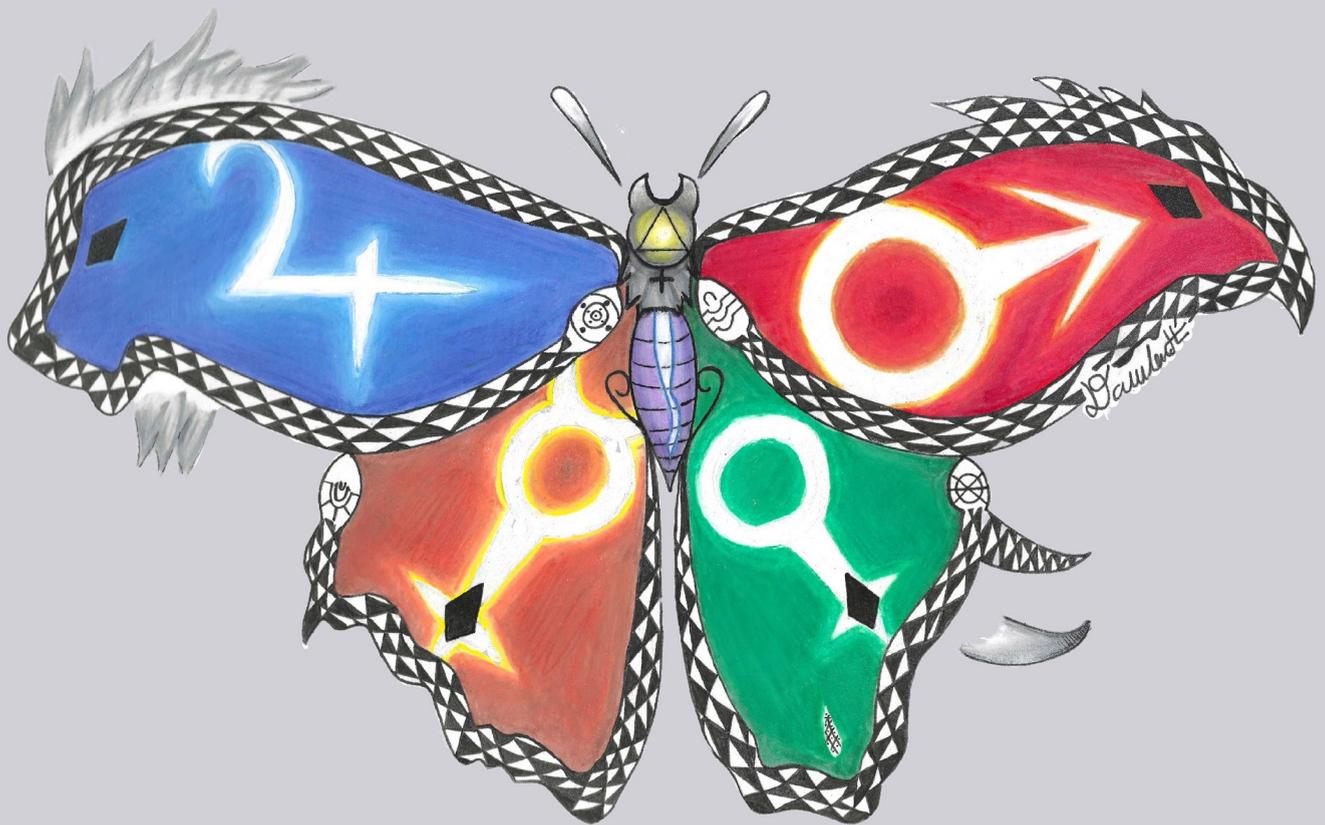
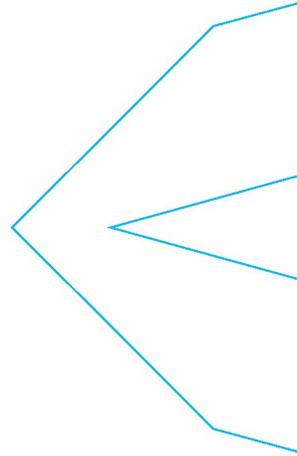


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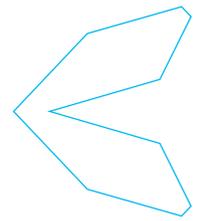
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EDITORIAL

To Engage, Inform, and Inspire: The Many Facets of Scientific Writing

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Why does anyone invest the time and effort to write (or even to read or review) journal articles? It is easily presumed from the long history of scientific publishing that the obvious answer is to communicate new knowledge or information. In fact, the demand by many journals for submissions with lower word counts arguably encourages an economy of expression that better engages and collectively benefits publishers, authors, and readers, all of whom compete in an information-saturated society which has a shrinking attention span (Lorenz-Spreen et al., 2019). For example, shorter and easier to understand article titles tend to garner more interest and citations (e.g., Habibzadeh & Yadollahie, 2010; Letchford et al., 2015). This is critical intel given Meho's (2007) research indicating some 90% of papers published in academic journals are never cited and that 50% of papers are apparently never read by anyone other than their authors, referees, and journal editors. In some sense, academic writing is revisiting its historical roots as simple correspondence between colleagues (Kronick, 2001). But other literature suggests additional facets or purposes of scientific writing — some transactional, others transpersonal. These are worth noting and even protecting because they are in danger of being stifled as greater emphasis is placed on brevity versus creativity. Three key categories neatly describe these broader and equally legitimate author motivations.

SCHOLARLY & HISTORIC DOCUMENTATION

To be ignorant of what occurred before you were born is to remain always child.
(Cicero, 1913, p. 395)

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There are meta-realities to many articles that transcend topical summaries of new information or cumulative knowledge. *First*, papers can be real-time archives of technical information that increase the transparency and access to important raw data for verification or extended analysis, as well as critical details that enable others to conduct strict or conceptual replications. Data sharing used to be a common and expected part of academic etiquette, but sadly has become an increasingly thorny issue (e.g., Evans, 2010; Gewin, 2016; Nelson, 2016; Parka & Gabbard, 2017; Soranno et al., 2015; Tenopir et al., 2011). Thus, one may understandably ask what constitutes *too* much detail or data to share with readers? Authors can sometimes file information with online repositories, and a number of journals likewise offer options for archiving datasets or other supplemental material. On the other hand, authors or journals do not always have these options or capabilities, which can introduce multiple steps for interested readers or researchers. There is something constructive, therefore, about papers being conveniently self-contained and comprehensive. Simply put, saving readers' time is surely as desirable as conserving journal space.

Second, articles of all types often and unwittingly serve as records of time, place, or other contextual variables that will help future researchers to understand the academic eco-system of the day that produced those works. Publications can thus reveal important insights about scientific trends or switching behavior (akin to “fads or crazes,” see, e.g., Zeng et al., 2019) across themes, approaches, or ideologies that define a particular Zeitgeist. Cyberpsychology was all the rage 20 or so years ago when the internet became a tool of the masses, whereas twenty years from now, scientists will undoubtedly revisit with fresh and discerning eyes the assumptions and conclusions that dominated the myriad of studies on purportedly “conspiratorial thinking and misinformation” about the COVID-19 pandemic. Superficial content analyses of article titles or keywords are always feasible, but studies that aim to explore complexities and nuance arguably can only be done with material containing rich details.

PROFESSIONAL LEARNING & DEVELOPMENT

Publish or perish
(Coolidge, 1932, p. 308)

Career pathing and self-improvement—key elements of a professional scientist’s self-concept—are obvious and potentially strong tangible benefits of academic writing. A transpersonal perspective might go further to suggest that some papers can promote an author’s “self-expansiveness.” This term denotes the malleable nature of self-concept, which can expand under certain situations and cause people to understand their identities as something beyond the limitations of “self” and the here-and-now (Friedman, 2013). For example, the ongoing process of writing (and reading others’ works) provides important lessons about the best ways to organize or articulate one’s observations or arguments. Influential publications indeed bring a certain level of prestige by demonstrating research productivity or establishing ownership of ideas, that is, taking public credit for ground-breaking methods, important observations, or innovative conclusions (see e.g., Rawat & Meena, 2014). This can positively affect a researcher’s job prospects and ability to be promoted or gain tenure, as well as other financially profitable arrangements in academia or even overtures for commercial consultancies. But other direct rewards are no less profitable. The writing process and aftereffects of articles can set roadmaps for new work or bring invitations or introductions to fruitful scientific collaborations that push an individual’s personal and professional development. Expanding one’s professional networks or intellectual boundaries are wonderful outcomes that also advance

the scientific process, but be wary of giving undeserved (or “honorary”) authorship or not being formally acknowledged for one’s contributions to published works, i.e., “ghost” authorship (Pruschak & Hopp, 2022, p. 1)

PERSONAL LEISURE & ENRICHMENT

Either write something worth reading or do something worth writing
(Franklin, 1738, Month: May, Column: 2)

Some authors approach academic writing as a wearying chore or necessary evil. Yet, colleagues more often tell me that it gives them a satisfying sense of building or creating something novel and meaningful. A select few have even described what sounds eerily like enlightening “Eureka or Ah-ha!” experiences during the writing process. The online *APA Dictionary of Psychology* (2023, para. 1) describes this as “the emotional reaction that typically occurs at a moment of sudden insight into a problem or other puzzling issue. It is the experience one would have upon realizing, for example, how to fix a computer problem, master a dance step, or resolve some other difficulty. In psychotherapy, it is specifically a client’s sudden insight into his or her motives for cognitions, affects, or behaviors.” This is perhaps not too surprising. Moravcsik (1974) noted long ago that both artists and scientists are similarly motivated by a strong sense of *curiosity*, with *inspiration* then compelling these creative individuals to act on their insights and ideas (Oleynick et al., 2014).

Paralleling the idea of self-expansiveness above, Varella (2021) further observed that *intrinsic* factors (e.g., personal taste, aptitude, fulfillment) typically are more important artistic motivations than *extrinsic* factors (e.g., the influence of social norms, salary, or prestige). This is certainly not a hard-and-fast rule, as some research has found mixed results concerning the effects of intrinsic versus extrinsic rewards on scientific and artistic creativity (Xue et al., 2020). But, the point still stands that scientific research and writing is inherently a creative outlet for self-expression (Massoudi, 2003). In fact, Qiang et al. (2020) reported that a “creative self-concept”—the belief that one has the capacity to perform creative work effectively (Tierney & Farmer, 2002)—fully mediated the link between critical thinking disposition and scientific creativity.

ARTICLES WITH THE “WRITE STUFF”

It is reasonable to ask what all this means for *JSE*’s standards for submissions. Make no mistake: clear, direct, and concise writing is valued and encouraged. Many examples readily demonstrate that judicious editing can

transform *good* papers into *great* ones (Bem, 2004; Sternberg, 2018). While scientific publishing is not exactly “show business,” it is a “show and tell” business. Readers might thus expect articles to capture their attention and interest, next convey critical ideas and information, and finally stoke personal or professional enrichment or spur new thoughts or actions. Simply put, articles with the “write stuff” should altogether engage, inform, and inspire readers. The same also could be said for entire issues of journals. It is, therefore, better for frontier scientists to have the journal space to suitably explain and express themselves rather than editing to the point where large theoretical, explanatory, or contextual chunks go missing. This is a tricky balance, but ease of reading can have a cost in detail. Accordingly, the editorial team tolerates - sometimes to others’ irritation - lengthier papers when the scale or scope of exposition seems warranted for various reasons.

Allowing flexibility and creativity in academic writing might further benefit some readers. Hollis (2021) reported that *nonfiction* writing was valued for its directness, assessable authorship, and questioning. However, *fiction* writing was found to uniquely drive critical evaluations through the subtle and circuitous way it presented ideas, its complication of veracity, as well as giving rich and deep understandings of the real-world. These findings suggest that fiction reading experiences are connected with critical thinking in ways distinct to nonfiction and could be an avenue for promoting critical thinking or understanding in readers with less technical knowledge of a particular topic. Longer, more “expressive” articles might effectively draw on this principle. Scientific papers certainly should not be book-length, but neither should they constitute a dense collection of dull, tedious, or elitist phrases. Objective and fact-based writing certainly can be infused with energetic elements, descriptive content, and boldly stated insights or conclusions.

Journal editors wield tremendous influence as gatekeepers of scientific information (Primak et al., 2019), but at the same time, academic journals often have multi-faceted goals (Rallison, 2015). My own stance is that Editors-in-Chief should promote not only the transactional goals of scientific articles (i.e., the clear and direct communication of quality data and analysis) but likewise recognize and support their creative or transpersonal aspects. This is why we have published, for instance, lengthier Guest Editorials that are citable as “edutorials,” i.e., integrative and data-driven commentaries versus mere diatribes or opinion pieces. Most topics covered in the *JSE* are likewise quite complex and controversial, even to other frontier scientists. Added to this is our request that authors discuss in their papers how their frameworks,

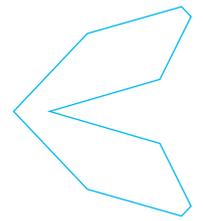
methods, or conclusions might connect to other areas of anomalistics as a means of academic bridge-building or cross-pollination (Houran, 2022).

As a result, scientists need ample space to articulate a productive stream of consciousness that satisfies all the facets or goals of their papers. Some readers might disagree with our occasional tolerance of longer articles. In fact, the *JSE* has been criticized for other recent practices, such as addressing certain socially-charged topics, calling for citizen science papers, and platforming provocateurs who stir heated debates. Nevertheless, our forum is the *Journal of Scientific Exploration* — a title that juxtaposes two anchoring principles and conveys a philosophy and mandate to publish content of intellectual merit (“scientific”), along with permission for authors to ponder the different levels of meaning and purpose in their works (“exploration”). It makes perfect sense from this perspective to accept, and even celebrate, certain scientific papers for what they ultimately are...time capsules filled with creative descriptions of intellectual inspirations. Hopefully, our maverick audience will agree that literature crafted with this mindset is valid and supremely worthwhile reading.

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RESEARCH
ARTICLE

Directional Scopaeesthesia and Its Implications for Theories of Vision

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HIGHLIGHTS

A review of the evidence suggests that the potential ability to “detect stares from an unseen onlooker” is directional — often the person or animal being stared at responds by turning straight back at the source.

ABSTRACT

The sense of being stared at, or scopaeesthesia, is very common, and its existence is supported by experimental evidence. However, it contravenes the standard scientific assumption, dating back to Kepler’s discovery of retinal images in 1604, that vision involves only the inward movement of light – intromission – but not the outward movement of images or attention – extramission. From this point of view, scopaeesthesia is impossible. Yet, paradoxically, the conventional explanation of virtual images in mirrors is still based on Euclid’s (c. 300 BC) extramission theory, and most people implicitly believe in visual extramission, which could help provide a basis for scopaeesthesia. If scopaeesthesia depends only on the detection of another’s attention, it could conceivably be a scalar phenomenon, with a magnitude but not direction, analogous to telephone telepathy, in which people feel who is calling but do not know where they are. In this case, scopaeesthesia would tell us little about the nature of vision. But if scopaeesthesia is normally directional, enabling those stared at to detect the direction from which the look is coming, it would be more like a vector phenomenon, with both magnitude and direction and would provide evidence for visual extramission. Experimental tests of scopaeesthesia have so far been devoted to establishing its existence and have not looked at its directionality. Here, we examine the natural history of the phenomenon based on a collection of 960 case histories collected over 25 years involving both humans and non-human animals. This collection includes more than 80 interviews with surveillance officers, detectives, martial arts teachers, celebrity photographers, wildlife photographers, and hunters who have extensive experience of watching people or non-human animals. In 466 (49%) of the cases, directional effects were explicit, in that the person or animal looked at responded by turning and looking directly back at the looker rather than searching at random for the source of attention. In 186 (19%) of the cases directional effects were implicit. In most of the other cases, directional effects were not mentioned, usually because they were general statements lacking detail. In online surveys, including a survey of a group of skeptics, the great majority of respondents said they had experienced directional scopaeesthesia. We conclude that directionality is a normal feature of scopaeesthesia in real-life situations and suggest that this finding supports the idea that minds are extended beyond brains and that this extension involves some kind of visual extramission. We quote from more than 40 case histories and, in the online Supplementary Material make the entire collection of 960 cases available to those who would like to look at the data for themselves.

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KEYWORDS

Scopaeesthesia, staring detection, theories of vision, intromission, extramission, directional sensitivity, case histories, extended minds.



INTRODUCTION

Most people have experienced being looked at from behind, turning round to find someone looking at them. Most people have also had the converse experience – looking at someone else and finding them turn round and look back. This phenomenon is variously known as the sense of being stared at, stare detection, and, in scientific terminology, *scopaesthesia*, from the Greek *scopein*, to see, as in telescope, and *aesthesia*, feeling, as in synaesthesia (Carpenter, 2005). In surveys of adults in Europe and the United States, 77 – 90% said they had experienced it (Coover, 1913; Braud et al., 1993; Sheldrake, 1994). Likewise, most children said they had felt the looks of others. In studies carried out by Gerald Winer and his team of psychologists at Ohio State University, 94 percent of 11-12-year-old schoolchildren answered “yes” to the question, “Do you ever feel that someone is staring at you without actually seeing them look at you?” So did 89 percent of college students. In response to a question about the converse effect, “Do you think that other people can feel (without seeing) when someone is looking at them?” Ninety percent of the children and 88 percent of the college students answered “maybe” or “yes” (Cottrell et al., 1996).

Numerous experimental tests have given significant positive results that suggest that this is indeed a real phenomenon. In most of these tests, blindfolded subjects were looked at, or not looked at, in a randomized series of trials, and indicated whether they felt they were being looked at or not. On average they scored very significantly above the chance level; in other words, they showed an ability to detect whether they were being stared at from behind (Sheldrake, 2005a). This phenomenon also seems to work, although more weakly, through closed-circuit television (CCTV). When subjects were watched at random intervals through a CCTV monitor in a distant room, they were significantly more emotionally aroused during the staring than in the non-staring periods, as measured by the galvanic skin response (Schmidt et al., 2004).

None of this is possible from the point of view of the orthodox scientific theory of vision, according to which vision depends on light entering the eye and on changes in the retinas and the brain. The brain then produces three-dimensional images inside itself that are experienced as visual perceptions that seem to be in the external world, whereas, in fact, they are representations inside the brain. As Gray (2004) expressed this idea, the “real world” is “a virtual reality show constructed in consciousness by the brain and through which the unconscious brain navigates” (p. 110). The neuroscientist Anil Seth (2022) suggests that our brains produce “controlled

hallucinations” within themselves. Lehar (2004) makes this point particularly vividly with the example of looking at the sky. When you look at the sky, the sky you see is in your brain. Your skull is beyond the sky!

Thus, for the orthodox theory, the production of representations inside the brain cannot possibly affect a person or animal being looked at. Scopaesthesia is impossible, and therefore, any apparent evidence for it must be a result of superstition, error, chance coincidence, selective memory, experimental incompetence, faulty statistics or fraud. As Carpenter (2005) put it,

Nothing is better calculated to enrage a right-thinking scientist than popular belief in a phenomenon whose existence cannot quite be disproved but which, if true, must bring into question the most fundamental axioms on which the scientific description of the world is constructed. The existence of a sense that one is being looked at... is just such a belief.

Carpenter approvingly quoted the philosopher Bertrand Russell’s views on such beliefs: “The fact that an opinion has been widely held is no evidence whatever that it is not utterly absurd; indeed in view of the silliness of the vast majority of mankind, a widespread belief is more likely to be foolish than sensible.”

In a series of questionnaire studies of the feeling of being stared at, Winer and his colleagues found not only that most children and adults said they had experienced stare-detection themselves, but also that most of them believed in the extramission of visual images, together with the intromission of light (Winer & Cottrell, 1996). Winer and his team were shocked by this discovery and regarded it as revealing a failure of scientific education. They were particularly dismayed to find that most psychology students at their own university espoused “incorrect” extramission beliefs. They proposed that such unscientific beliefs should be “eradicated” by proper scientific education. For a short while, they were successful. In tests immediately after their re-education, most students gave the “correct” answer: vision occurs by intromission only. But, to the researchers’ disappointment, within a few months, they reverted to a belief in extramission as well (Winer & Cottrell, 2002).

For defenders of the intromission-only orthodoxy, it is frustrating that most people believe in the extramission of images even after they have been taught the intromission theory at school and in psychology courses at university (Winer et al., 2002). Even among university students and others who claimed not to believe in visual extramission, recent experimental tests revealed an implicit belief

that the eyes emit force-carrying beams (Guterstam et al., 2019).

In a series of ingenious experiments, Arvid Guterstam and his colleagues showed that participants attributed a gentle force to the gaze of a cartoon-like figure on a computer screen looking at a diagrammatic upright “paper” cylinder. The cylinder gradually tilted towards or away from the watching eyes. The angle at which participants thought it would collapse differed according to whether the cartoon-like figure was looking at it or not looking at it when diagrammatically blindfolded. In the “looking” condition, it was as if there were a force like a gentle breeze emanating from the eyes. When participants were told that the cylinder was made of concrete rather than paper, this effect disappeared; the imputed force was too weak to move something so heavy (Guterstam et al., 2019). Guterstam and Graziano (2020) shed further light on this implicit belief in visual extramission with a visual motion-adaptation procedure, which showed that “participants implicitly treated attention as though it were a flow moving invisibly through space from an agent to an object.” Guterstam et al. (2020) took this discovery yet further by using fMRI scans to show that brains process the gaze of others in areas concerned with visual motion “to encode gaze as implied motion.”

Guterstam and his colleagues hypothesized that this use of the visual motor system to track the directional gaze of others has evolved because of the importance of keeping track of others’ visual attention in complex social environments. They suggest that “basic theory-of-mind mechanisms have provided people with highly inaccurate intuitions and biases about the properties of the mind, leading to common myths and folk beliefs that have been intuitively compelling to humans across cultures and time periods” (Guterstam et al., 2019, p. 13165). They took it for granted that scopaesthesia did not exist, resting their case on skeptical dismissals of the phenomenon in 1898 and 1913, ignoring all further discussions and experimental investigations. Like Winer and his colleagues, they assumed that explicit or implicit beliefs in extramission represent a “fundamental misunderstanding” of the nature of vision (Winer & Cottrell, 2002). However, their speculation that these persistent and near-universal beliefs result from brain mechanisms that evolved in social contexts would make even better sense if directional extramission were real rather than illusory.

As Carpenter (2005) pointed out, the ability to detect stares does indeed bring into question fundamental scientific axioms, and in particular, one of the oldest pillars of scientific orthodoxy, namely the intromission theory of vision as established by Johannes Kepler in 1604 – the idea that vision depends only on light coming into the

eyes and that nothing goes out of the eyes.

This axiom is fundamental because it appeared to be the winner in a longstanding debate about the nature of vision that was going on 2,500 years ago in ancient Greece and continued in the Roman Empire and Arab worlds, then in medieval and renaissance Europe until the question seemed finally to have been settled by Kepler’s discovery of retinal images, small inverted images of the outside world produced on retinas through the optical effects of lenses. Kepler’s discovery was both foundational for modern science and also a culmination of medieval and renaissance science and technology. It built on the making of spectacle lenses from the thirteenth century onwards, the camera obscura, in which inverted images were projected onto the wall of a darkened room through a pinhole serving as a kind of lens; the development of perspective in the visual arts; and the discovery that the lens of the eye is lens-shaped, not spherical as previously believed (Lindberg, 1981).

Before Kepler’s triumph, there were three main theories about how we see (Figure 1A). First, the intromission theory, literally “sending in” emphasized the importance of images flowing into the eyes from the outside world. Second, the extramission, or “sending out”, theory stressed the active nature of vision and the outward projection of images from the eyes, as well as the inward movement of light; in effect this theory combined intromission and extramission; light flowed into the eyes and visual currents flowed outwards. Third, some theories focussed more on the medium through which vision took place than on the directions in which influences traveled, as in Aristotle’s philosophy of the “transparent”, which is not something that we see but something through which we see, the medium that links the observer to the visible object (Lindberg, 1981).

Despite the dominance of the intromission theory since the time of Kepler, vision itself remained unexplained, as Kepler himself acknowledged (Lindberg, 1981). Two small inverted two-dimensional images on the retinas did not explain how we see one image of things the right way up in three dimensions and full color, apparently outside ourselves. The problem is still unsolved today.

Intromission theories dealt with the movement of light into the eyes, and extramission theories dealt with how we actually see. Around 300 BC, the geometer Euclid emphasized that vision is active rather than passive. He gave the example of looking for a pin; at first, we do not see it, but then find it. What we see changes through looking and finding, even though the light entering the eyes remains the same (Zajonc, 1993). As part of the active process of vision, Euclid proposed that visual rays

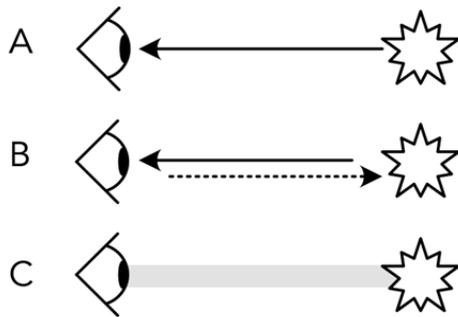


Figure 1. Diagrammatic representation of classical theories of vision. According to the intromission theory (A), images flow into the eye; on the combined intromission and extramission theory (B), light flows into the eyes from the object, and images flow out of the eyes in visual rays, which travel in straight lines, as represented by a dashed line; and the theory of the transparent (C) emphasizes the medium between the eyes and the object, linking together light and vision.

traveled outwards from the eyes in straight lines, projecting images. Usually, these images are projected to the places where objects actually are. Visual rays are like the opposite of rays of light, moving outwards, not inwards. However, unlike rays of light, visual rays are not reflected by mirrors. In the case of plane mirrors, the projections go straight through the surface, forming virtual images behind the mirror. Euclid’s ideas were developed further by Hero of Alexandria around 62 A.D. and by Claudius Ptolemy around 130 AD, who discussed the production of virtual images not only by plane, concave, and convex mirrors but also by refraction (Lindberg, 1981).

Isaac Newton endorsed the Euclidian interpretation of images in mirrors in the early eighteenth century (Fig. 2), and this theory is still taught in twenty-first-century schools with visual rays “produced” back behind the mirror by dotted lines to form virtual images (Fig. 3A).

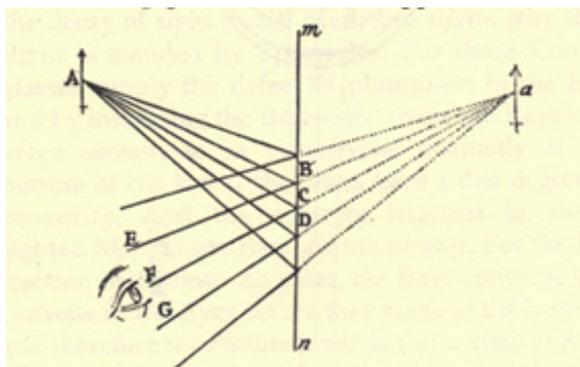


Figure 2. Newton’s depiction of a virtual image in a mirror (Newton, 1730, Fig. 9).

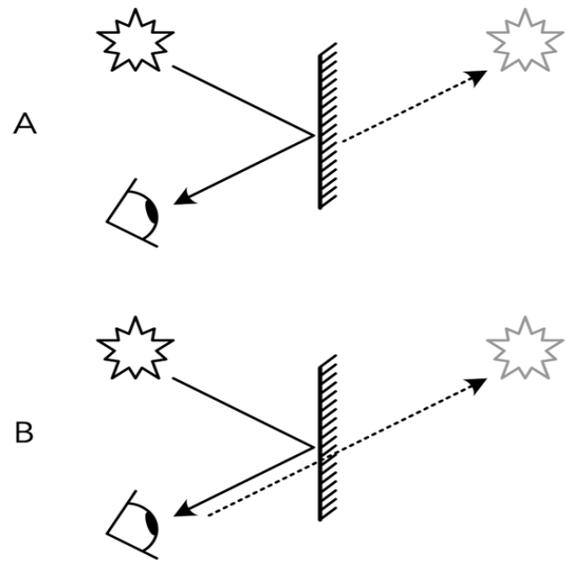


Figure 3. The Euclidian theory of images in mirrors involves both the movement of light into the eyes after reflection by the mirror and the extramission of visual rays, which produce virtual images located behind the mirror. In textbook diagrams, the extramitted visual rays appear only behind the mirror but are implicit between the eye and the mirror (A). The lower diagram (B) makes these visual rays explicit, showing the similarity to standard representations of extramission, as shown in Fig.1B.

Thus, paradoxically, the Euclidian theory of virtual images is still an essential part of orthodox science despite the denial of extramission. The scientific consensus asserts that vision works by intromission only, as explained by Kepler, yet the diagrams used in scientific textbooks to explain virtual images in mirrors assume some kind of extramission, although they try to minimize the outward moving visual rays by showing them only behind the mirror (Fig. 3A), rather than extending from the eye (Fig. 3B). There is a deep, confusing ambiguity passed on to generation after generation of students, who are taught both that intromission is the only correct theory of vision, and also that there is a kind of extramission of virtual images seen in mirrors. Orthodoxy is preserved by accepting the intromission-only theory as an unquestionable assumption – a dogma – and by avoiding thinking about the nature of virtual images.

Thus, there is a vast gulf between the experience of scopaesthesia by most adults and children and the denial of this experience within institutional science. Most people, including college students studying psychology, believe that vision involves extramission, despite being taught the scientifically “correct” intromission-only hy-

pothesis. Winer and his colleagues have shown that it is difficult, if not impossible, to eradicate what they called a “fundamental misunderstanding” about the nature of vision. Guterstam and his colleagues have shown that the attribution of a power to the gaze occurs automatically through brain systems and is implicit even in those who accept the “correct” theory of vision. One reason for the strength of these explicit or implicit beliefs may be that they are correct, not incorrect, and are continually reinforced by personal experiences.

To detect that someone is looking at you from behind implies that an influence is coming from the person looking. How is this detected? The most obvious possibility is that you are somehow sensitive to an outward movement of visual attention from the looker, which exerts a kind of force or virtual force. If the person looked at feels an outward flow of visual attention from the looker, this feeling is likely to be directional. The person may turn round and look straight at the person staring.

