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You Attract what You Are: The Effect of Unconscious Needs on Micro-Psychokinesis[1]

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Abstract: Quantum-based psychophysical correlation models offer an attractive framework for predicting mind-matter interactions. We report a test of such interactions in the form of observer effects on quantum-based random number generator (QRNG) outcomes. Specifically, we tested the influence of certain motive states on related stimulus presentations chosen by the QRNG. Deviations from randomness were expected among participants exhibiting high incongruence (HI) characteristics but not among those who exhibited low incongruence (LI). Our first experiment, testing the effects of three psychological needs—attachment, self-esteem protection, and control— with a Bayesian analysis yielded anecdotal evidence for H_1 only for self-esteem-related stimuli within the HI group. The second experiment was a selective continuation of the promising self-esteem protection condition, exploring the further sequential course of evidence for H_1 and its oscillation over time. Our criterion for confirming H_1 was initially reached in the target group. Shortly thereafter, a decline to a final result of anecdotal evidence for H_1 occurred. To test the systematic trend in the data against chance fluctuations, further post hoc analyses comparing the maximum Bayes Factor, the curve's energy, and frequency spectrum analysis between both groups to 10,000 simulations were performed. These analyses indicated that the HI subsample's data differed significantly from chance fluctuations, whereas the LI subsample's data did not. In sum, the results suggest that core affectively laden subconscious beliefs can manifest through volatile yet statistically detectable deviations from quantum randomness when precisely triggered by an adequate task.

Keywords: micro-psychokinesis, mind-matter, quantum measurement, intentional observation.

Various models describing the relation between mind and matter have been developed over time within different disciplines. The idea that these entities are different substances, as articulated by Cartesian dualism, poses two unsolved riddles regarding mind-brain interaction. First, the *hard problem of free will* concerns the question of whether phenomenal experiences can translate into physical events (Shariff et al., 2008). Second, the intricately related *hard problem of consciousness* (Chalmers, 1995) asks why and how a conscious mind that corresponds to the materialized reality evolves (Brüntrup, 2008). Thus, the core question is: How can two qualitatively different substances such as mind and matter interact with one another? Most current mainstream sciences tend to ignore this problem and seem to be

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satisfied with the position of radical emergence. In sum, they accept logical weaknesses, in particular its contradiction of the genetic argument, which states that conscious experience emerges from the pure configuration of different material units in an inexplicable and unpredictable way (Brüntrup, 2008).

By contrast, a possible means of avoiding these theoretical problems may lie in the consideration of dual-aspect monism theories, which consider mind and matter to be two distinct aspects of a common ground (e.g., Atmanspacher, 2014). One variant, psychophysical substance dualism, has a long tradition in philosophy, and can be found in Leibniz's monadology and Fechner's psychophysical theory (for an overview of this tradition in the Western culture see Skrbina, 2017). According to psychophysical substance dualism, interactions between mind and matter are located within a common ground, in which both aspects of reality exist as preforms (pre-conscious and pre-material), and, at this stage, are not yet separate from each other. This proposition of an existing pre-reality remained highly speculative until the advent of quantum theory. Newer versions of psychophysical substance dualism included quantum mechanics as their basic theoretical framework. Examples include the "unus mundus" theory developed by C.G. Jung and W. Pauli in a letter exchange between 1932 and 1958 (Atmanspacher et al., 2013), the "Implicate Order" theory (Bohm, 1985, 1990; Bohm & Hiley, 1982), and "Generalized Quantum Theory" (GQT) (Atmanspacher et al., 2002; Filk & Römer, 2011). Those approaches formalize the core idea that mind and matter form a unit on a deeper layer of potentiality and are separated only by measurement into the realms of conscious experience and corresponding matter at a higher level (for different approaches, see, Penrose & Hameroff, 2011; Pradhan, 2012; Römer, 2004).

The act of measurement constitutes a fundamental process in quantum physics in which a quantum system interacts with an outside system, a so-called observer. Before measurement takes place, specific features of a quantum particle, such as an electron's location, exist in a superposition of different states that are described by Schrödinger's wave function (Schrödinger, 1935). Upon measurement, one of these potential location states is determined with a probability reflecting the squared amplitude of the wave function on this position (Born, 1926). Orthodox quantum physics consider this random behavior to be ontic and inherent in nature (Bell, 1964; see Greenstein & Zajonc, 2006). Some authors (e.g., Mensky, 2014; Penrose & Hameroff, 2011; Pradhan, 2012; Stapp, 2007), however, allow an intentional observer to influence the quantum probabilities, making an outcome more likely than predicted by the Born rule (see also the correspondence between Jung and Pauli, but with the restriction that these effects can only be spurious and unsystematic; similar predictions are also made within GQT). In other words, a conscious observer's mind might play a more active role in the outcome selection than assumed within the original quantum theory framework (Schwartz et al., 2004).

With psychophysical substance dualism and dual-aspect monism in mind, Maier, Dechamps, and Pflitsch (2018) emphasized that such an influence must happen indirectly and emerge from the common ground prior to measurement. It is thus not the conscious deliberate intention itself that affects the emergence of materialization but, rather, the observer's pre-conscious (and therefore unmeasured) state of mind that impacts the becoming of conscious experience of a classical material result (Dechamps & Maier, 2019; Maier & Dechamps, 2018).

Micro-Psychokinesis

The influence of an intentional observer on deviations from quantum randomness during the process of measurement has been the subject of investigation for several decades. This area of research has been part of a wider field of research labeled micro-psychokinesis (micro-PK). Micro-PK effects are defined as "minute influences on inanimate, probabilistic systems, producing effects that can only be detected through statistical means. The target systems may include tumbling dice, coin tossing systems, or hardware random number generators (RNGs)" (Varvoglis & Bancel, 2015, p. 266). Several meta-analyses aggregated the results of hundreds of micro-PK studies involving a quantum-based true random number generator (QRNG), and observed significant overall effects (Bösch et al., 2006; Radin & Nelson, 1989). On average, intentional observation had an effect on the probabilities of quantum events. However, the rather unconventional high heterogeneity of effect sizes in these analyses left room for doubt (see, however, Radin et al., 2006). In addition, a large-scale study testing micro-PK with 12,571 participants also found no evidence of the effect (Maier et al., 2018). Furthermore, the "benchmark" experiment of the Princeton Engineering Anomalies Research (PEAR) program could not be replicated. The latter program consisted of over 2.5 million trials over twelve years, eventually yielding a remarkable *Z*-score of 3.8 (Jahn et al., 1987). Contrary to expectations, a direct replication attempt by a research consortium collecting 750,000 trials over three years failed, with an insignificant Z-score of 0.6 (Jahn et al., 2000). Although some of these discrepancies may be attributed to extreme outliers in the PEAR study and a subsequently underpowered design of the replication study (Varvoglis & Bancel, 2015), variable effects in micro-PK studies continue to challenge researchers (e.g., Maier & Dechamps, 2018).

Along with selective publication and enhanced study design, some authors attribute declining effects to individual psychological variables, such as the individual's motivation or stress level (Varvoglis & Bancel, 2015). This can be addressed by using fewer trials and working with paradigms that are less performance-based, in addition to applying study designs that work with effortless intention, rather than effortful, deliberate tasks (e.g., Braud & Braud, 1979; Debes & Morris, 1982). For that reason, in our study, we sought to subconsciously active implicit psychological variables to pair with the effect. However, psychological moderators can only account for declines concerning individual participants; they do not address declines over the course of a single study or more (Bierman, 2001).

Model of Pragmatic Information

A more global explanation for decline effects was originally proposed by von Lucadou, Römer, and Walach (2007) in their "Model of Pragmatic Information." It states that the novelty of a finding based on non-local entanglement correlations is complementarily related to its likelihood of confirmation (von Lucadou, 2006, 2015). The authors realized that a violation of the probability rule in quantum mechanics would also conflict with the "no-signal" theorem (or NT-Axiom in terms of the GQT), according to which no signal can travel faster than light. This could, in theory, be realized through a consistent and reliable occurrence of non-local entanglement correlations. Thus, the systematic detection of micro-PK effects and the potential signal-use of this effect must be prohibited (Atmanspacher et al., 2002). Replication of micro-PK effects, therefore, is highly unlikely, leading to a decline in the effect over the course of subsequent replications. Recently, Maier et al. (2018) modified this proposition somewhat, arguing

for a systematic counter-mechanism that eliminates the original micro-PK effect as long as it represents a signal, leading to an oscillating pattern of appearance and disappearance across studies and participants over time. This antagonistic force may also be related to the second law of thermodynamics, which states that entropy must always increase in closed systems, ensuring that order does not emerge from chaos (or information from randomness). This interplay between effect and counter-effect should manifest in a specific pattern of evidence for the effect across time, resembling a damped harmonic oscillation.

Directionality and Emotional Transgression of Micro-PK

In the studies presented herein, we tested observer effects on micro-PK using the participants' pre-conscious motive states as independent variables. Our focus on pre-conscious intentional states refers to the proposed origin (see Atmanspacher, 2014) of mind-matter interactions that locates them within the realm of the pre-reality that existed before the measurement of a quantum state. An increased likelihood of a specific pre-conscious mental state should find its correspondence after measurement in the increased likelihood of the equivalent physical state during conscious observation of the measurement's result. This means, micro-PK effects can only be congruent to implicit motives, rather than to deliberate goals. There is empirical evidence for this claim in studies that show directional psi effects of participants that were not consciously intending them.

