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Testing the Effects of Personality-Related Beliefs on Micro-PK[1]

Marissa-Julia Jakob* Moritz C. Dechamps* Markus A. Maier

Ludwig-Maximilians-Universität, München

Abstract: *Objective.* This preregistered study investigates mind-matter interactions by testing observer effects on quantum random number generator (QRNG) outcomes mediated by implicit intentions. *Methods.* We evaluated participants' personality traits (PTs), and presented them with goal-related or neutral stimuli based on QRNG outputs. We predicted deviations from chance, with high PT scorers expected to observe more PT-related sentences. We conducted three micro-psychokinesis (micro-PK) experiments for Cluster C's PTs: dependent, avoidant, and obsessive-compulsive. *Results.* The results revealed strong evidence (Bayes Factor > 10) for a micro-PK effect in the dependent PT group, with high scorers observing more sentences addressing their concerns than expected by chance. We did not find strong evidence for the other PT groups or low scorers. *Conclusion.* These findings suggest that intentional observation biases QRNG outcomes related to individuals' implicit concerns, potentially leading to self-fulfilling prophecies. The study's implications are discussed within the Unus Mundus model and the Model of Pragmatic Information.

Keywords: micro-psychokinesis, mind-matter interaction, quantum measurement, intentional observation, personality traits, Unus Mundus, Model of Pragmatic Information

Highlights

- Quantum-based psychophysical correlation models provide an extension of QM in which intentional observations contribute to the formation of macroscopic realities.

1 Shared first authorship. Address correspondence to: Marissa-Julia Jakob, Moritz C. Dechamps, Department of Psychology, LMU Geschwister-Scholl-Platz 1, 80539 Munich, Germany, **MarissaJulia.Jakob@psy.lmu.de**, **Moritz.Dechamps@psy.lmu.de**

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- In three preregistered micro-PK experiments, a task for three Cluster C PTs (dependent, avoidant, and obsessive-compulsive) evaluated observers´ biases on QRNG outcomes.
- The study partially confirmed the existence of a micro-PK effect in the data: Concerning the PT group "high-dependent," strong evidence for H_1 was found.

Following years of psychical research, the psychologist/philosopher William James concluded that extraordinary phenomena "can never be fully explained away, they can also never be susceptible of full corroboration" (in Wilson, 1985, p. 158). Wilson (1985) subsequently derived James's Law, claiming that the evidence is sufficient "to convince those who are willing to be convinced, but never enough to win over the sceptics" (p. 158–159). This law still applies to various frontier phenomena in scientific research. One particular group of exceptional phenomena involves the emergence of realities based on observers' specific motivational states not mediated by behavioral interactions between individuals and their environments. These purely mind-induced effects on physical settings challenge the causal closure of accepted theories regarding physical reality. One area of research called "micro-psychokinesis" (micro-PK; see Varvoglis & Bancel, 2015) is devoted to a subset of these mind-matter interactions.

Micro-PK applies various experimental settings to tackle the mind–matter relation by investigating intentional observers' influence on deviations from randomness, more recently with a focus on observer effects during quantum measurements. This research has a long tradition (e.g., Jahn et al., 1987; Stanford, 1976; Stanford et al., 1975; Schmidt, 1974) and has shown significant effects: observers' conscious or unconscious motivational states seem to influence the outcomes of a quantum number generator (QRNG) in accordance with their motives or intentions through the sole act of observation. Meta-analyses have supported the efficacy of intentional observations on the probabilities of quantum-based events (Bösch et al., 2006; Radin & Nelson, 1989).

When the unconventionally high heterogeneity of effect sizes in these analyses raised criticism, Varvoglis and Bancel (2015) calculated that an unrealistically large number of non-significant studies would be required in the file drawer if micro-PK effects were merely a phenomenon of publication bias (see also Radin et al., 2006). However, many original results could not be replicated directly or declined over time (e.g., Dechamps et al., 2021; Jahn et al., 2000; Dechamps & Maier, 2019; but see Mossbridge & Radin, 2021). These ambiguous findings with regard to direct replications and within-study robustness of micro-PK effects lead to different interpretations: skeptics argue that the initial effects are artifacts of error, random fluctuation, or based on questionable research practices (QRPs; e.g., Alcock, 2003; Wagenmakers et al., 2011), while proponents evaluate the findings as providing sufficient evidence (Cardeña, 2018; Cardeña et al., 2015; Radin, 2006). This debate and the actual status of the empirical evidence both reflect the validity of James´s Law in this field.

As a solution to this debate, Rabeyron (2020) suggested that unusual patterns in experimental psi research should be regarded not as impediments or random fluctuations but opportunities to investigate these effects' true nature (see also Atmanspacher et al., 2002; von Lucadou et al., 2007; von Lucadou, 2015). He specifically argued that preregistrations within psi research might enhance the results' confirmatory value. The present study was preregistered to determine whether psi effects can occur under these circumstances.

Quantum-Based Models of Psychophysical Correlations

Although the indeterminacy principle (quantum randomness, Born, 1926) during quantum measurement is considered an ontic principle in orthodox quantum physics (Greenstein & Zajonc, 2006), several authors (e.g., Mensky, 2014; Pradhan, 2012; Penrose & Hameroff, 2011; Stapp, 2007; Stanford, 1990) propose that intentional observers might be able to influence these quantum probabilities during measurement operations, making an outcome more likely than predicted by the Born rule (Born, 1926). Such quantum-based psychophysical correlation models may be understood as an extension of quantum mechanics, considering intentional observations and their effects on macroscopic reality.

One specific variant, the *Unus Mundus* Model (UMM), proposed by Pauli and Jung (see Atmanspacher, 2014; Atmanspacher et al., 2013), offers an elegant framework to explain psychophysical interactions during quantum measurements. In contrast to alternative observational quantum theories, the dual-aspect feature of the UMM provides a solution to the existing mind–matter gap (see Chalmers, 1995). Pauli and Jung propose that mind and matter form a unity on a deeper level of reality called *unus mundus*. The UMM considers this reality to be pre-conscious and pre-material as well as collective, merging unconscious (supra-)individual information and its corresponding quantum states. It overcomes and precedes the classical subject–object distinction. By implementing such a pre-reality as an interface between the two substances mind and matter, this approach allows us to describe different types of observer-dependent mind–matter interactions. The Cartesian dual realities, conscious experience and classical matter, become two distinct aspects of the world through an act of knowledge transition (from unknown to known), referred to as epistemic split (Atmanspacher, 2020).

