Authors' response:

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Signals: A Mechanism To Understand Psi Phenomena

Introduction

At the outset, we acknowledge and appreciate Drs. Hartmut Grote, Walter von Lucadou, Michael Nahm, Dean Radin, and Hartmann Römer for taking the time and effort to review and critique our paper. As Michael Nahm (2019: 65, this issue) has quite rightly stated, "[...] such discussions in which the strengths and weaknesses of particular theoretical approaches are meticulously carved out are necessary for real progress in theorizing about psi." One outcome of this exercise is that we, as a discipline, have progressed from asking the question whether psi exists to what is the process of psi, and examining this question from fundamentally different theoretical approaches.

Dr. Edwin May, a nuclear physicist, and I, a psychologist, have teamed up to investigate the theoretical underpinnings of psi phenomena from our domain specific expertise. In our paper, *Informational psi: Collapsing the problem space of psi phenomena*, we discussed various psi phenomena and their associated investigation methods leading to the view that psi phenomena can be unified into a single phenomenon—informational psi (IΨ)—the process of which can be explored from the physics and neuroscience domains, with domain specific questions. The basic premise is: (i) the universe is governed by physical laws; (ii) information is the ground field of the perennial external world; (iii) mind/consciousness is an emergent property of the impermanent brain; and (iv) mind/consciousness cannot exert a direct force on the external world, except by means of the motor system. Based in experimental data, the principles underlying the multiphasic model of informational psi (MMIΨ) and the decision augmentation theory (DAT) form the theoretical basis for collapsing the problem space of psi phenomena into a unitary concept, IΨ.

In the absence of clear-cut differences between the core aspects of various psi phenomena, aside from the experiential, collapsing the problem space provides a parsimonious approach for understanding the fundamental processes underlying psi experiences. In the absence of this approach, we would need to provide independent theories for understanding the process of

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each type of psi experiences. However, as we find, at the core of each of these personal experiences there is interaction with the external world and acquisition of information from the external world upon which the individual may or may not act, consciously or unconsciously. Having ruled out causal psi (CΨ), i. e., the possibility of the "mind" exerting effort on the external world, without the mediation of the motor system, perception of information becomes the core of all psi experiences. (See May & Marwaha, 2019a, micro-PK experiments with random number generators, and macro- and bio-PK experiments with small-scale physical systems such as strain gauges and single cell biological systems).

As stated severally across all our papers, this is a science in progress, there is a lot we know, a lot we do not know for some of which there are testable hypotheses, and the consequent raising of more questions. By the time we, as a discipline, crack this code, the term IΨ too will have evolved to reflect the greater understanding of the phenomenon.

As Radin (2019: 67–68, this issue) points out, several researchers in the past have posited that psi is a unitary process (Rhine, 1945; Thouless & Wiesner, 1946), including the point that "the idea of applying informational concepts to understanding psi was proposed over a half-century ago (Cadoret, 1961)". As Roe, Davey, and Stevens (2003) report:

> Gertrude Schmeidler (1988) posed the question: "Is it proper to use psi as a general term for ESP and PK? If it is—if they are alike enough to be classed together—is there any need for the separate terms?" (p. 172). Her question makes explicit an assumption that underlies much of the work in parapsychology, albeit rarely stated, that psi is an intrinsically unitary domain within which ESP and PK are complementary expressions of an inherently undifferentiable and integral set of processes (see also Irwin, 1985: 44; Thalbourne, 2004: 343).

Based on an examination of twelve major meta-analyses covering nine paranormal domains (DMILS, forced-choice, free-response/GESP/RV, dice-throwing, RNG, clairvoyance, precognition, ganzfeld, autoganzfeld) from the context of Thalbourne's theory of psychopraxia (2004), Storm and Thalbourne (2000: 291) state: "We have conjectured that a demarcation between the two traditional categories, ESP and PK, may not be sustainable." In a recent meta-analysis of ESP-dreams studies, Storm, Sherwood, Roe, Tressoldi, Rock, and De Risio (2017: 132) state:

> […] ESP is either a consistent effect across the three modalities [telepathy, precognition, clairvoyance], indicating a possible ESP limitation no matter what form it takes, or ESP is manifested in only one way, and the three modalities should be considered expressions of a single underlying psi phenomenon or function.

The core construct of informational psi (IΨ) reiterates the view that psi is a unitary phenomenon. The process of the signal-based IΨ can be understood from the physics and neuro-

science domains. Although IΨ signals arise from a distant spacetime point (physics domain, information-centric perspective); from the person-centric perspective (neuroscience domain), all perceptions, regardless of their spatiotemporal origin, are local to the percipient.

In this paper we first clarify key issues related to (1) informational psi and the multiphasic model of informational psi (MMIΨ), (2) the entropy hypothesis, (3) and the decision augmentation theory (DAT). This is followed by addressing specific issues raised by the commentators.

Informational Psi (IΨ)

Based in empirical data, informational psi (IΨ) is *defined as the transfer of information, which is based on entropic considerations, arising from a distant point in spacetime leading to the local acquisition of non-inferential information by an atypical perceptual ability*.

Although the term IΨ has been in use for a long time, we bring it to the forefront as information is at the core of the psi experience. That it is precognitive is determined by the experimental protocol—the target is generated *after* the response is secured, i. e., the target information is distant in time. In real-time protocols (across town, cities, country, continent) although the target is generated *before* the response is secured, the target is still at a distant point in spacetime. However, in this case, it is difficult to determine whether the psi-adept percipient obtained the information in the here and now, i. e. at this moment, or whether the information was acquired precognitively; this is reflected in spontaneous psi experiences. This implies that the experimental setup provides the ritual to note down the response. This is one of the biggest challenges in psi research—determining when and where the psi information was obtained.

Unless we are willing to posit that a putative IΨ signal or mechanism is different based on its spatiotemporal origins or that the varieties of traditionally classified psi phenomena will have different mechanisms, to make progress it is imperative that we reduce the phenomena to its single key feature—information. It is this recognition that prompted us to change the name of our model, all else being the same, to the multiphasic model of *informational psi*, instead of precognition.

The multiphasic model of informational psi (MMIΨ) (a. k. a., multiphasic model of precognition) is a signal-based process-oriented model that addresses the question, "How does psi happen?" Any signal model of psi must address the source, transmission, and detection of information. While the source of information is difficult to address, or even comprehend at this stage, transmission and detection of information are relatively easier to address.

Factors that have to be incorporated into a model include the following:

1. *IΨ can be applied.* Responses obtained by the method of remote viewing, using laboratory protocols, have been applied in operational—"spying"—situations along with data from other traditional sources of intelligence. Qualitative and quantitative data for applied IΨ is found in the entire database of remote viewing (RV) studies, i. e., applied IΨ (May & Marwaha, 2018a, b, 2019a, b).
2. *Innate ability.* One cannot be trained to develop a psi ability; it is an innate ability much like musical giftedness and other aptitudes that we have. The psi-adept may need to be trained for using the remote viewing (RV) protocol for applied situations.
3. *Information from a distant point in spacetime.* The psi information is obtained from forward in time and appears independent of distance.
4. *Information bit-rate.* The channel capacity appears to be low; that is, over any reasonable time for a session, the total amount of formal information is limited. Based on a computation of the bit rates for SRI/SAIC experiments, the weighted average of information transfer bit rate per symbol is approximately 0.176 ± 0.048 bits/symbol leading to a 95% confidence interval of [0.269, 0.082]. This bit rate is far too small to win a lottery, for example, because it limits the amount of information that can be acquired by a psi process in a given period of time. Thus, for a typical lottery of six 2-digit numbers, it takes approximately 7 bits of information for each pair including the correct order. Therefore, it requires 42 bits of information to win, and at the bit rate implied above, it would take approximately 50+ hours of continuous remote viewing. The bit rate is far too small to enable the detection of psi-in-process during an fMRI, considering the amount of "noise" from other sensory systems and internal processes.
5. *Nonstationary stochastic system*. IΨ may be a nonstationary stochastic system; that is, its statistical properties are not constant. Although this uncertainty could be in the source, transmission, or detector (brain) systems, it most likely arises in the detection system, like the vagaries of perception for other sensory inputs.

Remote Viewing (RV) Examples

The following two RV examples, drawn from our experiment on testing the entropy hypothesis, serve as a guideline for understanding IΨ. The target pool, consisting of 22 targets, was specially developed for this outbound experiment. The images for the targets were taken nearly six months prior to the start of sessions.

An IΨ Trial by Trial Protocol

1. At 10:00 a.m. Experimenter 1 (E1) and a participant (P) begin a session. At that time, both are blind to any target stimuli because these have not yet been generated. The tasking to P is this: "Please access and describe the first thing you see when we remove the blindfold in about an hour from now."
2. At approximately 10:15 a.m. the session ends and the E1 enters the response into a fuzzy set whose universal set of elements was pre-defined. This procedure is described in May, Hawley, et al. (2014). Upon completion, a computer code sends an automated SMS to Experimenter 2 (E2) who is 30 km away from E1 and P, only stating "the data collection is complete". Note that no response information is contained in that SMS. This procedure is followed for all sessions in the study.
3. At 10:16 a.m., E2 invokes a code on his computer that randomly generates five orthogonal sites and randomly selects one as the intended target stimulus. That code stores the details in the cloud (E1 and participant never have access to this file) and independently sends to E1 the five randomly-ordered target numbers in a simple CSV file.
4. E1's computer code automatically receives the above CSV file; finds from an Access database the pre-defined fuzzy sets for each of the five targets and conducts a Figure of Merit analysis for each of the five sites. The code generates an assessment and saves it in the cloud; it also generates a CSV file with the details of the analyses which is saved to the cloud as well.
5. After the above files have been secured in the cloud, E1's code sends an automated SMS to E2 requesting the intended target site stimulus. Experimenter 3 (E3) has created a cloud folder so that E2 is blind, and a separate folder so that E1 is blind. E3, then is the holder-of-record to maintain the blinded conditions and to secure the data.
6. E2 drives to the site and stands at the pre-designated location, stays there for 10 minutes until notifying E1 by SMS that E2 is leaving the site.
7. E1 and P prepare for the drive by blindfolding P.
8. At the site, E1 guides the blind-folded P to the predefined designated spot; orients the participant into the predefined direction; and then asks the participant to remove the blind fold.

