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ARTICLE

Psi Effects as a Result of Implicit Expectations About Probabilities – Investigating Micro-PK with a Biased Baseline

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HIGHLIGHTS

This pilot study explores micro-psychokinesis (micro-PK), defined as mental influences on random systems without physical interaction. Using a coin toss game, we tested whether implicit expectations, like anticipating a 50% win rate, impact micro-PK effects. Results suggest that aligning outcomes with participants' expectations may prevent a decline in these effects. Our findings emphasize the importance of psychological factors such as collectively shared expectations in psi research, though further replication is necessary.

ABSTRACT

This pilot study investigated micro-psychokinesis (micro-PK) effects using a masked coin toss game with biased base-rate probabilities. It was assumed that participants' expectation of fair coin tosses would exhibit a micro-PK effect with empirical mean scores deviating from the base-rates towards a 50% winning probability. Participants were assigned to either a 'lucky' condition with a pre-set 60% baseline win probability or an 'unlucky' condition with a pre-set 40% baseline win probability. In both conditions, a micro-PK biasing effect towards 50% was expected. Individuals' game outcomes were determined by a quantum random number generator (qRNG). Bayesian analysis revealed strong micro-PK effects towards 50% in the 'lucky' group but no effects in the 'unlucky' group. The results obtained in the 'lucky' group indicate that aligning outcomes with participants' probabilistic expectations may support micro-PK performance and potentially prevent decline effects. In contrast to our hypothesis, in the 'unlucky' group, null findings were obtained. Post hoc analyses suggest emotional detachment as a potential moderator of the findings. Further replication is necessary to validate these findings.

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KEYWORDS

Micro-PK, Psi, Decline Effects, Replicability, Expectancy Effects.

INTRODUCTION

Micro-psychokinesis (micro-PK) refers to the hypothesized ability to mentally influence random physical systems at the quantum or microscopic level without physical interaction. Unlike macro-PK, which affects larger objects,

micro-PK is typically tested using random number generators (RNGs) in controlled settings, where any deviation from randomness is considered evidence of an anomalous effect (Varvoglīs & Bancel, 2015). Over the past few decades, meta-analyses of micro-PK experiments have generally shown a small but statistically significant effect,



suggesting that micro-PK may indeed represent a genuine phenomenon (Bösch et al., 2006; Radin & Nelson, 1989). Despite these findings, micro-PK research faces challenges, including replication difficulties and the so-called decline effect, where psi phenomena weaken over time (von Lucadou et al., 2007). This pilot study aimed to address these issues by testing whether aligning experimental outcomes with participants' probabilistic expectations can produce stable micro-PK effects, mitigate the decline effect, and provide insight into psychological factors influencing micro-PK effects.

Radin and Nelson (1989) analyzed results from 515 studies examining influences on RNGs and found a modest but consistent deviation from chance. Similarly, Bösch et al. (2006) reviewed 380 RNG studies and found a significant but small effect size. The authors noted extreme heterogeneity, raising concerns about publication bias—a claim later criticized by Kugel (2011). These findings of a small but significant effect have sparked ongoing interest and debate, leading researchers to explore new methodologies and refine experimental designs (see Varvoglis & Bancel, 2015). *Open Science* methods such as preregistration, open data and reproducible analyses have proven to be useful tools in rendering results more credible, e.g., by providing an exhaustive meta-analysis of all micro-PK studies conducted at a specific lab, thus countering claims of publication bias (Dechamps, 2025).