There is, however, an alternative theoretical possibility. Scopaesthesia could involve an awareness of being the object of someone’s attention but without a sense of where the looker is. This could be compared to a scalar phenomenon, like temperature, with magnitude but not direction. Some psi phenomena may be of the scalar type, like telephone telepathy, where people feel who is ringing (Sheldrake & Smart, 2003) but do not identify the direction of the caller. The same is true of telepathy in connection with emails and text messages (Sheldrake, 2014). By analogy, scopaesthesia might conceivably involve no more than an uneasiness or sense of danger, which might then be followed by searching in all directions to try and find the looker by trial and error. By contrast, if scopaesthesia depends on some kind of extramission, which is by its very nature directional, then scopaesthesia itself would be directional, a vector rather than a scalar phenomenon, with both magnitude and direction. In this case, people should be able to detect from which direction the gaze is coming more or less immediately.

Here, in order to distinguish between these two possibilities, we examine the natural history of scopaesthesia. Is it usually directional or not? Can people feel not only when they are being stared at but the direction from which the gaze is coming? The experimental tests of scopaesthesia referred to above were not designed to answer this question, but rather to find out whether scopaesthesia occurs, irrespective of directionality. Hence, in the absence of relevant experimental data, at present, our best guide is natural history, which is, in any case, a good starting point for any new field of inquiry. Insofar as scientific inquiry is empirical, then people’s experiences are not irrelevant; they are highly relevant. The word

“empirical” literally means “based on experience”. If we hear just a few accounts, we might be tempted to dismiss them as mere anecdotes. But when large numbers of reports of personal experiences, submitted independently by people all over the world, show common patterns, anecdotes become data. At the very least, they show that there are repeatable patterns of experience, whatever people’s interpretations of their experience.

In this study, we looked at 960 case histories that we collected over more than 25 years. They concern both humans and non-human animals. In addition to the reports that people sent us about their own experiences, we also interviewed more than 20 detectives and surveillance officers who watched other people as part of their job and more than 40 celebrity and wildlife photographers who took photographs covertly. These professionals had many opportunities to observe the effects of watching humans or animals. In addition, we interviewed martial arts teachers who trained their students to become more sensitive to looks from behind and, in particular, to detect their direction. We also interviewed hunters, including deer stalkers, who had much experience of predator-prey relationships from the point of view of the predator. Finally, we conducted online surveys about directional scopaesthesia through social media, including a survey of a group of skeptics. We conclude by discussing some of the implications of directional sensitivity for theories of vision.

In this paper, we consider only cases of direct looking, as opposed to the more complex situations of looking at others through mirrors or CCTV, which we plan to discuss in a future publication. We also omit a discussion of cases in which sleeping people and animals were woken by being stared at. Again, we plan to discuss these cases in a future publication. Thus, we here confine ourselves to cases of direct looking at people or animals who were awake.

METHODS

Collection of Case Histories

Since 1996, we have built up computerized databases in which we collect accounts of people’s experiences that suggest the existence of unexplained human and animal abilities using the Filemaker Pro platform. By February 2023, our unexplained human abilities database contained 6,433 cases classified into 117 different categories, 15 of which concern various aspects of scopaesthesia. Our animal database contains 5,599 cases classified into 72 categories, 3 of which concern scopaesthesia.

Most of the accounts in our databases were submitted in response to requests for information in R.S.’s lectures, media appearances, and in a book that included

a section on the extended mind and the sense of being stared at (Sheldrake, 1994). We received many more accounts following the publication of another book by R.S., *The Sense of Being Stared At* (Sheldrake, 2003; second edition, 2013). Both these books were translated into a range of languages, and through interviews in the U.K., U.S., Canada, France, Germany, Switzerland, and other countries, R.S. had opportunities to appeal for information internationally. More recently, R.S. has appealed for information through his website and social media. Accounts submitted in foreign languages were translated by native speakers of those languages before they were added to our databases, which were and still are maintained by P.S. We and our colleague Jane Turney also interviewed people who watch other people or animals professionally, including detectives, surveillance officers, security guards, celebrity photographers, wildlife photographers, and hunters. We also interviewed teachers of martial arts who trained their students to become more sensitive to stares from behind.

The accounts we quote in this paper are only a small sample drawn from our collections, selected after reading through 960 reports concerning scopaesthesia in people and animals. These selections were made in order to provide representative examples. Anyone interested can examine the full collection, available as Supplementary Material online.

Our collections of case histories are not random samples and do not give us a measure of frequencies in the general population. But they do give direct insights into lived experiences, which fall into several categories, as discussed in this paper. Our interviews provide information from people with much experience of looking at other people and non-human animals.

Skeptics might argue that some of these stories were not truthful accounts of people's experiences and might have been made up. This is possible, but we think it unlikely, both because people would have had little incentive to do this, and also because we received numerous similar accounts from many different parts of the world spread over 25 years. At the very least, our collection of cases shows that stories about the detection of staring fall into a limited number of categories and have repetitive features.

Surveys Through Social Media

We conducted online polls through Instagram, YouTube, Twitter, and Facebook in order to find out how widespread experiences of directional scopaesthesia are. We carried out these surveys in May and June 2021 through R.S.'s social media and also with the help of

Deepak Chopra through his Instagram and Facebook media and Chris French's Twitter account. R.S.'s social media followers are mainly in the U.K. and U.S. Deepak Chopra is a popular author based in the U.S. and best known for his writings and lectures on meditation and holistic medicine. Chris French was a professor of anomalistic psychology at Goldsmiths College, London University, a former editor of the U.K. *Skeptic* magazine, and a well-known leader of the skeptic movement in the U.K.; most of his Twitter followers were skeptics. The details of the questions we asked are given below.

RESULTS

Experiences of Detecting Stares

On our database, there are 960 reports of stare-detection in which the looker was looking directly at a person or animal (as opposed to looking through a mirror or CCTV). Most direct-looking cases, 73%, involve human-to-human experiences; some cases (13%) describe scopaesthesia in non-human animals and some (14%) concern humans who detected when they were being looked at by animals (Table 1). The reports about animals describe experiences both with companion animals like dogs and cats and also with a wide range of wild animals, including birds, mammals, reptiles, fish, octopuses, and spiders. Scopaesthesia and the ability to induce it seem widespread among non-human animals. Humans share with many other species their sensitivity to looks and also their ability to affect others by looking.

As well as the accounts that people submitted to us in response to requests for information, our database also includes interviews with nine martial arts practitioners, 24 surveillance officers and detectives, ten celebrity photographers, 32 wildlife photographers and hunters, and nine gamekeepers, zookeepers, and birdwatchers.

It is illuminating to read some or all of this collection or even merely to dip into it. Now, together with the publication of this paper, we are putting our entire scopaesthesia database online as Supplementary Material, arranged in the general categories shown in Table 1. Anyone interested can explore this anonymized database for themselves,

Here, our focus is the question of whether scopaesthesia is usually directional or non-directional. As discussed above, if scopaesthesia is inherently directional, it would have profound implications for theories of vision. It would support the idea that influences move outwards from the eyes in vision, as well as light moving into the eyes. It would go against the theoretical possibility that scopaesthesia is a directionless feeling, followed by a ran-

dom search to find the source of the gaze.

In 49% of these reports, our informants explicitly mentioned directional effects, where the person or animal looked at responded by looking straight back at the looker rather than scanning at random. In 19%, directional effects were implicit, and in 31%, they were not mentioned (Table 1). Thus, if we take together the explicit and implicit accounts, a majority, 68%, indicated that scopaesthesia was directional.

In this analysis, we omit cases of scopaesthesia through mirrors and CCTV and also omit another kind of scopaesthesia, in which sleeping people and animals are woken by being stared at. We plan to discuss these cases in further publications.

The reports on our database are classified into passive and active categories and also into separate categories for people and animals. Thus, we have categories for the feeling of being looked at by a person or by an animal, in which the report came from the person looked at. Then, we have categories for the effects of looking at a person or animal, in which the report came from the person who was looking. In all these categories, there are explicitly directional cases, implicitly directional cases, and cases where no directional effect was mentioned. The numbers of cases in each category are shown in Table 1.

In the next section, we give examples of explicit descriptions of directional responses, which are part of the largest category of “explicitly directional”. These are the most informative cases. We then look at “implicitly directional”, “not mentioned”, and “delayed directional” cases.

2. Explicit Examples of Directional Scopaesthesia

In the explicitly directional category, there are 466 cases in our collection, 49% of the total. The explicitly directional cases were strongly represented in all four sub-categories, namely looking at a person or animal or being looked at by a person or animal. Here, we give examples of explicitly directional scopaesthesia of all four kinds, starting with person-person cases.

We first consider cases where the starers and the people stared at were at the same level. Then we give examples of cases in which they were at different levels, as when someone looked down at another person from an upstairs window; the person stared at had not only to look around but to look up: three-dimensional scopaesthesia. In 2.3, we discuss cases in which people or animals were looked at through binoculars, telescopes, or cameras, where their image had been magnified through lenses. In section 2.4, we look at experiences with non-human animals, both when the animals were looked at by people and when people were looked at by animals.

2.1 The Starers and The People Stared at Were at the Same Level

Reports From Lookers

Many examples occurred when people were in cars, looking out of windows. This is from a young man in the United States:

From my passenger seat, I was staring at this girl walking on the sidewalk. The street was crowded, there were also cars ahead and behind us, and out of the blue, she turned around and looked me directly in the eyes. Before you ask, no, the win-

Table 1. The Classification of Direct-Looking Cases, Showing How Many in Each Category Involved Explicitly and Implicitly Directional Responses to Being Stared at, and Those in Which Directional Effects Were Not Mentioned or Delayed.

Situation	Explicitly Directional	Implicitly Directional	Delayed Directional	Not Mentioned	Total
Looked at by person	163	60	1	61	285
Looked at by animal	82	23	5	23	133
Looking at person	169	84	2	161	416
Looking at animal	52	19	1	54	126
Total	466	186	9	299	960
Percent of total	49	19	1	31	100

dows were not down and we were not playing loud music which would make us noticeable.

This woman made a practice of looking at people when commuting to work by bus in London:

I used to be bored, so I would stare at the people in front. More times than I can mention, the objects of my staring would suddenly turn right round in their seats, as if I had spoken to them, and stare back at me with an expression of challenging inquiry.

From a man about an experience in a church:

There was a strikingly beautiful girl with long reddish hair, two pews ahead of me and about two persons to the left. I had never seen her before. For about 10 seconds, I had been staring at the back of her head, admiring her beautiful hair, when she quickly whipped her head around about 150 degrees and stared straight at me, looking me in the eye crossly, as though to say: "Stop staring at me!"

From a man who worked in a company in Massachusetts. His work required government security clearance, and he worked in a locked room:

Entrance to this room was gained by ringing a bell and showing your face at the small window in the door. A colleague of mine sat opposite this door with his back to it. I began, just for fun, to stare at the back of his head. Instead of ringing the bell when I wanted to come in. At first, it would take 10 or 15 seconds to penetrate his concentration and get him to turn around and buzz me in. After doing this several times a day for a week or two, I was able to reduce his response time to about two seconds. He was disquieted by this, and eventually, I stopped and resumed using the bell again.

Reports From People Looked At

From an Iraqi-British man in London:

It can happen through glass. Today, for example, I was in a glass meeting room at work, and my head turned to look behind me, and about 10 meters away, someone was looking at me. Sometimes, I turn to look in that direction when I feel

the stare, and on other times, my head turns almost violently on its own like a reflex.

This woman was at a large store with her young son:

I realized that he was hiding from me. I also knew that he would be watching to see where I would go. I stood still and thought about him and got a definite feeling of being watched. I turned round and looked directly at him.

This woman was at a rock concert in a large outdoor amphitheater with her teenage daughters seated in the center near the front:

I was really enjoying the show, and I was sort of bopping along with my head. In the midst of this free-spirited enjoyment, I felt my head and eyes suddenly dart to the extreme right of the stage. My eyes met the eyes of the bass player, who was staring right at me. I broke into an embarrassed smile, feeling foolish, and he responded with a huge smile and laugh. I must have looked awfully funny, I guess.

From a man in the United States:

My sense of being stared at is highly developed, probably due to my father "testing" me when I was a boy. In our house in Miami, we had a large, six-bladed fan in the kitchen window, which cooled the house in the summer. When I was in the kitchen with my back to the door, my father would walk up behind me and say nothing, and the fan made it impossible to hear his approach. I could feel him looking at me, which prompted me to turn around and face him. He never commented on this, but his facial expression of pleased surprise made me quite certain that he was doing it on purpose to see if I could detect his gaze. He was interested in such "taboo" phenomena.

2.2 Looks from Above

Some of the most striking examples of directional scopaesthesia occurred when the person who was staring was at a higher level, looking down. Responses involved both looking around and looking up.

Reports From Lookers

A young man serving in the U.S. Navy, when on land,

was looking out of a third-floor window:

I saw a friend walking away from the building. I decided to stare at the back of his head to see if he would notice. It took about ten seconds, and he turned around and looked straight up at me, and then I waved to him to sort of smooth over the weirdness.

From another young man:

On the garden rooftop of a four-story building, I looked down into a courtyard, where people were walking from building to building. When I looked down at a woman I recognized and liked, she immediately looked up in my direction.

This woman was attending a crowded ceremony in which her husband was participating, seated in one of the galleries surrounding the auditorium:

I searched for my husband below, and when I saw him, stared at him, "willing him", if you like, to look up, as I knew he was nervous and didn't know where the one friendly face in the sea of the audience was. Within a few seconds, he did look up and directly at me, though there was no reason for him to guess where I would be.

This woman was on the upper deck of a London bus:

I was on a bus and was lost in my own thoughts, and I was actually looking at somebody without intent out of the upper level, and he suddenly looked up at me and stared straight at me, and it really shocked me.

Reports From People Looked At

From a German woman in Stuttgart:

In my area, apartment blocks are five to six stories high. When I walked along the street, I usually kept my glances to the ground in order to avoid stepping into dog excrement, but sometimes I happened to look up and met the eyes of a person looking at me from one of the upper floors. This happened so often that I was surprised since this cannot be explained from seeing something in the corners of my vision and I exactly met the eyes of the person right away. This happened when I was about 20-30 years old. Today (I am

36), this does not happen so much.

From an English woman traveling in the passenger seat of her family van:

We were at a busy T junction waiting to pull out. I felt compelled to look high up and backwards over my left shoulder. My eyes met those of a man in an attic window. Our eyes were locked in "battle" with each other, so I looked away. The strange thing was only the top of his head and eyes were visible about the windowsill, and he was also at the corner of the window, which was closed. He must have been either kneeling or crouching.

From a retired police officer in Britain:

For about a third of my duty days, I was on night duty patrolling empty streets in the small hours. On many dozens or hundreds of occasions, I became aware that someone was looking at me. It came as a sort of tickling sensation around the back of the neck. On almost every occasion, I would look up and find someone watching me from a window or some such. I am not the imaginative type, I have no other unexplained experiences in all my duty life except this.

2.3 Looking Through Binoculars, Telescopes, or Cameras.

Scopaesthesia seems to occur when a person is observed through telescopes, binoculars, or cameras, even at great distances.

A woman who lived on the south coast of England told us that she liked looking out of a window through powerful binoculars at sailors on yachts. They were far away and could not have seen her with the naked eye; but often, she said, the sailors would turn and look straight towards her and seem uneasy. She was sure they were feeling her looking.

This sensitivity can manifest itself more dramatically in literally life-threatening situations. In 1995, a sniper in the US Marine Corps serving in Bosnia was assigned to shoot "known terrorists". While he was aiming through the telescopic sight of his rifle,

Within one second prior to actual termination, a target would somehow seem to make eye contact with me. I am convinced that these people

somehow sensed my presence at distances up to one mile. They did so with uncanny accuracy, in effect to stare down my own scope.

Long-lens celebrity photographers often look at people at a distance through telescopic lenses. We interviewed some of the leading practitioners in Britain to ask if they had noticed whether their subjects seemed aware of their focusing on them. The general consensus was that some people seem unaware of being watched, while others have an uncanny ability to know when they are about to be photographed, such as the late Princess Diana, who, over the years, seemed to become increasingly sensitive. One photographer commented:

She was possibly the most extreme example of somebody being constantly aware that there was a possibility of being photographed. Because she was so against being photographed, she honed that awareness down to such a fine degree that it was almost impossible to catch her unawares. She claimed that she had a sixth sense and said she could smell a photographer a mile away.

One long-lens photographer who worked for the *Sun*, the most popular tabloid newspaper in Britain at the time, said that he was amazed by how many times people whose picture he was taking would “turn around and look right down the lens,” even if they were looking in the opposite direction to start with. He did not think they could see him or detect his movements. “I am talking about taking pictures at distances of up to half a mile away in situations where it is quite impossible for people to see me, although I can see them.”

The ability of people to detect when they are being stared at through telescopic lenses suggests that telescopes might not only focus light into the eye of the observer but also focus the looker’s attention onto the person observed. Although the magnified image is a virtual image, it is located in the same direction as the person being watched, rather than in a different place and direction, as with virtual images seen in mirrors or with images on the screens of CCTV monitors.

2.4 Experiences With Non-Human Animals.

Many people described experiences with non-human animals, mainly dogs and cats, but also with wild animals, that suggest the animals can feel when they are being watched and respond directionally. Conversely, some people have experienced being looked at by animals and turned to look at them directly in the eyes.

Reports From Lookers

Many people have noticed that their pets respond directionally to their looks. Here is a typical example:

My cat was working on her scratching post, and I was watching her, then suddenly she turned and looked right at me, instant eye contact, as if she knew exactly from where she was being watched.

The reports were not confined to familiar animals, like people’s own pets. This account, from a woman in Surrey, England, concerns other people’s cats:

I work from home in my conservatory, looking out into the garden. The garden is on a well-known cat run, as many cats use the same route each day. When I catch sight of them and look directly at them, they usually freeze and look straight at me. I hasten to add that sometimes they are walking away from me and would not be able to see me, so it is not a matter of sensing me move. This happens too often to be coincidence.

Some of the reports concern birds, both wild and domesticated. This Australian woman’s family kept chickens when she was a child:

I used sometimes to delight in fixing my gaze on any one of the chickens through a nail hole in their iron fence. I would see it pause its wandering, scratching or feeding, look ill at ease, then fix its gaze on the nail hole.

We interviewed more than 30 wildlife photographers, many of whom concealed themselves within hides (called “blinds” in the U.S.) from which they watched and photographed animals. Most were convinced that animals often detected when they were being watched; they became fearful or wary, and sometimes, they looked straight at the hidden camera through which they were being observed. One British photographer said that on several occasions when photographing eagles, they “stared right down the barrel of the camera lens” at him. Another photographer was watching some pools of water from a hide in the evening when “a fox came down to drink, and suddenly lifted his head up and looked back at the hide.”

Reports From People Looked At

Some wildlife photographers spend a lot of time outdoors and have found that they can locate animals by re-

sponding to their looks.

If I am walking through a valley and I am intent on the ground ahead of me, I will suddenly look up to the cliffs, and at the exact spot I look, there will be a goat staring down at me. It happens fairly frequently. You can go around looking for certain animals and birds, and you do not see anything for quite a while, and you suddenly look in a particular direction, and there it is.

Similarly, another photographer was returning after a long day walking in the hills in Scotland:

I had no further intention of doing any photography as the light was getting low. As I walked, something made me look up to my left, and about half a mile away on the skyline, there were three or four deer looking at me. It wasn't that I was scanning the skyline and noticed them. It was a case of looking up and looking straight at them.

This Canadian woman was in a remote part of British Columbia:

I was standing by myself looking into a river, watching several hundred chinook salmon spawning in a long, shallow stretch of river. This was in a fly-in-only wilderness area with no roads or other people around. I then turned to continue my hike up the trail. For that mysterious reason, people have, I turned around and looked behind me before starting to walk. About thirty feet behind me, standing tall while sitting on its haunches, was a large, light-colored wolf. It was watching me watching the salmon. It had a bemused smile on its face. Very peaceful and friendly looking. A kind smile. I turned and walked up the trail. Because of the expression on the wolf's face, I was unafraid of it, and indeed, it caused me no harm.

In Australia, this woman liked walking in the forest and looking for koalas. She found it tiring to look for them in the trees, but developed an easier method of finding them:

In my walks through the forest, I had the feeling of being watched. I used to go out looking for koalas, but over time, I realized that I didn't need to look for them. I just had to focus on myself, and the moment I felt watched, I would know where

to look, and the animal would be there.

Thus, both animals and humans seem to respond to being watched in similar ways, and the effect is usually directional.

3. Implicitly Directional Cases

In this category, most of the descriptions were less detailed than in the explicitly directional cases but nevertheless implied a directional effect, as in the following examples:

I have caught people looking at me lots of times, particularly when working in foreign countries with repressive regimes. As a journalist, you will be followed and watched, and I have caught people looking at me over newspapers or in hotel foyers. I would say this was due to a sixth sense sometimes. Sometimes, I get a tingle in the back of my neck.

The ability to tell when you are being stared at is something I teach in my tai chi classes. You have to exercise and practice so that this awareness is growing and growing, so you can feel what is going on all around you, at the back and sides of you.

I went to my children's school. It was an open day, and the headmaster asked me to walk around taking pictures of people, so I chose a big, long telephoto lens. Even though I was right across the other side of the school garden, if I had it trained on someone, they knew.

On several occasions, whilst out walking with my Alsatian bitch I felt I was being told to stop. When I looked back, she had stopped to urinate and was staring at me most intently, her expression plainly saying, "wait for me."

In classifying cases as showing an implicitly directional response, we erred on the side of caution because many of these cases were on the borderline of being explicitly directional but simply lacking in detail.

4. Directionality Not Mentioned

Most cases in which directional effects were not mentioned were general statements, such as the following.

I frequently am aware of being observed both by surveillance cameras or just other people.

Throughout my life, I have often experienced this phenomenon and have also observed it in pets. I can usually tell when someone is staring at me, and can often cause others to react to my staring at them.

My brother is an ex-US marine. He says they were taught in boot camp to never look directly at an enemy soldier when sneaking up for attack but to use their peripheral vision.

The fact that most of the accounts in this category did not mention directional responses seems more owing to a lack of detail than a lack of directionality. However, in a few cases, directional responses were not possible because the looker was hidden, as in this distressing experience of a woman in Missouri, U.S.:

I lived in an apartment complex with outside parking on a large lot. I returned home late one night and parked my car about 20-30 feet from the front door. As soon as I stepped out of my car, I felt someone was not only watching me but watching me with great hostility. The feeling was sudden and strong. It was as if a switch had been turned on as soon as I got out of the car. The parking lot was full of parked cars, but there was apparently no one else around. I dismissed the feeling as over-imagination and walked briskly to the front door. I even stopped to get my mail. As I was opening my mailbox, with my back to the front door, I heard the front door open suddenly, and someone step into the room very quickly. I turned and saw a man standing naked, holding his folded clothes in front of his face. I quickly opened the hallway door and, practically ran to my apartment and then called the police.

There were also a few cases where a person responded to being stared at not by looking at the person watching them but by paying attention to the part of the body that was being looked at. Here is a British example:

I am a man without a sexual partner, and when I notice an attractive woman, I look at her. This seems to be a largely automatic process. I look first at her face, then my gaze drops to her breasts, and then quickly moves away. Amazingly often, without looking at me, the woman

instantly gazes down at her breasts, perhaps to check that she is properly dressed. This mysterious "sense" could perhaps tell that sexual interest is present, which would explain how she knows not to return the look.

This disabled elderly woman described herself as a "people watcher":

I spend time watching people as they go by, passing the time by experimenting with their receptivity to being watched and mentally touched somewhere on their bodies. It never fails to amaze me that if I stare at a certain part of their bodies, mentally touching them, the majority of people will unconsciously touch, pat, swipe, or pat that part of their body without really being aware of doing it. Like they were actually touched on that body part and are checking it out on a subliminal level. They often sort of quickly look around them as well, checking unconsciously on their surroundings to be sure no one is close to them.

Probably in most situations, scopaesthesia occurs when people's heads, neck, or back are being looked at. Perhaps when other parts of the body are being observed, it draws the person's attention to that region first, and this may or may not be followed by a directional response. In the case of the "people watcher", such directional responses were unusual and somewhat delayed:

Once in a great while, I find someone who will actually slap at the area I am looking at and look around them, then turn to look straight into my eyes with an accusing attitude, which is surprising because it's rare to have someone find me out. I just smile and look them right in their eyes.

We also received several reports from or about nude models in life drawing classes, who have had much more experience of being looked at than most other people. In the very nature of their work, they have to sit still and cannot look at the people drawing them when those people are behind them. This is from a woman artist:

I find that many models are particularly sensitive to having their hands and feet drawn. This occurs whether or not they are facing you (the artist) while they are posing. With some models, their hands or feet respond in these instances when I am concentrating on them as if they have been

tickled.

In summary, the great majority of the cases in which a directional effect was not mentioned were generalized accounts with little detail. Only a few cases explicitly mentioned responses that were non-directional. Some were in situations where the looker was invisible, as in the case of the seemingly deserted car park at night. Others occurred when parts of the body other than the head, neck, or back were looked at. In these cases, the watched person's attention seemed to go first to the part of the body being looked at, and only sometimes was this followed by a directional response, looking at the looker.

5. Delayed Directional Responses

In our collection of cases, there are only nine that concern delayed directional responses (Table 2). One type of delayed directional response occurred when the looker concentrated on parts of the body other than the head, neck, or back, as described immediately above. Here are some other cases:

As I sat on a train reading my paper, I had a steadily growing feeling of being stared at. It got so strong that I had to turn round to view the other passengers to find out who it was, but there were not many people in the carriage, and none appeared to be looking at me. I carried on trying to read my paper, but the feeling got more and more intense until eventually I had to stop the pretense of reading feeling literally "hot round the collar," and folded my paper up. As I did so, I happened to glance across the carriage to the floor below the table of the seats alongside me to find a delightful little French Bulldog sitting on the floor there, staring intently at me, willing me to talk to him.

When I was in Death Valley with my son, we both felt as if we were being watched, something was making us uneasy. We scanned the rock face above and eventually saw a huge white bird of prey sheltering in a shady cranny, staring out at us, forcing us to go away. He succeeded because we left his territory, acknowledging his dominance!

I was snorkeling on a reef in Hawaii, and I was alone. I went quite a distance from shore when I had a very distinct sense of being stared at. I picked up my head to look around but saw no

one. I went back to swimming when I had the same sense again, I picked up my head again, but there was no one there. I then looked down at the reef and saw a small octopus looking up at me, tucked into a rock. I am convinced that I was sensing the octopus' stare.

This story was told to us by the late Dame Miriam Rothschild, an eminent naturalist:

In the war, I went out at dusk to shoot a pheasant for dinner. There was snow on the ground, and I went into thick cover to wait among the bushes for birds coming in to roost. There was an open space ahead of me, and I began to feel I was being watched. I began looking across the open space and then cautiously to right and left there was no one to be seen, but the feeling grew. I told myself I was just being hysterical. Then suddenly, I looked up, and there was a barn owl about three feet above me, sitting on a branch and staring at me!

However, cases in which directional response were not immediate were rare, making up only 1% of all cases. In several cases, like those above, the delay occurred because the respondents assumed that they were being stared at by other humans rather than by non-human animals. In other cases, the watching person or animal was camouflaged or partially concealed, necessitating a search rather than instant identification.

6. Online Surveys

Social media offer simple methods for conducting surveys. They do not provide random samples but enable rough estimates to be made of the prevalence in a specific group of people interested in these phenomena. We carried out such surveys through R.S.'s own social media (Facebook, Instagram, and YouTube) and asked Deepak Chopra to do similar surveys; his media have far larger numbers of followers. It could be argued that R.S. and Chopra's followers are likely to be biased in favor of the existence of scopaesthesia, so we asked Prof. Chris French to carry out a similar survey among his Twitter followers, most of whom are skeptics. His followers might, therefore, be expected to be biased against the existence of scopaesthesia or at least to view it skeptically.

In these surveys, respondents were asked two questions:

1. Have you ever had the experience of turning around to find someone is staring at you?

2. If so, was the effect directional? Did you look straight at the person watching you?

Chris French prefaced these questions by a brief statement as follows: “ I have agreed to a request from Rupert Sheldrake to help him collect data on the common experience of the sense of being stared at (however that might be explained).”

The results of the Instagram and Twitter surveys are shown in Table 2. A large majority of respondents said they had experienced scopaesthesia. Of those who had experienced this effect and responded to the second question, 83-92 percent said they had experienced it directionally.

Similar surveys among R.S.’s Facebook followers gave similar results, with 97% of respondents answering “yes” to question 2. Unfortunately, the Facebook report did not reveal the actual number of respondents, but from the “engagement” metric, this is likely to have been about 300.

In addition, we carried out a survey through R.S.’s YouTube channel. The YouTube protocol permits only one question and two answers, so the format was somewhat different. The question was: “If you’ve ever felt like you were being watched and discovered you were, did you:

1. Search until you found someone looking at you?

2. Turn and immediately make eye contact?

Respondents could vote “yes” to only one of these questions, and out of 852 respondents, 758 (89%) answered “yes” to question 2, again indicating that a large majority had experienced directional scopaesthesia.

In summary, although these online polls are non-random samples of the wider population and are not as precise as some other survey methods, they indicate that most people have responded directionally to being stared at.

DISCUSSION

Our collection of first-hand accounts of scopaesthesia shows that reactions are usually directional both in

humans and non-human animals. We have quoted only a few of the many cases in our collection; anyone interested in reading more is welcome to do so. The entire collection discussed in this paper is available online as Supplementary Material.

Consistent with the case histories, in online surveys, most of the respondents said they detected the direction from which looks were coming. Those who doubt these findings can easily carry out their own surveys, formally or informally. We predict that most of their respondents will say they have experienced directional scopaesthesia.

Insofar as it is directional, scopaesthesia is more than a sense of being at the center of someone’s attention, a scalar phenomenon, as it were. Most people and animals do not seem to have a generalized feeling of being stared at and then search in all directions to find out where the looker is. Cases of delayed directional scopaesthesia make up only 1% of our collection, and some of those depended on a false expectation that the starrer was human rather than a non-human animal, and in others, the starrer was hidden. Most directional responses were more or less immediate.