To reiterate, the session was conducted before selection of target set, and scored before the analyst was informed about the location of the target site. This protocol had in-session controls.

Example 1: The Chain Link Fence

This session, dubbed "the chain link fence", was carried out on 20 April 2014. The target set and response can be seen in Figures 1 and 2.

Category: Towers
Target: Water Tower
FoM Rank Obtained: 1

Category: Buildings
Target: Fire Station
FoM Rank Obtained: 2

Category: Bridges
Target: Shoreline Bridge
FoM Rank Obtained: 3

Category: Ponds
Target: Quarry Lakes
FoM Rank Obtained: 4

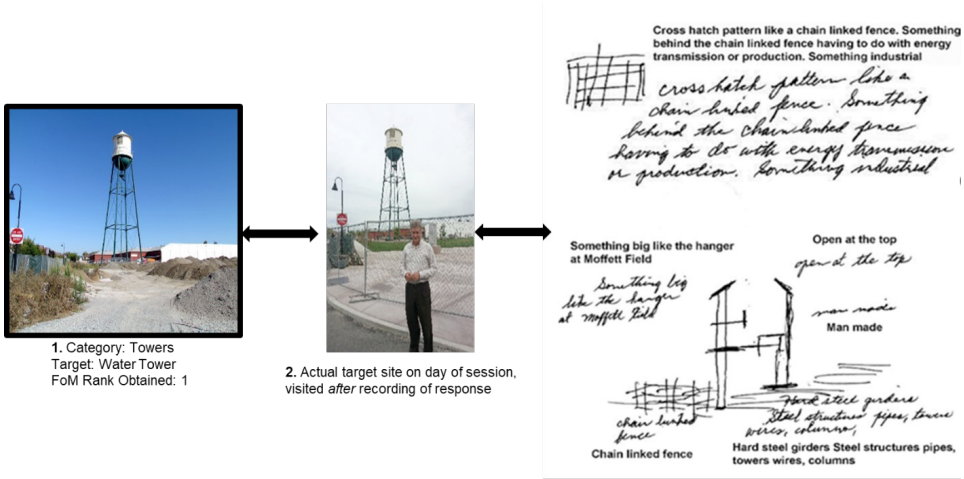
Category: Parks
Target: Pulgas Ridge Open Space Preserve
FoM Rank Obtained: 5

Figure 1: The randomly selected target set for a precognition remote viewing session. Targets have been arranged according to the rank order obtained.

In Figure 2, it is interesting to note that the response is similar to the target site on the day of the session, rather than the target image in the target pool that was taken about six months ago. This raises the interesting question about the source of the information—was it the computer based image or was it the site?

Example 2: The Path

This session, called "the path," was carried out on 28 July 2014, using the same protocol described above. While noting down his response before the target was generated, the viewer said "Doesn't seem to be much of interest", and completed the session within a few seconds. However, he obtained a figure of merit rank of 1 (Figure 3).

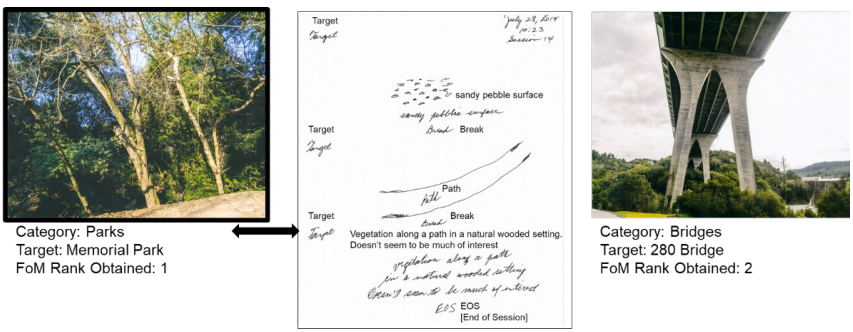


1. Category: Towers
Target: Water Tower
FoM Rank Obtained: 1

2. Actual target site on day of session, visited *after* recording of response

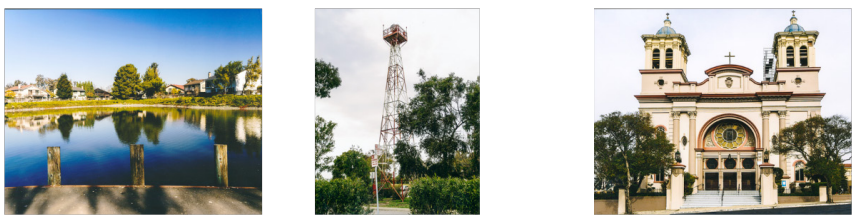
3. Remote Viewing Response

Figure 2: 1: Image in target set. 2. Actual target site on day of session, visited after recording of response. 3. Remote viewing response: "Cross hatch pattern like a chain linked fence…"



Category: Parks
Target: Memorial Park
FoM Rank Obtained: 1

Category: Bridges
Target: 280 Bridge
FoM Rank Obtained: 2



Category: Ponds
Target: Lake Shore Park
FoM Rank Obtained: 3

Category: Towers
Target: Beacon Tower
FoM Rank Obtained: 4

Category: Buildings
Target: Catholic Church
FoM Rank Obtained: 5

Figure 3: The randomly selected target set with response for a precognition remote viewing session. Targets have been arranged according to the rank order obtained.

Why Sensory Systems and Signals?

All of our known sensory systems are signal based, and all of them have carriers of the information that is acquired by each system. This is, of course, a basic observation or premise of physics; that is, propagated information that can do work (i. e., be used) must have a carrier. For example, the visual sensory system detects photons, the auditory sensory system detects phonons and so forth. Another feature of these systems is that all of them are primarily gradient detectors; that is, they are far more sensitive to changes at their front ends (i. e., the signal transducer) than to steady states. In the visual system, for example, even when there is a static fixation point, the eyes are still moving to provide the gradient inputs to that system (Martinez-Conde, Macknik, & Hubel, 2004). It might be that IΨ as a putative sensory system may violate these rules; nonetheless, they serve as a theoretical starting point to understand the mechanisms behind IΨ.

It is not unreasonable to expect some limit to an IΨ ability. If it turns out that it is mediated via some sensory system—which is strongly suggested in that IΨ correlates with the gradient of Shannon entropy and not with the entropy itself—then a limit would be expected. All of our known sensory systems have limits. For example, we cannot directly detect γ- or x-rays, we do not have the sensory range of some other organisms, such as a dog's sense of hearing or smell. From a signal perspective, we do not know if the putative limiting factor has its origin at the source of the information, the channel through which the information propagates somehow, (called the channel capacity in engineering terms) or, finally, in the CNS detector system itself (May & Depp, 2015).

The evidence to date is strongly suggestive, however, that IΨ is a sensory system, at least in conformity with one of the two rules above—gradient detection. Figure 4 shows the relationship between the quality of IΨ and the gradient of entropy for a single study ($n = 75$). While this figure is from a single study, it is characteristic of seven lengthy studies ($n = 229$, $r = 0.211$, 95% confidence interval [0.084, 0.332], $p = 6.4 \times 10^{-4}$) supporting the same conclusion. In our view, these data are strongly suggestive of some kind of a sensory system because of the gradient argument above.

With regard to the carrier for a putative sensory system for IΨ, the speculative notion serves as a plausibility argument. As stated in Marwaha and May (2015a), one candidate for a carrier of information, even from the future, was provided by Verlinde (2011), in a different context. In this paper, Verlinde proposes an entropic force and goes so far as to suggest that it is more fundamental than gravity and should replace gravity as one of the fundamental forces in nature. We speculate that this might be the energy behind an IΨ carrier. This idea is supported by several papers in the physics literature. (Jensen & Karch, 2013; Maldacena & Susskind, 2013; Sonner, 2013). The concept was supported further by the observation of gravitational waves by

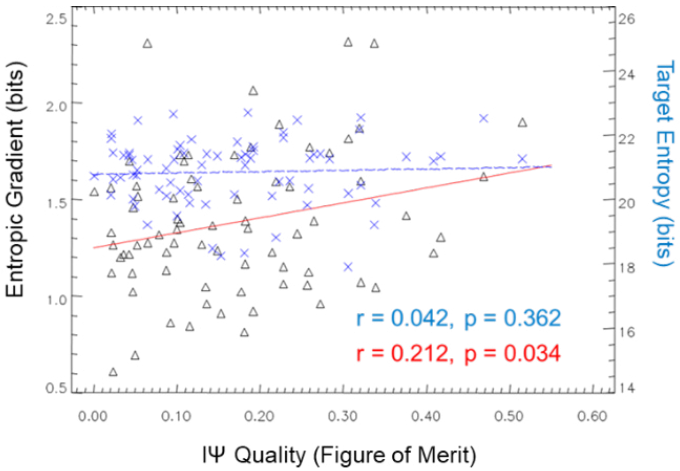


Figure 4: The red line indicates the best fit line to the triangle data—gradient data. The dotted blue line indicates the best fit line to the X data—entropy itself. Although the correlation is weak, it demonstrates that the quality of IΨ is dependent upon a gradient and not upon the steady state of the same parameter.