However, a central issue in micro-PK research is the difficulty in replicating initially successful experiments (e.g., Dechamps & Maier, 2019; Dechamps et al., 2021; Maier et al., 2018; Walach et al., 2021). This has sparked discussions on differentiating natural replication failures following false-positive results from volatile psi effects and the presence of a systematic decline effect – a progressive weakening of observed psi phenomena over repeated trials or replication attempts, which are commonly observed in parapsychology (Colborn, 2018; Dechamps et al., 2021). One explanation for such a systematic decline considers the cascade of observers of a micro-PK experimental result. Since an increase of observers (participants, experimenters, authors, paper readers, etc.) goes hand in hand with increasingly varying and conflicting expectations and intentions, observer-dependent influences on random outcomes could no longer be directed but resemble a chaotic decoherence and eventually an approximation to randomness (Bierman, 2001; Walker, 1975). Von Lucadou et al. (2007) propose a Generalized Quantum Theory that postulates micro-PK to arise from non-local entanglement

correlations between mental and physical systems. Information is limited in these systems and must be divided into its novel and confirming aspects. The GQT argues that over time, as data accumulate, spontaneous autonomous effects decrease due to the increased likelihood of convincing confirmatory results (Maier et al., 2022).

This theory posits mind and matter as complementary aspects that relate to subjective and objective reality respectively, thereby creating inherent limitations in demonstrating mental influences with objective measurements (Maier et al., 2024). The debate on decline effects remains active and is not limited to parapsychology, possibly suggesting a more general issue with experiments involving biological systems (Radin, 2006).

A psychological explanation for a decline effect as a result of multiple observers or increasing objectification quality was formulated by Eisenbud (1992). He postulated the existence of a defense mechanism—a subconscious resistance to psi shared among most humans, arising from a subconscious desire to preserve order in nature and ensure reality follows familiar rules. Eisenbud speculated that certain natural laws, particularly probabilistic laws, are governed by unconscious expectations and presuppositions. Consequently, increasingly improbable experimental results, as indicated by robust objectification, may trigger a subconscious desire to maintain familiar natural laws, overshadowing individual psi-inducing motives. Similarly, expanding the observer group could lead to the cancellation of individual motives, favoring archetypal psi tendencies grounded in shared experiences of natural laws.

Following this argument, subconscious or implicit expectations, beliefs, and prior experiences—particularly in probabilistic contexts—should be considered when designing micro-PK experiments. Similar ideas are reflected in models like Stanford's PMIR (Stanford, 1990) and the emotional transgression model (Jakob et al., 2020).

The Present Research

This pilot study investigated the role of preexisting assumptions, expectations, and probabilistic experiences on a micro-PK task. To counteract potential subconscious resistance to psi, we masked the micro-PK effect by presenting outcomes that align with common experiences and expectations of probability. Specifically, we utilized the widely recognized randomness of coin tosses. For most participants, prior experience and implicit expectations align with a 50%-win probability. Unknown by our participants,

we implemented biased coins with either a 60% ('lucky' condition; LC) or 40%-win probability ('unlucky' condition; UC) and hypothesized that psychological factors typically responsible for the decline effect would, in this context, support an actual randomness biasing micro-PK effect i.e., a tendency towards 50% probability in both conditions.

Specifically, we predicted that individuals in the UC (40% win probability) would exhibit more than 40% hits on average, and in the LC (60% win probability) would exhibit fewer than 60% hits on average, to confirm their deeply rooted 50% probability expectation. This setup aimed to counteract opposing forces to micro-PK influence due to unease associated with experiences that do not match pre-existing probabilistic notions.

METHODS

Ethical Guidelines

Participants were informed about the voluntary nature of the study and data protection measures at the beginning of the online experiment. Informed consent was obtained via a button press. Data collection and analysis were conducted anonymously. The study was approved by the ethics committee of LMU Munich's Faculty of Psychology and Education.

Participants

A total of 1,602 participants took part in the study, with 21 excluded for requesting their data not be included and 18 excluded for being underage. Another 38 participants who did not answer the data integrity question were also excluded, resulting in a final sample of 1,526 participants (1,012 female, 491 male, 23 diverse). The data exclusion criteria were consensually stated before data collection and performed before data analyses. The mean age was 32.47 years ($SD = 13.94$), with most participants being students (40%) or employed (38%). The study was conducted online in German (89%) and English (11%). Incentives for participation included course credit for psychology students (11.4%), while other participants were not compensated.