The direction of the psychogenic influence may be derived by the Emotional Transgression Model (ETM)—a model for the emotional impact of motivational goals on unconscious behavior activation. According to this model, every motivational goal of an individual is based on an emotionally laden unconscious expectation grounded in a certain belief. Two emotions are primarily relevant here: hope and fear (see Elliot, 2008). When goals are based on approach-oriented expectations grounded in the aim to succeed during goal performance the driving emotion is hope for positive outcomes. On the other side, when goals are based on avoidance-oriented expectations grounded in the expectation of a negative outcome the underlying driving emotion is fear of loss. For example, if someone wishes to find a job an approach orientation would be characterized by the hope to find a perfect job pretty soon. Confidence in getting a desired job would be the underlying belief here as this is the core theme of hope. In the case of an avoidance orientation, the individual would anxiously desire to find a job. Fearful doubts about getting a desired job would be the underlying belief here as this is the core theme of fear. In both cases the individual's explicit goal is to find a job, but the emotional expectations that lay behind are completely different. We argue that micro-PK effects are dependent only on those emotional expectations. As is apparent in this example, they cannot be translated directly from explicit goals but depend on the emotional transcription that goes along with them. Thus, an avoidance-based goal should unconsciously lead to a negative self-fulfilling prophecy. Empirical evidence can be found in Stanford's work regarding his theory of "psi-mediated instrumental response". Studies showed the occurrence of a directional psi effect within subjects that were not consciously intending them (Stanford, 1976; Stanford et al., 1975). The ETM extends the non-intentionality (Stanford, 1990) and goal-orientation (Schmidt, 1974) postulates regarding psi effects and proposes that the directionality of the effect is directly dependent on the emotional interpretation of the goal shaped by a basic core belief. Our goal in this study was to identify

strong and measurable subconsciously active beliefs that may trigger either an approach- or an avoidance oriented micro-PK effect using the predictions of the ETM.

Consistency Theory

In view of the above, we selected Grawe's "consistency theory" (1998) as a model of basic motivational determinants measurable with reliable questionnaires like the "Inkongruenzfragebogen" (INK; "Incongruence Questionnaire") (Grosse Holtforth et al., 2004). According to Grawe's "functional model of the psychic event", the elementary function of adequate adaptation to an individual's environment is successful if the basic psychic needs are fulfilled. Similar to comparable concepts (e.g., the Cognitive-Experiential Self-Theory by Epstein, 1990), consistency theory considers "attachment/connection," "self-esteem enhancement/protection," "orientation/control," and "pleasure maximization/distress avoidance" as the four basic human needs. In our study we selected "attachment," "self-esteem protection," and "loss of control" to create a specific micro-PK task and excluded "pleasure maximization/distress avoidance" as it could not be operationalized sufficiently for our experiments. In the course of socialization, motivational patterns develop individually and are expressed through certain goals and behaviors that fulfill these needs. In consensus with other authors (e.g., Elliot et al., 1997) Grawe (1998) considers approach- and avoidance-motivation to be two distinct psychic systems for self-regulation. The approach system focuses on the maximization of need fulfillment, whereas the avoidance system aims to protect the individual from harmful experiences. If the basic psychic needs are frustrated, they become increasingly urgent and "energized" through their connection with strong emotions. This state is described as incongruence of needs. Therefore, high incongruence is more strongly associated with avoidance-oriented goals than with approach-oriented ones, as the approach system is more directly connected to need fulfilment. Furthermore, avoidance strategies develop from enduring experiences of need frustration, which also enhance expectations of not having enough. For example, if the need for attachment is frustrated by early experiences of social rejection, the individual may develop the emotional belief of not being likeable for others and corresponding motivational patterns like avoiding to openly engage with other people in order to protect oneself from further harmful experiences of exclusion. We consider incongruence to be a strong indicator for subconsciously active core beliefs, which should possess the capability to trigger a micro-PK effect distorting the results of random events according to the predictions of the emotional transgression model.

Hypotheses

In the first experiment, we expected an initial micro-PK effect for the target group of participants who exhibited high incongruence (HI) characteristics, but not for those who exhibited low incongruence (LI). Therefore, we hypothesized that the HI group would show significant deviations from randomness while observing stimuli addressing deprived needs vs. neutral ones selected by a QRNG. For micro-PK tasks involving targets designed to resemble an approach-motivated means of satisfying a need in this experiment through the presentation of positive, need-relevant pictures, we assumed that participants who exhibited HI (i.e., individuals who are generally unable to adequately satisfy those needs) would elicit fewer positive target stimuli than chance suggests. The ETM would predict an outcome of fewer positive pictures than would be expected by chance, as the HI group is more likely to have inner fearful doubts

of being rejected or left by others. Comparatively, for micro-PK tasks using negative need-relevant target stimuli designed to resemble an avoidance-motivated means of satisfying a need, we predicted that HI participants (i.e., individuals who are generally unable to adequately avoid such negative events) would show more negative targets than expected by chance. In the case of the need for self-esteem protection, this means according to the ETM that individuals exhibiting HI-characteristics are less likely to avoid derogatory stimuli as they are prone to have inner fearful concerns of not being good enough in any task or only deserving negative responses. When trying to avoid a loss of control, the ETM would predict a higher likelihood for participants who exhibit HI to attract experiences in which they lose control, as they are more likely to have inner fearful doubts of losing control of a situation or not being able to affect their environment at all instead of a hopeful feeling of self-efficacy. Furthermore, for the LI group, no significant deviations from chance were predicted, since unconsciously active beliefs should not be triggered by this micro-PK task (see Figure 1). From a wider perspective, we assumed the micro-PK effect to be volatile and to follow a systematic oscillating pattern across participants over time. Therefore, we expected to observe a decline in our second experiment, after strong evidence (*BF* = 10) had been obtained. The researchers' a-priori belief that the hypotheses in this study would be supported can be classified on a scale from 5 = "strong belief" to 1 = "strong non-belief" as 4 = "moderate belief".

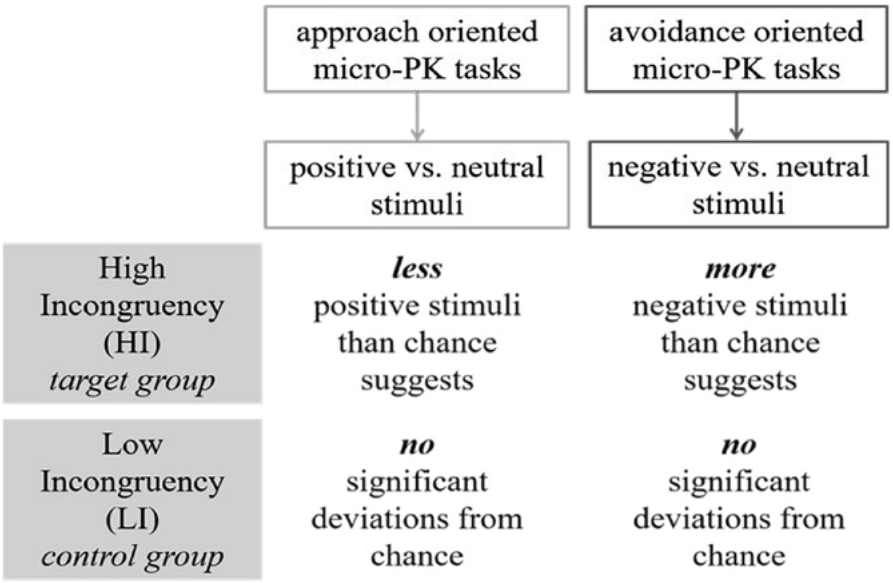

Figure 1. Predicted directions of the effect for both experimental groups concerning micro-PK tasks that resemble approach- vs. avoidance-motivated means of satisfying a need.

Method

This study was preregistered at the Open Science Framework (https://osf.io/xm4wf). The instructions did not reveal the study's purpose, but assured anonymization and emphasized the participants' right to withdraw from the experiment at any given time. Voluntarily participation was ensured by obtaining written consent. An explanation about the study's purpose was offered individually after the tasks were completed. This procedure and the experiment were approved by the ethical board of the Department of Psychology.

Design

For this study, we selected a between-subject design with two conditions. We conducted a quasi-experiment with LI and HI in basic psychological needs as independent variables. Participants were divided into these groups based on their individual average overall-incongruence score measured by the INK (Grosse Holtforth et al., 2004). The dividing point was the standardized average value for healthy individuals as detailed in the manual. Furthermore, we developed specific micro-PK tasks for the psychological basic needs "attachment," "self-esteem protection," and "orientation and control," testing various modes of operationalization concerning stimulus formats, tasks, and approach- vs. avoidance-motivated focus. Each micro-PK task comprised ten trials of stimulus presentation on a screen. For each trial, a QRNG chose between a need-related and a neutral stimulus. The number of need-related stimuli displayed served as a dependent variable (DV).

The first micro-PK task focused on the need for attachment, and implemented an approach-oriented design, using positive pictures of happy couples as targets and neutrally rated pictures as control stimuli. Participants were required to observe the pictures attentively. The DV was the number of positive target pictures selected by the QRNG tested against the expected value of five out of ten presentations under chance.