Weiss, Barish and Thorne (2017), for which they were awarded the 2017 Nobel Prize in physics. These collectively suggest that it is possible for information to propagate from the future to the present even by current understanding of theoretical physics.

We acknowledge that these speculations are a long way from a testable theory, but nonetheless, we consider these speculations as support for our idea that IΨ is mediated by some kind of a sensory system.

Smallness and Elusiveness of Psi

That IΨ may function like the other sensory input is also indicated by the sources of error. Errors in IΨ perception and cognition may occur due to several factors: (i) narrow psi informational channel bandwidth, (ii) detector efficiency, (iii) inattentional blindness, (iv) no prior knowledge or memory of target, (v) error in recognition and/or inference from perceived signal, (vi) error in decision making regarding response, (vii) error in response, i. e. failing to note down a percept. As for other cognitive activities, performance can also be affected when the percipient is under stress due to various factors (Marwaha & May, 2019a: 25–28). Mihalasky and Dean have observed psychological/physiological stress in the subject or experimenter,

stress in the immediate environment of the subject and experimenter, and general emotional stress and turmoil in a whole country or area caused by some major event can affect psi ability (Dean, Mihalasky, Ostrander, & Schroeder, 1974: 178). These factors will contribute towards the "smallness and elusiveness of psi effects" (Römer, 2019: 71, this issue).

The Multiphasic Model of Informational Psi (MMIΨ)

The MMIΨ divides the process into two phases: (1) Phase I: the physics domain (PD) and (2) Phase 2: the neuroscience domain (ND). Figure 5 illustrates the phases and domains of the model, with the proposed hypothesis for the ND.

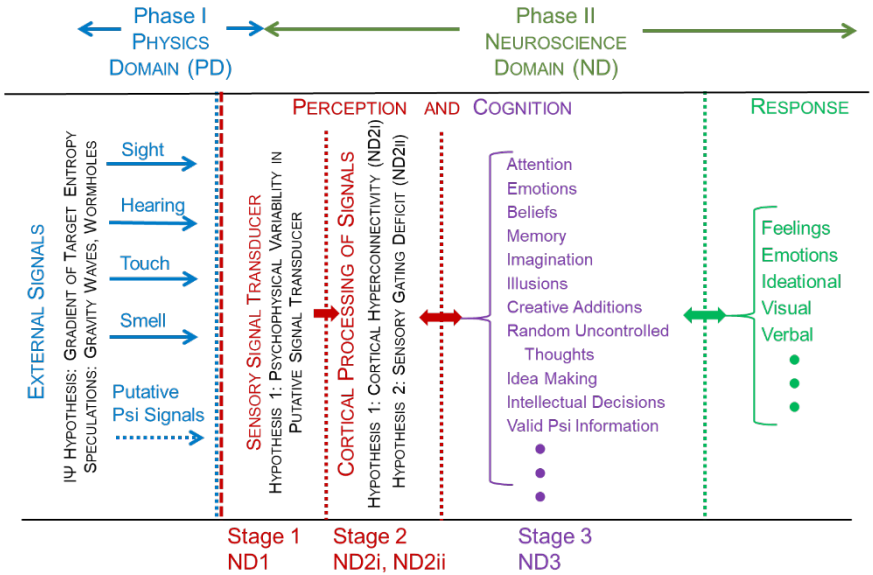


Figure 5: The multiphasic model of informational psi (MMIΨ).

Phase I: The Physics Domain (PD) — Information-centric Perspective

The PD addresses the question of how information is carried from an external source, which is acausally separated, i. e., distant in time and space, from the percipient. The biggest challenge in this domain is determining the nature of the information signal emerging from a distant spacetime point—the putative IΨ signal—and the carrier that propagates backward in time. Questions such as whether detected futures are fixed or only probable remain currently dif-

ficult to address as experimental data support both possibilities. As in the neuroscience domain (ND), several hypotheses will need to be put forward to understand the processes involved in this domain. Thus far, we have the entropy hypothesis that addresses the gradient of entropy of the target system. Speculative hypotheses, so far, include (1) gravity waves, and (2) wormholes.

Intrinsically dependent on the carrier is the nature of the psi signal transducer that can convert energy from the carrier into a form that can be processed by the central nervous system. While the answers to these questions are not immediately forthcoming, in our view, understanding the ND will eventually lead to clues for understanding the PD.

The Entropy Hypothesis

The entropy hypothesis for IΨ was derived from several studies carried out at SRI-SAIC (May & Depp, 2015). To account for the success of such trials, instead of the energy considerations, we chose a different direction: this class of operational targets seem to share another physical property besides rapid energy release—a dramatic and rapid increase in thermodynamic entropy. This hypothesis was specifically examined, yielding supportive results (May, Hawley, & Marwaha, 2017). The basic concept here is to conduct a thermodynamic change of entropy at a remote site to see if that change focuses the participant's attention to that location. This idea arose because of operational RV anecdotes that operational psi targets involving large changes of thermodynamic entropy were rarely missed (May & Lantz, 2010).

Because entropy and its changes connect the micro- to the macro-flow of time, and because IΨ appears to violate that flow at the macro-level, these data strongly provide a clue on how to move forward in the PD (Marwaha & May, 2015b: 10.)

Phase II: The Neuroscience Domain (ND) — Person-centric Perspective

The ND addresses the acquisition and interpretation of psi signals. We propose that this occurs across three stages:

Stage 1 Perception of Psi Signals (ND1)

We hypothesize that psychophysical variability in a putative signal transducer permits the perception of psi signals. Since the visual system is a major means of acquiring information from the external world, we propose that persons who are *outliers* in the normal visual bandwidth—400–700 nm—may be psi adepts.

Stage 2 Cortical Processing of Psi Signals (ND2)

***Hypothesis 1: Cortical Hyperconnectivity* (ND2i):** Since we have to account for a possible difference in the nature of the IΨ signal and limited population distribution of psi-adepts, we have to propose a process that can account for this. In order to do so, we propose that the processing of IΨ signals is mediated by a cortical hyper-associative mechanism.

***Hypothesis 2: Sensory Gating Deficit* (ND2ii):** While this hypothesis has not been fleshed out as yet, we present it here anyway to demonstrate that the MMIΨ is an evolving one, without altering its main structure. Sensory gating describes neurological processes of filtering out redundant or unnecessary stimuli in the brain from all possible environmental stimuli. A gating deficit can of course affect any sensory modality. This hypothesis proposes that psi-adepts will have deficits in sensory gating such that information from the environment is readily available. It is hypothesized that the psi-adepts attention leads to the sensory overload such that requisite IΨ is cognized.

Stage 3: Cognition, Mediated by Normal Cognitive Processes (ND3)

Once the IΨ signals are on board, we propose that they are processed in the same manner as are signals to other sensory systems. This stage is addressed by the field of cognitive sciences and associated disciplines, and hence does not require further elaboration in this model. Psi research has, thus far, focused primarily on this stage.

Decision Augmentation Theory (DAT) and Causal Psi (Psychokinesis)

The decision augmentation theory, earlier known as intuitive data sorting, provides mathematical formulations for determining whether the data obtained in a random number generator (RNG) study, or any study that uses statistical inferences, is due to causal or informational processes. While this has been covered in our primary paper, in this section we revisit it. Details of the DAT model and formulation can be found in May (2015), and May and Marwaha (2019a), which contain all the original papers on this model co-authored with Jessica Utts, James Spottiswoode and others.

Basic Concepts of DAT

Schmidt (1969) first proposed the notion of RNG PK studies. The title of this report, "Precognition of a quantum process" indicates what Schmidt had in mind for the mechanism. All later papers by Schmidt on RNG experiments referred to the phenomenon as micro-PK.

In micro-PK studies it was noticed early on that whatever the mechanism, it appeared to be independent of the complexity of the RNG internal mechanisms; i. e., the results were similar

whether the randomness was derived from a computer algorithm, a radioactive source, or an electronic noise source. This observation spawned a number of papers illustrating the concept of "goal-oriented psi" (Stanford, 1978; Kennedy, 1979, 1995, 2004). Given that goal-oriented outcomes stepped over the details and was only concerned about the result, DAT and its earlier incarnation, intuitive data sorting, formalized this notion.

As the number of RNG experiments grew, the idea of a micro-PK effect modifying the hardware became problematical. If each bit in a binary sequence is modified by a PK effect, then simple algebra demands that the *z*-score should scale as the square root of the number of binary bits in a single run. For example, if the observed *z* for n =100 was 2, then increasing n to 400 should yield a $z = 4$. However, the *z*-scores were statistically independent of the number of bits obtained in a single run.

Figure 6 shows a DAT analysis of 128 different RNG studies up to 1989. The number of bits per run ranged from 16 to 10,000.

