Journal of Scientific Exploration, Vol. 35, No. 2, pp. 383–388, 2021 0892-3310/21

COMMENTARY

Reply to: Grote, H. (2018). Commentary: Intentional observer effects on quantum randomness: A Bayesian analysis reveals evidence against micro-psychokinesis. *Frontiers in Psychology, 9*, 1350. https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01350/full

Markus A. Maier

markus.maier@psy.lmu.de
Department of Psychology, Ludwig-Maximilians-Universität München, Germany

Moritz C. Dechamps

Department of Psychology, Ludwig-Maximilians-Universität München, Germany

Günter Schiepek

Department of Psychology, Ludwig-Maximilians-Universität München, Germany

Submitted April 10, 2019; Accepted February 22, 2021; Published June 15, 2021

https://10.31275/20211535

Keywords: quantum observation; micro-psychokinesis (micro-PK); model of pragmatic information, random number generation; RNG

Maier et al. (2018) reported a study that tested mind–matter effects in a micro-psychokinesis (micro-PK) task. They found strong evidence against micro-Pk in a Bayesian analysis of the aggregate sample's mean score when tested against its expectation value. In addition, they performed supplementary post hoc analyses testing the sequential time course of the effect among participants; these additional tests aimed to explore a postulated systematic time-dependent variation of

this effect. Unsystematic variations of micro-PK effects, and thus an overall decline of effect sizes across studies, have been theoretically postulated by von Lucadou et al. (2007) and meta-analyses seemed to confirm their proposition (see Walach et al., 2014, p. 624). Maier et al. (2018) slightly extended this innovative approach by arguing that the time course of experimental evidence for micro-PK effects will vary in a systematic and oscillative manner, rather than varying unsystematically. Their argument maintains that any violations of the core principles of standard quantum mechanics, such as the randomness postulate, would also violate the Second Law of Thermodynamics. Consequently, the authors suspected a time-delayed entropic counter-mechanism that, through interaction with the micro-PK effect, might lead to an oscillative change in the evidence for that effect over time. Accordingly, this should lead to non-random periodic changes of the effect. Maier et al. (2018) estimated a harmonic oscillative function of the experimental data, represented as a cumulative *z*-score that varied with increased sample size, and compared the oscillation amplitude parameter ω and its confidence interval with that of one set of simulated data.

Grote (2018) criticizes this procedure on two levels: First, he argues that due to its cumulative nature the cumulative *z*-score, which possesses strong similarities with the sequential Bayes Factor of the main analysis, must always have a tendency to decline given a constant oscillation of an original effect size; this is because more data go into the *z*-score calculation. The authors of this paper agree with Grote's argument that artificial oscillations are, to an extent, produced by accumulation of the effect among participants. However, these authors argue that these method-specific variations of evidence for the effect can be controlled by comparing the experimental data with an enormous number of simulated data that have been treated with the same accumulation algorithm. In the analyses provided below, we provide 10,000 simulated datasets that match the human data in every methodological detail. These data were obtained using the same true random number generator (tRNG) with which Maier et al.'s (2018) participants interacted. If more pronounced systematic variations with significantly higher amplitudes were to be found in the original experimental data as compared with these control datasets, then any artificial contributions could be ruled out since they were kept constant.

Grote's (2018) second argument was based on an empirical finding. Specifically, when Grote compared the ω -score of the experimental data reported by Maier et al. (2018) with 1,000 control data created by random permutations of the original data, more than 38% of the simulated ω -parameters were higher than the ones in the original data. These authors agree with Grote's conclusion that this indicates an insignificant difference from these random datasets.

These authors, however, do not agree with Grote's conclusion that these higher dominant frequencies found within many of the simulated ωs contradict Maier et al.'s theory of non-random, high-amplitude oscillations in the experimental data. Conversely, these authors argue that the method used by Maier et al. (2018), when estimating the frequency parameter and its amplitude, was insufficient. In an additional post hoc analysis, these authors therefore applied a state-of-the-art methodology to the original sequential Bayesian analysis to identify non-random, periodic variations therein. The Bayes Factor is strongly indicative of evidence for a micro-PK effect (as well as its counter-mechanism) and was originally used by Maier et al. (2018) to test the existence of micro-PK. The new non-randomness check was applied to this sequential Bayes factor representing the micro-PK effect. The analysis performed has previously been used in many scientific fields to determine periodicity of time series data. This mathematical approach, which uses an algorithm called the Fast Fourier Transform (FFT), can be used for a time series. FFT explores periodic dynamics or rhythms in time series data, disaggregating any dynamic pattern therein into its sinusoidal frequency components (Penrose, 2017, p. 461). The amplitudes of these components obtained from the sequential Bayes Factor were then compared with those received from the FFTs of 10,000 simulated datasets that were obtained from the same tRNG used in the Maier et al. (2018) research and their sequential Bayes Factors (each with an $n = 12{,}571$).