The second micro-PK task focused on the need for self-esteem protection, and implemented an avoidance-oriented design, using derogatory adjectives as targets and neutrally rated adjectives as control stimuli. Participants were instructed to read the words attentively. Again, the DV was the number of negative target words selected by the QRNG tested against the expected value of five out of ten presentations each under chance.

The third micro-PK task concerned the need for avoiding a loss of control. This task differed from the first two, as participants had to press a button after each trial. In every trial a repulsive picture was presented at the screen. Participants were either able to end the display of the picture as soon as it appeared, by pressing a button ("in-control trials") or it lasted 2500 ms regardless of a button being pressed or not ("loss-of-control trials"). A QRNG output for each trial decided whether a trial was an in-control or a loss-of-control trial. To create a strong feeling of loss of control, we chose a percentage of 75% "in-control trials" instead of 50% as baseline for the QRNG. This made the loss-of-control trials more outstanding and awkward since the usual experience was to be in control. The DV was the number of trials in which pressing a button did not end the display ("loss-of-control trials"). As the baseline probability for those trials was only 25%, we tested against an expectancy value of 2.5 out of ten instead of five like in the other two micro-PK tasks.

Materials

Hardware and Software. The lab study was conducted on a set of ten experimental computers, all of which had been prepared identically. The stimuli were presented on a black background at a size of 500 x 400 pixels. A presentation procedure was programmed in jsPsych, which translated the output of the random number generator into the selection of either need-related or neutral stimuli. For stimulus randomization, we used a hardware-based QRNG, the "BitBabbler Black" (BitBabbler, 2014–2015),

which passed all important tests for randomness (ENT, FIPS 140-2, Dieharder, NIST SP800-22, and TestU01). A truly random source during stimulus selection is essential to allow a state of superposition to emerge, which might enable an unconscious interaction between motivational patterns and quantum processes. The "BitBabbler Black" offers an external physical process, including quantum mechanical and semi-quantum mechanical procedures using different sources of electrical noise. These signals are reinforced and integrated in a way that none of the deterministic processes in the analog circuit can exert an influence on the outcome. During the transition from the analog to the digital circuit, the noise signals are transformed through a 3.3V logic into a binary output (Bit 1 and Bit 0), which serves as a quantum-based source for randomness for each experimental trial.

Stimuli. To ensure adequate emotional valence, all neutral pictures used as control targets in the task for attachment were obtained from OASIS (Kurdi et al., 2017), a picture set containing 900 validated stimuli. Furthermore, we conducted a pre-study to rate all other stimuli without sufficient empirical validation in the present literature with regard to the target pictures (all need-related pictures for "attachment" and "loss of control") and all word stimuli (negative and neutral) on the three dimensions of valence, arousal, and content-related association (see Table 1). For this evaluation the sample consisted of N = 26 students (25 females n = 25; age: M = 22.27 years, SD = 1.70) enrolled in a course on experimental psychology. All 80 stimuli were assessed on a seven-point scale with respect to emotional valence ("How does the induced emotion feel?"; from 1 = "very negative" to 7 = "very positive"), arousal ("How intense does the induced emotion feel?"; from 1 = "very weak" to 7 = "very strong") and content-related association (pictures: "How closely do you associate this picture with relationship/disgust"; words: "How strongly do you feel evaluated by this word?"; from 1 = "very weak" to 7 = "very strong").

To address the need for "attachment" in the first micro-PK task, the set of target stimuli contained 20 pictures of happy couples. The material was obtained from Shutterstock (www.shutterstock.com), a provider of royalty-free stock photographs. The mean subjective association with the concept "attachment" obtained from the pre-rating of the pictures was M = 5.41 (SD = 0.94) with a rather strong arousal (M = 4.94; SD = 0.73) and a positive valence (M = 5.39; SD = 0.98), indicating the pictures' on average clear attachment-relevant and emotionally loaded content. The neutral pictures used as control targets in this task were obtained from the picture set OASIS (Kurdi et al., 2017), with ratings with respect to valence and arousal on a seven-point-Likert-scale for each stimulus. Twenty pictures, each depicting everyday objects, rated very low on arousal (M = 1.98; SD = 1.37) and with neutral valence (M = 4.09; SD = 0.66), were selected.

For the self-esteem-protection task, all word stimuli were presented in Arial font with white letters on a black background. The 20 neutral adjectives with low arousal (M = 2.85; SD = 1.42) and a neutral valence (M = 3.99; SD = 0.19) focused on attributes that are not typically used to characterize a person and consequently do not possess any qualities associated with self-esteem (association: M = 2.52; SD = 1.38), namely geometric shapes and surface textures (e.g. "five-cornered," "dotted"). Twenty derogatory adjectives (association: M = 4.87; SD = 1.27) with a rather high arousal (M = 4.47; SD = 0.78) and a negative valence (M = 2.49; SD = 0.48) were generated, based on the dimensions of the "Feelings of Inadequacy Scale" (Janis & Field, 1959). This included words related to self-esteem ("useless," "boring." "inferior," "unimportant," "worthless"), to academic skills ("dumb," "unsuccessful," "incompetent," "weak,"

"bad") and to physical attractiveness ("unlovely," "off-putting," "ugly," "inexpressive," "disgusting," "unsightly," "unattractive," "nauseous").

To establish aversive trials for the simulation of a loss of control in the third task, participants were presented with unpleasant, nauseating pictures (association: *M* = 5.46; *SD* = 0.58) with rather strong arousal (*M* = 5.24; *SD* = 0.67) and a negative valence (*M* = 2.04; *SD* = 0.41) also obtained from Shutterstock. These typically involved scenes of environmental pollution, feces, dirty toilets, or similar.

Table 1
Descriptive results of the validation study.

		M	*SD*	Min.	Max.
attachment					
	association	5.41	0.94	2.80	6.75
	arousal	4.94	0.73	3.45	6.20
	valence	5.39	0.98	2.65	6.55
loss of control					
	association	5.46	0.58	4.45	7.00
	arousal	5.24	0.67	3.90	7.00
	valence	2.04	0.41	1.05	2.75
neutral adjectives					
	association	2.52	1.38	1.00	4.25
	arousal	2.85	1.42	1.05	4.55
	valence	3.99	0.19	3.55	4.40
derogatory adjectives					
	association	4.87	1.27	1.60	6,55
	arousal	4.47	0.78	2.50	5.90
	valence	2.49	0.48	1.70	3.50

Questionnaire. Incongruence in basic psychological needs was measured by the long version of the INK (Grosse Holtforth et al., 2004), which takes around ten minutes to administer. For interpretation, the manual contains standard tables with t-values. The standard sample varies in gender and age and was based on *n* = 707 healthy individuals and *n* = 569 patients from different psychotherapy settings. The questionnaire consists of 94 items, rated on a five-point scale. The first part concerns approach-goals and contains 57 items. Participants must assess whether they feel that the concrete needs were fulfilled "recently" (from 1 = "far too little" to 5 = "completely sufficient"). Because the questionnaire measures incongruence, these scales' ratings must be reversed. The particular scales are labeled "intimacy/attachment," "sociability," "helping others," "receiving help," "respect/appreciation" "being superior/impress," "autonomy," "performance," "control," "education/understanding," "belief/sense," "enjoyment of life," "self-confidence/self-esteem," and "self-reward".

Analogously, the second part captures the avoidance-goals by asking participants to rate how often aversive events have been experienced "recently" (from 1 = "not at all true" to 5 = "very true"). This includes the scales "loneliness/separation," "contempt," "humiliation/disgrace," "accusations/criticism,"

"dependence/loss of autonomy," "tensions with others," "vulnerability," "helplessness," and "failure". In addition to the individual scales, the questionnaire provides an incongruence value for approach- and avoidance-goals and an overall-incongruence score. This overall-incongruence score, split into a HI and a LI group, was used as an independent factor. The splitting criterion refers to the standard sample of healthy individuals based on a *t*-scale (with *t* = 50 as the average value and *SD* = 10). Participants with an overall-incongruence score of *M* = 2.2 or above were considered to exhibit HI characteristics (*t* = 51). The INK is an appropriate measure, as it guarantees high objectivity by providing standardized instructions, clear analytical guidelines, and *t*-values for interpretation. Internal consistency across the different standard samples ranges from acceptable to very good for most scales. For the approach-scales, the retest-reliability lies between *r* = .42 - .91, with an average of *r* = .68, and for avoidance-goals between *r* = .54 - .79, with an average value of *r* = .64.

Procedure

Participants were tested in the department's laboratory, which contained ten identically set-up testing computers separated by room dividers (see Fig. 2). The entire experiment took around 30 min. The experimenter read a standardized instruction text aloud explaining the procedure in a friendly but factual manner. When the participants had no further questions, the experimenter gave them the signal to begin the INK. After completing all questions, the participants were instructed to continue by clicking the "next" button and to initiate the image display by pressing any key as soon as they were ready. Participants attentively observed three consecutive series of ten trials each. The micro-PK tasks were performed in the following order: "attachment," "self-esteem protection," and "loss of control". After each task, the program advised the volunteers to remain focused and press the button again to confirm their attentiveness. In each trial, they looked at a fixation cue (700 msec) first, then at the stimulus (pictures: 400 msec; words: 800 msec), and, finally, at a black screen (inter-stimulus-interval: 400 msec). This process was repeated 30 times in total (see Figure 2). In every sequence, the QRNG decided whether the next image shown would be from a set of need-related or neutral images. BitBabbler's randomness function selected which of the stimuli in the selected set would be displayed. At the beginning of each trial, the QRNG chose a number corresponding to one of 20 stimuli in both sets. After the fixation cue, the sequence produced by the QRNG was completed to select the definite stimulus by determining the category. Stimuli were selected by sampling with replacement.