Another argument against a purely attentional hypothesis of scopaesthesia comes from exploring the parallel with attention through listening. Can people detect non-visual attention in a similar way to detecting visual attention? Is there a “sense of being listened to” comparable to the sense of being stared at? If attention is the key factor, then auditory attention might have similar effects to visual attention. With our colleague Tom Stedall, we investigated this question experimentally. We carried out tests with telephones to investigate whether people could tell when they were being listened to by a partner or not listened to in a randomized series of trials. The results were no better than chance, giving no indication that people could feel when they were being listened to (Sheldrake, Stedall, & Smart, 2023). Moreover, there are very few stories on our database concerning being listened to compared with being looked at, only about 1% of the number concerning scopaesthesia. In addition, interviews with private investigators and surveillance officers

Table 2. Results of Online Surveys Conducted in May and June 2020 with Rupert Sheldrake and Deepak Chopra’s Instagram (I.G.) Followers and Chris French’s Twitter (Tw) Followers. Questions 1 and 2 Are As Described In The Text.

Survey by:	Question 1: Stare detection		Question 2: Directional effect	
	Respondents	Answer “yes” %	Respondents	Answer “yes” %
Sheldrake (IG)	107	97	104	92
Chopra (IG)	2,367	93	1,929	83
French (Tw)	86	76	33	85



revealed that none had noticed people being aware of being listened to when their phones were tapped; by contrast, they said that many people were sensitive to being watched. Thus, scopaesthesia depends not so much on being the center of an unseen person's attention in general but specifically on visual attention, which is, by its nature, directional.

The directional nature of scopaesthesia distinguishes it from telepathy, which is generally non-directional. Moreover, telepathy typically takes place between bonded members of social groups rather than with strangers, whereas scopaesthesia often occurs with strangers and with unfamiliar animals, both wild and domesticated (Sheldrake, 2003).

Scopaesthesia has two directional aspects. First, the looker's attention is directed toward the person looked at. Second, the person looked detects the direction from which the look is coming and usually looks back. In both cases, this directionality is coupled to light. For the looker, there is a close linkage between the incoming light, which is focused onto the retinas, and the outgoing direction of attention. Physics already describes the electromagnetic field of light and the focussing of this light by lenses onto retinas and also describes the outward movement of attention in relation to virtual images that arise when looking through with mirrors and lenses. Such outward-moving influences are also implicit in most people's understanding of vision, even if they explicitly deny the possibility of extramission, as Guterstam and his colleagues so ingeniously demonstrated (Guterstam et al., 2019, 2020; Guterstam & Graziano, 2020).

The simplest and most traditional interpretation of directional scopaesthesia is in terms of the extramission of visual or mental projections in the opposite direction to the incoming light, as, indeed, most people implicitly assume. Although many scientists and materialist philosophers believe that visual images are confined to the inside of the head as "representations", "virtual reality displays" or "controlled hallucinations", a growing number of theorists argue that vision does indeed involve the projection of images into the external world: minds are extended beyond bodies. When I look at a tree, my image of the tree is in the outer world where the tree seems to be, not inside my brain. Recent proponents of extended minds include Sheldrake (1994), Clark and Chalmers (1998), Velmans (2008), Thompson & Stapleton (2009), Noë (2009) and Manzotti (2018). This approach can also be described as "active externalism" or "extended cognition" (Clark & Chalmers, 1998) or as "enactivism" (Thompson & Stapleton, 2009). The theory of "direct perception" of J.J. Gibson also locates visual experiences in the external world rather than inside the brain (Gibson, 1979).

However, some extended mind theorists explicitly deny that visual projections flow out through the eyes. Velmans, for example (2008, his Fig. 6.3), pictures the externalized images as coming out of the top of the head. Other extended mind theorists seem to think of extended minds as entirely non-physical, with no possible external effects. They are, therefore, undetectable experimentally. This idea has the philosophical advantage and scientific disadvantage of being irrefutable. But if minds reach out beyond brains and in some way touch what is being looked at, scopaesthesia could provide empirical evidence that minds are indeed extended and open the possibility of further experimental explorations of how extended minds work (Gomez-Marin & Sheldrake, 2023).

Within institutional science, scopaesthesia is taboo because it does not agree with the doctrine that vision takes place by intromission only, nor with the materialist assumption that minds are confined to brains. "Minds are what brains do" (Minsky, 1986). Materialists habitually classify scopaesthesia as "paranormal", meaning beyond the normal. By contrast, most people think of stare-detection as normal and take it for granted. It is certainly normal in the sense that it is common. Scopaesthesia is only paranormal if normality is defined in terms of theoretical assumptions rather than empirical reality.

How can we conceive of visual extramission when it has been scientifically denied (except in the case of virtual images produced through mirrors and lenses) for so long?

One possibility is in terms of the outward projection of perceptual fields, closely coupled to the electromagnetic field of light entering the eye (Sheldrake, 2005b). As Clarke (2005) summarized this suggestion, "The perceptual field links the starrer and the staree into a single physical system that is itself possessed of consciousness. The conscious aspect, when focussed down onto the starrer, becomes the perception of staring; and when focussed down onto the staree becomes the perception of being stared at" (p. 79). However, Clarke, one of the few physicists to think about this problem, preferred an alternative possibility in which there is a dual aspect to the electromagnetic field itself, which could be both physical and conscious:

If consciousness is one of the aspects of such a combined system, then the object (or rather, aspects of it) will be part of this consciousness, *associated with the place of the object*, and it will be joined with a self-consciousness of the subject. These together will constitute the conscious perception of the object without the need for any projection or any further field... My own theory (Clarke, 2004) considers the perceiver and the

perceived to be entangled systems.

However, as Clarke added, in current understandings of quantum entanglement, information cannot normally be conveyed between entangled systems without the existence of a parallel non-quantum channel of information flow. Nevertheless, some theoretical physicists argue that a non-local transfer of information – as opposed to signals traveling at or below the speed of light – is indeed possible between entangled systems (Walleczek & Grössing, 2016). If so, the entanglement of the perceiver and the perceived could help to explain the directionality of scopaesthesia.

Perhaps we come back to a new version of Aristotle's transparent as the basis of vision. The transparent unifies light and conscious visual perception and, in contemporary terms, could be thought of as a combined electromagnetic-visual field. Light and vision are closely coupled and flow in opposite directions through the electromagnetic-visual field, which at the same time unifies them. Directional connections through this field may underlie scopaesthesia.

Of course, diagrams with rays and arrows, with the light going into an eye or visual rays going out of it, are a gross oversimplification. Our visual field is not only the focus of our vision mediated through the foveas near the center of our retinas, rich in cones as opposed to rods that predominate over the rest of the retina and mediate peripheral vision. The perceptual field that we project outwards when we see is not confined to the focus of our attention but includes the entire visual field, most of which is peripheral. But for scopaesthesia, the focus of foveal attention seems to be of fundamental importance. Hunters in diverse cultures are taught to look at their potential quarry with peripheral vision rather than focusing their direct visual attention on it to avoid alerting the animal to their presence. Wildlife photographers do the same (Sheldrake, 2003). So, although the kinds of images shown in Fig. 1 are crude and vastly oversimplified, there is indeed a focus of attention in a particular direction through the ambient light.

Our case collection clearly shows that scopaesthesia is not confined to humans; 259 out of 960 cases (26%) concerned animals looking at humans or human looking at animals. Most were directional, as they were in human-to-human cases. It may well be that scopaesthesia is widespread among animal species and perhaps even among invertebrates. Can flies detect when jumping spiders are looking at them? No one knows because there have been practically no investigations of scopaesthesia in the realm of animal behaviour. One of the few naturalists who paid attention to this phenomenon was the American William Long. For example, when he was ob-

serving foxes in the wild, he was impressed by the way that vixens maintained discipline among their cubs without uttering a sound:

For hours at a stretch, the cubs romp lustily in the afternoon sunshine.... The old vixen, who lies apart where she can overlook the play and the neighborhood, seems to have the family under control at every instant, though never a word is uttered. Now and then, when a cub's capers lead him too far from the den, the vixen lifts up her head to look at him intently; and somehow that look.... stops the cub as if she had sent a cry or a messenger after him. If that happened once, you might overlook it as a matter of mere chance; but it happens again and again, and always in the same challenging way. The eager cub suddenly checks himself, turns as if he had heard a command, catches the vixen's look, and back he comes like a trained dog to the whistle (Long, 1919, pp. 91-2).

Eyes evolved in the Cambrian period, about 540-530 million years ago, in which there was also a rapid evolution of many new forms of animal life, often called the "Cambrian explosion" (Gould, 1989). There may have been a causal relation between eyes and this burst of creative evolution because vision enabled new forms of predation to develop, along with new evolutionary responses to predation (Parker, 2003). Scopaesthesia could possibly have evolved as long ago as the Cambrian in the context of predator-prey relationships. Potential prey that were able to detect the stare of a predator may have tended to survive better than those that were insensitive (Sheldrake, 2003). From the outset, animal vision may have involved both the intromission of light and the projection of visual fields. The ability to detect directional visual projections could be evolutionarily ancient and very widespread.

IMPLICATIONS AND APPLICATIONS

Directional scopaesthesia means that people and animals detect not only that they are being stared at but also the direction from which the look is coming. This has major implications for theories of vision because it implies a directional influence flowing out of the eyes in the opposite direction to the light moving in. The conventional assumption is that vision depends only on intromission (sending in) of light followed by the construction of representations inside the brain, whereas directional scopaesthesia implies that there is also an extramission (sending out) of visual images in the opposite direction

to the incoming light; in visual perception, minds are extended beyond brains. This re-opens an ancient debate on the nature of vision in human and non-human animals.

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SUPPLEMENTARY DATA

The full collection of scopaesthesia cases, as classified in Table 1, is available online here: <https://www.sheldrake.org/research/sense-of-being-stared-at/directional-scopaesthesia-data>.

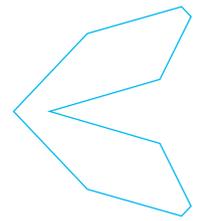
AUTHOR CONTRIBUTIONS

RS, Orcid 0000-0001-8814-4014: conceptualization, investigation, writing, review, and editing. P.S.: Data curation and analysis.

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RESEARCH
ARTICLE

Of Megalodons and Men: Reassessing the ‘Modern Survival’ of *Otodus Megalodon*

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INTRODUCTION

*Otodus megalodon*¹, colloquially known as the ‘megalodon’ or ‘megatooth’, was the largest predatory shark that ever lived. Recent estimates suggest it reached a maximum total length² of 18–20 meters (59.1–65.6 feet) (Pimiento & Balk, 2015; Perez et al., 2021). Its body form was likely similar to sharks of the family Lamnidae, which include great whites (*Carcharodon carcharias*), makos (*Isurus* spp.), and porbeagles and salmon sharks (*Lamna* spp.) (Cooper et al., 2020; 2022). While *O. megalodon* is classified in the separate family Otodontidae, lamnids are

still its nearest living relatives (Greenfield, 2022a; b). Like them, it was a very active predator, being partially endothermic and capable of burst speeds up to 37.2 kilometers per hour (23.1 miles per hour) (Ferrón, 2017). It had an estimated bite force 10–20 times higher than a great white’s and potentially the highest of any animal (Wroe et al., 2008; Rice et al., 2016). Bite marks on bones and teeth show that it preyed on seals and smaller whales (Collareta et al., 2017; Godfrey et al., 2018; 2021). Although teeth are the most common remains of *O. megalodon*, skeletal elements like vertebrae, jaw fragments, and possible rostral nodes are also known (Greenfield, 2022a; b). Its fos-

HIGHLIGHTS

Critical analysis suggests that presumed sightings of the gigantic, prehistoric-era shark called megalodon represent hoaxes or misidentifications of modern species.

ABSTRACT

The megalodon, *Otodus megalodon*, is arguably the most renowned ancient shark because of its extreme size and carnivorous nature. Paleontologists overwhelmingly agree that it went extinct towards the end of the Pliocene. However, some cryptozoologists have proposed that it never died out. Their evidence for its modern survival consists of alleged post-Pliocene teeth and sightings of unknown sharks. The sightings were compiled and critically reviewed via a study-specific scoring system that assessed physical and contextual characteristics. Prior research showed that the teeth were inadequately dated and are of conventional age. Consistent with this finding, the coding results of the eyewitness reports strongly suggested that they involved hoaxes or misidentifications of known sharks. Altogether, there is no compelling evidence for extant *O. megalodon* and ample proof of its extinction. The progression of the notion of its survival and the relationship to cryptozoological biases and popular culture are accordingly discussed.

KEYWORDS

Megalodon, sharks, prehistoric survivors, cryptozoology, paleontology, marine biology.



sils are found in most ocean basins and on all continents except Antarctica (Pimiento et al., 2016).

O. megalodon appeared in the early Miocene around 23 million years ago (Pimiento et al., 2016) and went extinct in the late Pliocene between 3.6–2.6 million years ago (Pimiento & Clements, 2014; Boessenecker et al., 2019). The emerging consensus is that its extinction was caused by interconnected environmental and ecological factors. These include loss of coastal habitat due to falling sea levels (Pimiento et al., 2017; Herraiz et al., 2020), decrease in prey diversity and quantity (Pimiento et al., 2016; Collareta et al., 2017), and competition with great whites (Boessenecker et al., 2019; McCormack et al., 2022). Despite the conclusive evidence for its extinction, there is speculation about the survival of *O. megalodon* into the modern day. This idea has a relatively recent origin, incorporating paleontology, cryptozoology, and popular culture.³ Two main claims are used to support it: teeth dated to the Pleistocene–Holocene and sightings of giant sharks. This paper reexamines and refutes these arguments for modern survival while tracking the evolution of the concept over time. The last major, skeptical review of this topic was 25 years ago (Roesch, 1998), and the need to address it has only increased since then.

Cryptozoology and the Prehistoric Survivor Paradigm (PSP)

The modern survival of *O. megalodon* is most often viewed through the lens of cryptozoology. Thus, it is first important to understand cryptozoological terminology and methodology. Cryptozoology is the study of animals that are reported to exist but have not been confirmed according to scientific standards (Heuvelmans, 1982).⁴ It is divided into subfields by taxonomic group; for pertinent example, the one for fishes is ‘cryptoichthyology’ (Berzas, 1998). These animals are called ‘cryptids’ (Wall, 1983), and their anecdotal status is referred to as being ‘ethnoknown’ (Greenwell, 1985). Cryptids are frequently interpreted as species traditionally thought extinct, a phenomenon termed the ‘prehistoric survivor paradigm’ (PSP) (Naish, 2010; 2016).⁵ The identification system of the PSP relies heavily on popularity. The more famous an extinct taxon is, the more likely it is to be associated with a cryptid, even if this association is contradicted by the available evidence. Paleontological discoveries and hypotheses have a significant influence on the PSP, but the osmosis of information is slow. As a result, cryptozoologists’ conceptions of ancient animals are usually based on obsolete science (Naish, 2001; Paxton & Naish, 2019). Pop culture has an equal influence, with the subgenre of

‘cryptofiction’ commonly featuring prehistoric survivors (Bosky, 2014; Mullis, 2019). These depictions are inaccurate and exacerbate the spread of misinformation within the field. Overall, the PSP is a critically flawed model that is not scientifically viable for analyzing cryptids.

Nonetheless, *O. megalodon*’s continued existence is widely discussed in the literature (Stead, 1963; Heuvelmans, 1965/1968; Matthiessen, 1971; Brown, 1973; Dennis, 1975; Housby, 1976; Goss, 1987; Raynal, 1987; Bright, 1989; Ellis & McCosker, 1991; Shuker, 1991; 1995; Roesch, 1998; Coleman & Clark, 1999; Eberhart, 2002; Renz, 2002; Coleman & Huyghe, 2003; Coudray, 2009/2016; Kriwet et al., 2009; Newton, 2009; Emmer, 2010; Conway et al., 2013; Marshall, 2018; Fuchs, 2020; Guimont, 2021; Hawthorne, 2021).⁶ As is normal for cryptids, it has been given alternate names such as ‘giant shark’ (Coleman & Huyghe, 2003), ‘great shark’ (Marshall, 2018), ‘lord of the deep,’⁷ and the tongue-in-cheek scientific epithet *Carcharocles ‘modernicus’* (Conway et al., 2013). Unlike other cryptids, though, interest in extant *O. megalodon* is inversely proportional to the amount of its support. Similarly well-known cryptids like sasquatch and the Loch Ness monster have hundreds or thousands of encounters with dozens of additional pieces of evidence (e.g., footprints, hairs, DNA, photographs, videos, audio recordings). In contrast, only a couple of teeth and a handful of sightings are attributed to living *O. megalodon*. For the latter, little connects them aside from involving huge sharks. This weak evidential basis, summarized below in two sets, demonstrates the power of the PSP in linking cryptids with extinct taxa. The superlative characteristics of *O. megalodon* and its corresponding fame are enough to fuel the idea of it being alive.

Evidence Set A: ‘Recent’ *O. megalodon* Teeth

O. megalodon teeth dated after its accepted extinction in the Pliocene are typically cited as indicating its survival. In particular, two teeth analyzed by zoologist Wladimir Tschernezky in 1959 (Tschernezky, 1959) are referenced. They were originally dredged from seafloor red clay by the British naval ship H.M.S. *Challenger* during its pioneering expedition in 1875. They were discovered 2,385 fathoms (4,361.7 meters/14,310 feet) deep at ‘Station 281’ in the South Pacific Ocean north of the Austral Islands (Murray & Renard, 1891). Both are housed in the Ocean Bottom Deposits Collection at the Natural History Museum in London, United Kingdom (Figure 1). Tschernezky measured the surface coatings of manganese dioxide (MnO₂) on these teeth, finding maximum thicknesses of 1.7 millimeters on the larger one (NHMUK M 481) and 3.64 milli-

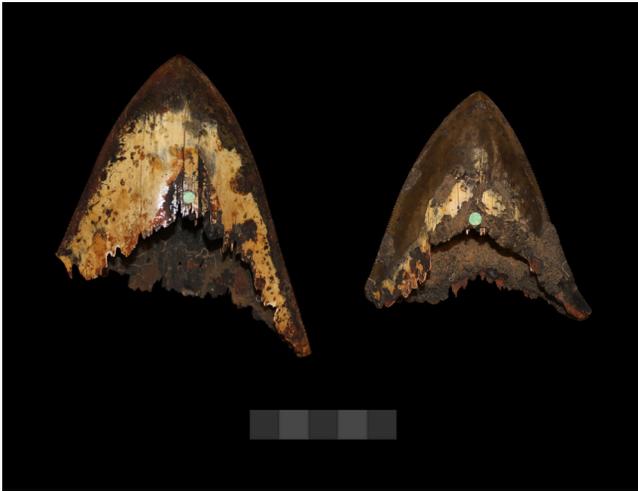


Figure 1. The two *O. megalodon* teeth unearthed by the H.M.S. *Challenger* and tested by Wladimir Tschernezky. Left: NHMUK M 481, the same as Murray & Renard (1891: pl. V, fig. 1) and Tschernezky (1959: fig. 2). Right: NHMUK M 482, the same as Murray & Renard (1891: pl. V, fig. 2) and Tschernezky (1959: fig. 1). The photographs were taken by Emma Bernard and are reproduced here with permission. The scale bar is 5 centimeters.

meters on the smaller one (NHMUK M 482). He then used the minimum MnO_2 accumulation rate of 0.15 millimeters per 1,000 years, which had been calculated by Pettersson (1955) through radium dating of oceanic manganese nodules. This resulted in estimated ages of 24,267 years⁸ (late Pleistocene) for the smaller tooth and 11,333 years (early Holocene) for the larger tooth. Tschernezky did not explicitly propose that *O. megalodon* is extant based on his findings, but that was likely his intended conclusion. He was also a cryptozoologist who studied the yeti and related it to the extinct ape *Gigantopithecus*, thereby advocating for the PSP (Tschernezky, 1960; Tschernezky & Cooke, 1975).⁹

Subsequent authors who employed the same dating technique (Gipp & Kuznetsov, 1961; Roux & Geistdoerfer, 1988) have not been mentioned in the cryptozoological literature. More importantly, a 1970 rebuttal by marine biologist Georgii M. Belyaev and paleontologist Leonid S. Glickman (Belyaev & Glickman, 1970b) has likewise gone unnoticed. They pointed out several factors which completely disprove Tschernezky's methods and results. First, Belyaev and Glickman noted that radium dating of manganese nodules is inaccurate and leads to calculated accumulation rates 20–30 times faster (and ages 20–30 times younger) than more accurate ionium-thorium dating. Second, they observed that the dentine roots and cores of the *Challenger* teeth had entirely decayed, leaving only the enameloid crowns, before the deposition of MnO_2 began. Third, they recognized the spotty coverage and varying thicknesses of MnO_2 on each tooth, which shows that deposition stopped and resumed multiple

times. These features are seen in other fossilized shark teeth recovered from the ocean bottom, like those collected by the Russian RV *Vityaz* expeditions that were examined by Belyaev and Glickman (Belyaev & Glickman, 1970a). Ultimately, even if an improved accumulation rate is utilized, MnO_2 is still worthless for dating because deposition started long after the teeth landed on the seabed and occurred at inconstant intervals.

The age of the *Challenger* teeth must be determined with alternative approaches. Belyaev and Glickman found that *O. megalodon* teeth are regularly accompanied by two other species of extinct sharks, the ancestral great white *Carcharodon hastalis* and the hooked megatooth *Parotodus benedenii*.¹⁰ They were restricted to the Miocene–Pliocene between 23–2.6 million years ago (Cappetta, 2012) and serve as index fossils in this case. The shark teeth gathered by the *Challenger* that are described and illustrated in its official report (Murray & Renard, 1891) contain *C. hastalis* and *P. benedenii*.¹¹ They were obtained at Station 281 and surrounding sites in the South Pacific, confirming that these localities are Mio-Pliocene.¹² Further confirmation comes from two *O. megalodon* teeth which were dredged by the German research ship RV *Sonne* in 2007 in the same region (Kriwet et al., 2009). These were dated to 18 million (early Miocene) and 6 million years ago (late Miocene) using strontium dating. Finally, the fact that all confidently-dated *O. megalodon* teeth are Mio-Pliocene should erase any doubt about the age of the *Challenger* specimens. Ironically, even if Tschernezky was correct and they were Pleisto-Holocene, they would not be proof of modern survival. Many animals went extinct throughout the Holocene before the present day (e.g., woolly mammoths; Vartanyan et al., 2008); theoretically, *O. megalodon* could have done so too.

Evidence Set B: Collection of Sightings

The reputed *O. megalodon* sightings that are most often talked about have been selected through a review of the literature. The list is largely the same as those covered by Roesch (1998), with the main difference being that the Great Barrier Reef sighting is here revealed to be plagiarized from J.S. Elkington's sighting (see below). They are presented in chronological order by the date they were first published, except for Loren Grey's, which is grouped with his father's. This collection has additional sources and information that have not been addressed before by cryptozoologists or skeptics, which were turned up by extensive searching. After the sightings are explained and interpreted, they are further scrutinized with a scoring system that compares them to *O. megalodon* and living sharks. On top of that, aspects that could denote dishon-

esty and coinciding motivations are enumerated. This is the first collation of the sightings with in-depth breakdowns of all their characteristics and contexts. Previous authors have credulously accepted or too quickly dismissed the data without proper rigor.

The Broughton Island Sighting

The most notable sighting claimed to be *O. megalodon* was recounted by marine biologist David G. Stead in his posthumous 1963 book *Sharks and Rays of Australian Seas* (Stead, 1963). It happened in 1918 near Broughton Island off the coast of New South Wales (NSW), Australia. Stead and his colleague Ebenezer J. Paton were told this story at Port Stephens by fishermen who trapped rock lobsters around the island.¹³ They allegedly witnessed an enormous shark, which they conflictingly guessed to be either 115 or 300 feet long (35.1 or 91.4 meters). Besides its size and uniformly white coloration, no other physical attributes were specified. The shark seized many of the fishermen's lobster pots, which were 3.5 feet (1.1 meters) wide and contained a few dozen lobsters each, and took their mooring lines with them. Although unconvinced of the extreme lengths, Stead believed the account to be otherwise true and the shark to be an *O. megalodon*.¹⁴ His opinion was informed by outdated length estimates of 80–90 feet (24.4–27.4 meters) for this species, along with his mistaken assumption that teeth he personally saw were unfossilized. Furthermore, his earlier theorization that sea serpents could be gigantic sharks (Anon., 1912)

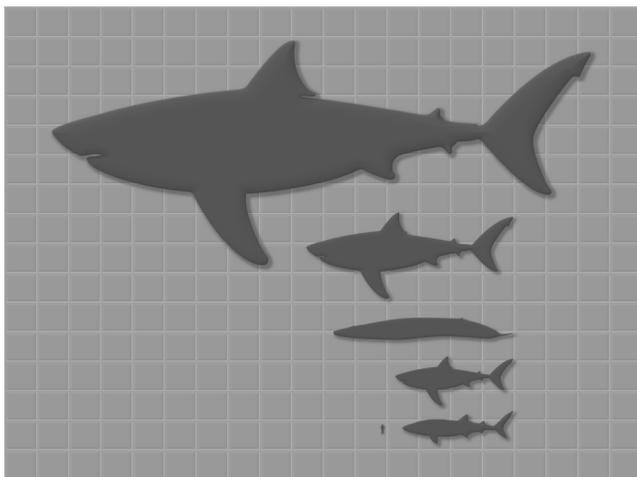


Figure 2. From top to bottom: the upper (91.4 meters) and lower (35.1 meters) sizes for the Broughton Island shark, a blue whale (30.5 meters), *O. megalodon* (20 meters), whale shark (18.8 meters), and human (1.8 meters). The *O. megalodon* silhouette is redrawn from Oliver Demuth's reconstruction in Cooper et al. (2020) (CC BY 4.0), the blue whale silhouette is modified from Scott Hartman's (PhyloPic, CC BY 3.0), the whale shark silhouette is modified from Christoph Schomburg's (PhyloPic, CC0 1.0), and the human silhouette is the author's own work. See end of article for full links.

might have contributed to his belief.¹⁵

This version of the incident has been ubiquitously repeated in the cryptozoological literature, but a contemporary newspaper article quoting Stead (Anon., 1918a) has been overlooked. It is consistent with the former yet reveals key details that were omitted. It was published in the January 30 issue of the *Sydney Evening News*, with the sighting implied to have transpired in the preceding days. There was a severe, monsoonal storm in the area that morning, and Stead and Paton were initially inquiring about damages suffered. An article regarding the storm was printed later in the same issue (Anon., 1918b). The fishermen, while remaining anonymous, were disclosed to be Greek immigrants.¹⁶ The shark supposedly appeared over the course of multiple days, ate the lobster pots and their contents whole, and on one occasion took a bite out of one of their 'launches.' This would have been a small, motor or steam-powered boat holding two to four men, according to another description of NSW lobster fishermen (Gruvel, 1911). Like Stead, the article writer matched the encounter with *O. megalodon* because of inflated size estimates and rumored unfossilized teeth,¹⁷ being the first ever source to postulate its modern survival.

The connection of the Broughton Island sighting with *O. megalodon* is tenuous at best. The reported sizes are almost twice as long as the largest *O. megalodon* at minimum and over four times at maximum (Figure 2). Even presuming that the lengths were greatly exaggerated,¹⁸ there are no identifying characters (e.g., the morphology of the teeth, head, body, or fins) that are shared between them. A more reasonable candidate is a whale shark (*Rhincodon typus*), which was posited by Hawthorne (2021). It is the largest living shark, reaching a total length up to 18.8 meters (61.7 feet) (McClain et al., 2015), and is closest in dimensions to the sighting (albeit still significantly shorter). An albino or leucistic individual has been seen (Anon., 2008), so an all-white color is possible. Additionally, the fishermen would have been unfamiliar with whale sharks. The species was not recorded in NSW until 1936 (Whitley, 1965)¹⁹ and in the fishermen's native Mediterranean Sea until 2021 (Turan et al., 2021). On the other hand, the reported behaviors do not line up. Whale sharks are filter feeders that eat pelagic organisms like zooplankton and small fishes (Rohner & Prebble, 2021), not large, benthic crustaceans like lobsters. They have minute, vestigial teeth (White, 1930), which are incapable of crushing lobster pots or biting chunks out of boats.²⁰ Their esophagus has a mere diameter of ~4 inches (~10.2 centimeters) (Gudger, 1940), so the pots could not be swallowed whole.

Another candidate that better fits the behaviors is a great white shark. Crustaceans are not a main compo-

ment of their diet, but they have consumed large crabs in rare instances (LeMier, 1951). Great whites can bite and crush crab traps and bite or ram other fishing gear and boats (Collier et al., 1996). In an extraordinary event, one smashed a hole into a small boat carrying two lobster fishermen and capsized it (Anon., 1953; Day & Fisher, 1954). Albino (Smale & Heemstra, 1997) and leucistic (Kabasakal, 2020) individuals have also been documented. However, great whites attain a top total length of approximately 7 meters (~23 feet) (Mollet et al., 1996), only about a third of that of whale sharks. A study of untrained witnesses found average errors under 0.5 meters (1.6 feet) when visually assessing the lengths of great whites (May et al., 2019). The species was already present in NSW well before 1918 (Whitley, 1939), so the fishermen were surely familiar with it. These factors make it less conceivable to be misidentified and exaggerated than a whale shark, especially at the close distance when the shark attacked the boat. It would also be an unlikely combination of unusual circumstances for an albino/leucistic great white to destroy lobster pots, eat lobsters, and bite a boat.

The most plausible explanation for the Broughton Island sighting is that it was a hoax perpetrated by the fishermen. This was mooted by Heim in Renz (2002), who speculated that they devised the shark story to cover up the loss of their equipment for a different reason. Now, with knowledge of the newspaper articles, that reason becomes clear: the storm. The gale force winds, heavy rainfall and consequent flooding, and turbulent waves all could have caused the lost pots and damaged boat. Neither were probably owned by the fishermen, instead being leased from a senior person or company since they were poor immigrant workers. They would have been liable if the situation was due to their own negligence, like if they improperly stored the materials or operated them out in the storm. To add to their financial woes, the years 1916–1918 experienced a marked decline in rock lobster catches in NSW as an effect of World War I (Montgomery, 1995). Considering their vulnerable socioeconomic status in this stressful time, the fishermen had a strong incentive to hide their fault and avoid reimbursement. A hoax of desperation accounts for the hyperbolic sizes and other inconsistencies with real sharks, which are doubtful to be honest errors.