MATERIALS

Coin Toss Game

Participants played a 20-round coin toss game, guessing the outcome of each coin flip. A quantum random number generator (qRNG) connected to the experiment's server determined the outcomes. The probabilities were

biased for two conditions: a 'lucky' group with a 60%-win probability (LC) and an 'unlucky' group with a 40%-win probability (UC). The qRNG generated a number between 1 and 100 for each toss. In the LC, a result of 60 or below signified a win, while a result of 40 or below indicated a win for the UC. Participants were unaware of this process.

Measures

Belief in Luck and Luckiness

Participants' belief in luck and personal luckiness were measured using the 16-item Belief in Luck and Luckiness Scale (BLLS; Thompson & Prendergast, 2013). The scale consists of two subscales: Belief in Luck and Personal Luckiness, each rated on a 5-point Likert scale (0 = Strongly disagree to 4 = Strongly agree) with higher scores indicating stronger beliefs. The scale showed high reliability ($\alpha = .82$ for Belief in Luck, $\alpha = .85$ for Luckiness).

Belief in a Just World

The General Belief in a Just World Scale (GBJW; Dalbert et al., 1987) was used to assess participants' belief in the fairness of the world. The six-item scale was rated on a 6-point Likert scale (0 = Strongly disagree to 5 = Strongly agree). Higher scores indicated stronger beliefs in justice ($\alpha = .78$).

Additional Questions

Three further questions were asked on a 5-point Likert scale, assessing participants' motivation to win, belief in unchangeable natural laws, and perceived ability to influence reality.

Procedure

Participants were recruited online through social media, university platforms, and personal networks and received a link to the online study. They were randomly assigned to either the 'lucky' or 'unlucky' condition and completed a questionnaire on their beliefs in luck. They then participated in a 20-round coin toss game. Each round, they were asked to guess 'heads' or 'tails' while viewing the corresponding sides of a made-up coin (see Figure 1). After registering their choice via button-press, a qRNG provided a number (1-100) to determine a win or loss. A 4000ms animation displayed a spinning coin, ending with



Figure 1. An Imaginary Coin was Created by an AI and Used as a Stimulus.

the chosen side (win) or the opposite side (loss), accompanied by feedback: “Well done!” or “Unfortunately, wrong guess.” Participants’ cumulative wins and losses were displayed throughout. After the game, participants reported their belief in a just world, responded to additional questions, and provided demographic information.

Design and Statistical Analysis

The study employed a single-group design with two conditions: a ‘lucky’ condition (LC; 60% win probability) and an ‘unlucky’ condition (UC; 40% win probability). The dependent variable (DV) was the number of successful hits in the coin toss game.

Data were analyzed using Bayesian statistics, with a small prior effect size estimate following an uninformed Cauchy distribution $\delta \sim \text{Cauchy}(0, 0.1)$, which was defined a priori before data collection. Hypotheses were tested using one-sample Bayesian t-tests, predicting fewer wins in the LC and more wins in the UC than would be expected by chance. A Bayes factor threshold of 10 (strong evidence for H1 or H0) was used for hypothesis evaluation. Data analysis was performed in R (version 4.4.1), with materials and data available at OSF (<https://osf.io/2zgp5>).

RESULTS

Main Analysis

To test for a micro-PK effect in the LC, a one-tailed Bayesian t-test was conducted to assess whether participants averaged fewer than 12 hits. The result showed strong evidence for H1 ($BF_{10} = 10.87$, Cohen’s $d = .09$), with participants averaging fewer hits than expected by chance in the LC ($N = 801$, $M = 11.80$, $SD = 2.13$). Figure 2 (red line) displays the change in BF across data accumulation. A robustness analysis of the prior revealed moderate

robustness, with strong support for H1 with medium prior widths and anecdotal evidence with larger priors.