After the third task was completed, participants were asked to complete the post-task questionnaire, which asked to indicate how unpleasant the disgusting pictures were perceived (from 1 = "very unpleasant" to 5 = "not unpleasant at all") and to state their assumptions about the study's aim.

Data Analysis

Data collection and analyses were performed using Bayesian inference techniques for hypotheses testing, as recommended by Wagenmakers, Wetzels, Borsboom, and van der Maas (2011), and the strategy was preregistered. While the frequentist approach makes assumptions about theoretically repeated replications of the same study, the Bayesian method accumulates data concerning the effect, and repeatedly updates an effect's likelihood given additional data. In this framework, the strength of evidence for the effect is considered dependent on both the given data's support for H_0 and for H_1. To determine

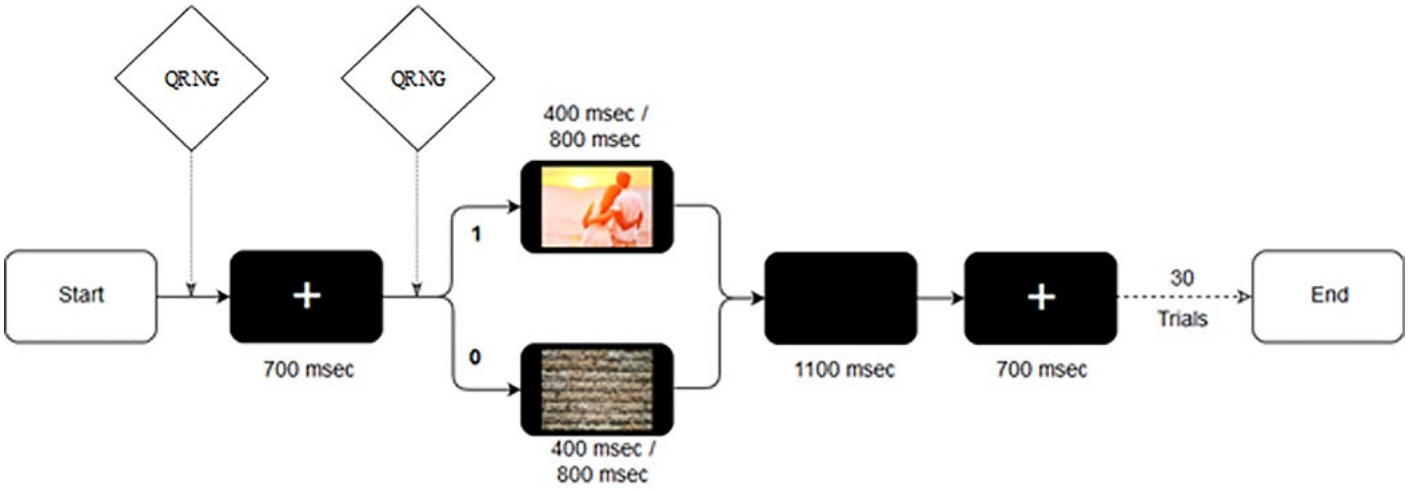

Figure 2. Each trial comprised the display of a fixation cue, a need-relevant or neutral stimulus, and a black inter-trial interval.

whether the data provide more evidence for H_1 or H_0, both likelihoods are pitted against one another. The resulting score is called the Bayes Factor (BF), and resembles the relative amount of evidence that the data provide for or against a postulated effect. A BF of 10 or higher is considered to indicate strong evidence for H_1 or H_0, respectively (see Jeffreys, 1961).

To calculate the BF, a probability distribution for the effect size must be specified a priori. Usually, a Cauchy distribution centered around zero with scale parameter *r* is used ($\delta \sim Cauchy(0, r)$) to identify the prior. Wagenmakers et al. (2011) recommend that *r* equals 1. The statistic software JASP, designed to perform basic Bayesian analyses, uses a default *r* of .707. Other authors recommend a lower *r* of .5 (Bem et al., 2011) or .1 (Maier et al., 2014) The choice of the prior provides a degree of freedom within the Bayesian approach. We decided to use $r = .1$, i.e. $\delta \sim Cauchy(0, .1)$. This score was determined and preregistered before data collection commenced.

Bayesian hypothesis testing offers several valuable advantages. One is that the BF combines information about the effect and the sample power within its score. A high BF can only be reached when sufficient power is provided through sample size, whereas the frequentist approach might accidentally detect an effect within a severely underpowered study. Thus, the frequentist approach requires an a priori power analysis and pre-definition of sample size to compensate for this potential problem, which is unnecessary when applying Bayesian techniques. Moreover, the Bayesian approach allows for data accumulation, (i.e., additional participants can be tested and included in the dataset until a pre-specified BF criterion for H_1 or H_0 has been reached). This also permits optional stopping and is therefore more effective than the frequentist method. We decided to use a BF of 10 as a criterion. In the study preregistration, we therefore set either $BF = 10$ in all of the three micro-PK tasks or a target sample size of $N = 300 - 352$ as the stopping rule for the first experiment. To do so, data were analyzed on a regular basis for every new 5 participants as soon as 50 participants had been tested.

Since researchers in the psychology field are more familiar with the frequentist approach than with Bayesian hypothesis testing, we outline our reasons for using the Bayesian approach here in greater de-

tail, and *p*-scores are also provided. We used the Wilcoxon signed-rank test, as the population cannot be assumed to be normally distributed. The statistical software tool JASP (Version 0.8.2; JASP Team, 2017) was used for all Bayesian analyses.

Experiment 1

This first experiment was implemented and analyzed according to the preregistration with all three outcome variables as described above.

Methods

Participants. In the first experiment, 318 participants were tested, and the target sample size of *N* = 300 - 352 came into operation when our given testing period ended. Due to technical problems, 23 data files were excluded from analysis: The QRNG connection was deficient in five sessions, during which the stimulus selection did not work. For 18 participants, incorrect software settings produced 100 trials rather than 10 in each of the three blocks. Therefore, *N* = 295 datasets of test subjects fulfilling all inclusion criteria were viable (female *n* = 210, male *n* = 84, unspecified *n* = 1; age: *M* = 23.27 years, *SD* = 6.46). Participants were recruited through the department's announcement board, handouts distributed during class, Facebook groups, and direct contact with the experimenters. Undergraduate psychology students could acquire credits for participation. Inclusion criteria included a minimum age of 18 years and proficiency in German.

Experimenters. For this study, 32 informally trained students were used as experimenters as part of a practical course on empirical psychology. Their task was to identify participants fulfilling the inclusion criteria. They had no knowledge about the experiment's goal at the point of data collection and were advised to only interact with the participants in a friendly but also factual manner. The experimenters sent raw data to the study's supervisor after each testing session.

Results

Separate Bayesian *t*-tests were performed for each of the three micro-PK tasks for the HI (*n* = 133) and the LI (*n* = 162) subsamples. The prediction was that the HI group would show a higher-than-chance score for the neutral pictures in the attachment task, for the derogative adjectives in the self-esteem task, and for the loss-of-control trials in the control task. No deviations from chance were expected for the LI group.

We first report the analyses of the HI group: The score of self-esteem protection stimuli (number of derogatory adjectives displayed) yielded an anecdotal effect close to the threshold of moderate evidence for H_1. The other two Bayesian *t*-test analyses showed no substantial deviations from chance, either for the attachment or loss-of-control tasks (see Table 2).

Table 2
Descriptive and frequentist outcomes for the HI subsample. A small but significant deviation from chance is indicated for the micro-PK task concerning the need for self-esteem protection.

	N	M (SD)	BF	Z, p-score
attachment	133	5.08 (1.57)	0.70	0.39, .35
self-esteem	133	5.27 (1.59)	2.95	2.17, .02*
loss-of-control	133	2.60 (1.30)	0.92	0.65, .26

For the LI subsample, three two-tailed Bayesian one-sample t-tests were performed. A two-tailed approach was adopted since, for the control group, no substantial deviations from chance were expected in any direction. As expected, no substantial evidence for H_1 was found, nor were deviations from randomness detected in any of the three DVs, although the BFs confirmed no substantial evidence for H_0 either (see Table 3).

Table 3
Descriptive and frequentist outcomes for the LI subsample. No significant deviations from chance were observed.

	N	M (SD)	BF	Z, p-score
attachment	162	4.91 (1.47)	0.54	-0.56, .71
self-esteem	162	5.15 (1.57)	0.74	1.12, .11
loss-of-control	162	2.51 (1.58)	0.46	-0.30, .62

Discussion

In sum, the results from the first experiment revealed moderate evidence ($BF < 10$) in

the postulated direction within the HI group for the self-esteem protection task but not for the attachment- or the loss-of-control tasks. As hypothesized, no substantial deviations from randomness were observed within the LI group, but the H_0 was not confirmed either. Since we had reached the end of our given testing period, we followed the stopping rule even though our criterion for strong evidence ($BF > 10$) for H_1 or H_0 had not been satisfied at this point.