According to general quantum theory (GQT, Filk & Römer, 2011), a mathematical formalization of the Pauli-Jung conjecture, conscious observation is the key process to initiate an epistemic split. Prior to this, mind and matter are believed to form acausal and non-local correlations of their pre-conscious and pre-material states in the *unus mundus*. After performing an epistemic split through conscious observation, both substances emerge as distinctive forms—the conscious mind and the macroscopic matter. They cannot interact directly anymore, as they now appear as two different substances. Still, they remain related to each other because of their common ground. To describe the specific nature of this indirect relation between the conscious mind and the corresponding macroscopic physical environment, Atmanspacher and Fach (2013) suggested two types of interactions: structural and induced correlations (see also Atmanspacher, 2020).

Epistemic splits based on structural correlations (SCs) form dual realities through passive, conscious registrations of classical physical occurrences. SCs are considered reactive in nature, such as in conscious perceptions of ongoing physical events, since they follow the Born rule during the transfer from the pre-material quantum states from the *unus mundus* into the classical state and its conscious experience. Psychosomatic correlations exemplify such SCs. This type of entanglement correlation is considered stable and reproducible (Atmanspacher, 2020), likely due to its reactive and passive nature, since such manifestations do not demand the intentional agency of the individual (Maier et al., 2022).

By contrast, epistemic splits caused by induced correlations (ICs) distort the balance between mental and physical reality typical of SCs (Atmanspacher, 2020). They are at least rudimentarily based on some form of intentional agency. ICs include active, goal-based formations of physical realities that bias the Born rule along an observer's motivational state during observation. That is, autonomous individuals exert a mental impact on reality creation out of a quantum superposition (see also Maier et al., 2022). Micro-PK phenomena are a prototypical example of such correlations, whereby the observers' goals form corresponding realities. Pauli and Jung (see Atmanspacher et al., 2013) labeled such phenomena "synchronistic events" and emphasized the unifying principle of meaning in their occurrence. Owing to the autonomous, non-deterministic aspect of personal meaning, they also emphasized the elusive nature of these effects, which cannot be described with deterministic laws or demonstrated objectively. Consequently, in contrast to SCs, ICs are not considered exactly reproducible across studies. The reason for this is that the psyche, as a driving force of reality creation in this context, adds an active, subjective component not captured by purely passive, objective descriptions of physical laws (Maier et al., 2022; see also Bierman, 2001; Jahn & Dunne, 1997). Atmanspacher (2020) and von Lucadou et al.

(2007) provided formal models to support this view. According to them, ICs violate the "no-transmission theorem" (von Lucadou et al., 2007) and therefore cannot be stable and reproducible. Any effects based on ICs, including micro-PK, must decline over the course of further confirmation attempts. In sum, Pauli and Jung's UMM and the model of pragmatic information (MPI; von Lucadou et al., 2007) form the theoretical basis for this study's predictions regarding micro-PK.

An experimental micro-PK design should provide the following conditions that allow ICs to be studied scientifically: 1) The mind, as the causal source of an IC, must involve—among conscious thoughts—unconscious mental processes to affect physical systems (QRNG outcomes), since its impact is transferred through the pre-conscious and pre-material realm into the physical world. 2) A meaningful connection between the mental impulse and the quantum-based RNG outcome must be established. That is, the stimulus material to be selected by the QRNG must include subjectively relevant information. 3) Regarding the effect's replicability, an initial appearance in a first study demonstrating the existence of the effect might most likely be followed by a decline of the effect during replication attempts. This is the consequence of the effect's elusive nature, as described in the UMM and mathematically formalized in the MPI. The present study aimed to address the first two pre-conditions using a quasi-experimental setup and for now set aside the replicability issue. Nevertheless, the confirmatory value of the study was intended to be maximized by using preregistration and a Bayesian testing approach, setting the evidence criterion for the confirmation of an effect (H_1) to strong evidence ($BF_{10} \geq 10$).

The Central Role of Emotions in Intentional Agency

Because human intentions, ICs' core driving factors, must exert their impact on reality formation via pre-conscious processes, they are presumably shaped by their emotional content (Jakob et al., 2020). At their deepest level, intentional goals can be conceptualized as implicit approach or avoidance orientations, and their accompanying emotions are hope and fear, respectively (Elliot, 2008). For example, in an achievement setting, an individual might strive for a certain end state (e.g., passing an exam). In an approach orientation, the agent seeks a positive result (e.g., success in an exam), and the underlying emotion is hope for success. The actor implicitly expects to be able to succeed. Consequently, the hope that success will be achieved is the basic information encapsulated in this goal.

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Conversely, avoidance orientation is characterized by a tendency to avoid failure (e.g., avoid failing an exam), and the underlying emotion is fear. The fear that failure will occur is the basic information encapsulated in this goal. These expectations of behavioral outcomes are pre-conscious and can differ from deliberate goals. Thus, although individuals overall wish to pass the exam, their implicit appraisal of the likely future scenario might contain completely opposite expectations and corresponding emotional consequences. Accordingly, hope will promote success-related realities, and fear will make failure-related realities more likely in this context (Elliot, 2008).

With regard to micro-PK, our assumption was that ICs bias micro-PK outcomes in line with an observer's motivational goals, whereby the affective part of the goal orientation, including implicit expectation, will primarily cause its outcome. This conjecture is based on the emotional transgression model (ETM; Jakob et al., 2020), which proposes that the emotionally coded information of an intention exclusively passes the border between the conscious, intentional mental realm from which an IC starts off and the pre-reality realm of the *unus mundus*. There, it increases the quantum probabilities of the affectively expected states. In this way, observers' expectation encoded in their emotions act like differential self-fulfilling prophecies in the context of micro-PK. During intentional quantum state observations, physical outputs whose content matches the observers' emotional states underlying their intentions will be more likely to emerge.

In the present study, we focused on avoidance-oriented goals driven by the emotional dynamic of fear. We aimed to identify individual differences based on certain personality traits (PTs) related to specific avoidance-oriented patterns. The corresponding fearful outcome expectations should induce a correlation with QRNG-selected stimuli (ICs) that express and confirm those fears.

