this paper in the journal *Advances in Methods and Practices in Psychological Science* (AMPPS). So far the journal has returned the manuscript to us for major revision with the reasoning that too much focus is placed on a project that is still ongoing and is unpublished. Now that the main study paper is published, we hope that we will be able to finish the publication of this additional manuscript as well. A preprint of this manuscript is already available (Kekecs, Szaszi, Aczel, 2020). We are also disseminating the knowledge gained in our project in talks at conferences and seminars. So far we have presented our results and methods at the International Meeting of the Psychonomic Society 2018, the Conference of the Society for Judgment and Decision Making 2018, the Society for Improving Psychological Science 2019 and 2022, the Metascience Symposium 2019, the Annual Conference of the Society for Judgment and Decision Making 2019, the SSE-PA Breakthroughs 2022, the Big Team Science Conference 2022, and multiple other seminars and events (see list of references below). We will continue these efforts in 2023 as well, we have submitted a panel discussion to Metascience 2023, and we have an invited presentation at the Society for Psychical Research Webinar series. We will also submit a paper to the Society for Improving Psychological Science 2023 as well.

Conclusions and Recommendations: Our paper describes methodologies that let researchers craft highly credible research. The credibility-enhancing methods include direct data deposition combined with born-open data and real-time research reports, to demonstrate data integrity. Piloting, checklists, laboratory logs, and video documented trial sessions were used to ascertain as-intended protocol delivery. Tamper-evident software and external research auditors provided further assurance of integrity. We demonstrate the application of these methods in a replication of Bem's 2011 experiment on extrasensory perception. Bem's findings were not replicated in our study. The failure to replicate Bem's and others' positive findings with this strict methodology indicates that it is likely that the overall positive effect in the literature might be the result of recognized methodological biases rather than ESP. However, the occurrence of ESP effects could depend on some unrecognized moderating variables that were not adequately controlled in this study, or ESP could be very rare or extremely small, and thus undetectable with this study design. Nevertheless, even if ESP would exist, our findings strongly indicate that this particular paradigm, utilized in the way we did, is unlikely to yield evidence for its existence.

Based on our findings we recommend that future research projects in parapsychology, and in psychological science in general, use a set of methodological tools that allow for a similarly high level of transparency and verifiable credibility. The methodologies applied in our project should be developed further to improve their usability for research projects with low or no funding and without expertise in programming. We also recommend that investigations aiming for finding evidence of precognition should not use Bem's 2011 experiment 1 protocol, as it is unlikely to yield such evidence, at least in its original form.

List of publications

Organization of seminars and conferences:

Kekecs, Z. (2019, October). Real time procedures to improve credibility in research. *Paper presented at the REAL TIME Pufendorf Advanced Study Group Seminars at Lund University, Lund, Sweden*. https://www.pi.lu.se/en/advanced-study-groups-0/real-time-data, https://osf.io/3d482

Conference presentation:

Kekecs, Z., Aczel, B., Palfi, B., Szaszi, B., Szecsi, P., Zrubka, M., … Arriaga, P. (2022, October). Towards Objective Indicators of Trustworthiness of Research Findings - Experiences and Results from The Transparent Psi Project (TPP). *Paper presented at the Big Team Science Conference, 2022 (online conference)*. https://osf.io/wjzhq

Kekecs, Z., Aczel, B., Palfi, B., Szaszi, B., Szecsi, P., Zrubka, M., … Arriaga, P. (2022, June). The Transparent Psi Project (TPP), a Consensus-Based Replication of Bem 2011 experiment 1. *Paper presented at the SSE-PA Breakthrough conference (online conference)*. https://osf.io/7pt5q

Kekecs, Z. (2022, June). Expert Consensus Procedure (ECO), for establishing robust scientific outputs, *Workshop at SIPS 2022, Victoria, BC, Canada* https://osf.io/9rk8p

Kekecs, Z. (2019, September). How to produce credible research, on anything. *Invited paper presented at the Metascience 2019 Symposium, Palo Alto, CA, USA* https://osf.io/793da

Kekecs, Z., Aczel, B., & Kovacs, M. (2019, July). Go real-time! Utilizing continuous data deposition, sharing, analysis and reporting to facilitate openness and credibility, *Unconference presented at SIPS 2019, Rotterdam, The Netherlands* https://osf.io/j5pq3

Szecsi, P., Palfi, B., Szaszi, B., Zrubka, M., Kovacs, M., Aczel, B., & Kekecs, Z. (2018, November). Consensus Design Process of the Transparent Psi Project, *Poster presented at the 2018 39th Annual Conference of the Society for Judgment and Decision Making New Orleans, LA, USA*. https://osf.io/qkcn2

Kekecs, Z., Aczel, B., Palfi, B., Szaszi, B., Szecsi, P., Zrubka, M., Kovacs, M., & Henninger, F. (2018, May). Taking Research Credibility to the Next Level, an Initiative for Verifiable Credibility. *Paper presented at the 2018 International Meeting of the Psychonomic Society, Amsterdam, The Netherlands.* https://osf.io/e2w43

Journal article:

Kekecs, Z., Aczel, B., Palfi, B., Szaszi, B., Szecsi, P., Zrubka, M., … Grassi, M. (2023). Raising the value of research studies in psychological science by increasing the credibility of research reports: The Transparent Psi Project. *Royal Society Open Science*. Preprint: https://doi.org/10.31234/osf.io/uwk7y

Kekecs, Z., Szaszi, B., & Aczel, B. (2020, September 25). Expert Consensus Procedure (ECO): Facilitating Robust Scientific Outputs. - *Preprint*. doi: https://doi.org/10.31234/osf.io/9gqru

Other (seminars):

Kekecs, Z., Aczel, B., & Kovacs, M. (2019, March). Valós idejű (real-time) eszközök a pszichológia kutatás megbízhatóságának javítására. [Real-time processes for improving the credibility of psychological research]. *Paper presented at Illyés Sándor Emléknapok, Budapest, Hungary* https://osf.io/3vhd6

Aczel, B., Kovacs, M., Kekecs, Z. (2018, November). Improving the Efficiency of Science - Expert Consensus Procedures, *Seminar, University of Gröningen, Gröningen, The Netherlands.* https://osf.io/uhtp9

Aczel, B., Kovacs, M., Kekecs, Z. (2018, November). Improving the Efficiency of Science - Expert Consensus Procedures, *Seminar, University of Amsterdam, Amsterdam, The Netherlands.* https://osf.io/uhtp9

Kekecs, Z., Aczel, B., Palfi, B., Szaszi, B., Szecsi, P., Zrubka, M., Kovacs, M., & Henninger, F. (2017, August). A Quest for Credible Research, Improving the Credibility and Acceptability of Research Findings via Consensus Design and Born Open Data, *Poster presented at the Departmental Retreat of Lund University Department of Psychology, Åhus, Sweden*. https://osf.io/5c7hb