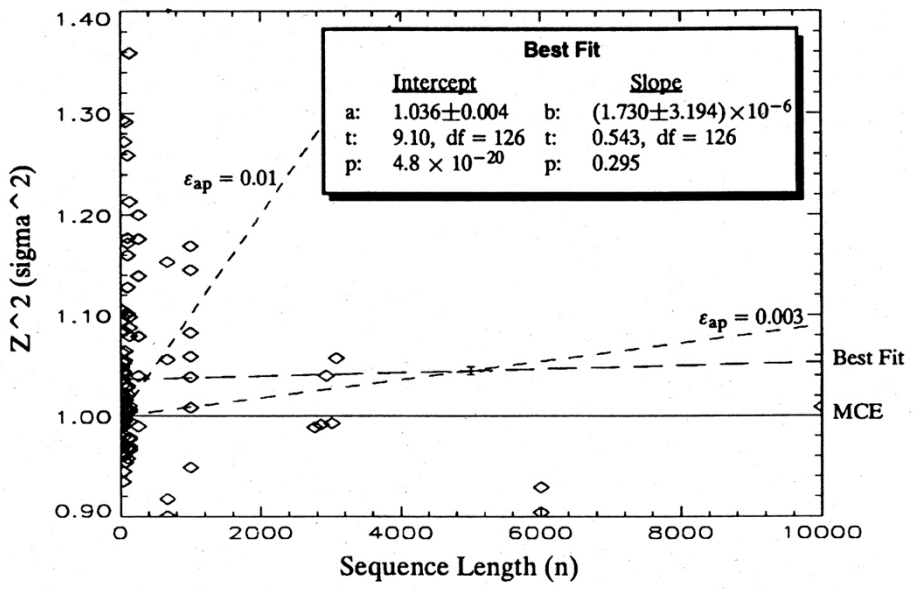


Figure 6: DAT analysis of 128 RNG studies. The $\varepsilon_{ap's}$ represent the effect size assuming a force per bit, the PK hypothesis (May, Spottiswood, & Utts, 1995/2019: 343).

For the ease of computation, the analysis used is the square of the *z*-score instead of *z*. Under the mean chance expectation, DAT posits a slope of the best fit line to the data of zero and in the intercept of one. If the process is IΨ, then DAT predicts a slope of zero with an elevated intercept above one. If the process is PK as expected, then DAT predicts the sloping lines shown as dashed in the figure.

The best fit line to the data had a slope of 1.730×10^{-6} and its 1-σ confidence interval surrounds zero; however, the intercept (at the weighted midpoint of the number of bits) was significantly above the MCE line ($p = 4.8 \times 10^{-20}$). We note that none of the PK-dashed lines come anywhere close to the above statistic. Therefore we conclude that the results from the RNG studies were not arising from a force per bit as thought at the time, but rather the process was the DAT-IΨ notion in support of the earlier idea by Schmidt in 1969 of precognition as the mechanism, or lending credence to the much earlier notion of goal-orientation in these studies. The type of RNG or the speed at which it was generating bits do not matter in either goal-orientation, or more formally in DAT.

DAT and Experimenter Psi

Experimenter psi raises the issue of whether it is the experimenter or the participant who is psi-adept, and is instrumental in starting the experimental runs based on psi mediated information. Thus, the description of DAT holds equally for the experimenter or the participant or both. For instance, in every discipline and every industry, some individuals stand apart from the crowd in their excellence. Undoubtedly, there are many mundane explanations for this, but research has shown that some part of the excellence may be attributed to an innate psi ability. In the classic work *Executive ESP* (1974), Dean, Mihalasky, Ostrander and Schroeder were the first to try to measure the impact of "hunches" and intuition upon business executives' decision making ability. They report significant correlations of business success with the ESP scores of business executives. Through the formulations of DAT, it is this expression of psi that is measured, to determine whether it is a causal or informational effect.

To reiterate what Jessica Utts (2016: 163), former President of the American Statistical Association, states:

> […] "decision augmentation" may be used routinely to help people make better decisions in the present about what actions to take, based on information about the consequences of those decisions in the future. If true, this kind of anomalous information about the future could include knowing when a favorable sequence is about to be generated by a random number generator, and that information could be used (unconsciously) in the randomization phase of clinical trials.

Utts concludes, "[…] the assumptions upon which most medical (and other) research is based may not be accurate" (p. 164).

DAT, Psi Mediated Instrumental Response (PMIR) Model, and Causal Psi (Psychokinesis)

DAT is based on Rex Stanford's psi mediated instrumental response (PMIR) model (Stanford, 1974a, b, 1976). PMIR proposes that an organism unintentionally uses psi to scan its environment for need-relevant objects or events or for information crucially related to such events and that when such information is obtained, the organism tends to act in ways that are instrumental in satisfying its needs in relation to the particular object or event in question.

Stanford outlined how his PMIR model could also apply to PK (Stanford, 1974b). All through his paper, Stanford acknowledges that applying PMIR to PK is more speculative, in that the model is primarily a psychological one—an organism fulfilling some need. Two examples are of note. The first is from what is called nonrecurrent spontaneous psychokinesis. As Stanford (1974b: 323) states:

> A well-known example of such a case is the loud, explosive sound which seemed to come, twice, from a bookcase in the presence of Freud and Jung when they were rather heatedly arguing about the occurrence of psi phenomena (Jung, 1963). In this instance the phenomenon certainly seemed to have need-relevance—at least for Jung, who was advocating the reality of psi phenomena in the face of opposition from Freud.

The second example comes from recurrent spontaneous psychokinesis (RSPK). Again quoting Stanford:

> Parapsychologists today consider that most RSPK ("poltergeist" phenomena) are unconsciously produced by a living individual and subserve his own needs including, often, a need for the release of pent-up feelings which cannot easily find more open expression. […] Such investigations have repeatedly shown that a "central person," or "agent," is involved, a person whose presence seems required for the occurrence of the phenomena. (1974b: 325)

By "poltergeist" phenomena, Stanford means examples of what appears to be macro-PK; that is, objects flying around the room, doors slamming, and the like. As Stanford indicates, even these dramatic events may be mediated by psychological needs of "agents" in the near environment. Often, these people are ostensibly troubled pre- or just post-pubescent teenagers who may feel threatened by the presence of a new infant in the family.

The final point here is that even in remarkably large-scale phenomena, Stanford's PMIR model suggests that people are fulfilling some psychological need—a clear example of what in

modern times we might label as experimenter psi. While Stanford (1974a) outlines nine experimentally testable assumptions for the "psi-mediated instrumental response model" (PMIR model), a few are repeated here for emphasis—using Stanford's numbering:

1. In the presence of a particular need, the organism uses psi (ESP), as well as sensory means, to scan its environment for objects and events relevant to that need and for information crucially related to such objects or events.
2. Preparation for or production of PMIR often involves such changes as motivational or emotional arousal, attention-focusing responses, and other preparation for response.
3. All else being equal, the strength of the disposition toward PMIR is directly and positively related to: (a) the importance or strength of the need(s) in question, (b) the degree of need-relevance of the need-relevant object or event, and (c) the closeness in time of the potential encounter with the need-relevant object or event.
4. PMIR tends to be accomplished in the most economical way possible.

As Stanford (1974a: 43) remarks with regard to the nine PMIR assumptions, "Some of the assumptions already have considerable experimental support; some are untested. All require further investigation."

The Components of Decision Augmentation Theory (DAT) (May, 2015: 207–208)

- *Proposition*. This differs a little from that proposed by Stanford (1974a). That is, we add to the complex number of variables with regard to decision making in general an additional, albeit weak, psi component to "bias" the decision process toward more favorable outcomes. In PK experiments, for example, DAT suggests that rather than mind influencing some target system, an array of precognition-mediated decisions by the experimenter and/or participant mimic PK.
- *Mechanism*. Precognitive IΨ.
- *Domain*. All models have a domain in which they are applicable. For example, the physics theory of special relativity is necessary only for speeds approaching that of the speed of light but can be safely ignored at human-scale speeds. DAT may be important in any experimental study in any discipline that uses statistical inference to come to some conclusion.
- *Falsifiable*. Falsifiable in this context means that psi-mediated decisions that may mimic a cherished hypothesis can be shown to be incorrect. DAT is unfalsifiable for a single point measure—say, collecting RNG data at only one sequence length. However, the

model provides explicit measures to determine which of two competing mechanisms (i. e., PK or IΨ) is a better fit to the data by using two or more measures. For example, in an RNG study, DAT requires taking data at two (or more) sequence lengths.

- *Statistical*. In experimental science, especially that involving human participants, there are two distributions to consider: the parent distribution—the way nature actually is; and the sampling distribution—the collection of data to estimate what the parameters are for the parent distribution. In psi experiments, there are four possibilities:
  - Nothing is happening. Mean chance expectation is confirmed.
  - The parent distribution is perturbed, and the sampling distribution is a fair approximation to it—an interaction is implied.
  - The parent distribution is unperturbed, but the sampling distribution is biased—DAT.
  - The parent distribution is perturbed, and the sampling distribution is biased.
- *Testable*. The model provides a number of ways to test its concepts. By using a multi-point measure (e. g., two different RNG sequence lengths resulting from single button presses), then a basic regression analysis easily provides statistical evidence to support or not a mean shift in the parent distribution. As will be shown later in this discussion, additional tests result from manipulating the number of decision points in a study.

DAT is not limited to experiments that capture data from a dynamic system. DAT may also be the mechanism in protocols that utilize quasi-static target systems. In a quasi-static target system, a random process occurs only when a run is initiated; a mechanical dice thrower is an example. Yet, in a series of unattended runs of such a device, there is always a statistical variation in the mean of the dependent variable that may be due to a variety of factors, such as Brownian motion, temperature, humidity, and possibly the quantum mechanical uncertainty principle (Walker, 1974). Thus, the results obtained will ultimately depend upon when the run is initiated. It is also possible that a second-order DAT mechanism arises because of protocol selection—how the order in tripolar protocols is determined and who determines them. In second-order DAT, there may be individuals other than the formal subject whose decisions affect the experimental outcome and are modified by precognition. Given the limited possibilities in this case, we might expect less of an impact from DAT. DAT, therefore, might be a general model for psi in that it reduces mechanisms for laboratory phenomena to only one—the transtemporal acquisition of information. We must keep in mind, however, that DAT was originally formulated to answer this simple question in RNG: is there a micro-PK force per bit? The answer to that is clearly *no*.