Personality Traits

To assess individual differences in our participants' fear-based motivational patterns, we used PTs, which reflect specific implicit expectations of behavioral outcomes and tend to cause high emotional activation when triggered (Sachse, 2001). Dysfunctional personality tendencies are described in the DSM taxonomy and can be measured reliably and validly using the self-report VDS-30 questionnaire (Sulz, 2000).

We focused on Cluster C, consisting of three fearful and anxious personality types: dependent, avoidant, and obsessive-compulsive. These three are most common in a normal population. Individuals with dependent PT (DE-PT) exhibit significant fear of separation and strong need to feel secure, welcome, and guilt-free in relationships. They may neglect the need for autonomy by avoiding making decisions or being alone, always agreeing in conversations, and engaging in even unpleasant activities to satisfy those around them. The key process is the fearful expectation of separation from others.

Individuals with avoidant PT (AV-PT) also exhibit fear of loss of love and an intense need to be welcome and free of guilt. To avoid criticism and rejection by others, they act reluctantly and are distant in company or even move away from conversations and social activities. The crucial process is the fearful expectation of rejection or humiliation by others.

Individuals with obsessive-compulsive PT (OC-PT) appear less anxious than those scoring high on the other two traits described above (Sulz & Müller, 2000) but also exhibit a need to feel welcome and a fear of losing control. To avoid mistakes, they tend to hold onto details and are very persistent. This trait can cause problems in finishing tasks, making decisions, or delegating responsibility. Consequently, the key process is the fear that loss of control will occur.

Hypotheses

A micro-PK task was designed using target sentences as outcomes that mirrored the typical concerns for the Cluster C PTs, in addition to neutral sentences. The micro-PK task comprised three independent consecutive blocks of stimuli, with each block's stimulus material addressing one of the three PTs. We hypothesized that individuals with pronounced PT characteristics (expressed by high scores on the respective scale = target group) would influence the QRNG to produce outcomes that match their implicit expectations within each block. That is, we predicted the presentation of more meaningful PT-specific target stimuli than expected by chance for high scorers. Individuals with low scores on the respective PTs (control group) should show no or weaker deviations from chance.

We tested a specific preregistered hypothesis for each of Cluster C's three PTs:

A) DE-PT: Participants with high scores on the DE-PT performing a micro-PK task will observe more relevant target stimuli that address their fears (e.g., "Will we part in dispute?") than neutral stimuli (e.g., "We see a forest").

B) AV-PT: Participants with high scores on the AV-PT performing a micro-PK task will observe more relevant target stimuli that address their fears (e.g., "What should I say?") than neutral stimuli (e.g., "The shirt is white").

C) OC-PT: Participants with high scores on the OC-PT performing a micro-PK task will observe more relevant target stimuli that address their fears (e.g., "Did I miss a mistake in my work?") than neutral stimuli (e.g., "Digital watches are common").

We hypothesized that no strong evidence for H_1 would be found for the three control subsamples (low PT scorers), and we predicted on a confirmatory level in the preregistration that at least one of the target groups (high scorers) would reach a $BF_{10} \geq 10$ indicating strong Bayesian evidence for H_1 during data collection.

The researchers' a priori belief that the hypotheses would be supported can be classified on a scale from 5 = "strong belief" to 1 = "strong non-belief" as 4 = "moderate belief." This study was implemented and analyzed according to the preregistration uploaded to the Open Science Framework (https://osf.io/gw98t). The data and analyses can be found at the OSF project´s repository (https://osf.io/qxu3s). In addition, some exploratory analyses have been proposed in the preregistration that will not be reported in this article but a summary of the analyses and results can be found at OSF (https://osf.io/qxu3s).

Method

Consent

All research was conducted in accordance with the ethical requirements of the American Psychological Association (APA). The instructions did not reveal the study's purpose but assured anonymization and emphasized the participants' right to withdraw at any time. Voluntary participation was ensured by obtaining informed consent from all participants. The procedure and experiment were approved by the ethical board of the Department of Psychology at the LMU Munich.

Design

We selected a two-group design and conducted a quasi-experiment with high and low scorers on Cluster C's PTs as independent variables. Participants were divided based on their individual scores measured by the VDS-30 (Sulz, 2000), as detailed below. We applied specific micro-PK task blocks for the DE-, AV-, and OC-PT presented in randomized order across participants. Each micro-PK block comprised of 30 on-screen stimulus presentation trials. For each trial, a QRNG selected from between trait-related and neutral stimuli with a baseline 50/50 probability. The number of trait-related stimuli displayed in each block served as the dependent variable.

For each PT, the sample was divided into control and target subsamples based on individual scores (low vs. high scorers). This was done for each of the three scales measured by the VDS-30. We used the norms for N = 166 non-clinical individuals from Sulz et al. (2009) (DE-PT: M = 0.45, SD = 0.66; AV-PT: M = 0.58, SD = 0.84; OC-PT: M = 0.47, SD = 0.82) and data from our own pre-study for stimulus validation on N = 138 students (102 females, 36 males; age: M = 23.41 years, SD = 7.95; DE-PT: M = 1.01, SD = 0.46; AV-PT: M = 1.11, SD = 0.65; OC-PT: M = 1.13, SD = 0.50) to derive a cut-off value of mean ≥ 1.00 as high for each PT. We deemed this score to adequately represent both the average of the norms provided by Sulz et al. (2009) and our pre-sample's average. Because this criterion's selection implies a certain degree of freedom, the specified cut-off value was preregistered in advance.

Participants

Overall, N = 2,403 participants were tested (56% females, 44% males, 0.2% unspecified; frequency of age categories: 18 – 27 years 62%, 28 – 37 years 17%, 38 – 47 years 8%, 48 – 57 years 9%, > 57 years 3%). Participants were recruited through the department's announcement board, handouts distributed in psychology classes, university Facebook groups, and the online recruiting platforms Mturk and Prolific. Students enrolled in the university's bachelor's psychology classes were awarded credits for participation. Out of all participants, n = 545 (23%) were recruited from Mturk, and n = 120 (4%) were recruited from Prolific and were paid $1.5 or 1.80 GBP respectively for their participation. Inclusion criteria were an age between 18 and 65 years and excellent knowledge of the German language. To ensure that participants paid attention to the stimuli on the screen during the three stimulus presentation blocks, we implemented an "attention check" later on in the course of data collection (at n = 1,105). During each block, a written request to press a "next" button appeared once at random occasions on the screen. Participant's response speed was assessed as an indirect indicator of compliance to the task. The attention check variable data were not part of the preregistration and will be used for exploratory analyses to check for any moderating effects.