Zane and Loren Grey's Sightings

The next sightings are one by novelist and sport fisherman Zane Grey and another by his son Loren. Zane's was presented in his 1931 book *Tales of Tahitian Waters* (Grey, 1931). It happened in June 1928²¹ in the vicinity of Rangiroa atoll in the South Pacific and was watched by him

and his entourage of several boats and crewmen. As they were reeling in yellowfin tuna, a big shark approached the surface towards them. It ignored the tuna and passed under the boats, then dove down and disappeared after a few seconds. It was yellowish-green colored with a few white spots and had a square head and large pectoral fins. The last third of its body and tail was noticeably thinner than its broad head and anterior body. Zane judged it to be 8 feet wide (2.4 meters) and at least 35–40 feet long (10.7–12.2 meters). Loren recalled his sighting in the 1976 book *Shark: The Killer of the Deep* (Grey & Grey, 1976). It occurred in 1933²², around 100 miles (160.9 kilometers) northwest of Rangiroa, while he was on the steamer S.S. *Maunganui* with his father. Loren spied the shark emerging from the ocean and alerted Zane and fellow passengers, who also saw it. It was yellowish-brown in color with hundreds of white spots, which were actually barnacles upon closer inspection and not patterning. It had a large tail that protruded out of the water, a round head 10–12 feet wide (3–3.7 meters), and it was 40–50 feet long (12.2–15.2 meters).

Neither of the Greys ascribed their sightings to *O. megalodon*, as opposed to the cryptozoological literature. They did not determine the species, but both were adamant that it was not a whale shark, regardless of the similarities. Indeed, Roesch (1998) contended that it was, in fact, a whale shark because of the resemblance. Zane's description is the closest match overall. The length is within the range of whale sharks, and the rectangular head wider than the posterior body²³, and prominent pectoral fins align too (Tomita et al., 2021). Zane indicated a low amount of white spotting, which is seemingly at odds with the numerous spots on whale sharks. Yet, nonoptimal lighting and water clarity can reduce the number of visible spots (Pianin, 2020). The yellowish-green coloration is not typical, but the aforementioned conditions could also cause the standard shades of blue, grey, or brown to look differently. Zane had previously seen a whale shark and perceived it as being green at first, then changing to blue (Grey, 1925).²⁴ The behavior of disregarding the hooked tuna is congruent with whale sharks, which do not eat fish of that size. Some of these aspects are contradictory to *O. megalodon*. Rostral nodes belonging either to it or its relative *Parotodus* are most alike porbeagles and salmon sharks (Greenfield, 2022a; b), suggesting that it had a pointed snout and tapering head.²⁵ It would have been solidly dark colored, not spotted, on its dorsal side as a function of its ecology (Cooper et al., 2020). The behavior is abnormal for any predatory sharks, which tend to depredate fish caught on lines (Mitchell et al., 2018).

Loren's sighting parallels whale sharks in some details, though others are incompatible. The length and

color are again within possibility, and whale shark heads could be construed as rounded since they have blunt corners. The infestation of barnacles is where the narrative deviates from known anatomy. All sharks have dermal denticles (a.k.a., placoid scales) covering their skin; whale sharks (Becerril-García et al., 2021) and *O. megalodon* (Nishimoto et al., 1992) are no exceptions. The hard, ribbed exteriors of these denticles, which are composed of enameloid like teeth, prevent barnacles from attaching to the epidermis (Bixler & Bhushan, 2013).²⁶ Whales are hosts for a variety of barnacles (Fertl & Newman, 2018), but Loren was positive that the animal was a shark and not a whale when seeing its tail. Whales and sharks have horizontally and vertically oriented caudal fins, respectively (Fish, 2023), so it would be difficult to conflate them. This paradox is a sign that the story was a hoax. Also suspicious is that Zane never attested to it, despite purportedly being a bystander, and that Loren waited until long after his father's death in 1939 to tell it. Loren may have concocted a more sensational tale in an attempt to beat Zane's, which would explain why his shark was somewhat longer and wider as well.²⁷

J.S. Elkington's Sighting

David Stead wrote about a further sighting in *Sharks and Rays of Australian Seas*. It was communicated to him in a 1939 letter from ship captain J.S. Elkington, who said it unfolded in 1894 off Townsville, Queensland, Australia. When Elkington was sitting in a 35 foot (10.7 meter) launch that had broken down, a shark came and laid within 10 feet (3 meters) of the boat for a half hour. It extended a few feet past each end of the boat and was yellowish-white in color. He was certain that it was a great white and ruled out a basking shark. Strangely, this anecdote was plagiarized by marine biologist Theo W. Brown in his 1973 book *Sharks: The Silent Savages* (Brown, 1973). Brown changed some parts: the source to an anonymous captain who told him, the date to 1963,²⁸ and the launch to 85 feet (25.9 meters). The location off Townsville (now specified to the Great Barrier Reef), the boat being stalled, and the shark being as long or longer than the boat and white colored were retained. Though Brown's has been referred to as a separate sighting, it is obviously a hoax that was lifted from Elkington's.²⁹

Contrary to Elkington's conviction, the size of his shark agrees with a basking or whale shark and not a great white. The peaceful disposition and potential albinism/leucism also conform to both of the filter feeders. Basking sharks are more comparable in body plan to great whites than whale sharks are to either (Ebert et al., 2021), so they are more plausible to be confused. His view may

have been biased by a reputed 36.5 foot (11.1 meters) great white captured off Port Fairy, Victoria, Australia (Günther, 1870), which was eventually reevaluated to be ~17.7 feet (~5.4 meters) (Randall, 1973). A dubious detail is that Elkington implied the shark sat still by his unmoving boat for the duration. Big pelagic sharks are ram ventilators, meaning they swim practically continuously to keep water flowing through their gills to breathe (Dolce & Wilga, 2013).³⁰ Whales can be motionless for over an hour while resting due to their air-breathing (Lyamin et al., 2001), and their carcasses can float (Moore et al., 2020), but it would be hard to mistake a whale for a shark as already elaborated. Once again, a hoax is most probable in light of this discrepancy. There is no corroborating evidence that it preceded all other sightings, as Elkington asserted. Therefore, his shark's coloration could have been copied from the Broughton Island sighting, with the length approximating the Port Fairy great white or Zane's sighting to make it more believable.

The Rachel Cohen Incident

In his 1969 book *Des Poissons si Grands*, pilot and sport fisherman Pierre Clostermann documented an attack by a gargantuan great white³¹ (Clostermann, 1969). The ship *Rachel Cohen* was traveling off Timor in March 1954 when it was rocked by an unseen collision on a stormy night. Upon returning to dry dock in Adelaide, South Australia (SA) for repairs, the culprit of the crash was exposed by 17 teeth lodged in the wooden keel. Their average crown height was 10 centimeters (3.9 inches), and base width was 8 centimeters (3.1 inches). They were arranged in an arc with a roughly 1 meter (3.3 feet) radius near the propeller shaft, which was bent from the force. Clostermann stated that unnamed ichthyologists had ascertained a length of 24 meters (78.7 feet) from the bite. After consulting historical materials, this narrative is divulged to be a mixture of truth, confusion, and embellishment. There was an Australian ship christened *Rachel Cohen*, but it was destroyed in a fire in 1924 (Anon., 1924). The *Rachel Cohen* was professed to have been the victim of a shark attack, but that was a mistake.

In 1897, the ship *Eclipse* was docked for refitting at Birkenhead, SA (a suburb of Adelaide) when shark teeth were removed from the copper plating on its hull (Anon., 1897). How many teeth, their measurements, and what species they belonged to were not declared. This event was reiterated in a 1926 article with alterations: the date was left out, and the *Eclipse* was switched for the *Rachel Cohen* (Saunders, 1926). The latter ship's immolation two years prior was probably fresher in the writer's memory, causing an accidental substitution. The modified retelling

was then included in Victor Coppelson's 1958 book *Shark Attack* (Coppelson, 1958). Clostermann plausibly could have pulled the vessel's name and port and the general scenario from Coppelson. The features of the teeth might have been drawn from a different interaction. In 1950, a fishing boat in Streaky Bay, SA, was assailed by a 17 foot (5.2 meter) great white³² (Anon., 1950). Its head projected over 3 feet (0.9 meters) out of the water when it moved alongside the boat. The shark was soon caught and three of its teeth were extracted from the planking. Perhaps Clostermann misinterpreted the particulars, with the 17 feet changed to 17 teeth, three teeth to three-inch-wide teeth, and three-foot-high head to three-foot bite radius. The 1954 date, contact off Timor, mangled propeller, and length estimate all seem to be fabrications by Clostermann.

Scoring the Sightings Collection

Comparative analysis with a scoring system has been utilized in some cryptozoological research. For instance, Woodley et al. (2011) used this process for comparing a baby sea serpent to other animals. They were dealing with an intricate account and sketch with 29 traits and 14 candidates.³³ Unfortunately, the sightings here are all far less detailed and lack drawings, and have a more limited pool of candidates. Four of them were included, with the Great Barrier Reef sighting and *Rachel Cohen* incident eliminated since they are definite hoaxes. They have been sorted into a simpler tabulation with six categories of characteristics and four species (Table 1). *O. megalodon* was chosen because of its correlation with these sight-

ings by cryptozoologists. Basking, great white, and whale sharks were chosen because they are the biggest sharks that both inhabit the South Pacific and often come to the surface. Whales were excluded because they are unlikely to be mistaken for sharks at short distances by experienced seamen. Each characteristic was considered at face value and independently of the others. If it matches a species, then one point was added to that species' score; if not, then zero points were added. Characteristics that pertain to all species (e.g., swimming, large pectoral and caudal fins) were not scored, while those that contradict all species were.³⁴ The species with the most points has the greatest similarity to the sighting, although it is not necessarily the best explanation.

Zane Grey's sighting is the only one in which all characteristics fit a single species, whale sharks. It is also the only one without a characteristic that contradicts all species. Great whites scored highest for the Broughton Island sighting, whale sharks for Loren Grey's, and basking sharks for J.S. Elkington's. These three had one contradicting characteristic each. Any characteristics that correspond to *O. megalodon* are shared with other species. It never garnered more than half of the available points for a sighting. Altogether, this system suggests that misidentified extant sharks were responsible and not *O. megalodon*. That being said, the scoring cannot fully resolve if hoaxing was involved or not. It encompasses questionable parts within the sightings but not information from elsewhere. The poor quality and quantity of the sample further restrict the applicability of this type of analysis. These shortcomings emphasize that additional context, rather than the base descriptions alone, is essential for

Table 1. The scoring system for sightings with the characteristics on top and the points for species on bottom.

Sighting	Length	Width	Head shape	Coloration	Behavior	Other characteristics
Broughton Island	115-300 feet ^X			White ^{B,G,W}	Swimming, attacking boats and traps to eat lobsters ^G	
Zane Grey's	35-40 feet ^{B,M,W}	8 feet across body ^{M,W}	Square ^W	Green and yellow with white spots ^W	Swimming, ignoring hooked tuna ^{B,W}	Large pectoral fins, last 1/3 of body narrower than head ^W
Loren Grey's	40-50 feet ^{B,M,W}	10-12 feet across head ^{M,W}	Round ^W	Brown and yellow ^{B,W}	Swimming	Large caudal fin, covering of barnacles ^X
J.S. Elkington's	>35 feet ^{B,M,W}			White and yellow ^{B,G,W}	Stationary ^X	Similar in appearance to great whites ^{B,G,M}
Sighting	(B) Basking shark	(G) Great white shark	(M) <i>O. megalodon</i>	(W) Whale shark	(X) Contradicts all	
Broughton Island	1/3	2/3	0/3	1/3	1/3	
Zane Grey's	2/6	0/6	2/6	6/6	0/6	
Loren Grey's	2/5	0/5	2/5	4/5	1/5	
J.S. Elkington's	3/4	2/4	2/4	2/4	1/4	

Table 2. The final appraisal of the sightings supplementing the scoring system with context.

Sighting	Most likely explanation	Scoring results	Problematic context
Broughton Island	Hoax	Does not match a species in all characteristics One characteristic that contradicts all species Lowest number of scored characteristics	Only published in secondhand accounts All witnesses were anonymous Severe storm and negligence could have caused damaged equipment and boats Financial incentive to cover up damages and avoid liability Fishermen were already vulnerable due to being poor immigrants Stressful time because of a decline in the local lobster fishery
Zane Grey's	Misidentified whale shark	Matches whale sharks in all characteristics No characteristics that contradict all species Highest number of scored characteristics	Alleged other witnesses never confirmed they were present Insistence it was not a whale shark, despite describing one similarly before
Loren Grey's	Hoax	Does not match a species in all characteristics One characteristic that contradicts all species Second highest number of scored characteristics	First reported 43 years after it supposedly happened No corroboration that it happened when claimed Date changed in a later retelling Alleged other witnesses never confirmed they were present Similar to Zane's sighting, but with a larger shark Loren had a troubled relationship with Zane and wanted to one-up him Reported during a wave of public interest in sharks
J.S. Elkington's	Hoax	Does not match a species in all characteristics One characteristic that contradicts all species Second lowest number of scored characteristics	Only published in a secondhand account First reported 45 years after it supposedly happened No corroboration that it happened when claimed Similar shark coloration to the Broughton Island sighting Similar shark size to the Port Fairy great white and Zane's sighting

deciding the veracity of anecdotal evidence. Bearing that in mind, the sightings have been organized into a second tabulation that combines the scoring with problematic context (Table 2). The features indicative of hoaxes outnumber those in favor of misidentifications for the Broughton Island, Loren Grey's, and J.S. Elkington's sightings. The results of both comparisons should dispel the myth that *O. megalodon* has been witnessed by humans.

Evolution of the Concept and Popular Culture

The modern survival of *O. megalodon* was hypothesized as far back as 1918, yet it did not become a pervasive idea until much later. Tschernetzky's and Stead's works in 1959 and 1963, respectively, were the real starting points. Even then, their contents were not immediately disseminated. An example is the 1968 *In the Wake of the Sea-Serpents*, a foundational text on marine cryptids by 'father of cryptozoology' Bernard Heuvelmans (Heuvelmans, 1965/1968). He briefly touched on extant *O. megalodon*, insinuating that their rotting corpses could have inspired

legends of hairy sea monsters. However, Heuvelmans did not discuss the recent teeth or sightings and was apparently unaware of them. Peter Matthiessen's 1971 book *Blue Meridian: The Search for the Great White Shark* was the first to repeat the Broughton Island sighting (Matthiessen, 1971). He also incorrectly theorized that *O. megalodon* and great whites may be a single species, as support for its current existence.³⁵ This argument was parroted in Peter Benchley's famous novel *Jaws* in 1974 (Benchley, 1974). Matthiessen's and Benchley's books spurred writing on the subject among shark enthusiasts, leading to the induction of Elkington's sighting (via Brown's appropriation) into the canon (Brown, 1973; Dennis, 1975; Housby, 1976). The 1976 short story "He" by Alan Dean Foster was the earliest fiction about a live *O. megalodon* (Foster, 1976). It introduced the trope of the shark inhabiting an oceanic trench (the Tonga-Kermadec Trench in this iteration), which became a staple of ensuing crypto-fiction.³⁶

This rise of interest in the 1970's was ephemeral and

failed to impact the cryptozoological community. The early 1980's saw no developments aside from the first novel on the topic, Robin Brown's *Megalodon*, in 1981 (Brown, 1981). In 1986, Heuvelmans excluded *O. megalodon* from his comprehensive list of cryptids (Heuvelmans, 1986). Countering the next year, cryptozoologist Michael Goss published a magazine article favorable to its persistence (Goss, 1987). He added the Greys' sightings to the roster of evidence and referenced the *Challenger* teeth, but not Tschernetzky's dates for them. Those would be brought up by Michel Raynal's addendum to Heuvelmans' list the same year (Raynal, 1987) and Michael Bright's book *There Are Giants in the Sea* in 1989 (Bright, 1989). Richard Ellis and John E. McCosker covered modern *O. megalodon* in their 1991 book *Great White Shark* (Ellis & McCosker, 1991). Cryptozoologist Karl Shuker followed suit in a 1991 magazine article and 1995 book *In Search of Prehistoric Survivors* (Shuker, 1991; 1995). Steve Alten's *Meg: A Novel of Deep Terror*, the most influential pop culture property starring *O. megalodon*, was released in 1997 (Alten, 1997).³⁷ All these publications prompted a resurgence in attention that endures today. In 1998, marine biologist Ben Speers-Roesch provided the initial skeptical perspective on the issue (Roesch, 1998). He deduced that the sightings were hoaxes or misidentifications and the teeth were wrongly dated. He also outlined ecological and environmental aspects that preclude survival.

While Speers-Roesch discounted living *O. megalodon* completely, his analysis did not mitigate its popularization. Various books, articles, and papers on the matter have been written in the meantime, representing a spectrum of opinions (see 'Cryptozoology and the PSP' for a list). Television shows and movies have played a more substantial role as well. A 2009 episode of the cryptozoological docuseries *MonsterQuest* focused on *O. megalodon* (Hajicek, 2009). It created a link with recollections of the 'Black Demon' shark in the Gulf of California, which were hitherto unrecorded in the literature. Two cryptofictional films were misleadingly aired as 'documentaries' on the Discovery Channel, *Megalodon: The Monster Shark Lives* in 2013 and its sequel, *The New Evidence*, the year after (Glover, 2013; 2014). These programs portrayed faked photographs and footage as genuine and used actors posing as scientists to deceive the audience. Justifiably, they faced intense backlash from academics for misinforming the public on an educational network (Fuchs, 2020). *The Meg*, a cinematic adaptation of Alten's novel, premiered in 2018 (Turteltaub, 2018). A sequel, *Meg 2: The Trench* (Wheatley, 2023), and a competitor, *The Black Demon* (Grünberg, 2023), both debuted this year. Pop culture has carried the modern survival of *O. megalodon* to new heights; what began as scant teeth and anecdotes is now

the domain of multimillion-dollar blockbusters.³⁸

GENERAL DISCUSSION

When subjected to scrutiny, the putative evidence for *O. megalodon* in the present day does not hold up. The *Challenger* teeth were dated with an invalid method and are Mio-Pliocene in age, not Pleisto-Holocene, based on coeval fauna and accurately-dated teeth. The Broughton Island sighting was probably a hoax invented by the fishermen to deflect blame for their missing and broken equipment, which explains the outlandish size of their shark. Zane Grey's sighting is wholly consistent with a whale shark, notwithstanding his insistence otherwise. Loren Grey's and J.S. Elkington's sightings both have elements conflicting with sharks (barnacles and motionlessness) and were likely hoaxes trying to imitate their predecessors. The *Rachel Cohen* incident was an amalgamation of garbled shark attacks and hoaxing. The false equivalencies here are especially damning; if the original claims were absolutely true, they still would not signify *O. megalodon* being alive. Teeth from the early Holocene would not demonstrate it lasting into the modern era. The sightings have no diagnostic traits of *O. megalodon* and clash with its actual anatomy (and with each other). They are only associated because of the species' notoriety and the ever-prevalent PSP in cryptozoology. In reality, *O. megalodon* is not ethnoknown and is thus not a cryptid, since there are no legitimate accounts that can be credibly tied to it.

Conversely to widespread misconceptions, it is indeed possible to prove a negative position if there is sufficient negative evidence (Pasquarello, 1984; Hales, 2005).³⁹ The current nonexistence of *O. megalodon* is verified by strong lines of negative evidence. There are no known teeth that are authentically post-Pliocene, whether fossilized, sub-fossilized, or freshly-shed. This contrasts with the sheer abundance of its teeth during the Mio-Pliocene, which establishes that they should continually be produced in vast numbers if it was not extinct.⁴⁰ There have been no strandings on shores, and none captured by fishermen as bycatch, either live or dead. Extant species of large sharks have been washed up or accidentally caught many times (Oliver et al., 2015; Wosnick et al., 2022), and *O. megalodon* should be no different. No bite marks or embedded teeth on modern marine mammals have been discovered. It would need to feed and would leave traces of predation or scavenging, as it did in the fossil record. It would also need to reproduce and rely on shallow-water nurseries to protect its young (Pimiento et al., 2010; Herraiz et al., 2020), yet no such areas or offspring are found. No photographs or videos are taken in spite of the increas-

ing utilization of underwater ROV's and aerial drones for surveying sharks (Butcher et al., 2021). In summary, there is no conceivable way that *O. megalodon* could be living while utterly evading detection. Without any physical, visual, or testimonial backing, the burden of proof remains firmly on the proponents of its survival.

IMPLICATIONS AND APPLICATIONS

For cases mostly or entirely lacking physical evidence, a systematic content analysis of eyewitness reports is a viable technique to assess and contextualize cryptids. This approach has limitations and might not necessarily resolve the cases (or broader phenomena) under review, but it can generate or test hypotheses to certain extents. It is a more rigorous alternative to automatically designating cryptids as novel or relictual taxa. Various scoring systems have been put forward in cryptozoology (e.g., Champagne, 2001; 2007; 2016; Woodley et al., 2011), and most, including the one here, are centered on aquatic sightings. They could be expanded to incorporate more terrestrial and aerial sightings and begin to tackle larger datasets. It would be valuable to compare and refine these competing schemes to produce a standardized system that is widely adopted as the best practice tool.

ENDNOTES

1. Throughout its long history, the species *megalodon* has been placed in six genera: *Carcharias*, *Carcharocles*, *Carcharodon*, *Megaselachus*, *Otodus*, and *Pro-carcharodon*. This paper uses the combination *Otodus megalodon* following the argument of Shimada et al. (2017). For an opposing view advocating an assignment to *Carcharocles*, see Kent (2018).
2. Total length is measured from the tip of the rostrum to the tip of the upper lobe of the caudal fin in a straight line in life position. Lengths in the sightings investigated later in this paper are assumed to be total lengths.
3. This blending of modern science and culture was termed 'new mythology' by Guimont (2021).
4. The foremost scientific standard lacking by many cryptids is a physical type specimen (i.e., a whole body preserved in a museum). However, some species recognized by mainstream zoologists have also been described without physical types (see Krell & Marshall, 2017, for a list). The demarcation between cryptozoology and zoology can be ambiguous, and it is used here as a term of convenience.
5. The paleontological equivalent is a 'Lazarus taxon,' which reappears unexpectedly after a period of absence in the fossil record (Fara, 2001).
6. Young earth creationists have also forayed into cryptozoology, focusing on prehistoric survivors as falsifying evolution and deep time (Thunig, 2017). Tying into their ideology, some creationists have suspected the persistence of *O. megalodon* (Froede, 1995; Wieland, 2005). One pondered that it might have been the 'great fish' which ingested the Biblical Jonah (Lamb, 2006).
7. This name is supposedly taken from a Polynesian legend, but it should be regarded as apocryphal since no primary, native sources are cited. It was first mentioned by Brown (1973), who did not explicitly connect it to *O. megalodon*. That connection was made by Dennis (1975) and Housby (1976), then later revived by Shuker (1995) and Eberhart (2002). The 'box head lamnid' of the South Pacific (Champagne, 2001) might be another name intended for *O. megalodon*, owing to the similitude with the Greys' sightings, but this is unconfirmed.
8. A probable typographical error caused this to be printed as '24,206' by Tschernetzky. His two figures were also unintentionally switched around relative to their captions and descriptions in the text (i.e., fig. 1 actually shows tooth 'N2' [= M 482] and not tooth 'N1' [= M 481], and vice versa).
9. Tschernetzky was additionally a founding member of the International Committee for the Study of the Human-like Hairy Biped (Anon., 1962).
10. Like *O. megalodon*, these two species have convoluted taxonomic histories. *hastalis* has been referred to the genera *Carcharodon*, *Cosmopolitodus*, *Isurus*, and *Oxyrhina*, and *benedenii* has been referred to the genera *Anotodus*, *Isurus*, *Oxyrhina*, *Parotodus*, and *Uyenoa*. They are here assigned to *Carcharodon* and *Parotodus*, following Ehret et al. (2012) and Cappetta (1980), respectively. Early Pleistocene occurrences of both have been recorded (Ebersole et al., 2017; Boesse-necker et al., 2018), but these teeth were probably reworked from older sediments.
11. The teeth in plate VI, figures 1–7 are *C. hastalis* (identified as '*Oxyrhina*'), and those in plate VI, figures 8–11 are *P. benedetti* (identified as '*Oxyrhina*' or '*Otodus*') (pers. obs.). Two of the *P. benedenii* came from Station 281, while the rest came from neighboring stations. More teeth of '*Oxyrhina*' from Station 281, presumably including *C. hastalis* and *P. benedenii*, were alluded to but not figured.
12. Another possible age constraint is a layer of volcanic ash that overlaid the red clay at Station 281, which likely fell from a terrestrial eruption on the nearest islands of Rurutu or Tubuai (Murray & Renard, 1891). This layer has not been radiometrically dated, but

- the latest eruption on Rurutu was 1.17–1.12 Ma (early Pleistocene), and on Tubuai was 10.52–10.35 Ma (late Miocene) (Rose & Koppers, 2019).
13. Paton was an NSW Inspector of Fisheries, and only his surname was declared by Stead. His full name was sourced from a government notice of his retirement (Oakes, 1923). The crustaceans being caught were variously called ‘crayfish’ by Stead and ‘lobsters’ in some retellings. They were almost certainly the eastern rock lobster (*Sagmariasus verreauxi*), which are abundant and commonly fished along the NSW coast (Stead, 1910; Holthuis, 1991).
 14. Stead did not use its scientific designation and instead dubbed it the ‘white death type’, an informal name for *Carcharodon* (which *megalodon* was placed in at that time). The newspaper article about the sighting did so too. His assessment of its length may have been influenced by the equal result of Dean (1909), who used a reconstructed dentition and jaws which were later proven to be far oversized (Applegate, 1971).
 15. Stead suggested a form akin to the frilled shark (*Chlamydoselachus* spp.) that grew to be 80–100 feet (24.4–30.5 meters) long or more. Similar propositions of massive, serpentine sharks were made by Gill (1887) and Heuvelmans (1965/1968; 1986), the latter of whom christened this cryptid the ‘snark’.
 16. Stead labeled them ‘outside’ men in his book, perhaps hinting at them being immigrants.
 17. The article purported that the unfossilized teeth were dredged in the Pacific by the American naval ship U.S.S. *Albatross*. However, the official report of fossils retrieved during its 1899–1900 expedition has no indication of such teeth (Eastman, 1903).
 18. Both can be rejected considering that they exceed the longest sharks and the longest marine vertebrate, the blue whale (*Balaenoptera musculus*), which probably does not surpass 30.5 meters (100.1 feet) (McClain et al., 2015). The disproportionate gap in the lengths is unusual for eyewitnesses of the same creature, who tend to conform with each other (Paxton & Shine, 2016).
 19. Incidentally, this first observation also occurred close to Broughton Island.
 20. Basking sharks (*Cetorhinus maximus*) have the same problems. They can grow to 12.3 meters long (40.4 feet) (McClain et al., 2015) and can be albino (Frøiland, 1975) but are planktivores with nonfunctional teeth (Welton, 2013).
 21. There is no concrete date, but Zane stated that they arrived at Tahiti on May 30 and returned there around July 1, with the excursion to Rangiroa sometime in the middle.
 22. In a later version, Loren changed the date to two days after Zane’s sighting in 1928 (Thomas, 1994). This is assumedly erroneous because Zane made no mention of a second encounter or Loren participating on that trip (Grey, 1931). He also added that the tail stuck out 10 feet (3 meters) above the surface, but that is disregarded here given the ambiguity of the measurement (i.e., whether it was the whole caudal fin or not) and the discrepancy in this version.
 23. Basking shark heads can appear somewhat squarish or rounded while the wide mouth is open for feeding, but the pointed snout results in an ovate shape distinct from whale sharks (Crowe et al., 2018). This leads to the front of the head being narrower than the posterior body.
 24. This took place in April 1925 in the Gulf of California. Zane noted that it had a wide, flattened head and large pectoral fins, like the shark he saw in 1928, which makes his denial of the latter being a whale shark particularly illogical. He instead called it “one of the man-eating monsters of the South Pacific”. This determination may have been prompted by David Robbie’s 1909 encounter with a 40 foot, square-headed ‘shark’ near Fiji. Robbie equated it to the maneating shark god Dakuwaqa (Wall, 1918), but it might have been a whale since it was said to have a flat, broad tail (horizontally-oriented?).
 25. Whale sharks do not have rostral nodes and cartilages, hence their unique head shape (Denison, 1937).
 26. A single species of barnacles (*Anelasma squalicola*) lives on sharks, but it is a highly specialized form that only parasitizes smaller and slow-swimming deep-water sharks (Rees et al., 2014).
 27. Loren resented his father and sought to be a better writer than him (Markman, 1986). Moreover, he could have been motivated by the renewed fascination with *O. megalodon* and sharks in general in the 1970’s (see ‘Evolution of the Concept and Pop Culture’). He did refer to his shark as a vague ‘prehistoric monster’.
 28. This is a blatant reference to the publication date of *Sharks and Rays of Australian Seas*.
 29. Roesch (1998) misattributed Brown’s rendition to B.C. Cartmell’s 1978 book *Let’s Go Fossil Shark Tooth Hunting* (Cartmell, 1978; not seen by the present author).
 30. Whale sharks can stay stationary in a vertical, head-up orientation when feeding, but for ~1.35 minutes or less (Montero-Quintana et al., 2021). Dead sharks are obviously immobile, but their carcasses sink because most species are negatively buoyant (Gleiss et al., 2017).

31. Clostermann labeled the shark a *Carcharodon carcharias*; it is unclear whether he thought it was a relic or just an outsized specimen. He was under the impression that great whites and *O. megalodon* were one species, like some of his contemporaries (see 'Evolution of the Concept and Pop Culture').
32. It was called a 'pointer', short for 'white pointer', vernacular for a great white.
33. Champagne (2001; 2007; 2016) created and refined another scoring system for aquatic cryptids. The present author disagrees with some of his credibility criteria (e.g., that an investigator's opinion speaks for the reliability of a sighting) and uses other criteria which he did not include (e.g., whether a sighting was first- or secondhand, how long before it was reported, if dates and other witnesses were corroborated or not). His system does not test similarity to known animals and operates under the assumption that credible accounts represent new species.
34. Published maximum widths were not found, so they were measured by scaling the 3D model of *O. megalodon* from Cooper et al. (2022) and illustrations of the other species from Ebert (2014) to their maximum lengths. Unlike size and body form, which have been scientifically reconstructed, exact colors and behaviors (e.g., whiteness caused by albinism/leucism, interactions with humans) were not scored for *O. megalodon* since they are unknown.
35. Matthiessen credited this conjecture to James F. Clark of Harvard University. Ellis & McCosker (1991) said it originated from an unpublished 1968 undergraduate paper by Clark titled "Serpents, sea creatures and giant sharks" (not seen by the present author).
36. Sharks are mostly absent in the abyssal zone (depths 4,000–6,000 meters/13,123.4–19,685 feet) and entirely absent in the trench/hadal zone (depths >6,000 meters), likely due to physiological limitations (Laxson et al., 2011; Treberg & Speers-Roesch, 2016). The deepest record of a shark is a 'dogfish' observed at 4,050 meters (13,287.4 feet) (Houot, 1954; 1958).
37. Alten relocated the shark to the Mariana Trench, which has become a cliché in internet lore (e.g., Evon, 2016). There is even a physics paper dedicated to debunking that premise (Carlisle et al., 2020). Housby (1976) spoke of a nameless scientist he met whose squid-baited steel cable was snapped while fishing above the Mariana Trench. The scientist surmised that the assailant was a sperm whale, while Housby proffered it was an *O. megalodon*. This tale was never repeated elsewhere and seems too obscure to have inspired Alten, but is noteworthy as the first to unite *O. megalodon* with that trench.
38. These media are successful, in part, because they capitalize on the mystery and fear of the deep sea among the public (Jamieson et al., 2021).
39. 'Negative evidence' is used here in the sense of Mills (2007), as inferences derived from data which should exist in a given situation but is lacking.
40. An individual *O. megalodon* would lose an estimated 34,071–38,717 teeth in its lifetime (Greenfield, 2022a). Its teeth also have a high preservation potential because of their exceptional size and the hardness of enameloid.