That said, if the "mind" is indeed able to perturb large scale matter, PK can be examined under stringent laboratory conditions to determine the plausibility of such large-scale phenom-

ena. The simple rationale being, if the "mind" can effect change on large-scale matter, so too it is likely that it can effect change at a small-scale. Thus, (1) PK effects can be measured using well-calibrated instruments, controlling for environmental artifacts that may otherwise confound the results. (2) Manipulating RNGs is the method of choice for examining micro-PK effects. (3) Macro-PK can be examined on small-scale physical systems (e. g., strain gauge) and biological systems (e. g., bacteria, marine micro-organisms, blood) (May & Marwaha, 2019a: 12).

In general, causal psi (CΨ), i. e. PK, research poses substantial difficulties in two domains. The first is, the negative definition in that it becomes prohibitively costly to rule out alternatives. The second results from the application of inferential statistics. There is good news in this case, however, by applying a proper protocol, it is possible in many circumstances to determine whether the observed effects were informational or arose from influence of some sort.

The problem of isolating sensitive putative PK hardware from the environment is aptly described in Volume 3 of the Star Gate Archives (May & Marwaha, 2019a). It was, in part, why SRI was not tasked to conduct further CΨ/PK studies. Clearly it is not possible to prove the null hypothesis that CΨ does not exist. The best that can be said is that there is insufficient evidence in support of the causal psi (CΨ) hypothesis. Results from CΨ studies can be understood in terms of DAT; that is, using informational psi that mimics CΨ.

One of the most important conclusions to be drawn from the PK research in the Star Gate program is that conducting proper CΨ research requires substantial engineering skill and insight into the many things that may mimic CΨ but is not. These endeavors were so costly, that it was recommended to the sponsors that they should no longer fund PK investigations. The money would be more productive in the IΨ arena.

Synchronicity, Generalised Quantum Theory (GQT), Model of Pragmatic Information (MPI) and the MMIΨ

One of the key issues raised by the commentators is that, in presenting an analysis based on an IΨ model, we have turned a blind eye to other models (GQT, MPI) in the field. In this section we present an overview of these models, following which a comparative analysis with the MMIΨ is presented.

Intuition, Synchronicity, and Informational Psi (Precognitive)

In his comments, Hartmann Römer states (2019: 70, this issue):

> Searches for stable and reliably usable signals in Psi research were consistently frustrated. Even the big and extensive *Star Gate* project […] did not identify a clear, unambiguous

> and unanimously accepted psi signal. This accumulated negative evidence should leave one prepared seriously to consider the notion of *synchronicity* as envisaged by C. G. Jung and W. Pauli, according to which psi phenomena should not be understood as causal influences or informational signals but rather as meaningful coincidences, i. e., as merely constellational holistic features of some systems.

But first, a brief digression. The Star Gate program at SRI initially examined I. M. Kogan's ELF-psi hypothesis, through efforts such as sensory shielding (under sea water, faraday cages) they found that this did not affect the acquisition of psi information. The question of when and where does the psi percipient acquire the information—when the session is fixed a few days prior, on the way to lab—becomes a crucial problem in shielding studies. That said, it is important to clarify that the Star Gate program did *not* undertake a concerted effort to search for a "psi signal." Nevertheless, the effort in other areas pointed to psi functioning as a sensory system. The subsequent effort at the private Laboratories for Fundamental Research (LFR) has continued the trajectory of the Star Gate research (with very limited funding).

Intuition is generally understood as knowledge or an insight, especially leading to a decision that does not seem to be arrived at by logical deliberation. Often it seems contrary to what would be expected by logical analysis (Broughton, 2010: 61). Intuitive thinking is fast, automatic, and effortless whereas analytical thinking is slow, contemplative, and effortful (Kahneman, 2011; Williams, Kappen, Hassall, et al., 2019). Based on the work of Bechara and Damasio (2005) and Damasio (1994) intuition is defined as:

> […] a complex set of inter-related cognitive, affective and somatic processes, in which there is no apparent intrusion of deliberate, rational thought. Moreover, the outcome of this process (an intuition) can be difficult to articulate. The outcomes of intuition can be experienced as an holistic "hunch" or "gut feel", a sense of calling or overpowering certainty, and an awareness of a knowledge that is on the threshold of conscious perception. (From Hodgkinson, Langan-Fox & Sadler-Smith, 2008: 4)

There are two major differences between IΨ and intuition: (1) the source of data for IΨ is acquired from a distant source in space and time, for intuition through learning, and (2) IΨ is primarily a PD-ND1-ND2 process, whereas intuition is primarily an ND3 process (see Figure 5).

The concept of *synchronicity*, "an acausal connecting principle" that links two events together in a meaningful way, as formulated by Jung (1973), has frequently been considered alongside or synonymous with psi leading to much confusion over the two terms. In synchronicity, we observe relationships between two or more events occurring in the present, but even though the events happen in a meaningful pattern—meaningful to the perceiver—they are not *caused* at any level.

IΨ differs from synchronicity in that it is *not an observation of a meaningful correlation*, but it is the acquisition of *non-inferential information* from a distant spatiotemporal point, and *foreknowledge* of the likelihood of a certain event occurring in the *absence* of any supporting information. The two RV examples cited in this paper are not examples of synchronous events from which the percipient draws some personal meaning, rather they are about an impersonal site, randomly selected from five probable targets, to which the percipient has no emotional attachment, nor do they have any religiocultural or spiritual significance. In fact, in example 2, the percipient was not interested in the target that was yet to be generated at the time of noting his response; nevertheless, the response was ranked 1. The question that must be raised here is, can an existing target site, or target pool, be influenced by the interaction of the percipient at a quantum level? Can the principles of complementarity and entanglement be a possible answer for the two RV examples? We think not.

Generalized Quantum Theory (GQT)

Extending beyond the domain specificity of quantum theory (QT), Atmanspacher, Römer, and Walach (2002) developed the weak quantum theory (WQT) to extend the concepts of complementarity and entanglement beyond physics to philosophical, psychological or psychophysical problem areas (e.g., psychoanalytic countertransference, p. 399) by direct and complete analogy to the physical quantum theory. It was known as the weak quantum theory "because it arose by weakening the axioms of physical quantum theory." However, Filk and Römer (2011: 212) felt that the theory had a far wider range of applicability, hence renamed it the "generalized" quantum theory (GQT). The authors believe that a theory (QT) that "was so successful in explaining the material world might also be useful in other contexts", as in psi phenomena (Walach, Lucadou & Römer, 2014: 612).

As Walach, Lucadou, and Römer (2014: 613) state, "Whenever a measurement necessarily and inevitably impacts on the measured object and changes its state, we have a non-classical situation that needs to be described by a quantum type, or a non-classical theory." In their view, "psychology is in fact a good candidate for a quantum-like theoretical treatment", for instance, in a therapeutic situation, the attention of the therapist alters the state of mind of the client, i.e., the observer alters the state of the observed. As they further state, "GQT, as well as physical quantum theory, predicts a generalized form of nonlocal correlations" (p. 616).

They further state that, as in quantum physics, in GQT entanglement correlations cannot be used for information transmission between different subsystems (p. 618). It is this criteria of no signal transmission in entanglement that probably inhibits them from considering a signal-based approach to the understanding of psi phenomena, aside from the currently undiscovered nature of the putative IΨ signal, which is indeed, a difficult problem.

As Walach, Tressoldi, and Pederzoli (2015: 325) state, GQT is "the theory that our minds, our behaviours, and their physiological correlates can show quantum-like non-local correlations." They ask, how is it possible to create an entanglement between human minds or entangle a human mind with a physical or biological object? There are two main procedures:

> The first procedure type, which we will call Type C (conscious), is based on conscious voluntary, intentional control by a person. Each "mind", meaning each experimental participant, is asked to visualize an image of the mental, biological or physical "object" to be entangled with, and maintain this connection to the object for a given time period so as to seemingly merge with it, simultaneously generating positive emotions related to the target object. For this type of entanglement procedure to be effective, the participants must have a certain ability to concentrate, either naturally, or accomplished by applying meditation techniques.
>
> The second procedure type, we will call Type U (unconscious), is characterized by an unconscious (with respect to the participant) creation of an entanglement between the target and the participant's behaviour and/or psychological and neurophysiological correlates. (p. 316)

In essence, the GQT refers to any form of social interaction and the psychosocial dynamics that give rise to individual and group behavior, both conscious and unconscious, verbal and nonverbal. Social interactions are a continuous process, from within and without, and cannot be quantized. We struggle to understand why this is called the generalized *quantum* theory, and its relation to psi phenomena.

Walach, Tressoldi, and Pederzoli (2015: 320) use the example of a meta-analysis of intentioned healing by Roe, Sonnex, and Roxburgh, (2015), where standard statistical methods have been used, and cast it in the language of the GQT. This leads us to the view that, possibly, the GQT is essentially a method of analysis, rather than an explanatory model of conscious or unconscious processes for understanding IΨ. Within the context of GQT, the RV examples 1 and 2 (see figures 1–3) in this paper cannot be explained only in terms of Type C (conscious) or Type U (unconscious) processes, it *may* be possible to use the GQT formalism to analyze the data.