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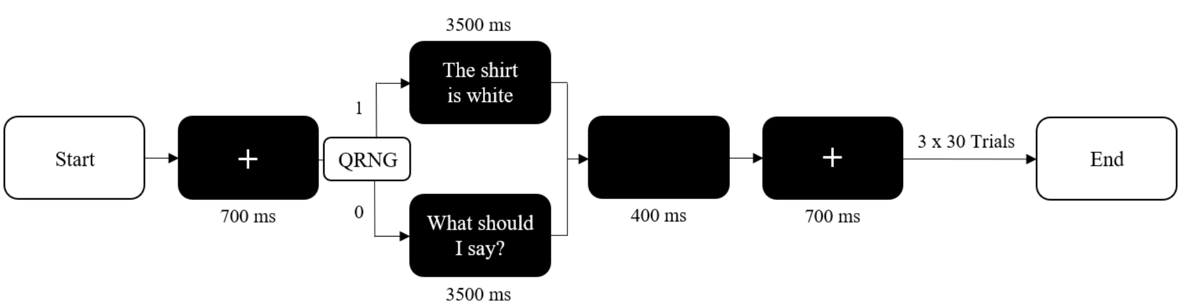
Materials

Procedure. The participants were tested in an online study comprising two experiments in fixed order. The present study was the second. Together, both studies took around thirty minutes. Participants first confirmed their agreement on a digital consent form. The present study began by assessing demographic data and the three Cluster C PT scales. Participants subsequently progressed to the experiment, comprising of three blocks, with 30 trials each. The blocks' order was randomized across participants using a quantum based random number generator (QRNG; "Quantis" by idquantique). Each block used experimental stimuli (short sentences) closely semantically related to one of the three Cluster C PTs, in addition to neutral control stimuli. The instruction was to pay full attention to the different sentences being presented on the screen. Participants then passively observed three consecutive series of 30 trials (no manual response required). After each block of 30 trials, the program advised the test participants to maintain focus and press a button to confirm their readiness. The volunteers looked first at a fixation cue (700 msec), then at the stimulus (3500 msec), and finally at a black screen (inter-stimulus interval: 400 msec). Immediately before the stimulus presentation, the QRNG determined whether the next stimulus sentence shown on the screen would be out of the trait-related or neutral stimulus set. This process was repeated 30 times per block (see Figure 1). Three blocks with 30 trials each were presented, each using target sentence stimuli relating to one of the three PTs.

Figure 1

Overview of a Prototypical Trial Sequence Including Presentation Times.



Hardware and Software. This study was conducted online. The stimuli were presented on a black background with a size of 500 x 400 pixels. For QRNG-based stimulus generation, a presentation procedure was programmed in jsPsych (v 5.0.3; de Leeuw, 2015), which translated the QRNG's numerical output into either trait-related stimuli or neutral sentences during each trial. The QRNG used in this study produces quantum states using photons sent through a semi-conductive mirror-like prism. The photon is equally likely to be deflected in one direction or another, producing a superposition of both states. The photon's location on either path with 50% probability is then transformed into a numerical score such as 0 or 1, depending on the track on which it was located (Quantis transforms 8 such bits into 1 byte). Thus, this procedure follows the structure of a double-slit quantum experiment. This hardware passed all serious tests of randomness, including the DIEHARD and NIST tests, and is among the most effective QRNGs (Turiel, 2007). This QRNG does not use a post-correction procedure during this standard process (confirmed via personal conversation with an idquantique representative). Consequently, a true quantum source for randomness was provided for each experimental trial.

Assessment of Personality Traits. The Cluster C PTs were measured using the VDS-30 (Sulz, 2000), which takes around ten minutes to administer: norms are given in Sulz et al. (2009). The standard sample varies in gender and age and represents 166 healthy individuals and 945 patients from psychotherapy settings. The questionnaire consists of ten items per PT, rated on a four-point scale. Participants indicate how adequately they feel described by the presented items (from 0 = "not" to 3 = "very"). The scales refer to Cluster C's three PTs (DE, AV, and OC). These scores were split into a target group (high scorers) and a control group (low scorers)—based on our preregistered cut-off (mean ≥ 1.00)—and used as independent factors. Internal consistency for the non-clinical sample can be considered good for all scales, with Cronbach's alpha ranging from $\alpha = .72$ to $\alpha = .86$. Retest reliability lies between $r = .70$ (good) and $r = .83$ (very good), with $r = .81$ (very good) on average (Sulz et al., 2009). The questionnaire's construct validity was confirmed by comparing it to the Munich Personality Test (Zerssen, 1993) and the Personality Traits and Disorders Inventory (Kuhl & Kazén, 1997) by Sulz et al. (1998, 2009).

Stimuli. For each of the three PTs, five target stimuli were created. Their content was related to the original items of the VDS-30 questionnaire (Sulz, 2000). The questions were designed to trigger inner doubts in individuals exhibiting the respective PT. For example, for the DE-PT, one experimental sentence was "Is she mad at me?" For each set of five experimental sentences, five neutral control sentences were selected from a greater set created out of neutrally rated words provided by Ben-David et al. (2011) or were self-designed in the same manner.

To ensure that each final set of experimental sentences closely matched the content of the respective PT, we conducted an online pre-study in which for each

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PT, ten potential experimental and ten neutral sentences had to be rated on valence for each PT. For each stimulus, participants were asked how pleasant they perceived the sentences to be (1 = "very unpleasant" to 7 = "very pleasant"). The mean rating obtained for each sentence was then correlated with the respective PT of the raters assessed using the VDS-30 (see Tables 1 and 2). For this evaluation, the sample comprised $N = 107$ undergraduate students (88 females, 19 males; age: $M = 22.30$ years, $SD = 6.83$) in total.