Several limitations concerning the operationalization of the attachment- and the loss-of-control tasks might explain why the effect failed to appear for these outcome variables. The results from the stimulus validation show that, despite the valence of the attachment-related pictures being positively rated on average, the minimum value lies within the negative range. Therefore, images of happy couples may not always be perceived as positive stimuli, but may also cause envy or sadness, particularly

in individuals experiencing HI of the need for attachment. The more complex and socially related the operationalized constructs become, the more the images might be prone to unconscious individual interpretations, which could be a source of confound for implicit micro-PK experiments of this nature. Furthermore, during the testing phase, the loss-of-control task design failed to create the intended impression of a key that is sometimes stuck. This may be due to the small number of trials, which may be insufficient to establish a feeling of control over the picture presentation and its loss during several trials. Oral reports from experimenters and participants confirmed this guess: this task was unclear to many test subjects, with some reacting by not pressing the button at all. Nevertheless, the operationalization of the micro-PK task for self-esteem protection appeared more suitable, as the words concretely and precisely addressed the need in question, without accommodating individual interpretations. Therefore, we selected this condition for further exploration.

Experiment 2

As none of the effects in Experiment 1 yielded clear evidence for H_1 or H_0, we continued collecting data until strong evidence for or against the postulated effect was obtained. We focused on the promising outcomes of the self-esteem-protection task, excluding the other two tasks for economic reasons. Otherwise, the procedure and analysis strategy remained unchanged. To maintain the original study duration, another separate experiment was added at the beginning.

In view of the non-replicability problem common within psi studies, the data collection continued beyond obtaining strong evidence ($BF > 10$), to investigate a potential decline effect in micro-PK experiments. We did not propose a concrete hypothesis concerning the volatility of the effect in the original preregistration, as decline effects were not expected within the target sample size of the first study. Because experiment 2 will enlarge the sample size considerably and has a replication character to some extent, we additionally assumed a decline for the further data collection in our second experiment after initial strong evidence ($BF > 10$) had been reached.

Methods

Participants. In the second experiment, 217 further participants were tested. QRNG connection was deficient in five of the sessions, so $N = 212$ (female $n = 155$, male $n = 57$, unspecified $n = 1$; *mean age* = 23.60 years, $SD = 7.13$) datasets of test volunteers fulfilling all inclusion criteria could be added, making a total sample size of $N = 507$ (i.e., previous study $n = 295$ plus this study $n = 212$).

Experimenters. Three informally trained undergraduates (female $n = 2$, male $n = 1$) were responsible for recruiting and testing. Again, they had no knowledge of the study goal at the time of data collection and received the same instructions for interacting with the participants according to the standardized protocol. The two females experimenters ranked their attitudes towards psi by self-assessment of their belief on a scale from 5 = “strong belief” to 1 = “strong non-belief” as 4 = “moderate belief.” Unfortunately, we could not obtain this information from the other two experimenters.

Results

Sequential Bayesian analyses. Individual Bayesian one-sample *t*-tests of the micro-PK tasks on self-esteem protection were conducted for the HI and the LI subsamples. The graphs below represent a sequential analysis of the BFs for the HI (see Figure 3) and LI group (see Figure 4).

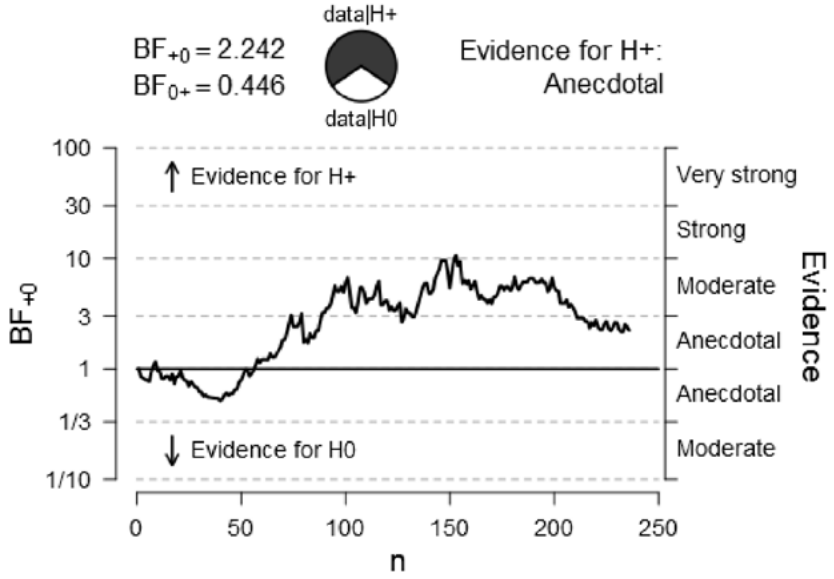

Figure 3. Sequential analysis of the BFs within the HI subsample. Shortly after the significance criterion of *BF* = 10 had been reached at *n* = 153, evidence declined again to a final result of *BF* = 2.24.

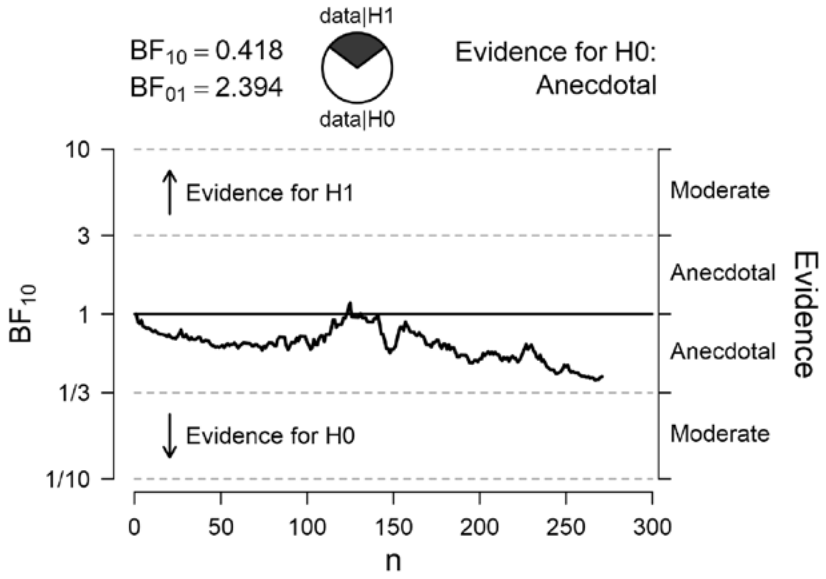

Figure 4. Sequential analysis of the BFs within the LI subsample. The graph shows a null curve, which almost always runs under the mark towards evidence for H_0.

In the HI subsample of *n* = 236, results reached the significance criterion of *BF* = 10 at *n* = 153 (*BF* =

10.72), and declined shortly thereafter to a final result of *BF* = 2.24, which can be classified as anecdotal evidence. In the LI subsample, there was no substantial deviations from chance at any time (see Table 4).

Table 4
Descriptive and frequentist outcomes for the HI and the LI subsample.

	N	M (SD)	BF	Z, p-score
HI	236	5.18 (1.58)	2.24	1.86, .03*
LI	271	5.04 (1.54)	0.42	0.43, .67

Exploratory analyses. Concerning the selective continuation of the self-esteem protection task, the course of the effect across participants over time differed considerably between the experimental groups. The curve of the target group seems untypical of chance fluctuations, whereas the control group's sequence does not. To test the likelihood that such a sequence would be produced by chance, we performed post hoc exploratory analyses based on Dechamps and Maier (2019). These analyses were not included in the preregistration, as we were unaware of these methods at that point. Encountering frequency analyses as a procedure for capturing differences in evidence sequences on a quantitative level led to the post hoc adjustment of our hypotheses. Doing so, we looked at the sequential Bayesian analyses of both the HI and LI group and compared them to 10,000 simulations (see Figure 5). For a better comparison, the graph of the control group was also based on a one-tailed Bayesian one-sample t-test in the same direction as in the target group for this analysis. These simulations consist of 2710 random bits each (271 subjects * 10 trials) that were aggregated in the same manner as the experimental data. Subsequently, a sequential Bayesian t-test with the same parameters as for the experimental data (one-tailed; δ ~ Cauchy (0, .1)) was conducted for data points 10 to 271. These simulations represent an experimental null-effect dataset.

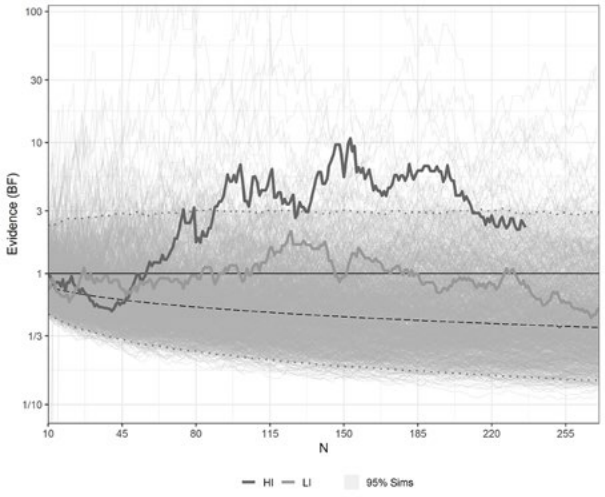

Figure 5. Sequential one-tailed Bayesian analyses of the HI and LI group in comparison to 10,000 simulations (1,000 depicted in the figure), the median of the simulations (dashed line) and the Confidence Interval of 95% for the BF (hatched area between the dotted lines).