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RESEARCH
ARTICLE

Channelers' Answers to Questions from Scientists: An Exploratory Study

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HIGHLIGHTS

A fresh study asked channelers to access the same “nonphysical being or spirit” source and answer a set of questions from scientists. The answers and their claimed source had low agreement, but other analyses found coherent and common themes in the channeled responses for many of the questions.

ABSTRACT

Background and Objectives. This exploratory study aimed to evaluate the potential usefulness of channeled information for ten questions from scientists. The study's objectives were to 1) assess the correspondence of channeled and non-channeled answers within questions, 2) evaluate the correspondence of different channelers' responses for each question while in channeling and non-channeling states, 3) examine whether channelers believe they are receiving information from the same source, and 4) explore qualitative themes that emerge for each question. **Method.** Fifteen channelers provided answers to 10 questions in a channeled and non-channeled state. The first three objectives were quantitatively evaluated by three judges using structured criteria to assess correspondence. The last objective employed qualitative thematic analysis of the channeled answers.

Results. The quantitative analyses found 1) low correspondence between channeled and non-channeled answers as hypothesized, 2) virtually no correspondence for each question across channelers, contrary to our hypothesis, and 3) little support that the channelers perceived they were accessing the same source of information. The qualitative analysis resulted in coherent and common themes in the channeled responses for many but not all ten questions. Several methodological lessons were gleaned from the study, such as refining inclusion/exclusion criteria and the questions asked of channelers, allowing a similar amount of time for channeled and non-channeled answers, ensuring consistent methods across study sites, and including additional quantitative measures informing on the channelers experience in channeling and non-channeling states.

Conclusions. This exploratory study offers insight into improving future studies attempting to obtain valuable information through channeling.

KEYWORDS

Trance, channeling, mediumship, cross-cultural.

INTRODUCTION

Brief History of Channeling

The type of channeling in which people enter a trance has been called by various names throughout history, such as prophecy, oracle, spiritual communication, and spirit possession (Hastings, 1991). Regardless of the term used, the process appears to be similar in that the channeler receives and communicates information believed to come from some other being or dimension of reality that is different from everyday reality. Historical records suggest that this channeling type has existed worldwide, in various cultures, for over 3,000 years (Helfrich, 2009). Evidence of channeling dates back to some of humanity's earliest written records, as far back as the 14th century BCE (Hastings, 1991). Moses's reception of the Ten Commandments within Judaism and Christianity and the advice from "protector beings" or *Dharmapala* in Tibetan Buddhism could be interpreted as channeling (Plakun, 2008).

The concept of talking to or being possessed by spirits is a cultural phenomenon found in many societies worldwide, such as traditional areas of Ladakh (Crook, 1997), Spiritist groups in Brazil (Hageman et al., 2009; Negro Jr et al., 2002) and Spiritualists in the United Kingdom (Roxburgh & Roe, 2011), with cross-cultural psychiatrists and anthropologists engaging in extensive investigations of this topic (Bastos et al., 2015; Bourguignon, 1976; Cardeña et al., 2023; Hunter & Luke, 2014). A global survey in the 1970s found that 53% of 488 societies had some form of ritually-induced altered states of consciousness (Bourguignon, 1976). Multiple religious traditions include trance channeling-like rituals as part of their spiritual practices, including Spiritualists, Charismatic Catholics, Pentecostals, Spiritists, and African-American religions (Moreira-Almeida & Cardeña, 2011).

One potential reason channeling has persisted over human history is that channeling is believed to transmit valid and important information in many cultures and contexts. For example, within the spiritistic religions of Candomblé, Kardecismo, and Umbanda (Krippner, 2008; Seligman, 2005), Brazilian mediums engage in trance methods to interact with and embody "spirit agents" who are believed to carry important information, such as warning the community about potential issues, diagnosing illnesses, and prescribing cures (Hageman et al., 2009).

Source of Channeled Information

The definitive source of channeled information is currently unknown. However, possible sources have

been proposed, including the unconscious mind of the channeler, a transpersonal or "higher" self, telepathic or clairvoyant sources, and various non-physical entities (Wahbeh, 2021, pp. 105–113). Interestingly, when 83 English-speaking channelers, mostly (78%) from the United States, reported their source of channeled information in a survey, the most endorsed was the higher self (65%), followed by non-physical being groups (56%), and deceased humans (56%) (Wahbeh & Butzer, 2020). These source results may vary in non-English speaking channelers around the globe (e.g., African religions (Stöckigt, 2014)). However, the source of channeling may, in fact, be many different sources depending on the channeler, the information type they want to channel, the audience, and the situation. In addition, a single channeling session may include multiple sources that function together (Merlin, 2020). While many traditions believe channelers are directly channeling non-physical beings, this does not necessarily need to be the case for accessing useful information unavailable to the conscious mind.

Types of Information Received

Most studies show that people access different information types through channeling experiences. In our surveys, we asked people what kind of information they accessed (Sagher et al., 2019; Wahbeh & Butzer, 2020). One study included 899 people from the United States who endorsed a wide range of channeling experiences (Sagher et al., 2019) and the other 83 English-speaking trance channelers (Wahbeh & Butzer, 2020). Participants were asked to review a list of channeled content categories and select all that applied to their received messages. With few exceptions, the responses to these surveys fit within the following categories: guidance and personal messages, ageless wisdom, descriptions of life in non-physical realms, the past or the future, artistic and creative expression, scientific or technological material, health, healing, and information from or about deceased humans (Klimo, 1998, pp. 176–191).

Guidance and personal messages (78%) were the most frequently selected, followed by ageless wisdom (72%), descriptions of life in non-physical realms (60%), the future and the past (59%), healing (59%), information from or about deceased humans (53%), health (45%), artistic and creative expression (43%), and scientific or technological material (40%) (Wahbeh & Butzer, 2020). Ninety-two percent of the respondents said they channeled multiple types of information. Some respondents shared that there was no limit to the information type they received during channeling in an open text field.

Verifying the Information

Regardless of the type of information received, the more critical question is whether the information accessed through channeling is correct or useful. Researchers have evaluated whether information received from mediums about deceased humans was accurate. Historically well-documented cases of accurate information obtained by mediums include Leonora Piper (1859–1950), Gladys Leonard (1882–1968), Pearl Curran (1883–1937), Luiz Antonio Gasparetto (1949–2018), José Jacques Andrade (b. 1945), and Chico Xavier (1910–2002) (Braude, 2003; Fontana, 2005). More recently, a meta-analysis of 18 experimental studies published from 2001 to 2015 found an .18 (95% CI [.12, .25]) overall standardized effect size, corresponding to approximately 6 to 14% above chance level, estimated with both frequentist and Bayesian random-effects models and that passed publication bias tests (Sarraf et al., 2021). Another review evaluated data from studies where sitters (the loved ones of deceased individuals) provided binary accuracy responses for mediumistic readings and did not find significant positive findings (Rock et al., 2021). Perhaps even more interesting is another study that evaluated the accuracy of mediums and controls to ascertain the cause of death of 180 facial photographs (Delorme et al., 2020). Researchers found a significant above-chance result for controls *and* mediums, with the results being primarily driven by control responses. That is, in this study, one did not need to be a medium to accurately obtain information about a deceased person. Despite not knowing the actual source of information,¹ Some, but not all, studies demonstrate that mediums (and controls) can provide information about deceased persons that they could not possibly know through traditional means beyond what would be expected by chance.

Could the Information Be Useful?

However, these results focus on information about deceased humans. What about whether getting useful information about questions from scientists is possible? Could channeling be used to acquire valuable answers to science-related questions? Moreover, if so, is that information actionable? Many scientific breakthroughs have been attributed to channeling (Schwartz, 1990). Srinivasa Ramanujan was a mathematical theorist who believed he received many formulas from the Indian goddess Namagiri and Saraswati, the deity of language, song, and logic. His peers recognized his work as excellent (Hastings, 1991, p. 18). Other scientists have commented that their remarkable ideas do not originate with them but rather from something beyond themselves. For example, Thomas Edison said,

People say I have created things. I have never created anything. I get impressions from the Universe at large and work them out, but I am only a plate on a record or a receiving apparatus—what you will. Thoughts are really impressions that we get from outside. (quoted in Dossey, 2013, p. xiv)

These are just a few examples of scientists who received inspiration through perhaps channeling experiences that inspired scientific discoveries. Many channelers feel they receive scientific or technological information through channeling. Channeling researcher Jon Klimo had planned to include a summary of scientific or technical channeled information in his comprehensive book on channeling. However, while summarizing the collated books, articles, and unpublished manuscripts he had collected, Klimo (1998) developed over 50,000 words of content and decided to include the information in a separate book (p. 192). As far as we know, that book has not yet been published. Still, Klimo's experience reflects the vast volume of channeled materials said to be scientifically or technologically relevant but have not been thoroughly examined.

One of the few verified channeled scientific information examples was from Chico Xavier. Xavier possessed many alleged mediumistic abilities, including psychography or writing under the apparent influence of a non-physical being. Xavier was a prodigious channel, producing over 450 books psychographically on various content, including scientific topics. One formal study compared the information he channeled about the pineal gland in the 1940s to current scientific evidence (Lucchetti et al., 2013). The authors found multiple themes from Xavier's writings that matched the current understanding of the pineal gland, such as its relationships to mental health, reproductive function, endocrinology, exercise, spirituality, and the importance of the hormone secreted by the gland. Importantly, what Xavier communicated regarding the pineal gland in the 1940s was not yet scientifically known at that time. Only by comparing the content to today's scientific understanding of the pineal gland is it possible to appreciate that much of it was accurate.

Allan Kardec, the founder of Spiritism, speaks of the process of receiving scientific or other information from channelers. Spiritism purports that humans are all immortal beings temporarily embodied and implies positive and negative effects from spirits on living humans (Lucchetti et al., 2013). He suggests that the information received by channelers on any spiritual or scientific topic rarely is transmitted completely, asserting that "spirits have divided the labor by disseminating the subjects of study and observation, as in certain factories different

parts of the object manufactured are divided among different workman" (Kardec, 2022, sec. 52). Thus, collating information from many channelers and comparing notes may result in a more comprehensive view of a given topic. Kardec (2022) suggests this process is not unusual, as science proceeds similarly, with many often contributing to some scientific understanding:

There is no science which has, in all its parts, proceeded from the brain of one man. All, without exception, are the product of successive observations, leaning upon preceding ones, as upon a known point, in order to arrive at an unknown one. (sec. 54)

Many channelers and their sitters can be frustrated because they do not receive an answer to their questions, or the answers they do receive appear contradictory or inconclusive. Kardec (2022) explains this phenomenon, proposing that only when the time is right is the information transmitted universally. Interestingly, Kardec recommends how to discover valuable scientific information through channeling. Using a systematic cross-correspondence approach, Kardec suggests gathering channeled information to compare and analyze them, discerning the confidence level one should assign them as well as those that are contradictory, illogical, or incorrect in order to create a complete picture of the channeled question or topic (sec. 52).

This also highlights the point that channeling is not always accurate at best and is blatant fraud at worst (Alcock, 1996). For example, the famous channeler Edgar Cayce provided over 14,000 well-documented readings in his lifetime, many of which were verified for accuracy. However, not all were, and some have suggested that Cayce "was guilty of searching for answers from 'inappropriate sources' and that his own biases would have filtered the information, especially in nonmedical readings" (Johnson, 1998, p. 88). Others are skeptical of Cayce's work because all the positive case reports are anecdotal, and no controlled studies of Cayce's abilities were conducted. Furthermore, his readings were guided by clinicians who "interpreted" them for his clients (Beyerstein, 1996). Some famous channelers have been accused of fraud, such as Helene Blavatsky, who was judged an imposter by the Society for Psychical Research in 1885 (Alcock, 1996). Much of this skepticism stems from the alleged source of the channeled material because it is difficult to definitively verify whether the content arises from some aspect of the channeler or from the purported source. Some have suggested setting aside the question of the source until adequate tools exist to confirm or deny

the true source of channeled information; in the meantime, the focus can remain on the validity and usefulness of the content itself (Wahbeh, 2021, pp. 119–120).

Along these lines, and in an attempt to evaluate the potential usefulness of channeled information about questions from scientists more formally, we conducted an exploratory study, which is the first of its type as far as we know. We asked channelers from the United States and Italy to answer ten questions during channeling and non-channeling states. The objectives of the study were to: 1) assess the correspondence of channeled and non-channeled answers within questions, 2) evaluate the correspondence of different channelers' responses for each question while in channeling and non-channeling states, 3) examine whether U.S.-based channelers believe they are receiving information from the same source, and 4) qualitatively analyze the channeled answers for both the United States and Italy for common themes for each question. Finally, we informally asked scientists to evaluate the answers for their usefulness.

METHODS

Participants

Participant recruitment and inclusion criteria for both sites are described below. Because of the exploratory nature of this study, each site proceeded with recruitment and inclusion criteria independently, resulting in different methods. Some recruitment method variation is expected, considering the studies were conducted in separate countries. However, future studies should be pre-registered with consistent methods across sites (as much as practically feasible considering differences in local ethical guidelines).

United States. We recruited participants through a subject-specific listserv, blog, and general email list (membership ~65,000), social media (membership ~85,000), and listservs in the channeling community. Inclusion criteria were: English fluency, over 18 years old, ability to correspond by video chat and email, self-reported ability to initiate channeling sessions at will, and history of receiving scientific or technological information through channeling. Participants were compensated \$100 for completing all three sessions. All study activities were approved and overseen by the Institutional Review Board (IRB) at the Institute of Noetic Sciences (IORG#0003743).

Italy. Participants were selected according to the following inclusion criteria: having practiced at least ten sessions of channeling induced after hypnotic suggestions with the same hypnotist and being strongly interested in participating in scientific investigations related to channeling. All study activities were approved and overseen by

the EvanLab Ethical Committee prot. n. 2/2020, and participants were not compensated for their participation.

PROCEDURE

Question Selection

HW contacted approximately 100 scientists worldwide through a parapsychology listserv with the following request:

We are developing a group channeling protocol. Part of the study will include a list of science questions from which one or two will be selected and asked of multiple channelers simultaneously. They will answer the question in a non-channeling state and then in a channeling state. This will be done through video conferencing so that the channelers will not see/hear the other participants' answers. Do you have any science questions you would like to be included on our question list?

To this request, we received 47 questions from 12 scientists (two physicists; one critical theorist; four psychologists, three of whom also call themselves parapsychologists; two neuroscientists, one economist; one computer scientist; and one physician researcher) hailing

from four countries (Australia, Italy, United States, and the United Kingdom). HW and PT reviewed the entire list of questions, narrowing it down to 10 that would be posed to the participants. The selected questions were chosen because of their content interest to the investigators. Some questions were scientific in nature, and others were metaphysical or philosophical. Question #4 differed between sites because of confusion about the final choice for that question, and two different questions were administered at each location. Additional site meetings would have supported a greater understanding and confirmation of the final questions. The questions are listed in Table 1. Note that Question 4US was included only for the United States-based respondents, while Question 4I was used only for Italy-based respondents.

Research Sessions

United States. A research assistant asked the participants the questions over three online video chat sessions, each approximately one hour in length. These sessions were designed so that the research assistant could observe the participants while answering the questions to ensure that they did not text, email, or otherwise research the answers during the answer period. The participants did not know the questions they would be asked before they were posed. During the session, the participants were instructed to answer questions in both non-chan-

Table 1. Questions Posed to U.S.- and Italy-Based Channelers

#	Question Code	Full Question
1	Nature of "Observation"	The Physicist describes an observation as a "collapse of the wave function," or, as a possibility turning into actuality, or as a realization in mind of one branch of the multi-universe. From your vantage point, what does an "OBSERVATION" look like?
2	Reincarnation	How do you explain the succession of incarnation experiences in a timeless dimension?
3	Pre-life experience	Who or what prepares the physical body for his/her own incarnation? How is it created?
4US	Universal constant	US: Just as Planck's Constant sets the scale of quantum phenomena and the Fine Structure Constant the scale of electromagnetism, is there a UNIVERSAL CONSTANT (or constants) that characterize the mind/matter interaction? What is the magnitude of dimensions of this (these) constant(s), and how could we go about measuring these numbers?
4I	Supernova	Italy: What month and year will the next supernova occur, and in what part of the sky (specific constellation, if possible, or North or Southern Hemisphere)?
5	What is matter?	What is what humans call "matter" made of?
6	Why we forget?	Why is it that with each new incarnation or experience of life, we are not reminded of all the previous experiences and of our true nature?
7	What is love?	What is love?
8	Nearest exoplanet with intelligent life	What is the nearest exoplanet that harbors intelligent life?
9	Creative force	What creates life in plants, animals, bacteria, etc.?
10	Nature of dark matter	What is the nature of dark matter, and how could it be detected?

Note. Question 4US was included only for the United States-based respondents, while Question 4I was used only for Italy-based respondents.

neling and channeling states. Answering a question in a non-channeled state allowed the study team to ascertain the channeler's baseline understanding of the question and the answer from their rational mind. The stated intention for the channeling state was that the channelers would attempt to tap into the same source for the information in an attempt to maximize correspondence between the answers. Ultimately, we can not definitively demonstrate the origin of channeled information. However, channelers believe they can access data from specific sources, so soliciting their perceived information source would be useful to evaluate corroboration. Before the sessions, participants were asked to decide how to record their responses to questions: typing their answers in the Zoom chat (preferred) or via an audio recording that was then transcribed.

The first two video sessions covered three study questions each. The third session covered four questions. All sessions consisted of the following steps:

1. Introductions and a brief explanation of the study from the principal investigator (session one only).
2. The research assistant then asked one of the questions, displaying the question on the channelers' screens.
3. In a non-channeling state, channelers had five minutes to record their answers using their rational mind. Channelers were instructed not to use any research, telepathy, or other sources of information to answer the question. This process was repeated for each question being presented for that session.
4. After answering all the questions in a non-channeled state, the channelers were invited to enter a channeling state and connect to the same source or being as other channelers.
5. Then, the research assistant asked the same questions, displaying the question on the channelers' screens.
6. The channelers had 10 minutes to enter the channeled state and answer the question by typing into the chat or recording their verbal answer. The longer time for channeled answers allowed channelers to enter the channeling state. All participants were muted, so they could not hear each other. This process was repeated for each question being presented for that session.
7. After all questions for that session were answered in both non-channeled and channeled states, the session was complete for the day.

The sessions were conducted on January 21, January 22, and January 28, 2021, from 3:30 p.m. to 5 p.m. PST. Participants who recorded themselves orally sent their audio files to the researchers. Then files were then pro-

fessionally transcribed by ScriptoSphere™ (<https://www.scriptosphere.com>). Italian channelers provided their responses in Italian, which were translated into English by author PT.

ANALYSES

What is the Correspondence Between Channeled and Non-Channeled Answers? (U.S. Data)

All statistical tests were conducted in Stata 15.0, StataCorp, LLC, College Station, TX. First, each answer's number of characters was calculated by channeling versus non-channeling state. A Wilcoxon matched-pairs signed-rank test (*signrank*) was conducted to evaluate differences in text volume for channeled versus non-channeled answers; the number of character variables was not normally distributed (*swilk*). A non-parametric Kruskal-Wallis equality of populations rank test (*kwallis*) was used to evaluate text volume by question, channeler, and state (channeling/non-channeling), which results in a chi-square statistic (χ^2). Three judges reviewed the channeled and non-channeled answers to each question for each channeler. They rated the correspondence between the two answers according to the following Correspondence Rating Scale:

- 3 - Good correspondence with relatively little differing information/content.
- 2 - Good correspondence with several matchable elements intermixed with some differing information/content.
- 1 - Some matching elements, but not sufficient to suggest results beyond chance expectation.
- 0 - No Correspondence.

The judges' scores were averaged across questions within channelers and across channelers. Interrater reliability was assessed with percent agreement (*kappa* etc). We hypothesized that averaged scores would be ≤ 2 for each question. We included this hypothesis to evaluate whether participants "simulate" channeling or enter a different consciousness state.

What is the Correspondence Between Channelers on Channeled Answers? (U.S. data)

First, the number of characters was calculated for each answer by the channeler. The Friedman test, a non-parametric alternative to the repeated measures analysis of variance, was conducted to evaluate differences in text volume by channeler (*emh*). Three judges reviewed the channeled answers for each question across

Table 2. Number of Characters for Answers and Correspondence Score by Channeling or Non-Channeling State

#	Question	Number of Characters				Correspondence Score	
		Non-Channelled		Channelled		Mean	SD
		Mean	SD	Mean	SD	Mean	SD
1	Nature of "observation"	292	160	2419	2086	0.86	0.50
2	Reincarnation	338	170	2183	2102	1.29	0.59
3	Pre-life experience	467	291	1576	1198	1.29	0.40
4	Universal constant	159	150	3101	2777	0.90	0.37
5	What is matter?	190	188	1587	1372	0.71	0.52
6	Why we forget?	507	294	2579	2067	1.14	0.33
7	What is love?	256	184	2295	1884	1.20	0.30
8	Nearest exoplanet with intelligent life	289	371	2266	1517	1.06	0.80
9	Creative force	178	133	2811	2176	1.61	0.53
10	Nature of dark matter	167	155	2623	1539	1.06	0.80
Total		289	239	2335	1855	1.12	0.56

Notes. U.S. participants were given 5 minutes for non-channelled answers and 10 minutes for channelled answers. U.S. channelers were given an extra 5 minutes compared to non-channelled answers to enter the channeling state. This extra time might have been a factor in more characters for the channeling condition if channelers could enter the channeling state quickly. Italian channelers were allowed all the time they needed in both conditions.

channelers. They rated the correspondence between each pair of channelers according to the Correspondence Rating Scale in a pairwise fashion. For example, the three judges gave separate ratings for the answer for question 1 for channelers 1 and 2, channelers 1 and 3, channelers 1 and 4, etc. This resulted in 181 pairwise comparisons with three ratings each. The judges' scores were averaged for each pairwise comparison (181 values) and then averaged for each question (10 values). We hypothesized that averaged scores would be ≥ 3 for each question. A score of three or greater was chosen to represent the highest level of correspondence between channelers. A Kruskal-Wallis equality-of-populations test evaluated any statistical differences in the correspondence scores by question. The non-parametric Kruskal-Wallis test was used because the correspondence score variable was not normally distributed.

Do Channelers Report Accessing Information from the Same Source? (U.S. Data)

Channelers were asked what they believed the source of their channelled information was for each question. These answers were qualitatively compared across channelers. We anticipated that the disclosed source would be the same because of the shared intention to connect to the same source. Thus, we hypothesized that 80% of the

channelers would report accessing the same source for some questions. This threshold was chosen as substantial but not perfect agreement of source information ($< 0 = \text{Poor}$, $0-20 = \text{Slight}$, $21-40 = \text{Fair}$, $41-60 = \text{Moderate}$, $61-80 = \text{Substantial}$, $81-100 = \text{Almost Perfect}$; Landis & Koch, 1977).

Thematic Analysis (U.S. and Italy Data)

A dataset in Microsoft Excel (Redmond, WA) was created for the textual responses. Each answer was listed on one row with the following variables: country (the United States or Italy), channeler (ID), question (1 through 10), and state (channeling or non-channeling). The dataset was uploaded into Dedoose web-based qualitative data analysis software (Dedoose, 2013).

Thematic analysis characterized the data by grouping repeated semantic code patterns into meaningful categories/themes, as Braun and Clarke (2006) described. Thematic analysis was chosen because it can provide a straightforward yet rich description of participants' beliefs and experiences. Thematic analysis consists of six steps: familiarization, coding, generating themes, reviewing themes, defining and naming themes, and reporting. The approach to coding was inductive (Saldana, 2013). The researchers performed the initial coding and applied descriptive labels generated by the data using the follow-

ing steps: 1) Read through both channeled and non-channeled answers once to become familiar with the data; 2) Read through everything again, this time making notes on general observations and themes for each question; 3) Read through everything again, this time proposing codes for each question; and 4) After generating a list of preliminary codes for each question, continually refine and consolidate the codes into 7–12 codes per question as well as 12 overall codes that applied to every question.

The final codebook was developed with definitions and a brief description of when to use each code. Each answer was independently coded in duplicate (once by each researcher) using Dedoose. Coding was iterative, with each researcher going over the data at least twice each. There were less than ten discrepancies in coding, and were resolved through researcher discussion until a consensus was reached. Theme summaries are provided in the results section with representative quotes for the descriptive analysis. Quotes from the data were edited with articles, punctuation, and extra clarification to support the reading flow and comprehension.

RESULTS

Participants: United States

Sixty-seven individuals responded to the survey providing information about their channeling background and experience channeling scientific information. These responses were reviewed for 15 participants who had > 11 channeling sessions, could channel at will, and were comfortable with the idea of channeling scientific or technical information, who were then invited to participate. Seven agreed to participate, having experienced more than 50 channeling sessions.

Based on their responses to our intake survey, all seven participants identified as women. Five were between the ages of 39 and 52, one was 55, and one was 66 years old ($M = 49$, $SD = 9$). Four were of only European ancestry, one was of Native American and European ancestry, one was of only Latinx or Hispanic ancestry, and one was of only Native Pacific Islander ancestry. All participants claimed to have channeled specific beings. While all answered positively about being comfortable channeling scientific or technical information beyond their personal knowledge, one did not have experience doing so. The channelers self-selected multiple types of channeling abilities: mediumship (6), trance channeling (5), automatic writing (5), clairvoyance (2), clairaudience (7), and clair empathy (6). All seven channelers attended all sessions. While we did not formally assess spiritual or religious affiliation, we informally asked the channelers after the study for this information. Four (out of seven)

channelers responded and shared that they were raised Catholic (3) or Christian (1) and were currently Catholic (1), Christian/spiritual but not religious (1), and spiritual but not religious (2).

Participants: Italy

Seven females and one male were selected among the participants of the EvanLab panel, given their experience in hypnosis and hypnotically induced channeling with the same hypnotist. The Italian channelers had, on average, 100 hours of experience. Their chronological age ranged from 35 to 67 years old ($SD = 15$). The hypnotist had more than 20 years of experience in research hypnosis. The Italian channelers were not asked about their spiritual or religious affiliation. Italian Catholicism is the dominant religion in Italy, and as far as the researcher knows, no Italian channelers were active members of “new age” groups.

What is the Correspondence Between Channeled and Non-Channeled Answers?

Channeled answers were significantly longer than non-channeled answers (Table 2; $z = -6.77$, $p < .00005$), although this may be because of the longer amount of time given for channeled answers for the US channelers. The correspondence scores for channeled versus non-channeled answers were low over all questions ($M = 1.12$, $SD = 0.56$, range 0.86 to 1.61). The highest correspondence was found for question nine. The interrater reliability as measured by percent agreement was .56 overall (range .33 to .78). The hypothesis that these correspondence scores would be ≤ 2 for each question was supported.

What is the Correspondence Between Channelers on Channeled Answers?

There was a marked difference in the number of characters for the channeled answer text by channeler (C1: $M = 626$, $SD = 174$; C2: $M = 569$, $SD = 205$; C3: $M = 4241$, $SD = 1754$; C4: $M = 2376$, $SD = 1077$; C5: $M = 3047$, $SD = 1104$; C6: $M = 557$, $SD = 109$; C7: $M = 4224$, $SD = 1294$). Channelers 3 and 7 had almost twice as much text as the others. The correspondence scores between channelers by question ranged from $M = 0.36$, $SD = 0.51$ for question eight to $M = 1.51$, $SD = 0.28$ for question nine. The correspondence scores significantly differed across questions ($\chi^2(9) = 61.9$, $p = .0001$). The interrater reliability, as measured by percent agreement, was .46 overall (range from .40 to .70). The hypothesis that these correspondence scores would be ≥ 3 for each question was not supported.

Do Channelers Report Accessing Information From

the Same Source?

There were 16 sources listed by the U.S. channelers for the information they received: collective, which is a group of beings from another universe; a different group of entities (a micro collective consciousness); Arcturians; Collective of the 1200; Edgar Mitchell; God energy; Jesus; Pleiadian collective which includes Arcturians, Blue avians; Sashastra; The Keeper; The Light; The Purist; The Scientist; Different unnamed source; The Telluride (Large male being in white robes, long straight hair, an Asian sort of stance, but hulking in stature); and The Wind (an energy mass, swirling with light blue). We had hypothesized that 80% of channelers would list the same source of their information, but this was not supported. Multiple channelers did mention a collective of beings or something similar. Four channelers reported the same source across questions, and three gave different sources depending on the question.

Thematic Analysis of Channeled Answers – U.S. and Italy Data

Overall, the data showed significant differences in the amount of text provided by country ($X^2(1) = 78.3, p = .0001$). The number of characters for Italian channelers for all questions was $M = 360.9, SD = 284.8$ (range 156 to 559). In contrast, the number of characters for United States channelers was $M = 2340.3, SD = 1854.4$ (range 1581 to 2628). The Italian channelers provided their answers in Italian; thus, their shorter responses were not dependent

on English fluency. The thematic analysis resulted in multiple codes for each question. The U.S. channelers gave more examples or metaphors to describe their answers than the Italian channelers. All provided answers are publicly available on Figshare10.6084/m9.figshare.19971104. The codes are listed in the Supplemental Data section. Theme summaries are provided below with representative quotes for the descriptive analysis. Quotes are followed by channeler code (I = Italy; US = United States).