The Model of Pragmatic Information (MPI)

The Model of Pragmatic Information (Lucadou, 1987) starts from a system-theoretic perspective, using concepts from GQT, and is now considered as a subclass of the GQT (Lucadou et al., 2007). It is applied primarily to the analysis of various types of PK events, including both macro- and micro-PK, particularly to recurrent spontaneous psychokinesis (RSPK). Like the GQT, the MPI assumes that the structure and function of a system are complementary observ-

ables. Entanglement correlations are pattern matches within organizationally closed systems measured from outside of the system that are created by the relevant pragmatic information. The model draws from Jung and Pauli's synchronicity theory, and does not consider psi phenomena a result of any causal influence of mind on matter or other minds. Rather, it employs "meaningful coincidences" as correlations mediated by correspondences of sense and meaning. Like the GQT, it is a phenomenological model that operationalizes the process and interprets our description of our interaction with the external physical world (Kornwachs & Lucadou, 1985; from Lucadou, 2015: 221–222).

The two basic assumptions of the MPI are: (1) any description of nature must have a structure similar to the axiomatic structure of quantum theory (QT), and (2) there must be an exchange of a minimal amount of pragmatic information or interaction with another system to enable informational exchange and a measurement of it (Lucadou, 2015: 223).

The most important aspect of the MPI is the so-called "nontransmission-axiom", which assumes that the origin of psi phenomena are not signals, but entanglement correlations, which are created by the "meaning" (pragmatic information) of the situation (Lucadou, Römer & Walach, 2007). MPI and GQT assume that these entanglement correlations cannot be used as signal transfers or causal influences.

Key Concepts of the MPI

- *Pragmatic information (I)*. The meaning of given information measured by its action on a system.
- *Novelty (E)*. Aspect of pragmatic information that is completely new for the receiving system.
- *Confirmation (B)*. Aspect of pragmatic information that is already known by the receiving system.
- *Autonomy (A)*. Behavior of a system that cannot be predicted.
- *Reliability (R)*. Behavior of a system that is expected.
- *Temporal dimensionality (D)*. Measure of the interrelationship of temporal events that belong to a history.
- *Minimum action (i)*. Smallest amount of action on a system that cannot be avoided during a measurement or observation. (Lucadou, 2015: 225)

The concept of pragmatic information has been developed to quantify the meaning of given information. It is assumed that the potential action that the meaningful information exerts on a system can be used for such quantification.

The GQT-MPI and the MMIΨ

In this section we briefly discuss the GQT-MPI and their relation to the MMIΨ. Several of the issues raised in the commentary by Drs. Walter von Lucadou and Hartmann Römer are addressed in the section on decision augmentation theory and the following section.

Lucadou (2019: 55, this issue) states: "Finally, it must be mentioned that on the basis of the GQT and the MPI it is not necessary to negate a large part of the spontaneous phenomena such as RSPK just because it does not fit the IΨ model. This shows that entanglement relationships (embodiment) can be quite powerful (Lucadou & Zahradnik, 2004, 2006)."

The GQT-MPI is a phenomenological model, whereas the MMIΨ is a process-oriented model. Despite this fundamental difference, the GQT-MPI can be placed within the ND3 of the MMIΨ—the cognitive-experiential part of the process (see Figure 7).

Phase	Theories
PHASE I: PHYSICS DOMAIN	Hyperdimensions (Carr*) ★ MMIΨ Entropy (May & Depp*) Approaches based on quantum mechanics*
PHASE II: NEUROSCIENCE DOMAIN	Evolutionary approach (Broughton**)
Stage 1: Transducer	★ MMIΨ
Stage 2: Cortical Signal Processing	★ MMIΨ
Stage 3: Cognitive Processing	★ Consciousness induced restoration of time symmetry (Bierman*) – IΨ ⅄ Consciousness-quantum mechanics based approaches – IΨ and CΨ ★ Decision augmentation theory (May, Utts & Spottiswoode*) – IΨ ★ First Sight model (Carpenter*) – IΨ ⅄ Generalized quantum theory – IΨ ★ Model of pragmatic information (von Lucadou*) ★ Psi-mediated instrumental response (Stanford) – IΨ ★ Theory of Psychopraxia (Thalbourne) – IΨ and CΨ
★ = testable; ⅄ = untestable	* May and Marwaha (2015); ** Broughton (2015); Thalbourne (2004)

Figure 7: Comparison of psi models

The GQT-MPI is primarily applicable to transactional situations and RSPK phenomenona. In our principal paper, we state: "Although field research has led to observations of macro-PK events that do not have easy or conventional explanations, they are difficult to tease into the laboratory and must be examined on a case-by-case basis" (p. 33, this issue). We make no claims of including behaviorally related phenomena in our concept of IΨ. It is simply a source-transmission-detection-processing model. This is also indicated in the definition of IΨ and the explanation of the definitional terms (pp. 15–18, this issue).

For the benefit of the readers, we provide here the meaning of poltergeist phenomenon (RSPK), as stated in the Society for Psychical Research's online *Psi Encyclopedia*.

> "Poltergeist", a German term meaning "noisy ghost" is traditionally used to describe the rare but extensively documented phenomenon of anomalous disturbances arising in connection with a particular place or person. The disturbances are characterized by "rapping" or "knocking" noises of unknown provenance, along with the anomalous and often violent movement of furniture and other objects, outbreaks of fires, inundations, and the like. The commotion often appears to have a mischievous intent, hence the traditional tendency to associate it with ghosts or other supernatural beings. However, in many cases it may equally be attributed to a force emanating from a living person, typically a child who exhibits symptoms of repressed emotion. An alternative view, not endorsed by most serious investigators, is that the phenomenon should be accounted for entirely in terms of trickery and natural events such as seismic activity (Colvin, 2015).

This description of RSPK is not related to the IΨ construct and the MMIΨ. That said, this exercise has served to be fruitful as we are now in a position to re-classify psi phenomena based on empirical evidence and theoretical understanding, rather than club all anomalistic psychology under the umbrella term "paranormal" or "parapsychology".

The proponents of GQT-MPI address all psi phenomena through this model, and agree that information is at the crux of the matter. GQT-MPI still needs information transfer and information processing to account for psi based information. Information from point A to point B requires transmission (PD), detection (ND1), processing (ND2), and storage and utilization (ND3) of the information obtained.

Some issues about the GQT-MPI that need clarification:

- In the GQT-MPI, the person is asked to mentally connect—get entangled—with the mind of another person or a target site (Walach et al., 2016: 317). The question remains as to what exactly is this "connection" that enables a remote viewer to produce the examples shown in figures 1–3 in this paper?
- In the GQT-MPI, there is no clarity on how the "mind" can become entangled with an external target.
- What exactly do we mean be entanglement in this context? What exactly is happening here? If it is imagining the target, it is not an IΨ condition, as the informational transaction is occurring *within* the percipient, and *not between* the percipient and the target. This implies that the system 1 (percipient) is using data stored within it, rather than acquiring new data from system 2 (target), as is the central condition for IΨ. It must be emphasized here that the information that the percipient acquires through IΨ processes,

is also stored in memory and brought up at opportune times, for instance, during the RV session, in dreams, and tacit knowledge on the basis of which he makes decisions.

- If there is entanglement, it implies that the mind, however defined, in some form or the other reaches out to the mind of another, or an object/site, and gets information. In this instance too, an information carrier is required. However, as Walach, Lucadou and Römer (2014: 618) state, entanglements cannot transfer information. In which case, how do we explain the two RV examples (figures 1–3) presented in this paper?
- Since there is no specific difference between the different types of psi phenomena in the GQT–MPI (Walach, Tressoldi, & Pederzoli, 2016), it will not be erroneous to state that the GQT concurs with our view of the unity of psi phenomena.
- If mind/consciousness is the principal agent, the question arises, how can a non-material mind/consciousness collapse the wave function, and interact with the material world?

Response to Comments

In this section we address some of the issues raised by Drs. Hartmut Grote, Walter von Lucadou, Michael Nahm, Dean Radin, and Hartmann Römer on our paper "Informational Psi: Collapsing the Problem Space of Psi Phenomena"; the finer details of some of these are beyond the scope of this paper.

Towards Simplicity

It is important to take stock periodically of where we are in understanding complex phenomena so that it can guide in laying out the trajectory for the future course of research. The move towards simplicity perforce includes accepting or rejecting what has been historically proposed, and incorporating changes in classification and nomenclature based on empirical evidence and theoretical advances. Simplicity by no means imply simplistic. Simplicity also implies first resolving a problem by using known laws and principles that have withstood the test of time across several domains, failing which, seeking solutions that are fundamentally different.

An overview of the commentaries indicates that the reviewers have conflated the phenomenon of informational psi (IΨ), the temporality of the phenomenon (precognition), the target (clairvoyance, telepathy, PK), and the model of IΨ. This conflation is an extension of the historical treatment of the subject. As John Palmer (1985) has stated:

> The term *psi* is defined negatively as some process that transcends currently accepted physical principles. It is not surprising, therefore, that the approach to its verification or

> validation has also been negative […] psi is considered to have been demonstrated if, and only if, all conventional processes, i. e., processes subsumed under the basic limiting principle, has been eliminated. (p. 10)
>
> […] no clear distinction is made between the [psi] phenomena under study and the quasi-theoretical principle [paranormality] proposed to account for them, between the explanandum and the explanans. (p. 13)

Thus, developing a model that is framed on the basis of a "reductionist physicalist world view […] in which mind/consciousness is regarded as a mere emergent phenomenon of brain chemistry that cannot have any effect on its environment" (Nahm, 2019: 57, this issue), also follows the line of simplicity. Attributing the process of one mystery (psi) to another mystery (nature of consciousness, whether brain based or transcendental) does not lead us very far, if understanding the *explanandum* and *explanans* of psi is indeed the aim of psi research. The advantage of identifying the core aspect of a personal experience and understanding the process of how it happens, makes a seemingly difficult problem easier to address, even though individual elements of the process may be, at this point, difficult or incomprehensible.