Maximum BF. First, we compared the subsamples' highest BFs to those of the simulations. The highest BF in the HI group is 10.72 at *n* = 153. Only 3.3% of all simulations reached a higher BF at any point. LI group's highest BF equals 2.10 at *n* = 125, which is surpassed by 26.1% of simulations.

BF energy. Next, we examined the overall orientation of the BF curve, calculating the area between the curve and the borderline of evidential power between H_0 and H_1 at *BF* = 1. A positive value of this area—also called the curve's *energy*—means an overall tendency for the BF to be directionally positioned toward H_1. The HI group's energy is 564.13, which is surpassed by only 1.9% of simulations. By contrast, the LI group's energy lies at -7.06, and is surpassed by 17.7% of simulations. The typical energy of a null-effect simulation was found to be *M* = -41.85 (*SD* = 647.40).

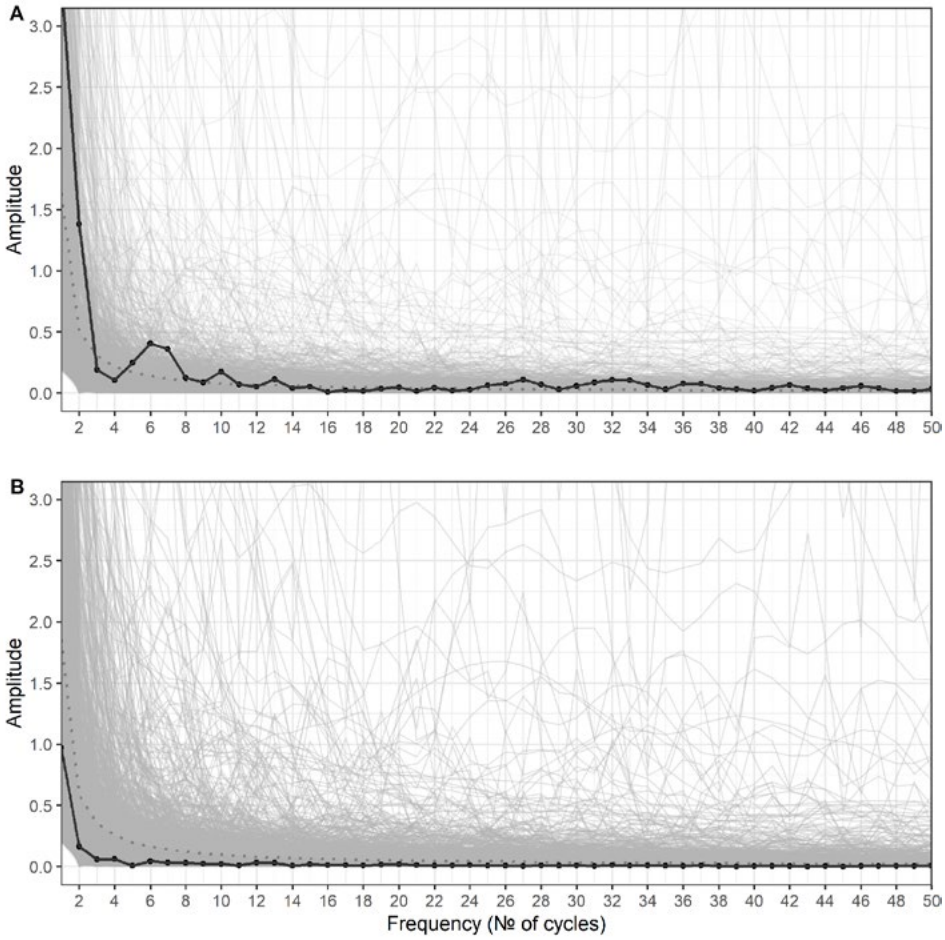

Figure 6. Fast Fourier transformation (FFT) on the sequential Bayesian analyses of the HI (A) and the LI (B) subsamples, and of all 10,000 simulations with the 95% Confidence Interval for the amplitudes (hatched area under the dotted line).

Bierman, Spottiswoode, and Bijl (2016) argue that "Pilot to Confirmation (PtoC)" should be considered a questionable research practice (QRP), as it increases the alpha error. This is the case when studies using frequentist statistical approaches are considered. Bayesian approaches, however, permit the selective continuation of a promising study, even when other, fewer promising studies are dropped. Because sufficient incremental evidence for H_1 can only be obtained with sufficient power in Bayesian

statistics, analyses of this nature rarely fall into alpha error traps. Furthermore, we preregistered all three micro-PK experiments concerning confirmatory hypotheses about the BF using an a priori set criterion of *BF* = 10 for significance. This degree of evidence was reached in one out of three experiments, and remains unlikely to be produced by chance fluctuations. Nevertheless, to examine the robustness of our post hoc exploratory analyses, we performed a further 10,000 simulations, which this time began immediately after the first experiment's end result (BF_{10} = 2.86). In other words, the sequential BF curve of the study's first part was combined with each simulation, and those 10,000 data sequences were then compared to the sequential BF curve of the complete experimental data keeping the first part of the data constant. As expected, the target group's curve is not as outstanding in comparison to simulations as it was in the original analyses (see Figure 7).

Frequency spectrum analysis. Adding toward the summation of all BFs, we examined the oscillatory pattern of the sequential analysis. Any input signal can be converted to a representation of its composited frequencies via a Fourier transformation, which indicates the amplitudes of all frequencies comprising the input sequence. For a random sequence, none of the frequencies should stand out. Noticeable spikes indicate the presence of a periodic element. A fast Fourier transformation (FFT) was conducted on the sequential Bayesian analyses of both subsamples and all 10,000 simulations. Simulations for the HI group were cut after *N* = 236 data points, to ensure comparability to the experimental data. Sampling rate was 1/N in each case. Since the resulting transform was symmetrical, only the first half was considered in the analysis. As Figure 5 indicates, the transforms of both subsamples differ systematically in most aspects. In comparison to the simulations' transforms, the HI subsample shows 81 amplitudes (68.6%) in the top 5% of all frequencies. Comparison to 1,000 further simulations indicates that the probability of such a proportion or above is 4%. By contrast, no frequencies show significant amplitude size at any frequency in the LI group (see Figure 6A and B).

Discussion

HI in basic psychological needs is shown to be promising as a subconsciously active motive state for triggering a micro-PK effect. The threshold of strong evidence for a non-random deviation of several words was reached over the course of further data collection in the self-esteem protection condition. Still, since we were well aware of the non-replicability common among psi studies (e.g., Jahn et al.,2000; Maier & Dechamps, 2018) we continued data collection to further investigate the nature of decline effects in micro-PK experiments, although our stopping rule was met and a Bayesian approach would have allowed the cessation of data collection. A decline became noticeable in the HI subsample (*N* = 507), leading to a drop in the BF to mere anecdotal evidence (despite a significant *p*-value).

Our explanation for the decline follows the reasoning of Lucadou et al. (2007) and Maier et al. (2018), who claim that systematic detection of micro-PK effects and a potential signal-use of this effect and, respectively, a decrease in entropy over time, cannot occur. Thus, Maier et al. (2018) argue for a systematic counter-mechanism that will eliminate the original micro-PK effect, leading to an oscillatory pattern of appearance and disappearance across studies and participants over time. The introduced explorative sequential Bayesian analyses of target and control groups, in comparison to 10,000 simulations, as suggested by Dechamps and Maier (2019), facilitated the investigation of non-random temporal data structures independent of the final score. All exploratory analyses revealed significant results in their ability to distinguish between

the HI and the LI subsample. Dechamps and Maier (2019) state that the close examination of the development of the BF for effects that are volatile in their strength may be fruitful. The performed analyses show that the energy of the HI subsample's curve, as well as its highest reached BF, are unlikely in purely random data, in contrast to the LI subsample. Furthermore, a remarkable difference is evident when the FFT is applied to the sequential Bayesian analyses of both subsamples and their corresponding simulations. The frequencies' amplitudes—meaning their significance in comprising the input signal—are higher in the HI subsample. When compared to 10,000 simulations, this transform features amplitudes in the top 5% of simulations for more than two thirds of all frequencies, suggesting a BF curve characterized by prominent harmonic patterns. Thus, the frequencies seem to follow a volatile dynamic rather than a pattern of decline effects and recoveries. Comparatively, the LI curve possesses no exceptional characteristics.