In the UC ($N = 725$), the one-tailed Bayesian t-test testing for more than 8 hits on average found moderate evidence for H0 ($BF_{01} = 3.76$), with participants’ performance aligning with chance ($M = 8.00$, $SD = 2.18$). Figure 2 (blue line) shows the BF progression.

Exploratory Analyses

There were no significant differences between the ‘lucky’ and ‘unlucky’ subsamples regarding belief in luck, personal luckiness, or belief in a just world. However, participants in the LC rated winning as more important ($M = 2.65$, $SD = 1.25$) than those in the UC ($M = 2.41$, $SD = 1.21$), $t(1512) = 3.86$, $p < .001$. Additionally, a marginally significant difference emerged regarding participants’ perceived ability to influence reality, with a higher sense of influence reported in the LC ($M = 4.04$, $SD = 1.03$) compared to the UC ($M = 3.94$, $SD = 1.09$), $t(1514) = 1.75$, $p = .08$. No differences were found for belief in unchangeable natural laws.

No significant relationships were found between the DV and other measures within each condition, except for the low-probability group (UC), where motivation to win showed a modest but significant correlation with the DV: $r(718) = .12$, $p < .001$.

Gender effects were not significant, but females showed a slightly stronger effect than males in both the LC ($M_{\text{female}} = 11.76$, $M_{\text{male}} = 11.88$) and the UC ($M_{\text{female}} = 8.04$, $M_{\text{male}} = 7.92$). No notable differences emerged based on age, occupation, education, language, or whether participants received compensation or not.

DISCUSSION

This pilot study aimed to investigate micro-PK effects by minimizing potential decline effects caused by participants’ implicit beliefs or experiences. Specifically, participants’ expectations of fair coin tosses and thus their preference for a 50% win probability and its effect on micro-PK was investigated (see Eisenbud, 1992). By employing a biased coin toss game, we tested two independent groups: a ‘lucky’ group with a 60% win probability and an ‘unlucky’ group with 40% win probability. We hypothesized that participants’ expectations would adjust outcomes towards a perceived 50% win rate. Bayesian analysis showed strong evidence for such an influence in the high-probability LC, while no effect was observed in the low-probability UC.