An FFT was conducted on the sequential Bayesian analysis of the original experimental data, as well as on each of the 10,000 simulated datasets, using a sampling rate of 1/12,571. Since the resulting transform is symmetrical, only the first half is considered in the analysis. Subsequently, we compared the amplitudes of these 6,285 frequencies

(12,571/2) of the original human data, with those of the simulated control data. To perform a test of significance, all amplitudes obtained from the FFT of the human dataset were added up, creating a sum score (Sum_{amp}). In the same way for each of the 10,000 simulations, the sum score of amplitudes was computed. The distribution of the sum scores of amplitudes across all simulations then served as the null distribution (see Figure 1). The sum score of amplitudes of the human

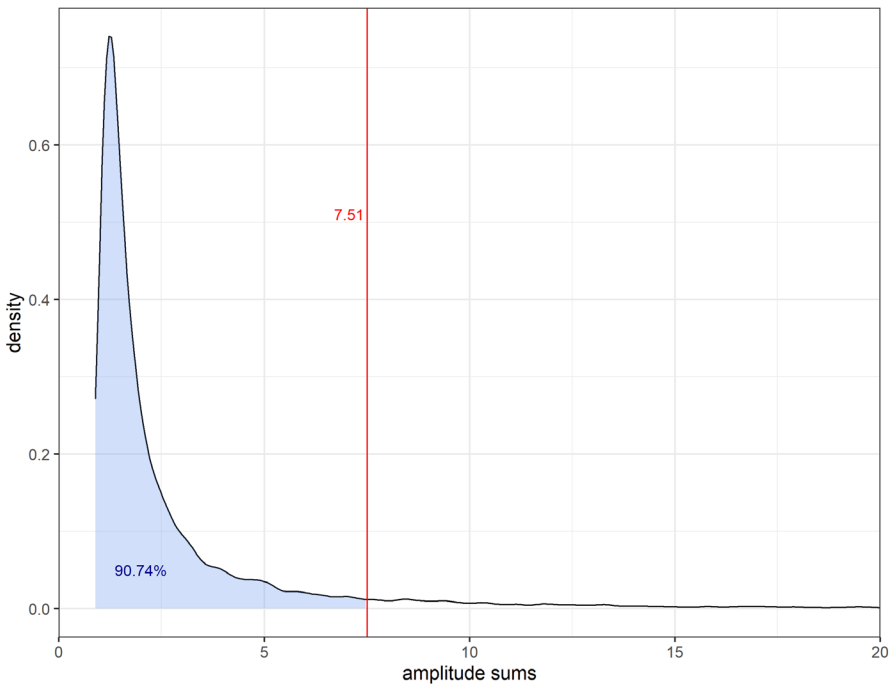

Figure 1. **Density distribution for the Sum_{amp}-scores obtained from FFT analyses performed with 10,000 simulations (black line = null distribution). The red line (straight vertical line) indicates the Sum_{amp} obtained from the FFT performed on the sequential Bayes Factor of the human data. The blue (shaded) area indicates the number of simulations that produced smaller Sum_{amp}s in their FFTs (90.74%).**

dataset was $Sum_{amp} = 7.51$. Only 926 of the 10,000 simulations' Sum_{amp}-scores (9.26%) reached a Sum_{amp}-score of 7.51 or higher.

In sum, the experimental data provided by Maier et al. (2018) contain a marginally significant amount of non-random periodic changes across time. This finding does not fully support Maier et al.'s (2018) post hoc claim that non-random, periodic changes with amplitudes higher than those expected from chance occur in their data. However, the statistical trend provides some hints that exploring oscillation patterns might be a fruitful strategy to test micro-PK effects in future studies.

A systematic variation of micro-PK effects, rather than their unsystematic disappearance over time, seems to be the viable hypothesis. In future research, micro-PK effects and similar psi-related phenomena should be analyzed according to non-random periodic changes using FFT analyses, rather than testing an overall mean score of the sample against chance (see, e.g., Dechamps & Maier, 2019).

REFERENCES

Dechamps, M. C., & Maier, M. A. (2019). How smokers change their world and how the world responds: Testing the oscillatory nature of micro-psychokinetic observer effects on addiction-related stimuli. *Journal of Scientific Exploration, 33*(3), 406–434.

Grote, H. (2018). Commentary: Intentional observer effects on quantum randomness: A Bayesian analysis reveals evidence against micro-psychokinesis. *Frontiers in Psychology*, *9*, 1350. https://www.frontiersin.org/articles/10.3389/fpsyg.2018.01350/full

Maier, M. A., Dechamps, M. C., & Pflitsch, M. (2018). Intentional observer effects on quantum randomness: A Bayesian analysis reveals evidence against micro-psychokinesis. *Frontiers in Psychology*, *9*, 379. https://doi.org/10.3389/fpsyg.2018.00379

Penrose, R. (2017). *Fashion, faith, and fantasy in the new physics of the universe*. Princeton University Press.

von Lucadou, W., Römer, H., & Walach, H. (2007). Synchronistic phenomena as

entanglement correlations in Generalized Quantum Theory. *Journal of Consciousness Studies*, *14*(4), 50–74.

Walach, H., von Ludacou, W., & Römer, H. (2014). Parapsychological phenomena as examples of generalized nonlocal correlations—A theoretical framework. *Journal of Scientific Exploration*, *28*(4), 605–631.