Informational Psi (IΨ)

In defining IΨ (see p. 15, this issue) we have clearly identified the phenomena that comes within its purview. We reproduce the figure that was presented in the principal paper, with slight modifications—PK on small-scale physical systems (e. g., strain gauge; see May & Marwaha, 2019a)—that lists the phenomena that are included within the IΨ construct, as information from the external world is at the core of these experiences (Figure 8). That "there then also have to be other forms may be other forms of psi different from IΨ" (Grote, 2019: 52, this issue), such as RSPK, apparent levitations, which have a different etiology, is not included within the IΨ construct.

Signals from the Brain

Comment: Grote (2019: 53) raises the question "If the signaling process is a physics-based one, then why would the brain (a physical system after all) not be able to send out psi information as well?"

Response: We have addressed this issue in the section on telepathy in our main paper. Briefly, even though the brain is a physical system, "(t)here is no evidence for informational signals emanating from the brain that can propagate across distant spacetime" (Marwaha & May, 2019b: 26).

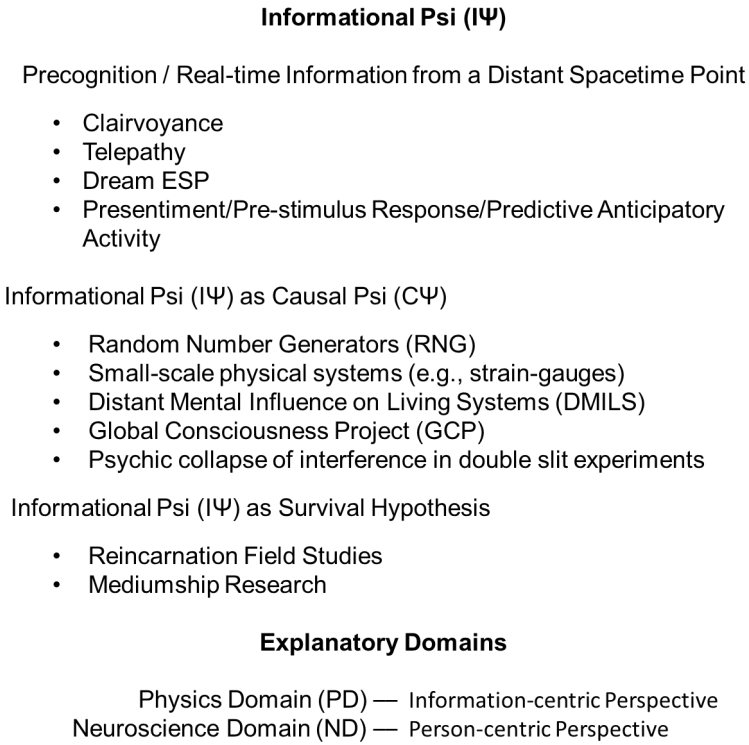


Figure 8: Phenomena included within the construct of informational psi

Informational Signals

Comment: Nahm (2019: 58) "[…] they don't mention the problems of percipient selection and timing, which are of at least similar importance, especially in collective and/or reciprocal ESP experiences."

Response: This is one of the questions that is open for investigation. The entropy hypothesis may come into play regarding how the percipient "selects" the informational signal. An analogy will serve us well here. In a crowded noisy room, one has to speak loudly to be heard by someone standing next to us. However, our attention immediately turns to the direction from where we hear our own name being called or the loud crash as a tray full of dishes lands on the floor.

Informational Signals, Meaning, and Emotions

Comment: The question of informational signals, meaning and emotions has been raised severally. As Römer (2019: 70, this issue) states: "A decidedly physicalist-reductionist world-view forces the authors to employ Shannon's notion of quantified information, stripping off from information any aspect of meaning. On the other hand, multiple experience with psi phenomena points to a crucial importance of meaning and emotion." Nahm (2019: 57, this issue) raises a related question: "[…] how mind/consciousness-related information including emotional content is loaded onto physical waves […]"; Radin (2019: 68) " […] 'informational aspects' was not meant in the entropic sense, but rather in the sense of meaning."

Response: This may be a misunderstanding of the physicalist-reductionist view, or at least a generalization. All proponents of this view do not deny the finer aspects of human nature—feelings, emotions, spirituality, creativity, abilities. The entire field of cognitive sciences is engaged in examining these issues. These human experiences, in fact, spur curiosity to seek answers to the question how does the biggest mystery, the human brain, give rise to these soul stirring experiences.

Emotional content is not "loaded on to physical waves". The meaning and emotional valence of information is attributed by the individual and is not in the "pure" external signal. For example, seeing the setting sun gives rise to different emotions in different people; for a couple seeing the sunset by the beachside, this may evoke feelings and emotions of romance, whereas, for children playing alongside, it may evoke concern that they have to be home before darkness sets. The MMIΨ incorporates the experiential aspect in ND3. The meaning of acquired information also rests in the ND3 and not in the PD (see Figure 5).

The MMIΨ

Aside from the concern about a physicalist-reduction approach to psi, several issues have been raised against a signal-based model, which we state and address in the following.

Comment: None of the problems associated with "physicalist wave-based models has been solved […] as a consequence […] always played a negligible role in parapsychological theorizing" (Nahm, 2019: 58, this issue).

Response: Dividing the problem space into the physics domain (PD) and neuroscience domain (ND) provides an approach to address the complex problem of IΨ. This enables experts to address domain specific problems, without being much concerned about the other domain. That there are several questions related to a signal-based approach, does not imply that it

should not be examined. This is particularly so because none of the other theoretical approaches have provided a satisfactory explanation for the process of psi. Since signal-detection is the way things work for our other senses, there is no real reason why psi should be different. Unless this approach has been conclusively rejected, it renders all other approaches open to question, as signal-detection is always an alternative.

Comment: Nahm, (2019: 57, this issue): "[…] how the percipients of extrasensory perception (ESP) are successfully selected among the millions of other potential percipients, […]".

Response: As Rhine and Pratt (1950: 83) report, "[…] the Boston Society for Psychical Research the estimates [for psi-gifted] varied from 1 in 4 to 1 in 7 people. Our estimate of 1 in 5 extrasensorially perceptive persons shows an interesting correlation to these figures." Using the Ball Test, Ertel (2015: 164) reports an estimate of 15–20% psi-gifted people (which is 1 in 7 to 1 in 5, using Rhine's scale). As the meta-analysis of the SRI RV studies concludes: (1) approximately 1% of the general population possesses a natural RV ability. [In recent writings, we have amended this to mean *selected* populations.], (2) experienced viewers are significantly better than the general population, (3) RV ability does not degrade over time. (May, Utts, Trask, Luke, et al. 1989/2018: 316).

The MMIΨ proposed hypotheses in the neuroscience domain—ND1 (psychophysical variability in signal transducer), ND2i (cortical hyperconnectivity), and ND2ii (sensory gating deficit)—are designed to identify psi-adepts.

Comment: Nahm, (2019: 57, this issue): "[…] how the often delicate timing of the ESP reception is accomplished, […]".

Response: The psi experience is not a multimedia extravaganza. In a sense, it is like having a conversation across a noisy crowded room, picking up some words, and then subconsciously filling in the context and content of the information based on the vast information already stored in memory, or correctly reading a sentence of jumbled words. One of the biggest challenges of psi research is that we do not know when and where the psi information is acquired. Experiment participants tell us that they do not have control over when they are "psychic". The process of assimilating psi data may start when notified of the impending RV session (or even before), during/after fixing the date for the session, or before the start of the session itself. (Most sessions are of 15 minutes duration). As viewers have reported, they find it very difficult to pinpoint a specific time when the perception of the data actually took place. Thus, by the time the viewer starts the session, he may have unconsciously assimilated several bits of information and processed it—as with other sensory information—such that it enables him to express the information during the session in the form of drawing, writing, narrating, or as dreams (Marwaha & May, 2019a: 26).

Comment: Nahm, (2019: 57, this issue): "[…] how this information is decoded to result in perceptions of events that mimic usual perceptions obtained via the normal sensory channels."

Response: The decoding of sensory signals is a normal cognitive process, and is accounted for in stage 3 of the neuroscience domain (ND3) of the MMIΨ. Since this inquiry is part of the cognitive sciences, we have not elaborated on it. The point to be emphasized here is that psi does not *mimic* normal perceptions, but is a normal perception, albeit, an atypical one.

Comment: The model does not address percipient "idiosyncrasies (and) poses difficulties for the model" (Nahm, 2019: 58, this issue).

Response: In the ND, we clearly state: "This hypothesis is based on the fact that individual differences are the sine qua non of biological and psychological development" (Marwaha & May, 2015a: 8). Individuals differ in the way they learn, for example, visual presentations, when they hear or read the matter. These individual differences, idiosyncrasies, will also influence the ways in which they process and express psi information, similar to information to other senses (Marwaha & May, 2019a: 18).

Comment: The model does not take into account the mental state of the sender/percipient. (Nahm, 2019: 59, this issue).

Response: "[…] psi ability appears to be statistically stationary over the life-span within a given individual, although, like other human activities, there is considerable variability across individuals during periods of physical/psychological stress, effects of medication, inattention due to various factors; not all of these factors are completely known at this time" (Marwaha & May, 2015a: 11; Marwaha & May, 2019a: 16; McMoneagle & May, 2004/2014).