As a first step, we collected data from $n = 73$ participants (58 females, 15 males; age: $M = 23.10$ years, $SD = 7.67$), assessing gender, age, and Cluster C's PTs. Sixty sentences—ten target questions and ten neutral sentences for each PT—were presented to each participant in randomized order. In addition, to avoid a general mood shift toward negative emotionality and confusion within participants while rating several sentences of negative valence, we randomly added 15 filler sentences of positive valence. As expected, all neutral sentences were barely rated as unpleasant, and their mean pleasantness scores showed no significant correlation with the individuals' PT scores (for further information see https://osf.io/qxu3s). For the DE- and AV-PT, four of the ten target sentences showed adequate trait-specific correlation (see Table 1). As the study design required at least five targets for each trait, one further target question was created without renewed evaluation for both PTs semantically closely related to one of the four already selected stimuli (DE-PT: "Is he disappointed in me?"; AV-PT: "Do the others see my nervousness?"). None of the given target sentences showed significant correlations with the OC-PT trait and, in many cases, the correlations with the other traits were significant. Thus, none of the 10 target sentences showed sufficiently high specificity for this PT.

We thus created ten new target sentences and tested them in a second prestudy for this PT only with $n = 34$ additional participants (30 females, 4 males; age: $M = 20.59$; $SD = 4.16$). The targets for the other two PTs were not included in this rating for economic reasons. In addition, five filler sentences, each comprising neutral and positive valences, were kept in the rating set. The results of this second pre-rating study showed that four out of ten target sentences correlated sufficiently with the participants' OC-PT scores and were thus selected for use in the micro-PK task (see Table 1). Again, one more missing target question ("Can I simply live from day to day?") was constructed without further evaluation based on an already-validated stimulus.

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Table 1

Descriptive Results of the Stimulus Validation Study for the Selected Trait-Related Target Stimuli

Target Stimulus	*M*	*SD*	DE		AV		OC	
			r	*p*	*r*	*p*	*r*	*p*
DE (*n* = 73)								
"Is she mad at me?"	2.32	0.91	-.32**	<.01	-.12	.15	-.07	.29
"Will we part in dispute?"	2.11	0.92	-.26*	.01	-.08	.24	-.03	.39
"Will nobody help me?"	2.52	1.23	-.10	.20	.03	.40	-.10	.21
"Do I get back as much as I give?"	3.47	1.08	-.20*	.04	-.13	.14	-.12	.15
AV (*n* = 73)								
"Will I blush in front of everyone?"	2.78	1.90	-.08	.25	-.23*	.03	-.09	.22
"Can I be myself in front of others?"	4.45	1.56	-.14	.11	-.31*	<.01	-.09	.22
"What should I say?"	2.86	1.92	-.12	.17	-.27*	.01	-.18	.07
"Can I show self-confidence?"	4.38	1.39	-.12	.15	-.27*	.01	.01	.46
OC (*n* = 34)								
"Did I miss a mistake in my work?"	2.26	1.02	-.04,	.41	-.08	.32	-.11	.26
"Have I allowed myself too much free time?"	2.79	1.04	-.41**	<.01	-.40**	<.01	-.31*	.04
"Did I waste my time?"	1.91	0.75	-.06	.38	-.08	.34	-.26	.07
"Did I really work enough?"	2.35	0.92	-.23	.09	-.27	.06	-.32*	.03

Note. *M* = Mean pleasantness; *SD* = Standard Deviation; *r* = correlation (one-tailed). **p* < .05, ***p* < .01.

Finally, fifteen of all neutrally rated sentences—five for each block—were randomly selected for application in the micro-PK tasks (see Table 2).

Table 2

Descriptive Results of the Stimulus Validation Study for the Final Neutral Stimuli

Neutral Stimulus	*M*	*SD*	*r*	*p*
DE (n = 73)				
"He is on deck"	4.15	0.72	-.01	.48
"There are magnets on the fridge"	4.29	0.66	-.01	.47
"We see a forest"	5.11	1.16	-.06	.31
"Some tablecloths are in the basket"	4.14	0.51	.01	.46
"Her book is under the bed"	4.04	0.77	-.05	.35
AV (n = 73)				
"The shirt is white"	4.27	0.71	.05	.35
"There is a pillow on the sofa"	4.64	0.98	.07	.29
"The spoon is on the table"	4.12	0.47	.08	.24
"The year has twelve months"	4.30	0.78	-.02	.42
"This is a trash can"	3.88	0.58	-.09	.22
OC (n = 73)				
"Red pipes are metal"	3.85	0.54	-.07	.28
"The room has many buckets"	3.67	0.69	.04	.38
"The cabinet has four drawers"	3.95	0.92	.01	.47
"The container has a blue lid"	3.99	0.31	-.02	.44
"Digital watches are common"	3.93	0.33	-.06	.30

Note. *M* = Mean pleasantness; *SD* = Standard Deviation; r = Pearson correlation (one-tailed). *p < .05, **p < .01.

Data Analysis

As recommended by Wagenmakers et al. (2011), the data were analyzed using Bayesian inference techniques with a preregistered strategy (for further details, see Jakob et al., 2020). The BF resembles the relative amount of evidence that the data provide for or against a postulated effect. For the three target groups with high scores on the PTs, each hypothesis was tested individually using a one-sided Bayesian one-sample *t*-test with the number of trait-related targets as the outcome variable, testing for more than 50% probability of occurrence.

For the control subsamples with low PT scores, we performed two-sided Bayesian one-sample *t*-tests against a probability of 50%. As 30 stimuli were presented for each trait, the expectation value under chance was 15. Based on previous findings (Jakob et al., 2020), we a priori decided on a narrow informed prior of δ ~ Cauchy (.05, .05). In the preregistration, an informed prior δ ~ Cauchy (0.5, 0.5) was erroneously mentioned. This was a typo. We address this error in the limitation section of our discussion and provide evidence there that this was a typo. Our a priori defined evidence criterion (stopping rule) was *BF* = 10, classified as strong evidence in any direction (H_0 or H_1). We predicted that a $BF_{10} \geq 10$ in favor of H_1 would occur during data collection for at least one of the micro-PK tasks (i.e., one of the three PTs' high groups). Since frequentist approaches are more common than Bayesian hypothesis testing in psychology, the *p*-scores of frequentist *t*-values are also provided. In addition to the BF stopping rule a maximum n of 1,000 participants was preregistered in case that at this sample size no clear trend towards BF = 10 in the data of at least one of the targets groups could be observed.