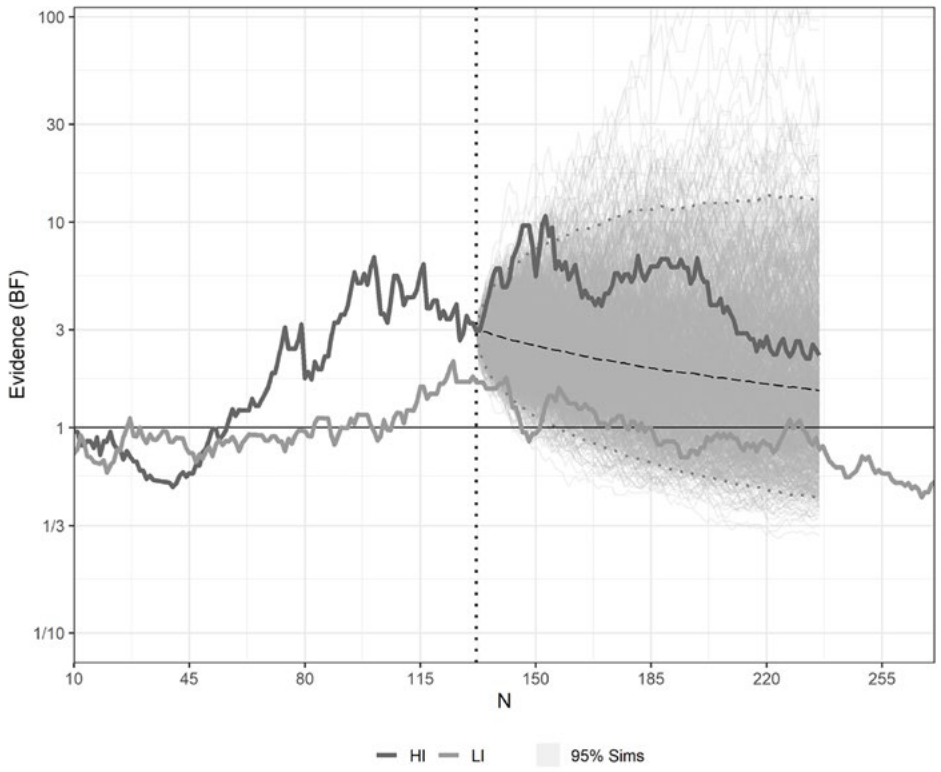

Figure 7. Sequential Bayesian analyses of the HI and LI group in comparison to 10,000 simulations (1,000 depicted in the figure) and the Confidence Interval of 95% for the BF, when the sequential evidence of the first experiment is kept as a constant.

This time, 11.8% (compared to 3.3%) of all simulations reached a higher BF than *BF* = 10.72 at *n* = 153, at any point**,** and the BF's energy of the HI group of 564.13 is now surpassed by 10.6% of simulations, rather than 1.9%. In comparison to the simulations' transforms, in the HI subsample only 13 (compared to 81) frequencies (11%) show amplitudes in the top 5% of all frequencies. Comparison to 1,000 further simulations indicates that the probability for this proportion or higher is 9.1%. A significant probability (< 5%) would require a minimum of 33% of amplitudes in the top 5% of all frequencies (see Figure 8). Nonetheless, for a random sequence, no frequencies should stand out, yet noticeable spikes indicate the presence of a periodic element.

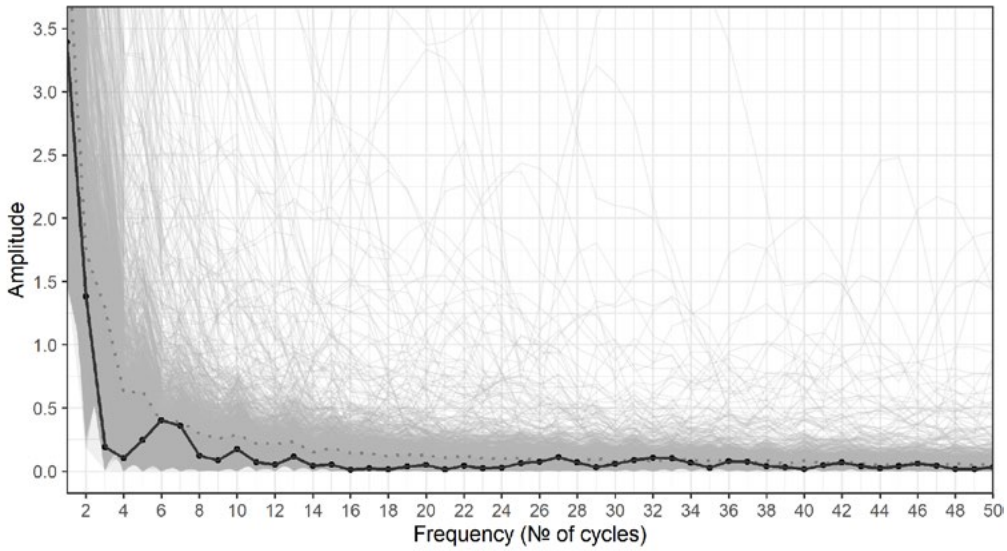

Figure 8. Fast Fourier transformation (FFT) on the sequential Bayesian analyses of the HI subsample and of all 10,000 simulations with the 95% Confidence Interval for the amplitudes (hatched area under the dotted line).

In sum, by controlling for the initial, more extreme data obtained in the first study on the need for self-esteem protection, less outstanding but still marginally significant results were obtained with the FFT. This specific study indicates a non-random variation of the effect across time, but the selective continuation may also be partly responsible for its outstanding course. Therefore, an exact replication of the micro-PK task on the need for self-esteem protection with preregistered hypotheses, including the sequential time course analyses, is required to ensure robust, confirmatory conclusions.

As the sharp decline of the BF to the final level of 2.24 occurs within the last fifth of the target subsample, varying sample characteristics of other external factors that are confounded by the date of data collection could serve as an alternative explanation. However, these possible influencing factors neither show up in noticeable differences in demographic variables nor in the sum score of incongruence of needs (freshmen: M = 2.25, SD = .50; others M = 2.20, SD = .49).

General Discussion

The study's aim was to tackle the problem of mind-matter interaction by investigating micro-PK effects as support for quantum-based models of psychophysical substance dualism. Therefore, we tested observer effects on quantum-based RNG outcomes using the participants' pre-conscious motive states of incongruence in basic psychological needs as an independent variable. We assumed that higher activation of an individual's specific pre-conscious mental state should, during the perception of a QRNG outcome meaningfully related to this pre-conscious state, result in a higher likelihood of the appearance of a corresponding material state and a corresponding conscious observation of a quantum measurement's result. Hence, we expected substantial evidence for deviations from randomness in the HI group but not in the LI subsample. The direction of the effect was predicted by the ETM, which is claiming that the core affectively laden belief of subconsciously active motives would determine the more likely out-

come for an individual. For targets resembling an approach-motivated means of satisfying a need, this would mean a display of less positive stimuli than chance suggests, as participants exhibiting HI characteristics are generally unable to adequately satisfy this need in their everyday lives. By contrast, for target stimuli resembling an avoidance-motivated means of satisfying a need, we predicted several negative stimuli above chance, as individuals exhibiting HI are generally unable to avoid negative experiences.

To test our assumptions, we first conducted a preregistered experiment with a specific micro-PK test for three of Grawe's (1998) four psychological basic needs—"attachment," "self-esteem enhancement/protection," and "orientation/control"—testing various ways of operationalization concerning stimulus formats, tasks and approach- vs. avoidance-motivated focus. The avoidance-oriented design of the need for self-esteem protection using negative vs. neutral word stimuli revealed anecdotal evidence close to the threshold for the moderate classification for H_1 in the predicted direction within the HI group. As hypothesized, no significant deviations from chance were observed within the LI group. Significant deviations from randomness were not found for the attachment and the loss-of-control tasks in any of the groups. As discussed, considering several weaknesses in the operationalization of these conditions, methodical explanations seem most plausible to us. Furthermore, these results raise the question of whether incongruence with basic psychological needs is conceptually the best indicator for micro-PK effects on self-related adjectives, since the need for self-esteem protection/enhancement is merely one aspect of this construct. Therefore, our future research will investigate other, similar psychological variables connected to inner core beliefs about the self, such as self-biases measured by the implicit-association test (IAT) or personality styles.

In the second experiment, we focused on further observation of the sequential evidence for absolute deviations from quantum randomness in the self-esteem-protection task, and investigated oscillatory changes overtime. Our significance criterion of $BF = 10$ was initially reached at $n = 153$ within the HI group by attracting more presentations of derogative target words than chance suggests in comparison to neutral words. Shortly thereafter, a decline to a final result of almost moderate evidence occurred, similar to the results of other experiments in this field (e.g., Jahn et al., 2000; Maier et al., 2018). Explorative sequential Bayesian analyses of the target and control groups, in comparison to 10,000 simulations suggest that the data of the HI subsample are highly unlikely to be produced by chance. This contrasts with the LI subsample, in which no significant deviations from randomness were observed.

Our finding of an initial micro-PK effect in the context of the basic need for self-esteem protection supports implicitly motivated observers' systematic influence on probabilities, as suggested by other proponents (e.g. Mensky, 2014; Penrose & Hameroff, 2011; Pradhan, 2012; Stanford, 1990; Stapp, 2007), at least for sessions within a certain period. For participants whose need for self-esteem protection is frustrated, the effect's direction can be explained by the ETM. This assumes that individuals who are unable to adequately avoid everyday experiences that reduce their self-worth will also attract the corresponding negative targets above chance during the testing phase. Thus, the unconscious fear of "being devalued" or "not being good enough" leads to a self-fulfilling prophecy. Consequently, this study's findings suggest that mind-matter interactions may occur according to quantum-based theories of psychophysical substance dualism on a common ground, in which both exist as pre-conscious and pre-material forms.

Moreover, a decline was observed in this study after strong evidence for the postulated micro-PK effect had been reached. Nevertheless, the introduced methods of sequential Bayesian analyses with simulations still enabled statistical detection of non-randomness in the data structure as well as differentiation between the target and control groups independent of the final average value. Furthermore, the frequency analysis suggests a volatile dynamic within the data sequence rather than a decline effect. Future projects will include predictions for these analyses with a priori set criteria for significance in our preregistrations. However, the mechanisms behind the frequently observed volatile effects remain unknown. Maier et al. (2018) argue for a systematic counter-mechanism that eliminates the original micro-PK effect, leading to an oscillatory pattern of appearance and disappearance across studies and participants over time, to compensate for initial violations of the second law of thermodynamics. Therefore, such volatility might be inherent in the nature of some effects and demands methods of evidence collection that transcend conventional modes of replication. Moreover, it is important to notice, that the results were checked on a regular basis during data collection as it is common for the Bayesian approach. Nevertheless, this procedure might allow observer effects on the course of evidence. This open question could be addressed by a replication of the study without any analyses during data collection but checking the data only in the end.