Question 1. The Physicist Describes an Observation as a “Collapse of the Wave Function,” or as a Possibility Turning Into Actuality, or as a Realization in Mind of One Branch of the Multi-Universe. From Your Vantage Point, What Does an “OBSERVATION” Look Like?

Seven of the 15 channelers mentioned multiple universes, and the others did not refute that there are multiple universes. Reality was expressed as multi-dimensional with infinite potentiality. Observation was described as one finite point in a field of infinite possibilities: “An observation...has finite properties, whereas the possibility has the properties of infinity” (US6) and “So, we could explain observation as being one point that is simultaneously infinite in and of itself as it is infinitely expanding, as it has its own energy field, and is breathing and existing and shifting and changing” (US5).

Channeler 16 stated, “In the presence of many universes, the observer creates the desired universe at that moment.” The observation is created by intention focused on a specific space-time. US7 stated,

When you humans observe from your vantage point, it is simply because you’re focusing on and bringing the attention to that point in time in your timeline. In this multiverse, in the vastness of space, there is no time, distance, or space, yes. So, what we are seeing is a folding in and a stopping in an observation...

Two channelers likened this collapse function to an image in a movie, e.g., “for example, the way you might see it as a million movies flashing in front of your eyes a million times and catch one frame” (US7). According to I5:

In a way, it’s as if there were many still frames from which to choose to create a sequence for a movie. A particular frame has meaning when in that sequence...but if inserted into another sequence – another movie – it could take on a different meaning.

Table 3. Correspondence Scores Across Channelers for Each Question

#	Question	Pairs	Correspondence Score	
		N	Mean	SD
1	Nature of “Observation”	21	1.02	0.34
2	Reincarnation	21	0.97	0.52
3	Pre-life experience	21	0.41	0.53
4	Universal constant	21	0.84	0.49
5	What is matter?	21	1.01	0.42
6	Why we forget?	21	0.90	0.35
7	What is love?	10	1.13	0.42
8	Nearest exoplanet with intelligent life	15	0.36	0.34
9	Creative force	15	1.51	0.28
10	Nature of dark matter	15	1.00	0.31
Totals		181	0.90	0.51

They also shared that it is a function of human perception that there is a collapse, a finite point, but that in reality, there is no such collapse as everything is connected and full of infinite potential: "So, there is no collapse of anything. Only a collapse of the human's notion of separateness" (US4).

Intention and choice (i.e., free will) create the collapse. The observers choose to observe and direct their intention to some space-time. One channeler explained this process as a binary system: "Reality is multi-dimensional and contains a specific dimension with only two alternatives, 1 (yes)/0 (no), and gives rise to the phenomenon" (17). This ultimately leads to the idea that the observer creates the reality they are observing. Depending on the context from which they observe, reality will appear different. 16 stated, "In the presence of many universes, the observer creates the desired universe at that moment."

Another theme that arose was that observation affects reality. That is, the intention to observe influences the world around the observer. Many channelers communicated that the act of observing impacts material reality, e.g., "Regarding the act of observing something, each time there is an intention to observe there is a chain reaction that alters that same level of reality and consequently other states too" (14). Channelers also alluded to aspects of reality that we do not yet understand. For example,

For the mind to grasp these concepts, a new paradigm must account for wave-like particles that behave in a way similar to quarks. Yet to be discovered, these particles have a mass of greater value but an acceleration that makes them difficult to measure or even conceive. (US6)

Others implied that the question was simplistic in that it assumed observation was something specific that could be isolated. 15 stated,

These three possibilities can co-exist, because, in a way, they're all true. The particle exists in the multiverse, and its observation is the same as "looking" at it in the pre-chosen Universe, or choosing it randomly, or taking a snapshot of the wave function at a certain moment: in all three cases, it is based on the probability of finding a particle in a certain point at a certain time, and the observed particle at that moment exists because its appearance is "created."

Also, direct answers to the question were rare and mostly inconclusive. One typical example: "It's not the

same observation that you see with your eyes. We do not have eyes from our vantage point...From our vantage point in the multiverse, we see endless space and lines of creation" (US7).

Another interesting concept for this question was about supposed space travel in light ships by uniting two disparate focal points in awareness:

...collapsing of wave functions that you refer to are actually points of jumping in space as well because there is no time, distance, or space; it's simply a focal awareness where you line up a coming together of your awareness of where you are, and where you want to travel to... And this is how our light ships can travel between these points. This is also a black hole. (US7)

Thus, the overall themes for Question 1 revolve around infinite potentialities existing in the multi-dimensional space of multiple universes that are observed through intentioned focus as one point in space-time through the observer's context, which appears different depending on the context.

Question 2. How Do You Explain the Succession of Incarnation Experiences in a Timeless Dimension?

Channelers were nearly unanimous in one part of their response to this question: The linear, successive nature of time is an illusion. This means the common understanding of a single enduring soul/entity returning to this plane of existence in different, successive physical forms is not entirely accurate. As one channeler said, "There are not multiple physical lives - it's like putting on different clothes. What is interpreted as successive lives are actually simultaneous and can be counted in any order, even in terms of evolution of consciousness" (17).

They expressed that timelessness is not the same as no time. Time only exists on the material plane. In the non-physical dimension, there is an infinite continuum. Thus, the same being can experience lives in multiple times simultaneously that appear linear from a human perspective. What is labeled as "past lives" are actually only different simultaneous experiences of the same consciousness: "all of these timelines are happening at the same time...even though from your vantage point, you're only having one lifetime at this time" (US7). The lives are not in temporal sequence, but each level is contrasted with the others in terms of awareness.

Other comments broadened the idea that there is no linear time to include space and multiple dimensions. 14 stated,

The same being lives on multiple levels. For you, it's like a three-dimensional effect so that many human beings, on different levels, can share the same 'soul,' the same consciousness. What are labeled 'past lives' are really only different and simultaneous experiences of the one consciousness...

One channeler gave the metaphor of life as a movie:

It's like having many movies: each movie is a life. We can watch one, then another, and so on, seeing them as successive lives, but they are all simultaneously present. They are sequential from our point of view because it is instructional, an "experience of lives." (I5)

The individual consciousness is part of a larger consciousness, and that consciousness can shift to experience different aspects and that those lives influence each other. I4 explained,

They are not in temporal sequence, but the level of each is contrasted with the others in terms of awareness. It's a relative judgment which is continually expressed and influences life and the choices of all humans who are part of the same consciousness, the same "soul."

Other comments expanded on the idea that reincarnation results in wisdom not because it happens sequentially but because it adds to a soul's experience in a non-linear fashion. US7 stated, "It's really just more about experiencing, expanding, creating, and aligning, and becoming more and more and more of a creator."

Overall, the channelers communicated that our senses narrow the human perception of time and space, that we have multiple lives, and that from our perspective, they may be sequential in linear time but that, in actuality, they are all happening simultaneously in no-time.

Question 3. Who or What Prepares the Physical Body for His/Her Own Incarnation? How is it Created?

Who or what prepares? There were diverse answers in response to who or what prepares. Two channelers from Italy mentioned a matrix, one as "the matrix of invisible worlds" (I3) and another as "a matrix expressed by the Supreme beings" (I4). Two channelers talked about the intent to have an experience, which then produces a plan for incarnation. I5 stated, "The intent to have an experience produces the plan." US7 stated, "But it is mostly

and truly the intent of the consciousness of what it wants to expand and create and co-create together with the other consciousnesses that are curious and expanding and growing and creating together."

There was an apparent dichotomy in the amount of preparation required. Channelers offered a wide range of often conflicting perspectives. For instance, participants were split on whether the spirit and body went through a high or low level of preparation before being incarnated. Multiple channelers stated that there was significant preparation: "The spirit that will inhabit the body is what must be prepared. It is a difficult journey, one that requires complete healing from previous experiences. The soul is prepared as one might prepare for a sacred ritual" (US6), and "you are involved in co-creating your form and co-creating your physical body, and... there are many stages to preparing the physical body pre-incarnation to this earth body that you know, or that you are currently inhabiting at this time. (US5)

Others mentioned that the soul is a director of what their life and body would look like and that the soul decides the experiences it wants for expansion. In coordination with a guidance team, it receives an assignment for its growth. Then, it chooses its family and what its life will look like in an attempt to obtain those experiences. US3 stated,

When the individual identifies what they are to become for their own evolution and expansion as a soul. They are given an assignment for such expansion that the soul is the one that decides how it wishes to expand. And then it is in coordination with spirit to receive that assignment.

Another participant asserted the opposite:

There is no dress rehearsal... Life doesn't end. It's just a different place that you go to learn, reflect, and accept responsibility for the things you need to do from your previous actions. You could have been living on Sirius B as a blue person, or as a prisoner of War, or you could be an ethereal helper in an inter-dimension, helping those who are struggling to cross. It all doesn't matter in terms of preparation; it just is. (US4)

How is it created? Overall, responses to how the physical body was created were particularly diverse. Channelers rarely answered the question directly. Varied answers included being based on harmony or disharmony acquired in other lives and karma. For example, one channeler shared, "It's a cluster of sub-atomic particles that

come together in an ever more complex way, following a construction plan, a matrix expressed by the Supreme Beings" (I4). Another expressed that the body is created "from the void, from a breath, and is made of primary structures" (I6). A third shared that "the human structure is a mirror of the greater collective crystalline consciousness that is earth" (US5).

One answer began with the physical aspects but also included the metaphysical:

The physical body is created by two cells which unite... Before conception, there is a plan shared with the incoming Essence; even the accompanying thought-forms ... based on what occurred in the previous life and what will be required in the new life. (I8)

Another channeler gave a somewhat similar answer in that consciousness and intention were essential aspects of the creation process: "the body is created from that light, from that mind, from the programming, of course, within the cells, which as you know already, but it is mostly and truly the intent of the consciousness" (US7).

Finally, the theme related to multiple parallel lives that arose in Question 2 was also present here: "An Essence may, however, live multiple parallel lives simultaneously on different dimensional planes, multiple gestations with associated births, on multiple planes" (I8).

In summary, Question 3 revealed answers ranging from the physical to the metaphysical, with various descriptions of who or what prepared the body and how the physical body was prepared. Perhaps the only similarity was that channelers described it as a complex, intentional process.

Question 4 Italy. What Month and Year will the Next Supernova Occur, and in What Part of the Sky (Specific Constellation if Possible, or North or Southern Hemisphere)?

The eight channelers in Italy gave eight very different answers to this question. Three (I2, I5, I8) commented that providing a definite answer to the question was impossible. For example, I5 stated, "Future predictions assume precise agreements in time, which in reality does not exist; it is also necessary to know which future path will be undertaken. Certainly, there will be a supernova, but precisely placing this event into your reality lies outside my ability – there are too many variables."

The dates given by the other channelers were 2024, 2050, 3000, and 6050. For the locations, two channelers gave the location of Leo, with one adding Antares. Other answers were Cassiopeia, Andromeda, and Northern

Hemisphere (Scorpius or Serpens).

Question 4 illustrated a lack of coherence on a question requiring specific answers. Whether the question is not knowable or all the various answers are accurate is unknown. The 2024 prediction in the constellation Leo will be testable in a couple of years. The others will not happen in most of our lifetimes.

Question 4 US. Just as Planck's Constant Sets the Scale of Quantum Phenomena and the Fine Structure Constant the Scale of Electromagnetism, is There a UNIVERSAL CONSTANT (or Constants) That Characterize the Mind/Matter Interaction? What is the Magnitude of Dimensions of This (These) Constant(s), and How Could We Go About Measuring These Numbers?

Is there a Universal constant that characterizes the mind/matter interaction? Three channelers (US3, US5, US7) mentioned the heart or electromagnetic field of the heart as the constant; for example, "We would say that the heart field is the governor of all the wholeness that exists" (US5). One channeler gave specific frequencies: "starting with the heart frequency I think is 528 hertz above, which -- there are lower ones that can create some things, but the experiments that you're specifically looking for are 528 Hz and above" (US7).

The other answers to this question were quite varied. They ranged from "The mind of God is the source of all creation" (US2) to "It's related to the Fibonacci sequence, but the vibration changes, so there's a dynamic there" (US7) to "intentional thought via creative love" (US2). Five of the seven channelers mentioned light or aspects of light. For example, dark or cold star energy was mentioned as a pure source of light and creation:

Grand Central Sun, or a source light energy field, a sort of nucleic structure that is operating in the center...your source light is in many ways a golden kind of energy, and there's a lot of heat, fire, electricity that moves out from it. (US5)

Another channeler mentioned that one can only "see" the constant when it has created versus "the emptiness, darkness and void when it is not there and has not created light" (US2).

However, none of their answers offered a useful, specific number, and the wide range of answers did not suggest a clear path for further study. Most channelers did not mention the magnitude of dimensions. One channeler stated, "The magnitude varies within and between the species/entities being considered" (US6).

Notably, none of the channelers denied a universal

constant governing mind/matter interaction. We prepared a code for this, but we only used it to tag a single excerpt, “The first answer to this question is, there is no such thing as a constant...The only universal constant is constant creation, and every constant creation lives within a pattern” (US3). As far as measuring this constant, answers were similarly scattered. Many participants mentioned the electromagnetic spectrum but in inexplicable ways, such as “It comes to the electromagnetic spectrum” (US4) and “She slides down the light spectrum” (US4).

A few channelers asserted that there was a constant, but it could not be measured. US3 stated, “There is no way to quantify the nature of the mind without adopting a model of the soul, and a model of spirit.” Others mentioned that there was a constant that could be measured but not with the tools we currently have at our disposal. US6 stated, “Yes, there is a universal constant for the interaction between mind and matter. It is already known, though it hasn’t been recognized as such...You cannot measure that which you have yet to describe or discover.” US4 stated, “You do not have equipment at this point, which also slides down the light spectrum. Until you have equipment which does not manifest and then does manifest, almost contract the being as the being slides down.”

In summary, most channelers said there was a constant, although what that constant was and its magnitude was not apparent. The potential measurement of such a constant is likely possible but perhaps not with the available tools.

Question 5. What is What Humans Call “Matter” Made of?

Three coherent themes arose from the channelers’ answers to this question. The first revolved around matter as various forms of energy. For example, one channeler states that matter is dense energy:

Matter is an illusion... we would describe a table or a physical object that you call matter, we would say that it is extremely dense energy that has come into physical form, and beyond that, there is a shared belief system among the perception of what is being seen. (US5)

Another listed multiple energy forms, stating, “[Matter is] sound, it’s light, it’s intention, it’s frequency. Yeah, all of those things. And information, of course. And so, within that matter is information” (US7). Two other channelers (I8 and US3) mentioned sound in their answer, for example, “Matter is comprised of sound and vibration” (I8). Five channelers (I2, I4, I6, I8, and US7) mentioned vibration in their answers.

The second theme revolved around matter as a product of thought, consciousness, or mind, with 11 out of 15 channelers mentioning this concept. For example, “Matter is the concentration/fulfillment of the ‘thought from our subtle/soul part’ in Earth’sEarth’s dimension” (I1); “Matter is a type of intention” (I5); “Matter is this micro-consciousness” (US1); “Everything is made with thought” (US4); “All matter is composed of the energy of the divine mind” (US6); and “Matter is spirit force into physical form. It is the essence of alchemy, the spoken word, the command spoken or thought with intention is the power to create. Thought into form is manifestation” (US2).

Further, there was the idea that thought-forms became denser or vibrated at a particular frequency, thus becoming matter: “What you call matter is a solid state of thought-forms and vibrational frequencies” (I2), and “It is made from the same substance as thought, but with a more condensed vibration, which becomes matter” (I6).

A third, more minor, theme centered on the matter’s purpose. One channeler described matter as a learning tool for our experiences, stating,

It was created as a game, a distraction, and as an instrument for growth. We put energy, emotion, thought, love, and reproduction into a microcosm of your Universe. Each element of matter is a map and guide to your Universe, and you need to learn to use it. (I3)

In summary, answers to Question 5 were some of the more coherent, expressing that matter is a condensed form of thought/consciousness/mind with a vibratory nature.

Question 6. Why is it That With Each New Incarnation or Experience of Life, We Are Not Reminded of all the Previous Experiences and of Our True Nature?

Channelers communicated two broad themes in response to this question. One was that everything a soul experiences across their lifetimes is integrated into the soul. The other theme was that this knowledge is purposefully hidden from the person in the current incarnation so they can focus on their present life. Notably, all channelers agreed that humans experience things in past lives or other dimensions—none of them challenged that part of the question.

Channelers expressed that the experiences from each life are integrated into the soul between lives. Then, there is a resetting of the memory to facilitate learning in the next life. I5 stated, “Each life should correspond to a

'reset,' a zeroing of previous life experiences...It is not the details of other lives that count, but the experience and level of consciousness attained." Similarly, one channeler said, "each consciousness retains all experiences crucial for growth and challenges: it is the synthesis of all experiences" (18). Another shared,

Just as each day is greeted anew by the dawn, so it is with the life of the soul between lifetimes. Imagery of a wipe-off board, symbolizing the "start fresh" nature of another lifetime, yet there is a to-do list in the corner, reminding the owner of that saw that they are a work in progress. (US2)

Most channelers mentioned this idea in some way.

Some answers referred to a veil or obstacle that blocked humans from seeing the truth of reincarnation and the soul's persistence across lives. I3 stated, "In each life there is a transition, and each transition there is a veil to remove." Also expressed was the idea that the veil or forgetting enables the desired learning of each life: "For each life the important thing is that life's experience, the task assigned to it. Remembering everything is detrimental to these requirements" (14).

One channeler noted how socialization represses these experiences: "So, these experiences are happening and children are having these experiences. They are just shamed profoundly, often through Western psychiatry into silence. The interesting part is when as curious adults you come across evidence from past lives, previous incarnations" (US4).

There were multiple similar explanations for why humans are not reminded of their past-life experiences. Channelers shared that the veil makes it easier for humans to deal with their present life. If they remembered all their actions from previous lives, including negative behaviors, it could cripple their ability to be engaged in their current life. It could even be detrimental to access these experiences in that it could create suffering or be overwhelming: "it's almost too much for the human brain and the experience to look back and know and remember all of these experiences....[people can] lose their mind or go crazy or suicidal" (US7). Another channeler said, "Since physical beings on Earth are largely low to medium level, experiences from other lives are blocked because they can be more damaging than the current life" (17). These quotes suggest that human suffering comes from realizing previous lives' negative actions or inaction, which stay with people through lives in their DNA:

Some of you were not very nice people doing not

very nice things in previous lives... Every single tiny word you said, every single action you performed in every single one of those existences comes with you... in your DNA. (US4)

Further, the apparent lessons to be learned in the next life karmically balance the actions from the previous life. US4 stated, "The point is for [the person] to atone for what she did in this life...So, she does not go to jail for being a murderer in a past life, in this life...she simply atones for taking [a] life in a past life."

Some participants also shared that the information is available within each person but is blocked. At some point, humans will not need this veil anymore. US3 stated, "One day that will change, one day humanity will start to assume that they are more than they can see," and US1 stated, "Soon earthlings will know the ancient truths of their planet, species, and souls alike." Some even shared that the veil can be removed through practice or spiritual growth: "your consciousness already knows all dimensions in which you are present physically and mentally. It is up to you to remove the veil separating you from it. Potentially, you are already able to do this at birth" (12). US3 shared that a person could access information beyond the veil through specific techniques like hypnosis:

And the reason that hypnosis works is because it put you in sleep. You, you that assumes this lifetime is all you are is your own nature; it turns off the mind that assumes that what you are is what you experience in this lifetime. And as it turns that off. What it returns is your condition, your true condition, your soul's recorded experience.

In summary, all channelers aligned with the concept of reincarnation and its educational and experiential purpose integrated across multiple lifetimes. Further, the forgetting between lives allows people to focus on their current life and not be overwhelmed with the potential trauma of knowing their negative behavior or experiences from previous lives.

Question 7. What is Love?

Most channelers expressed in various forms that love is simultaneously everything and nothing, the creative force of the Universe that permeates all. Some responses focused on the enormity of love, describing it as "the all" (13) and "so much more than we comprehend... It is simultaneously everything and nothing" (US1). Several channelers emphasized love as a creative wellspring, calling love "creative" (US4) and describing it as the "creator en-



gine of the all" (I1), "the primordial spark of creation of all that exists and doesn't exist" (I2), "the source from which we all originate and the core towards which we all converge" (I4), and "a life-giving water that supports all life" (US2). US7 explained this creative force, stating, "love does create—again, it is a vibration. Certain vibrational frequencies can create physical matter. It is vibration, harmonious vibration, light and intelligence that creates."

One channeler emphasized love's prescriptive power, saying, "it's a type of law that ceaselessly governs the universe itself" (I7), while I8 conceptualized love as the "purest reflection of the Supreme Entity." Some also spoke of the distinction between personal human love and transcendent Universal love: "In human life, pleasure is fundamental in the term love invoke the concept of maximum pleasure, both spiritual and physical" (I5).

One channeler spoke of the electromagnetic nature of love and the polarized aspects of human existence.

We would define love as more than an electromagnetic frequency... it takes on electromagnetic qualities to fuel the Torus field that all energies are a part of, specifically and especially in this Universe, because [it] functions on positive and negative structures or polarities. (US5)

The same channeler spoke of a person's specific characteristics of their own love signature that reflects their spiritual development, stating, "One's ascension could be measured based on the quality and texture of the 'love field'" (US5).

In summary, Question 7 elicited coherent answers describing love as the substrate of reality, distinguished from personal human love. Less common was the electromagnetic quality of this "field" of love.

Question 8. What is the Nearest Exoplanet That Harbors Intelligent Life?

Multiple common themes arose for this question: 1) a misunderstanding about "nearest," 2) the various exoplanets with life, 3) their characteristics, and 4) space travel. Regarding the first theme, respondents expressed that what we define as closest to us is relative to how one perceives the question. The question was intended to evaluate the closest in terms of distance. US7 stated,

They're kind of laughing and chuckling at this question, because near is relative to perspective. These exoplanets that seem that there is distance between you with your visual eyes, are actually quite close when you connect with the

jump points. The jump points of the timelines where there are vortices."

Similarly, US2 stated, "This question mischaracterizes distance for what is another dimension...These other worlds exist in form and substance that are beyond the reach of telescopes and astronauts...non-physical world[s]...You can reach them with your mind."

Some channelers answered the question not in relation to distance but other factors. For example, one channeler stated that the closest exoplanet that contains intelligent life is

In the Pleiades, not because they are the closest, but because they are directly linked to Earth via creation and genetics. Furthermore, in the Multiverse, there are millions of exoplanets with intelligent life, but they are not separated by time and space because they are within the Multiverse. (I3)

Another said something similar:

We would say that looking towards the Pleiades and Antares for an exoplanet that contains intelligent life would be beneficial. And the reason that we say these two primarily is because, as far as star races are concerned, these are the beings that have contracts with the Earth. (US5)

The Pleiades was the most commonly named location, with four channelers (I1, I2, I3, US5) mentioning it. Sirius was mentioned by two channelers (I6, US1). Two other channelers (I4, US4) also mentioned Alpha Centauri. The other locations were only mentioned by one channeler (Antares, Metatron, QW Zeta Reticuli, below the North star).

There were also multiple comments about travel between these planets and that the travel happens in a way that transcends traditional views of distance and space-time. One channeler mentioned a unique vehicle: "They are capable of interstellar flight, using vehicles like clothes that surround them and allow them to get around by moving the body" (I4). Another channeler not only described locations but also described the intelligent life's appearance:

They are about 1.5 m tall, their skin is colorless, and they have very big yellow eyes with a black vertical pupil. They have a large head, and 3 to 5-digit switch, and a lump like a small ball...they have spacecraft in which they travel in space and

are perceived as negative by humans because they behave purely as researchers with no mercy or empathy, treating people like guinea pigs, not malevolently but scientifically, towards something unknown to them. (17)

Some also talked about the characteristics of the planets and civilizations. For example,

It is massive and not a full sphere. It is shaped like a Crescent made mostly of Hematite and Galena, no sand or dirt, mostly crystal and water, also showing it is [has] a moon. Not technically a planet. Ships imitate blue angular birds. It's thriving with cities and complex social structures. A utopian society still with interesting problems that we deal with in a more complex way. (US1)

In summary, the channelers' answers did not refute that there was intelligent life on exoplanets or that travel between these planets is possible. They did express that the answer to the question is different based on how "nearest" is defined. The provided answers varied depending on how the channeler perceived the question.

Question 9. What Creates Life in Plants, Animals, Bacteria, etc.?

Our ninth question yielded one common theme: the life force of individual organisms is actually an expression of a single, common life force. US1 stated, "All life and beings are fractals or pieces of source expressed in all infinite ways," while I6 stated, "Everything has spirit, even a flower has a soul which was assigned an evolutionary path, but sometimes even involutory, depending on what actions occur in the life cycle." According to US4, "Every human is a strand of consciousness, of the same consciousness of God, your all facets of God. We are facets of God, same thing." US2 stated,

The energy, the living force not unlike the energy contained in a huge wave, or the wind, or gravity, or electricity, is the force that creates and sustains life in plants, animals, and bacteria. It doesn't matter how "low/primitive" or highly developed the creature or being is; that is a matter of vibration and intensity of the "voltage."

Many channelers (I1, I2, I3, US1, US4, US5) expressed that this life force is love, and some (I1, I2, I3, US4, US7) love and intelligence/knowledge. Others expressed that

this love is a consciousness and that it creates life as a way to express itself. What creates life is "love or source. Another way to put it is consciousness plus a desire to express" (US1). Similarly, another channeler described the impulse for consciousness to experience itself, thus creating life as a path to self-knowledge. US3 stated, "When the void was out without form, it was consciousness that in no way understood itself... It was simply pure consciousness and potential pure potential... I had a real revelation and began the creation through that I am now."

Some channelers highlighted distinctions between living and non-living things, e.g., "Life is like this – an unknowable flow of energy... This flow does not involve inanimate beings such as rocks: those are emanations transformed from vibrations into matter that is dense and lacking a spiritual essence" (I8). Others, however, communicated that this distinction was an illusion; for example, "All parts of planet Earth are living, there are no non-living structures, not even rocks" (I4).

In summary, many channelers' answers were coherent in that they suggested one force creates life regardless of its manifestation, that this force is consciousness expressing itself for self-knowledge, and is love and knowledge.

Question 10. What is the Nature of Dark Matter, and How Could it Be Detected?

There were three main themes in the answers to this question: 1) a reconciliation of opposites, 2) dark matter being involved in travel, and 3) the human mind's inability to comprehend dark matter—fewer channelers mentioned how it could be detected. Multiple channelers also believed dark matter represented an important polarity, and words representing opposites (e.g., light/dark, light/shadow, matter/anti-matter, absence/presence) were frequently used (I3, I4, I5, I7, I8, US7). For example, one channeler wrote, "Dark matter is like the shadow of something which is in the light representing normal matter. In a way, the object exposed to light acts on the light itself and the shadow is a 'reaction' to this action" (I5). Further, dark matter has within it the potentiality of both sides of polarities: "Within dark matter is everything. Polarity disappears and there is the ONE and especially love which meets death and vice-versa" (I3).

Another common theme (I3, I8, US1, US4, US5, US7) was the idea that dark matter represented an opportunity for space travel. I3 stated, "It's not possible to travel across the universe without it." US4 stated, "The closest analogy would be a fiber-optic cable, through which you can travel all through what you're calling dark matter," and US5 stated, "Dark matter, in many ways, contains

portals and energies that are detectable by other races and other beings that use them to travel.”

Channelers also frequently expressed (I8, US1, US2, US3, US5) that the human mind has difficulty understanding the concept of dark matter and its nature: “That too is a structure-non-structure that is very difficult for the human mind to understand” (I8) and “Your mind will not understand it” (US1).

Another interesting concept was the relationship of dark matter to various “supreme beings.” For example, one channeler noted,

Dark matter is something like tracks left behind from the motion of Supreme Beings: each time parts of a Supreme Being direct themselves towards physical or non-physical beings, the movement generates a sort of detritus which makes up what is called Dark Matter, which is as large as the Supreme Beings themselves. (I4)

Finally, some channelers highlighted that dark matter has not yet been detected (I2) and can not be perceived with the human sense organs (I8). One shared that it can not be detected at all: “How does one detect the vacuum, the emptiness and void of outer space? It is the lack of the vibration of energetic presence. Dark matter is also devoid of that energetic vibration that is the presence of the life force” (US2). Another channeler shared that it is detectable by other races and beings who use it for travel (US5).

Few channelers mentioned how one could detect dark matter. One said it could be detected with love (I3). Another noted that there is dark matter within the human brain and that activating the brain through meditation would allow us to detect it. US5 stated,

So, we would also suggest working with the human brain into activating parts of it. We don't mean by taking human created or pharmaceutical drugs, but in working with, sitting with, meditating with, and activating your brain, this will function differently for all people. But we perceive this to be the next step as one's heart expands, one's brain expands, that once you begin to understand the dark matter in the brain, you can start to understand the dark matter out into the Universe.

One channeler even mentioned using psychedelics to be able to detect dark matter:

The way that you can tune into this -- because dark matter itself is pure consciousness... It's to do mushrooms, psilocybin... There is some connection with that vibration of psilocybin, where the intelligence turns into the jump point, these empty spaces, these dark spaces of nothingness where dark matter reside. (US7)

In summary, there was cohesion in answers about dark matter, reflecting its relationship to polarities, space travel, and that the human mind may have difficulty understanding dark matter's nature.

Scientists' Feedback

Once all the answers were collected, the team collated them and sent them to the scientists who suggested that question. The scientists were asked: 1) Do these answers make sense to you? 2) Was there anything new stated that you did not already know? 3) Is any of the information useful and/or actionable? 4) Is there anything else you want to share about the content? In general, the scientists did not find the answers useful in any actionable way.

The scientists for questions 2, 3, 5, 7, and 10 felt that “Responses are more similar (in the channeling condition) for the questions not related to physics, i.e., 2, 3, 7, perhaps because participants refer to different (mental) energies that still are not considered in the mainstream physics.” They also felt that the answers provided new information, “For some questions yes, for example, questions 3, 5, 9 and 10.” They were uncertain whether the information was useful and/or actionable: “It is hard to say, but it can be useful for future investigations.” They also commented on the potential source of information, saying, “It is still difficult to discriminate whether the sources of information are different sentient entities (even if some participants clearly describe an interaction with them) or higher levels of consciousness of participants.”