Results

Analyses of Total Deviations

As a basis for the preregistered sequential analyses reported later, six Bayesian one-sample *t*-tests were performed within the target and control subsamples for each PT, assessing whether the mean number of the target sentences was greater than 50% (target subsample) or differed from 50% (control subsample)[2]. We expect-

2 Results of the exploratory analyses for the subsample with the attention check (n = 1,059): Mean reaction time over all three tasks *M* = 7.30 s (*SD* = 59.96 s; Min = 0.70 s; Max = 2,884.50 s). Therefore, the average reaction time can be considered acceptable for an online study. The standard deviation of almost

ed to reach strong evidence for H_1 for at least one of the three target subsamples. No strong evidence for H_1 was expected for the control subsamples of individuals.

We first report the analyses of the target groups: A Bayesian one-tailed *t*-test analysis of the mean number of trait-related stimuli for the DE-PT-high scorers (n = 1,400) yielded a final BF_{10} = 10.41 (M = 15.18; SD = 2.68), indicating strong evidence for H_1 (cf.: $t(1399) = 2.51$; $p < .001$). The other two Bayesian one-sample *t*-test analyses showed a final BF_{01} = 2.01 (M = 15.06; SD = 2.71) for the AV-PT-high scorers (n = 1,308) (cf.: $t(1307) = 0.78$; $p = .22$) and a BF_{01} = 2.41 (M = 15.05; SD = 2.74) for the OC-PT-high scorers (n = 1,462) (cf.: $t(1461) = 0.68$; $p = .25$), representing anecdotal evidence for H_0. The sequential Bayesian analyses for these three tests can be seen in Figure 2.

Two-tailed Bayesian one-sample *t*-tests were performed for the three control subsamples. A two-sided approach was adopted since, for the control group, no deviation from 50% in either direction was expected. As postulated, no strong evidence for H1 was found, although the BFs did not confirm H0 either. The control subsample for the AV-PT-low scorers (n = 1,095) showed with BF_{10} = 3.27 (M = 15.17; SD = 2.74), indicating moderate evidence for H_1 (cf.: $t(1094) = 2.08$; $p = .04$). The Bayesian *t*-test analyses for the DE-PT-low scorers (n = 1,003) yielded a BF_{01} = 2.17 (M = 15.06; SD = 2.69), indicating anecdotal evidence for H_0 (cf.: $t(1002) = 0.73$; $p =.47$), and for the OC-PT-low scorers (n = 941), a BF_{01} = 2.84 (M = 14.88; SD = 2.64) was obtained, indicating anecdotal evidence for H_0 (cf.: $t(940) = -1.37$; $p = .17$).[3]

Further Preregistered Exploratory Analyses

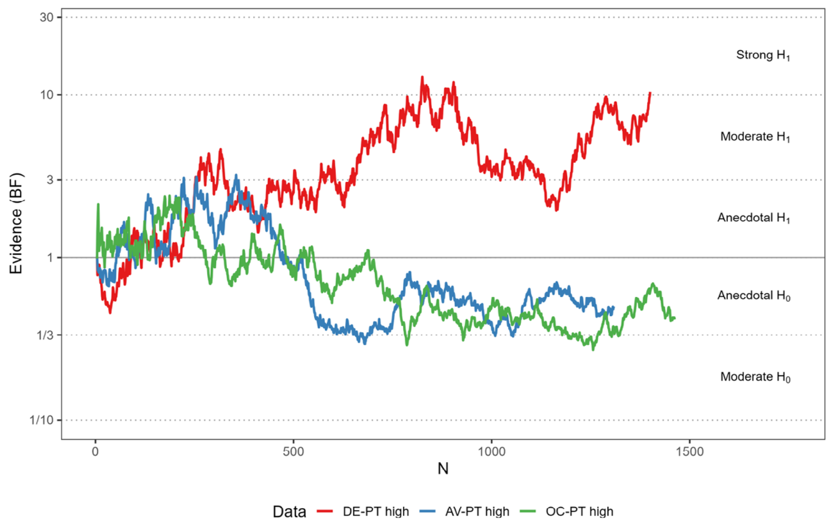
In the preregistration form, several further exploratory analyses regarding the influence of demographic variables (age, gender), the investigation of trait-specificity of the effect, Change of Evidence Analyses, and a test of a regression model with all PTs included at once as predictors were preregistered. These exploratory analyses have been performed but will not be reported in detail here. However, an overview of these results can be found at: https://osf.io/qxu3s.

one minute and the maximum response times of more than three quarters of an hour indicate that the sample included some inattentive participants.

3 Results for the erroneously preregistered prior δ ~ Cauchy (0.5, 0.5): DE-PT-high BF_{01} = 1.31, AV-PT-high BF_{01} = 30.19, OC-PT-high BF_{01} = 35.83; DE-PT-low BF_{01} = 29.04, AV-PT-low BF_{01} = 4.18, OC-PT-low BF_{01} = 16.37.

Figure 2

Sequential Bayesian One-Sample t-Test Analyses



Note. Red line: DE-PT-high, blue line: AV-PT-high, green line: OC-PT-high. Tests are one-tailed.

Discussion

This study aimed to provide empirical evidence of quantum-based psychophysical correlation models by investigating the micro-PK effects produced by QRNG. We tested hypotheses derived from Pauli and Jung's UMM and from von Lucadou's MPI. With reference to the UMM, we considered the activation of an individual's specific pre-conscious mental state while perceiving a QRNG outcome—meaningfully related to the observer's implicit goal orientations—as a type of IC. For specific fear-related motivational patterns, we predicted a non-local correlation between mind and matter, resulting in a higher likelihood of the appearance of a corresponding observation of a quantum outcome, that is, fear-related stimuli presentations. According to the ETM (see also Jakob et al., 2020), this bias can be explained by the individual´s pre-conscious outcome expectations. Only the affective content of an intention can pass the boundary from the conscious to the unconscious pre-reality realm and thus instigate changes in the quantum probabilities of the goal-related pre-material states. This motivational impact should bias the likelihood of a corresponding macroscopic manifestation. The observers' pre-conscious motive states were operationalized as Cluster C's PTs serving as an independent factor. These PTs mirror specific subjective theories about oneself and others and are strongly affectively laden. Moreover, they are grounded in unconscious fear-based expectations of need frustration. Therefore, the ETM predicts a higher probability that these trait-specific concerns will be realized within the macroscopic material reality—that individuals tend to attract in life that which they are afraid of.