Furthermore, assuming a systematic volatile effect across participants would mean the entanglement of the entire sample. Consequently, an individual's outcome in the experiment would depend on the results of predecessors unknown to the participant. As both experiments were performed as group testing with up to ten individuals within one session, participants completed the micro-PK tasks simultaneously on identical computers separated by dividers in the same laboratory room. Thus, this situation is open to non-local interactions. The collected data do not comprise information on the exact grouping of participants and, therefore, analyses on this topic cannot be provided. Nevertheless, it is interesting to consider this possibility concerning the interpretation of the given results. However, it is important to acknowledge that all interpretations of the current results refer only to the group level: the community of individuals with a certain shared motivational pattern, such as HI in the basic needs, might be more likely overall to attract events that confirm their inner core beliefs. Taking possible entanglements into account, no predictions on the level of individual participants are possible. Single-case studies with similar experimental setups, performed on a daily basis over several weeks, could help in exploring the meaning of such micro-PK effects for individuals in the future.

Conclusion

In this study, we identified HI within the basic psychological needs as a strong and measurable subconsciously active set of beliefs that can be addressed in a way that triggers a volatile micro-PK effect using the predictions of the EMT. Testing different ways of operationalization in the first preregistered experiment with a specific micro-PK test for each of the three of Grawe's (1998) four basic needs—attachment, self-esteem enhancement/protection, and control—the design of the need for self-esteem protection using derogatory vs. neutral adjectives revealed significant anecdotal evidence close to the threshold of the moderate classification in the predicted direction only in the target group, whereas significant deviations from randomness were not shown in any group for the attachment and the control task. Based on these results, we decided post hoc to focus on the further observation of the

sequential evidence for absolute deviations from quantum randomness in "self-esteem protection" and to investigate oscillatory changes overtime in a second experiment. Our significance criterion of *BF* = 10 was initially reached in the HI group, yet no significant deviations from randomness were observed in the control group at any time. Shortly thereafter, a decline to a final result of anecdotal evidence occurred. As volatility may lie in the nature of micro-PK effects (Maier et al., 2018), three different explorative sequential Bayesian analysis strategies were added post hoc in an effort to distinguish systematic sequences from random fluctuation (see Dechamps & Maier, 2019). All three procedures significantly indicate systematic variation, which is highly unlikely to be produced by chance, in the target group's sequence, but random fluctuation within the control group, in comparison to 10,000 simulations. This means, that the observed micro-PK effect might systematically oscillate around a random baseline, as has been observed in previous studies within this research field (e.g., Maier & Dechamps, 2018).

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Tu Attires ce que Tu Es: Les Effets des Besoins Inconscients sur la Micro-Psychokinèse

Résumé : Les modèles de corrélation psychophysique basés sur la physique quantique offrent un cadre alternative pour prédire les interactions esprit-matière. Nous relatons le test de tells interactions sous la forme d'effets observateurs sur les résultats d'un générateur de nombres aléatoires quantique (QRNG). Plus spécifiquement, nous avons testé l'influence de certains états motivationnels sur les présentations de stimuli choisis par le QRNG. Les déviations du hasard étaient attendues chez les participants montrant des caractéristiques de forte incongruence (HI) mais nous chez ceux qui montraient une faible incongruence (LI). Notre première expérience, testant les effets de trois besoins psychologiques – l'attachement, la protection de l'estime de soi et le contrôle – avec un analyse bayésienne ont montré des résultats anecdotiques pour H1, seulement pour les stimuli relatifs à l'estime de soi dans le groupe HI. La seconde expérience était une poursuite sélective de la condition prometteuse de protection de l'estime de soi, explorant les preuves favorables à H1 et leurs oscillations au cours du temps. Notre critère pour confirmer H1 était initialement atteint dans le groupe cible. Peu après, nous

avons constaté un déclin pour aboutir à un résultat final anecdotique pour H1. Pour tester la tendance systématique des données par rapport aux fluctuations du hasard, d'autres analyses post-hoc ont comparé le Facteur Bayes maximum, l'énergie de la courbe et l'analyse spectrale de fréquence entre les deux groupes sur 10.000 stimulations. Ces analyses indiquent que le sous-échantillon de données de HI diffère significativement des fluctuations du hasard, tandis que le sous-échantillon LI ne le fait pas. En somme, les résultats suggèrent que les croyances subconscientes affectivement chargées peuvent se manifester à travers des déviations volatiles mais statistiquement détectables du hasard quantique, lorsqu'elles sont précisément déclenchées par une tâche adéquate.

Du ziehst an, was Du bist: Die Wirkung unbewusster Bedürfnisse auf die Mikro-Psychokinese

Zusammenfassung: Quantenbasierte psychophysikalische Korrelationsmodelle bieten einen attraktiven Rahmen für die Vorhersage von Wechselwirkungen zwischen Geist und Materie. Wir berichten über eine Untersuchung solcher Interaktionen in Form von Beobachtereffekten auf quantenbasierte Zufallsgeneratoren (QRNG). Insbesondere testeten wir den Einfluss bestimmter motivationaler Zustände auf entsprechende Reizdarbietungen, die vom QRNG ausgewählt wurden. Zufallsabweichungen wurden bei denjenigen Teilnehmern erwartet, die Merkmale einer hohen Inkongruenz (HI) aufwiesen, aber nicht bei solchen mit einer geringen Inkongruenz (GI). Unser erstes Experiment, in dem wir die Auswirkungen von drei psychologischen Bedürfnissen - Bindung, Selbstwertschutz und Kontrolle - mit einer Bayesschen Analyse prüften, ergab anekdotische Evidenz für H_1 für die mit dem Selbstwertschutz zusammenhängenden Stimuli innerhalb der HI-Gruppe. Das zweite Experiment war eine selektive Fortsetzung der vielversprechenden Bedingung Selbstwertschutz, womit der weitere sequentielle Verlauf der Evidenz für H_1 und seine Oszillation über die Zeit untersucht wurde. Unser Kriterium für die Bestätigung von H_1 wurde in der Zielgruppe zunächst erreicht. Kurz danach zeigte sich ein Decline-Effekt bis zum Endergebnis der anekdotischen Evidenz für H_1. Um den systematischen Trend der Daten gegen Zufallsschwankungen zu testen, wurden weitere Post-Hoc-Analysen durchgeführt, bei denen der maximale Bayes-Faktor, die Energie der Kurve und die Analyse des Frequenzspektrums zwischen beiden Gruppen mit 10.000 Simulationen verglichen wurden. Diese Analysen ergaben, dass sich die Daten der HI-Teilstichprobe signifikant von Zufallsfluktuationen unterschieden, während dies bei Daten der GI- Teilstichprobe nicht der Fall war. Zusammengefasst deuten die Ergebnisse darauf hin, dass sich zentrale affektiv aufgeladene unbewusste Überzeugungen mittels flüchtiger, aber statistisch nachweisbarer Abweichungen vom Quantenzufall manifestieren können, wenn sie durch eine geeignete Aufgabe präzise getriggert werden.

Atraes lo que Eres: El Efecto de las Necesidades Inconscientes en la Micropsicoquinesis

Resumen: Los modelos cuánticos de correlación psicofísica ofrecen un marco atractivo para predecir las interacciones mente-materia. Reportamos una prueba de tales interacciones en forma de efectos de observación en los resultados del generador cuántico de números aleatorios (QRNG). Específicamente, evaluamos la influencia de ciertos estados de motivación en la presentación de estímulos relacionadas elegidos por el QRNG. Esperábamos desviaciones de la aleatoriedad entre los

participantes con características de alta incongruencia (HI) pero no entre con baja incongruencia (LI). Nuestro primer experimento, evaluó los efectos de tres necesidades psicológicas (apego, protección de autoestima, y control) con un análisis Bayesiano que mostró evidencia anecdótica de H1 solamente para estímulos relacionados con la autoestima dentro del grupo HI. El segundo experimento fue una continuación selectiva de la prometedora condición de protección de la autoestima, explorando el curso secuencial de evidencia adicional para H1 y su oscilación a lo largo del tiempo. Nuestro criterio para confirmar H1 se alcanzó inicialmente en el grupo objetivo. Poco después, se produjo un descenso a un resultado final de evidencia anecdótica de H1. Para valorar la tendencia sistemática en los datos contra las fluctuaciones al azar, se realizaron análisis post hoc adicionales comparando el factor de Bayes máximo, la energía de la curva, y el análisis del espectro de frecuencia entre ambos grupos con 10,000 simulaciones. Estos análisis indicaron que los datos de la submuestra HI difirieron significativamente de las fluctuaciones fortuitas, mientras que los datos de la submuestra LI no. En resumen, los resultados sugieren que las creencias subconscientes cargadas afectivamente pueden manifestarse a través de desviaciones volátiles pero estadísticamente detectables de aleatoriedad cuántica cuando se activan con precisión en una tarea adecuada.