For questions 1 and 8, the answers did not make sense to the scientist, specifically, “No more than any other word-salad drivel.” They also shared that they gleaned no new information from the answers.

For question 10, the scientist stated,

There is nothing from a scientific point of view that gives me any clue or new idea about the nature of dark matter or how to search for it. The closest to a statement on the nature of dark matter is something like “dark matter is consciousnesses, and the closest to advice on how to detect it is to take a little bit of psilocybin

mushroom! I kind of like that idea.

Whether this scientist was jesting is uncertain. However, this suggestion is undoubtedly actionable as increasing avenues allow for the legal exploration of psilocybin as a vehicle for accessing altered states amenable to exploring consciousness (Hadar et al., 2023).

DISCUSSION

In summary, this exploratory study found from judging correspondence scores a low correspondence between channeled and non-channeled answers as hypothesized and virtually no correspondence for each question across channelers, contrary to our hypothesis. We also observed little support that the channelers accessed the same perceived source of information. However, we did find coherent and common themes for many but not all ten questions through qualitative thematic analysis of both sites' data. Several lessons from this study can be applied to future studies.

Channelers

Channelers self-reported their inclusion criteria. That is, most channelers stated that they had channeled scientific or technological information. However, there was no process to verify that the information they received was valid. In addition, there was heterogeneity in the channelers' experience across sites. Future studies would attempt to validate previously channeled science content before enrolling channelers in such a study and setting a higher threshold of experience to participate. We also did not formally evaluate the channelers' childhood and current religious or spiritual affiliations, which may have influenced some channeled and non-channeled responses. Additional measures could be included to assess the channelers' states during each of the conditions. For example, the Phenomenology of Consciousness Inventory (Pekala, 1991) could have been used to quantitatively evaluate phenomenological experiences of channeling and non-channeling states.

Can channelers with no scientific background channel scientific information? The lack of correspondence of the channeled answers may be because they were in contact with differing ostensible "sources of information" and experienced difficulties "translating" information with their own words and concepts, particularly when the arguments were very complex. Some suggest that whatever the source of information, the "Library of the Mind" of the channeler, consisting of their memory, education, vocabulary, and cognitive capacity, is intrinsic to the process of successfully receiving information

(Wahbeh et al., 2018). Thus, if a channeler does not know the vocabulary the "being" wants to use, then they can not use those specific words. One idea to overcome this potential limitation is to train scientists to channel; thus, the channeler would have the correct Library of the Mind to channel relevant information. One such training involves hypnotic induction into a nonlocal consciousness perceived out-of-body state that is then deepened and, with consent, allows trance channeling to occur (Pederzoli et al., 2018). This process has been successfully applied to people naive to channeling and could potentially work for scientists. Future studies could recruit scientists, train them in trance channeling, and observe if the quality, relevance, and actionability of their responses compare to non-scientist channelers of the same questions.

Question Choices

Although scientists provided the questions used in the sessions, they were metaphysical in nature, such as "What is love?" and questions about reincarnation and preparation for incarnation. We expect answers to these questions to be more explanatory rather than offering actionable tasks. Regardless, the questions that included an objective aspect, such as detecting dark matter, did not reveal more specific information, though taking psilocybin to reflect on the nature of dark matter was one of the more actionable invitations suggested. Including more verifiable questions in future studies could support the assessment of channeling's utility.

There were no structured criteria for choosing the questions used for the sessions, and the final questions were biased by the investigators' curiosity. Future studies will also include systematic methods to select the questions. Ideally, multiple iterative studies would be conducted so that various question sets could be asked, allowing the assessment of answer variation by question type (e.g., content area). The nature of the questions was also quite broad. This may have contributed to the general and diverse answers received. Future studies would ask narrower questions for more specific answers. Others have experienced challenges in appropriately framing questions during channeling and have provided suggestions, such as ensuring that they are clear and precise, and not complex and allowing a natural flow from one to the other (Kardec, 1861, Chapter XXVI). Perhaps the complexity of the questions created by the scientists and discontinuity from one topic to the next negatively impacted the study.

Some questions also included leading language that could bias the answers. For example, question one stated

three options for how a physicist could describe an observation (i.e., the collapse of a wave function, possibility turning into actuality, realization in mind of one brain of the multi-universe). These concepts arose as common themes in the answers. The question could have been stated more simply without the leading options.

Channeled versus Non-Channeled Answer Correspondence

The amount of time given for channeled answers for the U.S. channelers was twice as long as for non-channeled answers. This is reflected in the volume of words for the channeled responses compared to non-channeled ones. However, this difference in time precludes us from knowing whether the difference in the channeled versus the non-channeled answers was simply an artifact of the difference in the time given to provide answers in each state. If U.S. channelers were given 10 minutes for their non-channeled answers, perhaps they would have been more similar to their channeled answers.

Channeled Answer Correspondence

After a review of sample questions and judging criteria, the three judges conducted the correspondence judging independently, resulting in three correspondence scores for each item. The interrater reliability amongst judges was not as high as we would have liked across all comparisons, with an agreement range of 33 to 78 percent. Refinement of the judging process would support correspondence evaluation in future studies. More ideally, sophisticated automated methods could be developed and implemented to evaluate similarities and differences in the text. The current challenge with these techniques is that they cannot assess complex and abstract themes and meanings and are focused on words. Thus, similarities may be underestimated for abstract channeled material.

Source of Channeled Information

We hoped this study would offer insight into the source of channeled information. Channelers were asked to tap into the same source of information for their answers. Despite this instruction, their channeled answers were quite different, supporting that the channelers tap into an information source specific to them rather than some common source. Perhaps the channeler's ego directs the information sources and thus overlays what the source of information is from their personality mind. For example, if the channeler feels their source is a guide team, then that is what they say the source is. The U.S. channelers gave very different answers to what they believed was the source, and their answers at the surface

level were also very different, as assessed by the correspondence scores. One would expect the answers to be more similar if the same source simultaneously transmitted the same information to all channelers.

Another important point regarding the source of channeling is the *source-of-psi* problem, a topic rigorously discussed among researchers in this area. There have been multiple proposed sources of channeled information (i.e., living agent psi, superpsi, psychic reservoir, and survival) and innovative ways to test the differences between them (see Beischel & Rock, 2009; Braude, 2003; LeBel et al., 2022). This study was not designed to discern between these potential sources but focused on the channelers' perception of the source.

Channeled Answers Content

We asked the channelers to give as much detail as they liked for each question. Requesting more concise answers may have served our study's research questions better. The latitude to provide detailed information created more variability in their descriptions, even though many of the same themes arose. That is, at face level, the answers were very different, but at the content theme level, there were many similarities.

Additionally, alternative analysis methods may help glean useful information from the volumes of available channeled content. We attempted to conduct automated text analysis for this study. However, we were advised that our dataset was not eligible for automated analysis because of the small amount of data for each question. We needed thousands of records per question for effective analysis beyond basic word counts. Automated qualitative analysis would dramatically support further research into the usefulness of channeled content, as manual qualitative analysis is time-consuming, requires extensive personnel time, and can be biased by the reviewers' worldview.

Implications and Applications

The main empirical novelty of this study is that, for the first time, we tested the feasibility of testing a group of participants' ability to enter a channeling state and explore their responses to a pool of similar questions. One project goal was to examine the feasibility of evaluating whether channeling is accessing a higher intelligence than the personal self and likely one with greater knowledge. Given the opportunity to continue our investigation, we are curious to understand how to integrate channeled information to inspire scientific understanding. As art has informed science in conventionally acceptable ways (e.g., Leonardo da Vinci's *Vitruvian Man* inspired mathe-

maticians, architects, and physicians with its harmonious design (Creed, 1986)), perhaps channeled information can lead us to find novel ideas to unresolved questions in science and society. This study also has the potential to support other studies in the fields of parapsychology, consciousness studies, and mediumship.

Overall, even if exploratory, this study offered insight into improving future studies attempting to obtain useful information from channeling. Ramanujan's channeled mathematics provides a positive case that channeling could, in theory, provide useful information. Suppose group channeling consistently provided correct answers to verifiable questions. In that case, one might be more confident in coherent, collated answers from group channeling about questions to which humanity does not know the answers or cannot be verified. However, modern-day methods need to be improved to allow this theory to be realized as a practical application. Some groups are attempting just that. For example, there was a convening through the Public Parapsychology group called The Exploring Consciousness-Based Applications for Climate Action Workshop & Ideathon, where they formed three teams: one exploring "subtle activism" as a psi application, one carbon removal Xprize team, and a team working on a mobile app for collectively focusing intent (Ventola, 2021). With improved methods and continued research, perhaps channeling will provide actionable insights into critical issues humanity faces today.

This work supports the development of a methodology for validating channeled information. Should a rigorous method be established, it could be applied to the voluminous and ever-growing channeled material. The applications of validated channeled material are only limited by its content and actionability. Ideally, feasible channeled information would be verified and acted on to evaluate its usefulness. The notion that we could tap into novel solutions to problems facing our world, regardless of their source, is worth pursuing.

ENDNOTES

- ¹ Discussing the various theories behind the source of mediumistic information is beyond the scope of this paper. For reviews of the living-agent psi, psychic reservoir, or survival theories see Braude (2003) or Beischel & Rock (2009).

AUTHORS' NOTES

Author's Contributions

HW – Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Supervision, Writing –

Original Draft Preparation, Writing – Review & Editing
PS – Data Curation, Formal Analysis, Project Administration, Writing – Original Draft Preparation

LP – Conceptualization, Data Curation, Investigation, Writing – Review & Editing

PT – Conceptualization, Data Curation, Investigation, Methodology, Project Administration, Supervision, Writing – Review & Editing

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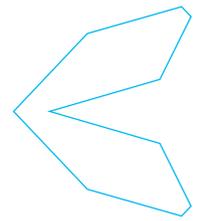
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ESSAY

A Three-Aspect Model of Consciousness

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HIGHLIGHTS

A new framework and model called “TAM” is proposed that unifies consciousness and psychic-type phenomena.

ABSTRACT

A model for consciousness is proposed based on Nisargadatta Maharaj’s interpretation of Jnana Yoga/Advaita Vedanta. Concepts from modern physics, neuroscience, and information science are integrated into that framework. A novel understanding of *information* in the context of a system with consciousness is proposed. Information generated in the neurophysiology of a brain’s unique “wiring structure” is hypothesized to become dissociated from the neurophysiology and transformed into a universal format within a nonphysical domain in which consciousness is assumed to occur. Sharing features with Bohm’s Implicate Order, the nonphysical domain has nonlocal properties which support instant correlation of information throughout. The energy of a carrier is not needed to transport information in the nonphysical domain. This allows for low-energy neurological systems to transfer information associated with thought across large distances, as observed in telepathic psi phenomena. An experiment to test for the existence of a nonphysical dimension that supports instant telepathic information transfer is discussed. It is argued that *three* is the minimum number of aspects necessary to model a practical framework for consciousness.

KEYWORDS

Consciousness, awareness, mind, brain, information, psi, nonphysical, memory, knowledge representation.

INTRODUCTION

In the prevailing scientific paradigm of materialism, the universe is comprised of matter-energy and space-time, and all phenomena are viewed as products of their interactions. This paradigm has worked supremely well for technological development, but it fails to account for what Chalmers (1995a) referred to as the “hard problem of consciousness.” Michael Levin (1995, n.d.) has argued

against the sufficiency of materialism in explaining consciousness and suggested that parapsychology provides the most forceful arguments against a materialistic worldview. John Beloff (1985) has argued that the existence of psychic phenomena is not compatible with materialism. Charles Tart claimed that the existence of psi phenomena requires us to consider a “nonphysical aspect to reality, rather than wait around with faith in what philosophers have termed *promissory materialism* to eventually explain

the phenomena away" (Tart, 2009, p.13).

A nonphysical aspect of reality is found in the philosophical position of *dualism*, whose modern formulation traces to Descartes: In addition to physical matter and energy, *dualism* holds that the universe contains *mind*, which is nonphysical – and, therefore, non-spatial – an element which cannot be reduced to matter or energy and is responsible for consciousness. *Dualism* implies the existence of a covert domain of reality outside the physical domain that interacts with the physical domain.

Physicist David Bohm proposed a theory in which there are two orders of reality: (1) the *Explicate Order*, which is the familiar physical domain of matter-energy and spacetime, and (2) the *Implicate Order*, a nonphysical domain based on *information* which exists outside space and time (Bohm, 1980). He theorized that the Implicate Order is the foundation for both matter-energy and consciousness. In a process called "unfolding," the Implicate Order "informs" (i.e., determines) everything that exists in the Explicate Order. The theory proposes an oscillation in which the Implicate Order "unfolds" into the Explicate Order, which then "enfolds" back into the Implicate Order, and so on. In this dynamic process he termed *holomovement*, Bohm used the example of a *hologram* to explain how the information contained in the Implicate Order is expressed in the Explicate Order. Like a hologram, every small region of physical space in the Explicate Order contains an expression of all the information in the Implicate Order. Bohm further hypothesized that every quantum particle in the universe is informationally and nonlocally interconnected within a single organically whole potentially infinite dimensional system, which is the Implicate Order. He asserted that in the Implicate Order, "the consciousness of mankind is one" (Weber, 1986, p. 41). Bohm's Explicate Order is the visible and measurable order that emerges from the Implicate Order, the unobservable, nonlocal, unmanifest realm of potentiality that underlies all physical manifestation. Bohm's theory can be seen as a form of *neutral monism* since it posits a holistic view of reality in which the physical and mental aspects are not fundamentally separate but are rather two aspects of a deeper, underlying unity. In Bohm's view, the Implicate Order represents this underlying unity.

Nisargadatta Maharaj (1897–1981), in his acclaimed book, *I Am That* (1981), expressed a model of reality as an organic whole which goes beyond dualism and Bohmian neutral monism in that it consists of three aspects. Two of these somewhat resemble the *mind* and *matter* aspects of *dualism*, while the third aspect, a source of *pure awareness*, is more fundamental and "beyond" the other two. Maharaj's book presents a complete, coherent, clear, and understandable description of his view of the structure of

reality and consciousness. Douwe Tiemersma, Philosophical Faculty, Erasmus Universiteit Rotterdam, Holland, wrote, "Maharaj's Interpretation of truth is not different from that of Jnana Yoga/Advaita Vedanta. But, he has a way of his own" (Maharaj, 1981, p.4). Maharaj's teachings on the nature of consciousness and reality have had a significant influence on modern spirituality, including the Neo-Advaita movement. In his book, *I Am That*, a collection of conversations, Maharaj expresses the profound thought accumulated in a tradition based on the Upanishads, which has, since ancient times, explored the nature of consciousness and its place in reality. This knowledge can provide the basis of a model for consciousness which includes psi phenomena.

In this paper, I will use the view of reality and consciousness expressed in Maharaj (1981) as a basic framework. Building on this foundation, I add operational principles from contemporary science to construct a model with three distinct aspects. I will argue that the three aspects expressed by Maharaj (1981) can explain what a single material aspect alone (materialism) or even a single material aspect and a single nonmaterial aspect cannot. I will argue that a 3-aspect framework provides a clear advantage for scientific investigation of consciousness phenomena over frameworks with fewer aspects.

Psi Phenomena Are Part of "Everyday Consciousness"

In order to understand any system that supports a variety of phenomena, it is necessary to include an examination and explanation of the endpoints of its behavior. When seeking to understand the system in which consciousness exists, normal conscious perception can be regarded as one end of the behavior range, while a variety of psi phenomena - intimately connected with the phenomenon of consciousness - represents the other end of the range. Maharaj's view is consistent with the view that psi phenomena are within the range of ordinary consciousness phenomena: "Q: Can you enter into the mind and heart of another man and share his experience? M: No. Such things require special training" (Maharaj, 1981, p.195). A skill that requires training, like learning how to swim, would not be expected to be classified as something out of the ordinary, "mystical" or "supernatural."

Spontaneous experiences of psi occur frequently and in all cultures. In the laboratory, experiments have produced a stream of statistically significant results, showing that psi is a phenomenon that can be studied and measured scientifically. People who experience various forms of psi in experiments (for example, telepathically perceiving a brief, blurred image of the Capitol Building

being viewed by a known person miles away) do not report these as “mystical experiences.” They are better understood as the operation of another “sense” that takes in information from somewhere – it is not clear where – and renders the received information perceptible in the imagination. Part of the imagination is called the “mind’s eye” when processing visual information. In the act of sending information out, for example, telepathically sending an image viewed on a screen to a friend, it is just a question of looking at the image and knowing who the intended receiver is. There is nothing mystical or supernatural in this case, either. What is amazing is that the receiver is able to accurately perceive the visual features of the image being viewed from a distance by someone else - although perhaps it is no less amazing than being able to perceive what is directly in front of our eyes. Psi researcher Rupert Sheldrake stated, “Telepathy is normal not paranormal, natural not supernatural [...]” (Sheldrake, n.d.).

In this discussion, it will be important to distinguish *the mechanism of consciousness* from the *contents of consciousness*. Seeing a flower, smelling a rose, feeling a touch, thinking a thought about what you want for dinner, perceiving a telepathic image of a red car near the overpass, in each instance, the *information* in the *contents of consciousness* can be represented by a *data structure populated with data elements*. In the cases above, each populated data structure would be different. But, the process by which the information specified by each data structure enters the *contents of consciousness*, the basic underlying mechanism, is assumed to be the same. Framed in this way, with the *contents* separate from the *underlying mechanism*, it is easier to understand how even what is viewed as a “mystical experience” may indeed have *content* that is “mystical” while the system that makes the *content* conscious may be no more mystical than the system that keeps the heart beating while the individual is having the experience. Nevertheless, it is important to distinguish what is clearly a “mystical experience” from the type of “everyday consciousness” that is the focus of this paper. A mystical experience is often described as a state of expanded awareness, heightened consciousness, or altered state of consciousness that transcends the everyday sense of self and the material world. Mystical experiences, which occur in all cultures, are often associated with feelings of awe, love, and unity, as well as with insights, revelations, and a sense of profound meaning and purpose. It can be argued that these types of experiences, which involve a sense of union or direct contact with ultimate reality or the divine, are in a class by themselves, outside the scope of “everyday consciousness” and deserve special treatment. They are outside the scope of this paper. The forms of psi which are considered

to be within the range of “everyday consciousness” and which receive continued experimental study in the laboratory are (1) telepathy – mind-to-mind connections, (2) clairvoyance – perceiving distant objects or events, (3) precognition – perceiving future events, and (4) psychokinesis (PK, MMI) – mind-matter interactions. These types of psi will be regarded as “ordinary psi” and part of the functioning of the “everyday consciousness,” for example, as experienced by subjects in experiments involving the four types of psi phenomena mentioned above.

Besides the mechanism that delivers content into consciousness, the second factor to consider regards *the mechanism that underlies the acquisition of different types of content*. Marwaha and May (2015, 2016) proposed that the many forms of psi phenomena, such as telepathy, clairvoyance, precognition, and mind-matter interaction (MMI), are all expressions of the same underlying process, and that process is precognition. However, experimental results and reports of spontaneous incidents provide evidence of psi phenomena that display a stimulus-response behavior pattern (Radin, 2004, 2017; Achterberg et al., 2005; Richards et al., 2005; McCoy, 2011). This evidence argues against precognition as the sole underlying mechanism for psi *content acquisition* since an underlying real-time mechanism in such cases would be the simpler assumption. But, the idea that the many forms of psi phenomena are all expressions of the same underlying process remains a powerful simplifying assumption. Others have held this basic view (see Radin, 2019; Williams, 2013). It is likely that the acquisition of *psi content* from different time periods (past, present, future) and different regions in physical space employs a single underlying mechanism.

Carpenter’s (2004, 2005) theory of *first sight* assumes that it is the norm to use psi ability “unconsciously at every moment as part of the holistic process of construction that leads to all experience and all action” (Carpenter, 2010, p. 1). In the world view expressed by Maharaj (1981), it is natural to assume that the same process that underlies normal consciousness also underlies consciousness in at least the four “ordinary” types of psi phenomena mentioned above.

In this paper, I will assume that parapsychological results are generally true. I will not discuss the evidence for the existence of psi phenomena such as telepathy, etc., as studies that do this are widely available. For meta-analyses on various modes of psi phenomena, see Cardeña (2018), Bem et al. (2016), Mossbridge et al. (2012), and Utts (2018), all of which report substantially significant effects. For credible accounts of cases of various forms of psi phenomena, see Mayer (2007), Targ (2012), Talbot (1992), and Mishlove (2016).

The model to be articulated below is called “TAM,” an acronym for “three-aspect monism.” Main assumptions of the TAM model are summarized in the Appendix.

Three “Expanses”

According to Maharaj (1981, p. 191), reality consists of three *akashs*, translated as *expanses*: (1) the expanse of matter-energy (EM), “the physical space with all that can be contacted through the senses,” (2) the expanse of consciousness (EC), “the mental space of time, perception and cognition,” also referred to as “universal mind (Maharaj, 1981, p. 227),” and (3) the expanse of the source (ES). The *expanse of the source* can be understood in the model as an omnipresent and fundamental source of undifferentiated nonphysical “*awareness energy*” which is required to bring about consciousness.

Current Western science is focused on the physical *expanse of matter-energy*. However, Maharaj points to an extensive nonphysical aspect of reality. The nonphysical *expanse of consciousness / universal mind* is claimed to be the home of the individual as well as the universal *mind*. Moreover, “The body can neither enjoy nor suffer. It is the mind alone that experiences” (Kak, 2016). The nonphysical realm is claimed to be that in which conscious entities experience the *contents of consciousness*.

In this view, the body with its brain is physical and exists in the *expanse of matter-energy*. Consciousness is viewed to occur when *pure awareness energy* of the *source* contacts *matter* (Maharaj, 1981, p. 83). With respect to human consciousness, this process will be understood as one that transforms information generated in the brain (made of matter) into *the contents of consciousness* in an individual *mind*, which can be understood as a *region* of the *expanse of consciousness*.

This view is parsimonious. It rests on the idea that there is a fundamental and universal source of pure awareness analogous to a source of physical energy. When pure awareness interacts with *nonconscious information* found in matter (e.g., a pattern of neural excitation in a brain), consciousness, which is nonphysical, is generated in the *mind* associated with the brain of the individual that generates the information. Everything made of matter, for example, a brain in the expanse of matter-energy (“EM”), is constantly in contact with the expanse of consciousness / universal mind (“EC”) and the “pure awareness energy” of the expanse of the source (“ES”). The result, under the right circumstances, is conscious experience, to one extent or another, strongly associated with that matter. An individual experiences *the contents of consciousness*. Conscious awareness is described as a type of “reflection of the *source*,” analogous to the reflection of the sun on

countless dew drops (Maharaj, 1981, p. 323). Consciousness is viewed as something that “does not shine by itself. It shines by a light beyond it” (Maharaj, 1981, p. 151). It is also referred to as something that is “borrowed” (Paramarthananda, n.d.).

In folklore, there is the expression, “a fish would be the last to discover water.” The *expanse of consciousness* should not be dismissed as something abstract and remote. If it exists, it must affect us all strongly and at all times. Its presence would act in every thought and sensation we have; we are essentially “swimming” in it and interacting with it significantly from birth to death. Accepting its reality would mean a significant minute-by-minute belief system shift from pure materialism.

Chalmers (1995b) suggested that “conscious experience be considered a fundamental feature, irreducible to anything more basic” (p. 83). Maharaj (1981) expresses the alternative position that consciousness is not fundamental since it is “dependent.” Maharaj claims that the *source* is fundamental and independent and cannot be explained or understood by the *mind*; yet it can be experienced in a state “beyond consciousness” (Maharaj, 1981, p. 232). Consciousness is viewed as being dependent upon the *source of pure awareness energy*. If the dependent component of consciousness can be regarded as not fundamental, there is reason to believe that much, but not all, of what is considered to be “consciousness” can ultimately be understood, simulated, and modeled.

Awareness vs. Consciousness

Maharaj makes an important distinction between *consciousness* and *awareness*:

There can be no consciousness without awareness, but there can be awareness without consciousness ... Awareness is absolute, consciousness is relative to its content; consciousness is always of something. Consciousness is partial and changeable, awareness is total, changeless, calm, and silent. And it is the common matrix of every experience. ... Since it is awareness that makes consciousness possible, there is awareness in every state of consciousness. (Maharaj, 1981, p.29)

Watch yourself closely, and you will see that whatever be the content of consciousness, the witnessing of it does not depend on the content. Awareness is itself and does not change with the event. (Maharaj, 1981, p.322)

Awareness becomes consciousness when it has an object. The object changes all the time. In consciousness, there is movement; awareness by itself is motionless and timeless, here and now. (Maharaj, 1981, p.180)

This distinction between *consciousness* and *awareness* indicates that *two components* are involved in the phenomenon of consciousness: one, the *contents*, can be defined in terms of *information*, the other, *awareness*, cannot be defined in terms of information and is outside both the physical aspect of matter (EM) and the non-physical aspect of the *mind* (EC). The definitions of these two terms are not distinguished in English. However, in this discussion, they should be understood as defined above, with “consciousness” always having informational content and “pure awareness” being something else entirely, unchanging and without content, not expressible in terms of mathematics or information. It is linked with the *expanse of the source* (ES) and is not “dependent” upon anything; it is fundamental.

Nonconscious vs. Conscious Information

Consider the case of looking at a red ball thrown at you to catch. The ball is red, but how does the subjective experience of the color “red” enter consciousness? This is equivalent to asking how pain or any subjective experience can enter consciousness. The human brain has over 25 spatially distributed neurophysiological centers that process different types of information in the visual field (Robles et al., 2014). One center contains neurons that respond to different colors; another analyzes shapes; another can compute the trajectory of a moving shape and generate information about where it will be along its trajectory. These separately located contributions of information to the contents of consciousness are generated within specific neural network structures in an individual’s visual and cognitive system – layers of neurons connected to other layers with various connection strengths. In a specific brain’s neural network, neuroscientists believe that the *activation pattern* of all the neurons in the network defines the totality of *information* being produced in that network at any one time. This information is meaningful within the specific brain’s neural wiring structure that generated it, a structure that changes and grows with the learning experiences of the individual.

The format of such brain-specific neurally encoded information is considered in the TAM model to be *nonconscious* because it is produced within the physical material of the brain, which, by itself, cannot experience conscious awareness. This *nonconscious information* is assumed to become *conscious information* in the nonphysical entity

referred to as the *mind* of the individual. This is assumed to occur when pure awareness energy from the *expanse of the source* contacts the matter of the brain, which includes the current state of the neural information structure of the neural networks in the physical brain. The *nonconscious information* produced in the brain can be understood as a *specification of information* for conscious awareness. I propose that the neurally-encoded nonconscious information (termed “neurological information”) is rendered into a conscious format based on the neurally generated information in its “pure state,” i.e., *as disassociated from the unique activation pattern within the “wiring structure” of a specific brain*. This “pure information” binds with qualia information resident in the *expanse of consciousness* and becomes *conscious information* in the *mind*. Furthermore, information in its consciously experienced form in the *mind* has a universal format in that *minds* of other individuals – i.e., other *defined regions* in the *expanse of consciousness* – can potentially access and understand it, regardless of the specific “wiring structure” of the biological system that generated it. The need for independence of “wiring structure” is clear from the psi phenomenon of telepathy since no two brains have the same “wiring structure.” But, since the format of this information is universal, even vastly different “wiring structures” can make use of the same information. For example, a human, a dog, a bird, or a bee can, in principle, understand a telepathically received visual image of a tree. It may also be true that similarity of “wiring structure” can strengthen psi sensitivity: There is some evidence to support the idea that similarity of “wiring structure” as found in monozygotic twins facilitates telepathy (Karavasilis et al., 2018).

It is important, however, to distinguish *format*, *content*, and *meaning*. The *format* of information in the EC is assumed to be universal in all cases. Then, there is the *content* of the information. Content has a *scope of universality*. In the case of an image of a tree, the visual shape content has a wide scope – a tree shape looks like a tree shape to any being with eyes. But other information, like color, is content with a narrower scope. A bee can see ultraviolet, which is not visible to humans. Information *content* can include *semantics*, which generally has a relatively limited scope. For example, a hand gesture might have a certain meaning for just a small number of individuals. Information can be more abstract, for example, the idea of danger. But, abstract information is connected with *meaning*, which is not universal. To summarize, the format of all *content items* in the EC is assumed to be universal, while each content item has a *scope of universality*.

Although *nonconscious neurological information* discussed above is viewed as distinct from *conscious informa-*

tion, both formats, along with the continuous operation of pure awareness, are viewed to occur holistically for the individual. This is the principle of *monism*: “All is one, however much we quibble” (Maharaj, 1981, p.128). The whole organ hosting the modes of physically produced nonconscious information and nonphysically produced conscious information deserves the term *brain-mind*.

Experimental results support the assumption that the intercommunication process between the physical brain and the nonphysical *mind* is bidirectional. In telepathy experiments, EEG and fMRI data showed a peak of brain activity at roughly the same time in both sender and receiver (Radin, 2004, 2017; Girolini et al., 2016; Richards et al., 2005). A question to consider is the similarity of formats of *dissociated neurological information* and the format of the same information encoded in the *expanse of consciousness* (termed in this discussion “EC-information”). Are the two formats identical? If so, the information generated as a result of an activation pattern in a specific neural network would already be formatted as “pure information” that is also formatted as EC-information, which enters the *contents of consciousness* already in a universal format without the need to undergo any further format conversion in the process.

Information Has Physical Purchase

Regardless of format, implicit in this formulation is the assumption that *information* is, in some sense, *real*, a *substance* that has the ability to cause a material effect in the universe. Though it may seem at first nonsensical and counterintuitive, this view is being increasingly embraced by the scientific community. Physicist John Archibald Wheeler enunciated this basic idea in his famous catchphrase “It from bit” (1989) — “it” refers to all the matter-energy of the universe, and “bit” meaning *information*. Bohm implied this view in the concept of the Implicate Order, which is composed of *information* and which, in his and Hiley’s (Bohm & Hiley, 1993) idea of *active information* (discussed below), has the power to influence matter. Just as space and time have joined the list of entities with degrees of freedom and dynamics of their own that interact with matter-energy, so *information* joins that list of concepts originally thought to be intrinsically lacking a dynamics of their own. Paul Davies considers information a “source of fuel” that has “physical purchase:” “the principle is established, that information is a source of fuel. It enters into the laws of physics. So, it has some physical purchase, and that’s the point” (The Planetary Society, 2020). “Information, not in its prosaic everyday sense but as an abstract quantity which, like energy, has the ability to animate matter” (Davies, 2019, p.7). Bohm

used the transitive verb “*inform*” as something information can do. The Implicate Order “informs” everything that exists in the Explicate Order. Hiley referred to the quantum potential (the information field of the Implicate Order) as internal energy and as a new quality of energy (Hiley, 2006). Some physicists claim that information is the primary substance of the universe and not matter (e.g., Wheeler, Bohm, Davies, Lloyd). Others place it on an equal footing with matter; “Nature can no longer be seen as matter and energy, but must be interpreted as matter, energy and information” (Campbell, 1982). When the information in a brain-mind is viewed in this active way, the psi phenomenon of mind-matter interaction (MMI) enters the outer reaches of possibility.