Consequently, we predicted strong evidence for deviations from randomness in a micro-PK task operating with fear-related (and neutral) stimulus presentations within subsamples of individuals expressing high PT levels but not for participants with low scores on these traits. Our primary prediction was confirmed: Within the target group for the DE-PT-high scorers, we found strong evidence (*BF* > 10) for our hypothesis (H_1). Participants scoring high on the DE-PT observed more fear-related target stimuli than chance. These findings can be considered a temporary confirmation of one of the tested hypotheses supporting the conjectures derived from the UMM and the MPI. Analyses of the micro-PK data of any other target and control groups found no strong evidence for the effects. Note that hypothesizing at least one of three tests performed with the target groups to show a result is a relatively weak postulate.

In sum, this study provided confirmatory evidence for a preregistered micro-PK effect for one out of three PTs. This evidence for a micro-PK effect within a subsample of participants expressing high extents of the DE-PT, if further substantiated in future studies, would support the assumption of a systematic influence of an implicitly motivated observer on quantum probabilities (von Lucadou et al., 2007; see also Mensky, 2014; Pradhan, 2012; Penrose & Hameroff, 2011; Stapp, 2007; Stanford, 1990). According to the ETM, individuals who fear losing security in relationships and others' support tend to attract such experiences at a macroscopic level. Thus, the pre-conscious, fearful expectation of abandonment might lead to a self-fulfilling prophecy. Such experiences might further confirm the individuals' expectations of behavioral outcomes, leading to a vicious circle of fear and fear-confirming realities that support the persistence of negative and psychopathologically relevant PTs. These findings corroborate earlier studies, including Jakob et al. (2020) or Maier and Dechamps (2018). It is unclear why no evidence for H_1 was found for the other two target groups. Design characteristics such as testing three different micro-PK effects within separate blocks in one study or sub-optimal target sentences' features might provide potential explanations.

One apparent limitation of this study is that the prior was incorrectly reported in the preregistration form. Instead of an informed prior with δ ~ Cauchy (.05, .05) used for the analyses reported above, δ ~ Cauchy (0.5, 0.5) was proposed. We would like to emphasize that this was due to a typo, and in fact, the δ ~ Cauchy (.05, .05) was meant. From our and others' previous micro-PK research, we knew that the overall effect size for such effects is small, usually in the range of d = .1 or even lower. This is what we also expected for our study, as mentioned in the preregistration text. A small effect size of d = .1 translates into an informed prior of Cauchy (.05, .05) or an uninformed δ ~ Cauchy (0, .1). In our own micro-PK research, we almost exclusively use these two priors (e.g., Jakob et al., 2020; Dechamps et al., 2021). There was no reason to expect any different effect size for the study here. Given that a small effect size was expected and proposed for the present study, and a Cauchy (0.5, 0.5) would imply a medium effect size and given the fact that a Cauchy (.05, .05) was adequately and successfully applied in our past research, the scores mentioned in the preregistration should be interpreted as a typo. We are aware that the choice of a prior provides a degree of freedom in Bayesian analyses. Therefore, it is of the utmost importance to specify and potentially preregister the prior in advance. Admittedly, such a typo, although ruled out by the additional information presented above, diminishes the empirical strength of the data presented here.

Furthermore, we checked the results regularly during data collection, consistent with the Bayesian approach. However, this procedure might allow observer effects of the experimenters on the course of the study. The data analyst may be considered another observer on a level above the participants. An interim result with a certain degree of evidence for or against one's own hypotheses represents meaningful information for the observer, potentially leading to affectively laden expectations. As the analysis did not include masking, the analyst's unconscious intention could cause another IC, biasing the likelihood of a certain outcome along with the analyst's own belief in micro-PK (see Rabeyron, 2020). Our research group was characterized by a moderate belief, and this experimenter psi effect might have contributed to the results reported here. This additional or alternative explanation should be investigated in the future, perhaps by dispensing with intermediate analyses or deploying masked analyses. It should be mentioned in this context that the maximum N = 1,000 criterion as specified in the preregistration was ignored due to the fact that a clear trend in the data of the high-DP scorers was observed at n = 1,000. This conditional stopping rule was mentioned in the preregistration and is in line with the Bayesian testing approach.

Another limitation of the study was that the attention check was not implemented from the beginning but rather during the course of data collection. The subsample's results showed an acceptable mean reaction time of M = 3.19 s (SD = 7.08 s), indicating that most people were attentive during the online study. However, the variance in the speed of responses suggests that some participants were distracted (e.g., 8% participants showed reaction times larger than 10 seconds). Due to the reduced experimental control within online studies, it cannot be excluded that some participants were less attentive to the study content. Our theory assumes that conscious observation of stimuli is essential to establishing a meaningful connection between the individual's mind and the quantum process. It may, however, be sufficient if a certain portion of the stimuli is consciously perceived. Nevertheless, for further online studies on micro-PK, we suggest a change in the task so that the selected stimuli should not only be observed attentively without any further action but also rated respectively in their valence. In this way, the participants' continuous attention could also be guaranteed through online experiments.

Finally, the high correlation among Cluster C's three PTs prompts the question of whether a combined index averaged across all three personality scales would deliver a more adequate independent factor. Further exploratory analyses and, if necessary, renewed confirmatory investigations are planned.

This study's objective was to test intentional observer effects on deviations from quantum randomness during the process of measurement to provide evidence concerning quantum-based psychophysical correlation models (e.g., the UMM and the MPI). As predicted in the study's preregistration, in one of the three target groups (DE-PT), we found strong evidence (BF_{10} > 10) for our hypothesis. By contrast, we observed no strong evidence for H_1 in the control groups. Overall, our findings align with earlier studies documenting evidence for the influence of unconscious observers' intentions on a QRNG (e.g., Jakob et al., 2020; Maier & Dechamps, 2018). In conclusion, an extension of quantum mechanics allowing intentional observers to contribute to the formation of macroscopic realities is worth considering as an alternative model for mind–matter interaction. This extension should also include ways to specify the degree to which the results can be objectified.