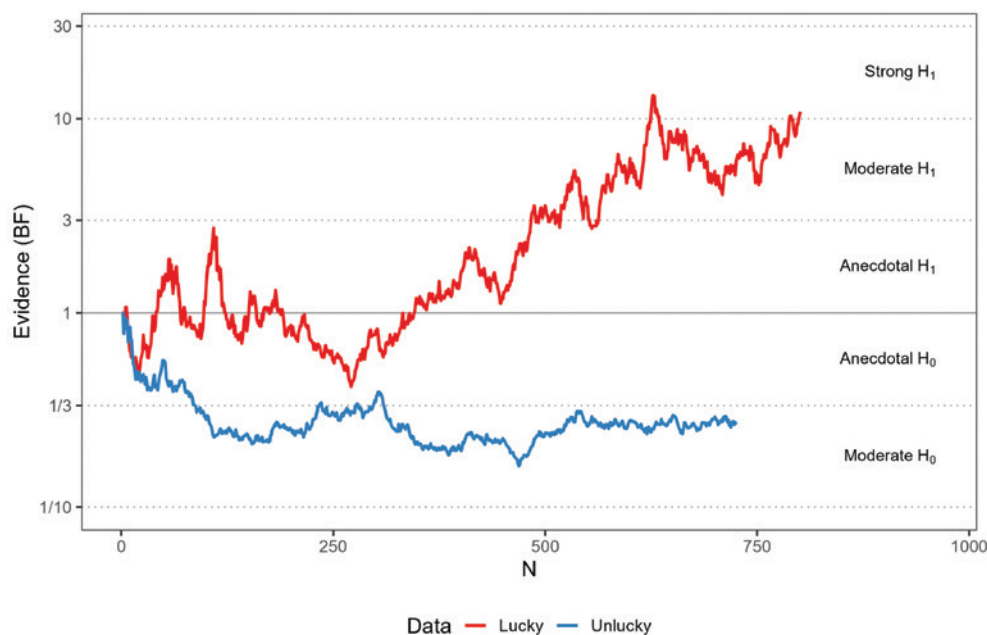


Figure 2. Sequential BF Curves for the 'Lucky' (Red) and 'Unlucky' (Blue) Subsamples.

The promising results in the LC suggest that the decline effect could be avoided by aligning outcomes with participants' expectations. If replicated, this supports the idea that psychological factors, such as prior experience or implicit beliefs, contribute to the decline (Eisenbud, 1992). However, the assumption of a shared implicit expectation among participants would be required to account for effects on a broader, experimental level. Failure to replicate would lean towards alternative explanations, such as pragmatic information in entangled psycho-physical systems (von Lucadou et al., 2007) or the influence of multiple observers with varying expectations (Bierman, 2001; Walker, 1975).

In contrast, the hypothesized micro-PK effect did not emerge in the UC, possibly due to a reduced motivation to win, as shown by a correlation between hits and post-game motivation. Given that motivation was assessed after the game, it's likely that participants who experienced more losses became emotionally detached, protecting themselves from frustration. This emotional disengagement could explain the lack of effect, particularly among male participants, who tend to be more competitive (Niederle & Vesterlund, 2007). The smaller sample size in the 'unlucky' group ($n_{\text{lucky}} = 801$, $n_{\text{unlucky}} = 725$), potentially due to higher dropout rates, further supports the notion of frustration-driven disengagement.

Several limitations must be considered. The study's external validity may be somewhat limited, as the sample was not fully representative of the general population in terms of age and gender distribution. However, by collecting data online, we accessed a community sample rather

than relying solely on a homogeneous student sample, which is common in psychological research. Many participants questioned the game's fairness, which may have impacted their engagement. Future studies could mitigate this by incorporating a cover story or subtler biases. Additionally, the display of performance may have framed the game too competitively, leaving less room for subjective experiences to shape outcomes. Emotional investment and its frustration, especially in the 'UC' group, may have hindered the emergence of micro-PK effects. Future studies could explore probabilistic scenarios without an active emotional involvement to better isolate the intended effects.

Finally, replication of the findings in the 'lucky' group is essential for understanding the mechanisms underlying the replicability and decline of psi effects. A direct replication of the findings of the LC subsample is already in planning. Investigating emotional detachment and its influence on micro-PK effects could offer further valuable insights into how attitudes influence outcomes.

IMPLICATIONS AND APPLICATIONS

The study's findings suggest that a decline of micro-PK effects might be circumvented by aligning experimental outcomes with participants' implicit expectations. This approach may be applicable to other psi effects, like anomalous cognition, but also beyond parapsychology, for example, in behavioral research or studies involving observer

effects. The integration of psychological and probabilistic factors could also inform interdisciplinary approaches in fields like quantum mechanics and consciousness studies, where the interaction between mind and matter is debated. Future research could explore similar designs in other psi domains or phenomena linked to probabilistic expectations.

AUTHOR CONTRIBUTIONS

Moritz C. Dechamps: Conceptualization, Methodology, Software, Formal Analysis, Data Curation, Writing – Original Draft.

Concettina G. N. Iovine: Methodology, Investigation, Formal Analysis, Writing – Review & Editing.

Markus A. Maier: Supervision, Project Administration, Writing – Review & Editing.

DATA AVAILABILITY

The primary data collected for this study, analyses scripts, and materials are available at OSF Repository: <https://osf.io/2zgp5>.

Researchers can access the raw data for independent verification or analysis. Further inquiries should be directed to the corresponding author.

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