Comment: "Analyses and discussions of apparitions have a long-standing tradition in the history of psychical research as well. Thus, they also need to be accounted for in the MMIΨ. […] the MMIΨ must offer alternative hypotheses about how veridical (crisis) apparitions that have been collectively and congruently perceived from different visual angles by different percipients can be explained by precognition" (Nahm, 2019: 59, this issue).

Response: While the MMIΨ does not address apparitions, other researchers have reported positive relationships between self-reports of auras and such seemingly psychic experiences as apparitions, ESP, out-of-body experiences, as well as mystical experiences and lucid dreams (Alvarado & Zingrone, 1994, 2007–2008; Kohr, 1980; Palmer, 1979, from Zingrone, Alvarado, & Agee, 2009).

Zingrone, Alvarado, and Agee (2009: 131) hypothesized that "[…] 'aura viewers' would report a higher frequency of other seemingly psychic, mystical and lucid dream experiences and a higher number of discrete psychic experiences than 'non-aura' viewers. […] aura view-

ers would obtain a similar relationship with synesthesia-like experiences and with measures of dissociation […], absorption […], and depersonalization." On the basis of their survey reports, they state: "This provides some support for the idea that the visual experience of an aura may be related to the transformation of information from a particular sensory modality, or from vague emotional impressions into perceptions of lights or luminous fields" (p. 162). If apparitions and auras are indeed manifestations of synesthetic experiences, they may have their basis in cortical structural hyperconnectivity, which is found to be the basis of synesthesia (Rouw, 2013: 513), and is also our hypothesis for stage 2 of the neuroscience domain.

Comment: "[…] the assumed entropy-driven precognitive information channel […]" (Nahm, 2019: 62, this issue).

Response: The entropy hypothesis is based on several studies, as elaborated in this paper. The physics domain (PD) is clearly a difficult problem, hence, several speculative approaches need to be considered.

Precognition: The Only Form of Psi?

Comment: "If one accepts the general veracity of the empirical findings of parapsychology considered in this article, precognition cannot be the only form of psi. Hence, if the conceptual implications of the MMIΨ for ESP are thought through to the end, the fundamental axiom of the MMIΨ must be regarded as refuted" (Nahm, 2019: 63, this issue).

Response: Assuming the validity of a signal-based approach, we may consider that, while informational signals are emerging from a future point in spacetime, from the person-centric perspective (ND) the information signals are present in real-time, unless we are willing to propose that the nature of putative IΨ signals differ based on their spatiotemporal origins. This implies that, from the person-centric perspective, all perception, regardless of its temporal origin, is local. This may hold the very concept of "pre"-cognition (a person-centric perspective) redundant. This is one of the reasons why we adopted the term "informational psi", instead of "precognition". Considering the validity of precognition studies, it is very difficult to determine exactly when the percipient acquired the information; it appears impossible to close the future door for the experimenter/percipient. Nevertheless, we continue using the term "precognition" because of its operational definition (target generated *after* the response is recorded), and for historical continuity of the term (Marwaha & May, 2016: 25f).

Comment: "[…] it is important to understand that information gained precognitively from a future point in spacetime *principally cannot contain information from the past that is unknown*

to all individuals involved in the presently occurring precognitive affair […]" (Nahm, 2019: 61, this issue).

Response: In most free-response IΨ experiments, whether a response is secured before or after the target is generated, the feedback is provided about 5 to 30 minutes later, either by showing the randomly selected target image or taking the percipient to the randomly selected target site. In some experiments or field studies the feedback is never provided or made available to the experimenter and participant several years down the line, as was the case for the operational RVs in the Star Gate program. In these instances the source of IΨ may be the target itself, and a potential "answer" book unknown to the team, or an answer book in the future. Since we do not know the temporal limits of psi information, we have to consider the possibility that there may always be a description of the target in some form or the other in the future or a distant location that serves as the answer book—the source of psi information.

Survival Hypothesis and Precognition

Comment: Nahm (2019: 61, this issue) raised several questions regarding precognition and the survival hypothesis. He argues that for "young children who claim to remember a previous life in CORT [cases of reincarnation type] cannot have obtained paranormally gained knowledge about the previous personality's life via direct precognition, but only via precognition of feedback received, for instance, via discussions about this previous personality."

Response: In our view, this would indeed be the case, although, feedback is not a necessary condition. In order to determine from what time frame RV information originates, Lantz, May, and Piantanida (1990) examined the role of precognition and feedback on RV quality. While there was evidence for RV (IΨ), none of the data showed significant correlation of feedback intensity with RV quality.

Comment: Citing the example of James Leininger, Nahm (2019: 61) argues against the primacy of precognition. In his view "(t)his logical circle and unsolvable paradox is rooted in a grave conceptual problem of the MMIΨ."

Response: Here we lay out the argument:

- *Circular argument:* (1) Little James precognitively receives information about his past-life. (2) He informs his parents (source of data for parents). (3) The parents provide feedback. Circular argument if James' source of information is the feedback—possible answer book 1, and the parent's source of information is James.
- *Precognition argument:* (1) Little James precognitively receives information about his past-life. (2) He informs his parents. (3) The parents find information to verify what

James has said from other sources—plausible answer book 2. (4) Parents provide feedback to James.

- *Source of James' psi information:* Answer book 2. (1) James receives precognitive information from answer book 2; (2) He informs his parents; (3) The parents find information in answer book 2 to verify James' story; (4) Parents provide feedback to James. If there is no answer book 2, there is no way to determine the validity of James' story.

For all psi experiences, there has to be a potential answer book in the immediate or long-term future that serves as a source of IΨ. Even in the absence of feedback (answer book 1) to the percipient, the answer book 2 still exists.

On a related issue, in a review of the Templeton Foundation supported Immortality Project Research, Cholbi (2018: 20) reports that "Fischer and Mitchell-Yellin (2016) deny that near death experience is metaphysically significant, but they affirm that it is ethically significant, inasmuch as such experiences are often life transforming and offer inspiring utopian visions of social harmony and peace."

Survival Hypothesis and Super-Psi Hypothesis

Comment: According to Nahm (2019: 60), "the move to equate IΨ with living agent psi is highly problematic. Living agent psi is often called superpsi to highlight the very high quantity and quality of telepathy and clairvoyance required in this model."

Response: Like other inherent skills, psi ability too is seen at varying levels of proficiency across the population, probably dependent on stages 1 and 2 of the neuroscience domain—ND1 and ND2 (Marwaha & May, 2015a: 8).

Data from operational/applied RV with highly gifted psi-adepts reveals a remarkable amount of detail in their reports. One of the classic examples is the September 1979 RV of a Russian submarine base from the United States by Joe McMoneagle. The remote viewer was tasked on this across several sessions. The information provided to the viewer included earth coordinates of specific building of interest and building photo. The reviewer reported the construction of a typhoon class submarine in the location, where the intelligence agencies knew something was happening. He also reported that a large new submarine would be launched in 100 days, from the date of the session. The intelligence agency reported that in late January 1980, approximately 120 days after the sources data, the new Typhoon class submarine was sighted in the harbor. (Detailed transcripts of two sessions are presented in McMoneagle, 2015).

There are several other examples such as this that formed a part of the Star Gate operational/applied RV program. The concept of "super-psi" has not been invoked for the very high

quantity and quality RVs. Remote viewing is a methodological procedure that was adopted for precognitive and real-time psi applications.

The super-psi hypothesis is defined as a "more refined and extensive psychic functioning that we discuss in controlled laboratory studies" (Braude, 2003: 11), That is, super-psi is psychic functioning of an extent and complexity without bounds (Rock, 2013: 12). However, as Beischel, Boccuzzi, Biuso, and Rock (2015: 85) state:

> […] survival psi, somatic psi, and even the oft-mentioned "super-psi" are theoretical constructs; just names for ideas that are not backed by any empirical evidence. […] Because we can neither disprove that mediums are communicating with the deceased nor disprove that communication with the deceased is part of every type of psi experience (i. e., telepathy, clairvoyance/RV, precognition, and psychokinesis), it would be irresponsible to posit a general "super-survival" theory for all psi phenomena or to continue to use super-psi-like explanations for mediumistic experiences.

Thus, including mediumship within the IΨ construct is appropriate, as acquiring information without normal sensory mediation is at the crux of the experience.

Open Questions

Some of the key questions in the physics domain include:

- What is the psi information signal carrier that can propagate backward in time, and can interact with and be processed by the brain?
- What is the actual transmission rate (bits/symbol) of the IΨ data and what are its limits?
- Is the information arising from actual or probable futures?
- From where does the information arise — from an event or from later feedback?
- Does the non-stationary nature of IΨ arise from the source or the channel capacity of the transducer?

Some of the key questions in the neuroscience domain include:

- When and where does psi happen?
- For how long does the reception of IΨ signals last?
- What and where is the nature of the signal transducer for the processing of IΨ signals?
- Which are the CNS regions involved in IΨ perception?
- What allows the participant to focus upon the relevant psi information?

This exercise of addressing critical comments and concerns about the IΨ construct and the MMIΨ leads us to conclude that it is premature to outright reject a signal-based approach to psi without empirical evidence to invalidate it. The possibility of IΨ signals will always confound the assessment of any other model as possible mechanisms for IΨ. The crux of the psi experience is indeed understanding the nature of time and information. The final frontier for understanding psi rests in the physics domain, for which the neuroscience domain has the potential to provide clues.

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