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Tester les Effets des Croyances Liées à la Personnalité sur le Micro-Psychokinèse

Marissa-Julia Jakob Moritz C. Dechamps Markus A. Maier

Résumé: Cette étude préliminaire examine les interactions entre l'esprit et la matière en testant les effets de l'observateur sur les résultats du générateur quantique de nombres aléatoires (QRNG), médiés par les intentions implicites. Les traits de personnalité des participants (PT) ont été évalués et des stimuli neutres ou liés à un objectif leur ont été présentés en fonction des résultats du QRNG. Des écarts par rapport au hasard ont été prédits, les participants ayant obtenu un score élevé à l'évaluation des traits de personnalité étant censés observer davantage de phrases liées aux traits de personnalité les concernant. Trois expériences de micropsychokinèse (micro-PK) ont été menées pour les participants présentant des traits de personnalité appartenant au groupe C: dépendants, évitants et obsessionnels-compulsifs. Les résultats ont révélé des preuves solides (facteur de Bayes > 10) d'un effet de micropsychokinèse dans le groupe des personnalités dépendantes, les personnes ayant obtenu un score élevé ayant observé plus de phrases traitant de leurs préoccupations que ce qui était attendu par hasard. Aucune preuve solide n'a été trouvée pour les autres groupes de traits de personnalité, ou chez les personnes ayant obtenu un score faible. Ces résultats suggèrent que l'observation intentionnelle biaise les résultats QRNG liés aux préoccupations implicites des individus, ce qui peut conduire à des prophéties auto-réalisatrices. Les implications de l'étude sont examinées dans le cadre du modèle *Unus Mundus* et du modèle de l'information pragmatique.

Translation into French by Antoine Bioy, Ph. D.

Zur Prüfung der Auswirkungen von persönlichkeitsbezogenen Überzeugungen auf Mikro-PK

Marissa-Julia Jakob Moritz C. Dechamps Markus A. Maier

Zusammenfassung: Diese vorabregistrierte Studie untersucht Geist-Materie-Interaktionen, indem sie Beobachtereffekte auf die Ergebnisse eines Quantenzufallszahlengenerators (QRNG) testet, die durch implizite Absichten vermittelt werden. Die Persönlichkeitsmerkmale (PTs) der Teilnehmer wurden eingeschätzt, und diese wurden mit zielorientierten oder neutralen Stimuli auf der Grundlage der QRNG-Ergebnisse präsentiert. Abweichungen vom Zufall wurden unter der Erwartung vorhergesagt, dass Teilnehmer mit hohen PT-Werten mehr PT-bezogene Sätze beobachteten. Drei Experimente zur Mikro-Psychokinese (Mikro-PK) wurden für die PTs von Cluster C durchgeführt: abhängig, vermeidend und zwanghaft. Die Ergebnisse ergaben eine starke Evidenz (Bayes-Faktor > 10) für einen Mikro-PK-Effekt in der Gruppe der abhängigen PTs, wobei Personen mit hoher Punktzahl mehr Sätze beobachteten, die ihre Probleme ansprachen, als zufällig erwartet. Für die anderen PT-Gruppen oder für die Personen mit niedrigen Punktzahlen wurde kein starker Nachweis gefunden. Diese Ergebnisse deuten darauf hin, dass die absichtliche Beobachtung die Ergebnisse von QRNG in Bezug auf die impliziten Bedenken von Personen verzerrt, was möglicherweise zu sich selbst erfüllenden Prophezei-

ungen führt. Die Implikationen der Studie werden im Rahmen des *Unus Mundus*-Modells und des Modells der Pragmatischen Information diskutiert.

Translation into German by Eberhard Bauer, Ph. D.

Testando os Efeitos das Crenças Relacionadas à Personalidade na Micro-PK

Marissa-Julia Jakob Moritz C. Dechamps Markus A. Maier

Resumo. Este estudo pré-registrado investiga as interações mente-matéria testando os efeitos do observador sobre os resultados do gerador quântico de números aleatórios (QRNG em inglês) mediados por intenções implícitas relacionadas à personalidade. Os traços de personalidade (PTs em inglês) dos participantes foram avaliados, e apresentados com estímulos relacionados a metas ou neutros, com base nos resultados do QRNG. Desvios em relação ao modelo foram previstos, com pontuadores altos de PT esperados, para se observar mais sentenças relacionadas a PT. Três experimentos de micro-psicocinese (micro-PK) foram conduzidos para os PTs do Cluster C: dependentes, evitativos e obsessivo-compulsivos. Os resultados revelaram forte evidência (Fator de Bayes > 10) para um efeito de micro-PK no grupo de PT dependentes, com pontuadores altos observando mais frases abordando suas preocupações do que o esperado ao acaso. Não foram encontradas evidências fortes para os outros grupos de PT ou pontuadores baixos. Essas descobertas sugerem que a observação intencional influencia os resultados do QRNG relacionados às preocupações implícitas dos indivíduos, potencialmente levando a profecias autorrealizáveis. As implicações do estudo são discutidas dentro do modelo *Unus Mundus* e do Modelo de Informação Pragmática.

Translation into Portuguese by Antônio Lima, Ph. D.

Una Evaluación de los Efectos de las Creencias Relacionadas con la Personalidad en Micro-PK

Marissa-Julia Jakob Moritz C. Dechamps Markus A. Maier

Resumen. Este estudio pre-registrado investigó las interacciones mente-materia evaluando los efectos del observador en los resultados de un generador cuántico de números aleatorios (QRNG), mediados por intenciones implícitas. Evaluamos los rasgos de personalidad de los participantes y les presentamos estímulos relacionados a objetivos o neutros basados en los resultados del QRNG. Predijimos desviaciones con respecto al azar, y esperabamos que los participantes con altas puntuaciones en PT observarían más frases relacionadas con PT. Realizamos tres experimentos de micropsicoquinesis (micro-PK) para los rasgos de personalidad del Grupo C: dependiente, evitativo, y obsesivo-compulsivo. Los resultados revelaron pruebas

sólidas (Factor de Bayes > 10) de un efecto micro-PK en el grupo de TP dependientes, en el que las personas con puntuaciones altas observaron más frases relacionadas con sus preocupaciones de lo que cabría esperar al azar. No encontramos pruebas sólidas para los otros grupos de TP ni para los de puntuación baja. Estos resultados sugieren que la observación intencionada sesga los resultados del QRNG relacionados con las preocupaciones implícitas de los individuos, lo que puede conducir a profecías autocumplidas. Discutimos las implicaciones del estudio dentro del modelo *Unus Mundus* y el Modelo de Información Pragmática.

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