The Nonphysical Domain Presents Like a Hologram in Spacetime

Bohm used the analogy of a hologram to explain how the information in the Implicate Order affects the Explicate Order. A hologram of a 3-D representation of a region of space can be created on a 2-D photographic plate and cut up into small pieces, and each small piece contains the information about all the space in the 3-D region. Not only does the hologram contain all the information, but *it contains a representation of all the information in every small region of the plate*. Bohm’s *holomovement* is like a continuous 4-D movie in which each individual who occupies a small region of spacetime has access to a representation of all the information in the universe used in the repeating “unfolding” operations of the Implicate Order. Bohm viewed the brain as part of the Explicate Order, which is a projection or unfolding of the Implicate Order. The brain was viewed to process information by enfolding/unfolding holographic-like patterns that are encoded in the Implicate Order.

In the context of the TAM framework, following Bohm’s and others’ example (Bohm, 1980; Talbot, 1992; Targ, 2012), the topology of the *expanse of consciousness* is assumed to present itself holographically in the *expanse of matter-energy*: each individual experiences a consciousness of reality from their perspective using what amounts to a local bidirectional viewport into a constantly-updating high-dimensional hologram that holds the entire information content of the *expanse of consciousness*.

Each *mind* is assumed to be *informationally connected* to the EC hologram. A change in one *mind* changes the entire hologram, instantly available to every small region of spacetime, which includes every *mind*. Targ, discussing Bohm’s work, mentioned, “The important idea here is that each of us has our mind in our own piece of the spacetime hologram, containing all the information that exists or

ever was [...]” (Targ, 2012, p. 206). Williams adopts a similar view: “...relying heavily on Bohm’s pioneering work, I am proposing that our conscious experience is ultimately rooted in an information rich, nonlocal ‘space.’ ... our minds share this inherently nonlocal space” (Williams, 2019, p.32). John A. Wheeler stated, “all things physical are information theoretic in origin and this is a participatory universe” (Wheeler, 1989, p.311).

Bohm spoke of the Implicate Order in terms of a high-dimensional “quantum field” as a base for both consciousness and matter. F. David Peat cautioned as to the correctness of referring to it as a “field”:

“Is it really correct, for example, to speak of a ‘field’ of information, since information does not fall off with distance, neither is it associated with energy in the usual sense. Possibly the notion of field should be widened...” (Peat, 1995).

Bohm mentioned:

“unlike what happens with electric and magnetic potentials, the quantum potential depends only on the form, and not in the intensity of the quantum field ... Such a notion is clearly fundamentally different from the older Newtonian ideas.” (Bohm, 1990, p. 276).

The quantum potential was also called by Bohm and Hiley an “information potential.” It influences the form of processes (i.e., it is *active*) and is itself shaped by the environment (i.e., it is *responsive*). Bohm and Hiley developed the notion of “active information:” The “overall form of the system ... exerts an influence on a given particle via active information no matter the distance. Thus active information is a way of describing a kind of action from an underlying field which in turn depends on the entire system’s configuration” (Williams, 2019, p. 15). In the TAM model, the nonphysical data structure of the EC is theoretically not structured according to time. Theoretically, it operates timelessly, outside space and time, in the *here and now*. There is ample experimental evidence to indicate that specific information from both the past and future exists in the data structure of the EC (Cardeña, 2018; Radin, 2006; Rosenberg, 2021; Targ, 2012).

Structural Information, Neurological Information, and EC-information

There are at least two very different types of information that can be associated with material objects. Taking a rock to be an example of a material object, such an

object can be considered as a structure from which all its configuration information can be abstracted. This familiar concept of information, which can be expressed in any number of formats, will be referred to here as “structural information,” or alternatively, “geometric information” derived from the *physical configuration of a material object*. But although the structure of an operating brain can be compared to that of a rock in that both are configurations of atoms, it is not like a rock in two respects. For one, it is a *living* object. For another, it is an *active* material object constructed from elements which, as discussed by Tononi et al., in order to be an acceptable physical substrate for consciousness (PSC), must “have at least two different states (for example, being on or off), inputs that can affect those states and outputs that depend on them” (Tononi et al., 2016, p. 452). Such an active structure, for example, a network of neurons in a living brain, has the ability to *produce information*. While the structure of both a dead and living brain can be characterized by “structural information” mentioned above, the information produced by the activity of a living neural network is of a different character entirely. This type of information – called “*neurological information*” – was described above as “nonconscious.” This type of information is directly associated with the specific “wiring structure” that produced it. This information, considered in its “pure form” when it has been dissociated from the structure that produced it, can be considered the *outbound stream of information* based on the state of the brain’s neural networks. This information, dissociated from the brain, will be regarded as being in “pure information format.” This system interacts with *pure awareness energy*, and pure information enters the EC, gets distributed holographically everywhere instantaneously, and becomes conscious in the individual brain-mind of the individual who produced it. The information in the EC will be referred to here as “EC-information” (“EC” = “*expanse of consciousness*”). In contrast to *structural information*, the format of EC-information is universal for all conscious entities (a working assumption). Note that calling this format “universal” is somewhat like claiming there is no format at all – in which case, this type of information would be “self-declaring” and “formatless.”

Neurological information is produced by neurological interactions, such as are found in a living brain made of atoms. Simultaneous with its production, it is acted upon by *pure awareness energy* and enters the region of the *mind* in the *expanse of consciousness* as EC-information where it may persist in the *data structure of the EC*. In psi phenomena such as telepathy, a receiver of psi information is able to tune into EC-information associated with a specific thinker. The received information is assumed to become conscious for the receiving individual when pure aware-

ness energy interacts with information-producing neurological subnetworks, which produce *the same or similar pure information*, causing them to activate, which leads to their entry into the *contents of consciousness*. In this case, we are looking at the *inbound information stream* into the brain, originating in the *mind*. An analogy can be made to the operation of existing holographic correlators, which can, in a single operation, retrieve item(s) from a large database even when the cue does not fully match the stored item or is a partially obstructed view of the stored item (see Shahriar, 2003).

In the TAM model, it is a working assumption that pure awareness energy can interact with information-producing neurological subnetworks in the brain in both directions, allowing information produced by a thinker to enter the EC, as well as any information resident in the EC to lead to selective neural activity via a process of attention. In both cases, the neural activity in the brain *informs* (to use Bohm's term) the *contents of consciousness* – the *mind*, and the *EC-information in the mind informs* the brain. Everybody's *mind* is a part of the EC, giving everybody potential access to the enormous information resources of the EC.

The Expanse of Consciousness Compared to Bohm's Implicate Order

Many core concepts of the Implicate Order apply to the concept of the *expanse of consciousness* (EC). In both, *information* is central. Both are nonphysical, nonlocal, and project holographically in the physical domain. In both, *information* can "act like a fuel" (The Planetary Society 2020), capable of "informing" the *contents of consciousness* and capable of *interacting with matter*. "The word *inform* is here taken in its literal meaning, i.e., to put form into (Bohm, 1990, p. 279)." As "active information" the Implicate Order both represents the information in a physical environment and can act on the physical environment to change it. Bohm and Hiley (1975) presented how this concept leads to the notion of an "unbroken wholeness of the entire universe." Maharaj expressed the same unbroken wholeness of the universe: "Everything affects everything. In this universe, when one thing changes, everything changes. Hence the great power of man in changing the world by changing himself" (p.360).

There are differences between Bohm's holographic universe theory and TAM. In Bohm's model, there is an oscillation between the Implicate Order and Explicate Order. There is no analogous oscillation between the *expanse of consciousness* (EC) and the *expanse of matter-energy* (EM) in the TAM framework. In this framework, all three *expanses* are viewed to operate holistically, simulta-

neously, and continuously. Bohm's model with its two orders can be seen as including both the EC and the ES into the Implicate Order since, in Bohm's theory, the Implicate Order is understood to represent the deeper underlying unity (ES) of both the mental (EC) and physical (EM) in the framework of neutral monism. But, the ES differs from the Implicate Order since the ES is clearly characterized as being *changeless* and "*contentless*" (Maharaj, 1981, p. 34), while the Implicate Order includes change and content. TAM is based on a "trinitarian" scheme, which adds a third aspect, a source of "pure awareness energy," to the physical and mental aspects. This *source* aspect Maharaj claims is fundamental and independent, that which makes consciousness possible, while the other aspects are viewed as dependent (1981, pp. 33-34, 161). Bohm's Explicate Order is also dependent since it derives from the Implicate Order.

The TAM model differs from Chalmers (1995a) suggestion that we explore how consciousness may be in some sense fundamental (not emergent from matter). The prevailing scientific opinion is that consciousness is an "emergent property" of matter with an appropriate structure as it grows in complexity. In the TAM framework, consciousness is not fundamental – its contents can be defined in terms of *information*. – and the assumption is that *pure awareness* is *agnostic* when it comes to its interaction with matter.

Nonlocality in Psi Phenomena

The idea of nonlocality makes sense in a holographically distributed "field of information" where the "field" is not populated with an energetic component that falls off with distance, and the "field" is not associated with energy in the usual sense. Nonlocality is supported by behavior observed in psi phenomena. The quality of received information in psi phenomena does not degrade with distance (Utts, 2018; Targ, 2012), nor is it hampered by physical barriers (Radin, 2006; Targ, 2012). Disregard for physical space and barriers is seen in telepathy, psychometry, precognition, remote healing, and other forms of psi. Disregard for space and barriers is also seen in the phenomenon of quantum entanglement. Disregard for time as well as space is not ruled out. "The future may be enfolded in the present as possibility" (Bohm 1985, p. 132). Note that in order to encode a future possibility in the context of a participatory universe in which the future is not determined, *computation* would need to be added to the data handling resources in the *expanse of consciousness*. The notion of adding a layer of computational complexity to the EC deserves serious consideration, given observed precognitive behavioral data from

psi phenomena (see, for example, Rosenberg, 2021). The other possibility is that the future is already determined, and the data structure of the EC stores all the information present, past, and future. If so, no additional computational resources would be needed to predict the probable future, but free will would appear to be lost. The *expanse of consciousness* (EC) is viewed to operate holographically, and all the information in the EC hologram is fully available in each small region of physical space. Operating nonlocally everywhere at once, any information transfer that takes place in this domain is insensitive to physical distance, physical barriers, and whose content is, in some way, insensitive to time as well. The meaning of “information transfer in the *expanse of consciousness*” is now examined.

Information Transfer in the Expanse of Consciousness

A conventional signal like radio or light propagates by using a source of energy that is transmitted across physical space. The energy of an electromagnetic field or other energy source is used as a *carrier*, and the movement of this energy through space (with the information it encodes) is limited to the speed of light. As it radiates out from its source in 3 dimensions, the amount of measurable energy of a signal available at a receiver decreases as the square of the distance (the “inverse square law”). Physical obstructions can block or weaken signal propagation. In contrast to a conventional signal, psi information transfer does not become weaker with physical distance or obstructions and is thought to be instantaneous. Since physical space in the EC between the source and receiver of psi information does not exist, the need for energy to accomplish propagation of information is eliminated. The information does not “go” anywhere. Since a carrier is not needed, no energy need be consumed in “signal propagation.” The very idea of “propagation” becomes misleading. Since instant information connectivity is assumed to exist between all *regions*, hence, all *minds* in the EC, this type of connection can be regarded, not as functionalized by “propagation,” but rather by “correlation.” “Correlation” is the term used in quantum physics to describe the phenomenon of entanglement.

Connectivity via correlation is found in “quantum theories of consciousness” which have been proposed by a number of physicists and philosophers. Penrose and Hameroff proposed a theory that suggests that consciousness emerges from quantum processes in microtubules in the brain (Hameroff & Penrose, 2014). Henry Stapp (2009) argues that the brain is a quantum device and proposed a “quantum theory of psi” in which the quantum processes

that occur in the brain can lead to nonlocal connections with other minds and with the physical environment. Dean Radin suggests that the universe is entangled and proposed that “psi is the human experience of the entangled universe. ... the mind/brain behaves as a quantum object. Imagine that our mind/brain is sensitive to the dynamic state of the entire universe... Maybe it doesn’t involve information transfer at all. Maybe it’s purely relational and manifests only as correlations” (Radin, 2006, p. 284).

The basic principle in quantum mechanics is that information is the currency of reality, not matter: the universe is an informational structure, not a substantive one (to paraphrase Stapp, 1999). A quantum object, for example, an electron, has an unknown location and can be anywhere while it is in its “wave function” format. But a transition occurs, called the “collapse of the wave function,” when there is a “*discontinuous change in our knowledge*” (Heisenberg, 2007, p. 29/1958). The question arises, where does a “discontinuous change in knowledge” take place? The cause of wave function collapse is known as the “measurement problem” and is the subject of continuing debate and research. In the von Neumann/Wigner formulation, the wave function of a quantum system does not collapse until it interacts with a conscious observer.

If the underlying operation of the TAM framework obeys the principles of quantum mechanics, the “knowledge” that undergoes a “discontinuous change” would refer to the *knowledge base of the EC*, which includes the *mind* of the individual. Stapp’s view is that consciousness arises from the collapse of the quantum wave function in the brain. He argues that the collapse of the wave function occurs when the brain is stimulated by an external event, such as a sensory experience, and that this collapse is responsible for creating conscious experience.

Radin posited that the “local effects” of brain state are stronger and more immediate than our “background” awareness of the entangled universe. “[the] sensory-bound brain state [is] entangled and influenced by the rest of the universe, but its local effects are so much stronger and immediate than our ‘background’ awareness that only on rare occasions are we aware of its entangled nature [...]” (Radin, 2006, p.265). In the framework of TAM, “brain state” equates to the production of *neurological information*, and the operation of the *expanse of consciousness* correlates information in the “entangled universe.”

Quantum mechanical theories of consciousness and psi are consistent with the TAM framework. It should be mentioned that a *region* of the nonphysical space of the EC has no location, rather, it is defined nonlocally as a *collection of information*. No “propagation” or physical

movement of energy over distance need occur. Because an energetic physical carrier is not used in psi information *correlation*, the communication of psi-encoded information via the EC requires only the small amounts of electro-chemical energy used in configuring the activation profile of brain neural network neurophysiology. Furthermore, if correlation is the correct way to view information transfer in the EC, then it is highly likely that the correlation is noise free, analogous to the 100% perfect correlation behavior of physically separated entangled particles which share information.

Currently, it is not possible to use entangled particles to communicate information because entanglement breaks when an attempt is made to measure the state of an entangled particle. Making a physical measurement “does something” to break the connection. This occurs in the case of making a physical measurement in the *expanse of matter-energy*, but when considering the telepathic correlation of information hypothesized to occur between *minds* in the nonphysical *expanse of consciousness*, the assumption is that while telepathy is occurring, there is nothing that would “do something” to break the correlation. Since psi information is only rarely received with high clarity and usually in brief glimpses, the widely observed loss of quality observed by receivers of psi information must be attributed to factors other than “a noisy channel.”

Only Some Neural Activity Becomes Conscious

Using the perception of color as an example, in humans, the color that is actually perceived consciously is specified only after complex calculations in higher brain centers have processed the raw signals from neuronal photoreceptors in the retina. These calculations correct the perceived color for ambient illumination color and intensity, the phenomenon of “color constancy” (Komatsu, 1998; Foster, 2011). Where a color is perceived in the visual image involves other complex calculations that correct for the distance of objects from the eyes – “size constancy” (Qian & Yazdanbakhsh, 2015; Chen et al., 2019). Other complex calculations combine visual information from the two eyes to generate a conscious, always upright 3-D percept with depth. Processing of visual data occurs in both directions in the hierarchical visual processing system, from low level inputs to high levels (“feedforward”), and from high levels back down to low levels (“feedback”), as well as laterally between and within dozens of brain visual data processing centers. The only information that enters consciousness from all this unconscious neural activity is the final output, the processed, corrected visual information. Low-level information and information

produced in intermediate processing stages is masked from consciousness, preventing conflicts with the final processed information and sparing the user from dealing with additional and unnecessary information processing of the conscious content. Also, none of the plethora of neural activity that results from brain-processed information dealing with digestion, heartbeat, temperature regulation, etc. becomes conscious. And when sleeping, the information that enters consciousness changes markedly. What mechanism is used to select what information in the brain becomes conscious and what does not? To date, nothing has been found in neuron physiology that differentiates between neurons whose activity have conscious correlates with those that do not.

Attention

A candidate for selective filtering of conscious information is the process of *attention*. In normal situational awareness, our attention does not include information of low importance in the current situation. One possibility is that *only what gets attention enters the contents of consciousness*. It is beyond the scope of this paper to describe in detail how a mechanism of selective attention might work (See Graboi & Lisman, 2003 for one potential mechanism), but although there is much work yet to be done, it is likely that the neural mechanism of attention will ultimately be understood, placing it in the category of Chalmers’ “easy problems of consciousness,” as opposed to the “hard problem.” Various attention mechanisms are already finding their way into artificial intelligence systems (Hwong, 2017). General findings show that neurons involved in attention typically have 20-30% increased firing rates, and increases in synchronous firing (spiking coherence) have also been observed (Lindsay, 2020).

An interesting question is whether a sender’s conscious attention to one particular object or feature in an ensemble affects what visual features are telepathically received. In telepathy tests in which the sender focuses attention on a particular object in the room, the receiver can get an impression, not only of the object being attended by the sender but of the larger field of vision viewed by the sender – including other objects (Graboi, unpublished data, 2021). And in the phenomenon of remote viewing, a telepathic receiver can actively focus visual attention to different locations in the sender’s field of view (see Targ, 2012); “Pat Price ... described psychically flying over the site at 5,000 feet to get a bird’s-eye view ... He then offered to “go inside” the bunker, where he found a file cabinet with names on the drawers ... He read off the names ... all of which proved to be correct” (Targ, 2004, p. 36). How does a receiver of visual psi information *navigate*?

What part of “psi navigation” takes place in the brain, what part takes place in the *mind*, and in what manner is the information about the scene encoded in the brain-mind so as to allow attention-driven navigation?

Qualia are Resident in the Expanse of Consciousness

If it is in the *mind*, not the body, that sensation occurs (Kak, 2016), and the *mind* resides in the *expanse of consciousness*, it follows that the *expanse of consciousness* must contain (or be able to generate on the fly) the information necessary to produce the experience of *sensation* in an individual. The human experience of “the redness of red” is termed a *quale*. The *quale* of “red” is provided to the consciousness of an individual at specific locations. These locations are specified by the individual’s visual perceptual processing stage that produces a conscious correlate for, e.g., the color of a surface, to be “red.” Columns of neurons have been found in the inferior temporal (IT) cortex of the macaque monkey, with a visual system very similar to that of humans (Komatsu et al., 1992). Within these columns, neurons highly selective to slight variations of the same color are stacked, one on top of another. In this region, there are many such columns, each tuned to a slightly different color (Zaidi et al., 2014; Conway & Tsao, 2009). IT cortex has millions of color-tuned cells, sampling the color space quite finely with narrow tuning (Zaidi & Conway, 2019). This region appears to be involved with binding colors to the surfaces of objects (Rosenthal et al., 2018; Zeki & Marini, 1998). It contains essentially a large lookup table for neurons selective to the perceptible colors around the color circle. It is sensible to assume that the visual system would activate one (or a relatively small number) of these color neurons most strongly (which typically inhibits adjacent neurons) and neurally associate this activation with the activation of the neurons involved in decoding the shape of the associated object in the visual field. This information, namely, the association of a specific “corrected” color neuron in IT with a specific surface of an object represented in a neural center devoted to shape analysis, is hypothesized to contribute to the visual neurological information that becomes EC-

Information in the *contents of consciousness* – the *mind* of the individual perceiving the object. In this process, an *information handling process* in the *expanse of consciousness* would bind the quale “red” to the specified visual field location in the perceived image. It follows that the *expanse of consciousness* must be home to a *process to access and merge* into the *contents of consciousness* the set of qualia that corresponds to the large lookup table of

different color selective neurons in IT.

Content-addressable storage (CAS) is a method used to store information so it can be retrieved based on its content. Holograms have been used to implement CAS (see Shahriar, 2003). If the EC hologram behaves in a way analogous to a CAS, and if the *pure information* output from the brain is in a compatible format, then a mechanism by which the brain might directly access specific information, including qualia, stored in the EC is conceivable. Karl Pribram (1991) discovered 3-dimensional electric fields in volumes of the fine dendritic webs found in deep cerebral cortex. These fields are consistent with the idea that human memory is distributed and structured as a hologram. If deep cortex is “holonomic” as Pribram suggests, a deep brain interface to a corresponding hologram-like information structure in the nonphysical domain is conceivable (see Di Biase, 2009). Currently, the notion that the brain processes information in a holonomic, holographic manner has not been definitively proven.

In psi phenomena, receivers of psi information often readily perceive colors, but the accuracy with which received color shades are perceived remains to be determined.

Data Structure of the Contents of Consciousness

We aren’t normally conscious of our breathing. It is automatic and does not normally enter what an individual is aware of at the moment, understood as the *contents of consciousness*. As discussed above, the “easy problem” of *attention* can be solved to determine what information enters the *contents of consciousness* at a given moment. The neurological information with the highest activation, having the highest current importance, would enter the *contents of consciousness* and receive attention. The lesser activated information can be considered to be *subconsciously activated* and, therefore, to be *subconsciously present* in the *contents of consciousness*.

The information in the *contents of consciousness* at any one time is therefore structured like a pyramid, with the currently most important information at the top having the most *current relevance* (or *importance, priority*) and consuming the most attention (a limited resource). The currently less important information would be found lower down in the priority hierarchy and receive no attention. Should the situation change and new information or information of low importance suddenly becomes of high importance, an automatic reassignment of relative activity-coded importance would occur. This notion of a structured *contents of consciousness* in which some of the contents receive attention and much does not receive attention broadens the structure of the *contents of con-*

consciousness in such a way that it includes both *conscious* and *subconscious* information. This broader concept is envisioned for the TAM model.

In the TAM model, an attentional process is assumed that occurs in the brain which operates automatically in a neural network based cognitive system. The brain output signal in this system is a stream of neurological information. Subject to a restructuring of relative activity by an attention process, this neurological information interacts with pure awareness energy and enters the *mind* as EC-information. Once in “pure information” format, it is enhanced with qualia, which are bound into the information cluster, which is rendered in consciousness. The conscious awareness of the *contents of consciousness* in the *brain-mind* is seen as a nonlocal phenomenon that exists outside of space and time, in a timeless and spaceless *information region* of the *expanse of consciousness hologram*. It cannot be found between the ears of the perceiver. This idea of an individual’s consciousness being outside of spacetime has been expressed by Chopra (Stillness Speaks, 2017), Bohm (the nonphysical Implicate Order), Maharaj (the nonphysical *expanse of consciousness*), and others.

The information resources in the EC can be conceptualized as a multi-user information management system in which everyone’s *contents of consciousness* is a changing collection of information. The EC hosts the *information input/output (I/O) data stream of every brain*, providing subjectively experienced conscious information to each user, as well as providing nonlocal information under appropriate conditions. If there is a pain to be felt in one part of the body, the nonconscious neurological information generated in the brain becomes EC-information in the *mind*, and the specified pain is felt as specified for the specified body location. When any thought occurs to an individual, that thought is assumed to be available throughout the *expanse of consciousness* (EC) where there is no effective distance between *minds*. This assumption follows logically from the position taken in the TAM model that every thought that every individual produces enters the contents of consciousness in the EC, and the EC is a shared domain of information among all conscious entities. Although it is clear from the data of psi experiments that at least some thoughts from some individuals can be assumed to become available in the EC, whether this is true for all thoughts, and how long different thoughts might persist in the EC, remains to be seen.

The qualia assumed to be resident in the EC can be understood as “subjective constants.” A specific color quale is assumed to be accessed by the activation of a specific color-selective neuron in the visual system, relative to the other color selective neurons, which specifies that quale.

It is reasonable to assume that any human with normal color vision that sees that color would activate the same color-analyzing neuron in the visual system which specifies the same quale, stored as a “subjective constant” in the EC. This suggests that all humans with normal color vision would experience the “redness of red” in the same universal way. A bee has different photopigments in the eye than humans, and bees can see ultraviolet. Whether a bee and a human experience the same color when viewing an environmental color that is in both of their color ranges would seem to be unknowable.

The *format* of information in the EC is universal, but the *content* of information specified in that universal format has a *scope of universality*. The *scope of universality* may be wide or narrow; in some cases, it extends across many species, and in other cases it is specific to a particular species or even more specific to a collection of individuals in a species. For example, *visual shape* content has very wide scope – a *tree shape* looks like a tree shape to all species with eyes. And all species with eyes can access this content item in the reception of visual psi information. But the color content of ultraviolet has a scope limited to animals capable of perceiving ultraviolet, such as bees, but not humans. All that may be said at this time about the format of information in the EC is that it is non-physical, universal, and it is distributed like a hologram. The data of psi phenomena has made it clear that a vast amount of information is “out there;” it remains a challenge for science to understand the details of its representation and the details of its handling.

The User Interface and its User

Donald Hoffman (2010) proposed that perception be viewed in terms of a *user interface*. Using visual perception as an example, as discussed above, neural signals from the retinas go through enhancement and corrective computational processing in various brain centers of which there is no conscious awareness. This pre-processing of visual information, modulated by an attention process, results in the processed visual information which contributes to the *contents of consciousness*. The consciously perceived information is presented in an intuitive way, with the currently most important information receiving attention. This scheme simplifies the information a user needs to decide the best action to take next to maximize survivability. For example, without color constancy, it would be necessary to check the current color of ambient lighting and then use that knowledge to figure out what color that berry really is, and decide whether it is safe to eat. Our visual consciousness system gives us an accurate assessment of the true color of the berry by doing back-

ground processing in the brain to subtract out the color of the ambient lighting before presenting the scene to consciousness.

To survive in a complex environment, an individual *must have an environmental sensing interface which it uses to base decisions* as to what to do in order to avoid harm and sustain viability. What better way to accomplish this than to have feelings and a sufficiently veridical multi-sensory interface? These conscious experiences do not go on “in the dark” because they are an integral and intermediate part of a continuous processing loop in which the *contents of consciousness* is one step in the process of dynamic decision making and survival in an environment. Multisensory enhanced pre-processed consciousness provides a user interface highly optimized for survival. Other interfaces are possible, such as found in robots, in which processing occurs completely “in the dark,” without consciousness.

What can be said about the *user* of the user interface of consciousness?

The Homunculus

In any model of consciousness, it is important to clarify exactly what element of the model is experiencing consciousness. Maharaj offers perspective on this point. He mentions the entity of the *personal self* (p.209), which is typically aware only of the ever-changing *contents of consciousness*. The *personal self*, which he also refers to as the *false self* (p.223), is distinguished from another entity, the “real you” which is “limitless” and “beyond consciousness” (Maharaj, 1981, p. 382). The “real you” is viewed as usually obscured from awareness because the “greedy mind,” falsely identified with the physical body, is insecure (p. 305) and more or less constantly keeps the consciousness of the *personal self* occupied.

Maharaj emphasized repeatedly that the *personal self* is constructed “from mere suggestion or imagination” (Maharaj, 1981, p.295). “you imagine yourself to be a person” (p.366). “In reality there are no persons, only threads of memories and habits” (p.34). A child acquires its personality from parental examples, cultural cues, examples from peers, etc., and this accumulation of traits an individual views as the “person” they are is seen in Maharaj’s view as “accidental:” “The image you have of yourself is made up from memories and is purely accidental” (p. 251). This notion that who we think we are is nothing more than “accidental” is difficult to accept. Certainly, some percentage is acceptable as “accidental.” But following Maharaj’s lead, and backed by ancient wisdom, in informational terms, the *user* will be considered in the TAM model as simply a *bounded belief system* (which changes through

experience). An appropriate term for the *user, person, personal self, false self, persona*, is “homunculus.” In its original Latin meaning, “homunculus” means “little man” or “man-ikin.” In the context of philosophy of mind, the term has been used in a critical way to refer to the idea of a central observer or director within the brain (Dennett, 1991). In the TAM framework, following Maharaj’s perspective, it refers to the bounded information-defined component of a potentially limitless fully realized human being. Chopra (2016) expresses a similar view when he points out the “biological robot” in humans. Another entity is assumed to exist outside of that bounded belief system, termed *the real you*, which Maharaj viewed as “neither your body nor your mind, nor even your consciousness” (Maharaj, 1981, p. 382). “You are the changeless background, against which changes are perceived” (p. 246).

By viewing the *mind* as the *contents of consciousness* which can be described in terms of information and information processing, and viewing the recipient of consciousness in terms of a bounded belief system, ultimately describable in terms of mathematics and systems of artificial intelligence, the *mystical element*, the “real you” is pushed out of the way into the third aspect of reality, the ES, leaving space for making further inroads into understanding the hard problem of consciousness in terms of phenomena in the EM and the EC. In any framework with less than three aspects, the unexplainable “hardest part” of the problem of consciousness would be confounded with that which can be understood and explained, introducing a difficulty for scientific exploration of the phenomenon.

Experimental Validation

Test for the existence of a domain where biological information communication takes place outside of spacetime. The validity of the TAM framework rests on confirming the existence of a nonphysical domain in which *information* plays a central role. If information transfer in the EC occurs outside of time and space and is best regarded as a correlation rather than a propagation, one prediction is that telepathic communication would be essentially instantaneous, like correlation in quantum entanglement (Caltech Science Exchange, 2022). Dean Radin pointed out that “It is not yet certain that psi is absolutely spacetime independent (2006, p.289).” It is, in principle, possible to measure the “speed of thought.” Radin and other researchers have found that two people can show correlated peak brainwave responses when one, a “sender,” sees an image flash on a screen (Radin, 2004, 2017; Richards et al., 2005). The delay between a peak EEG response in the sender and a correlated peak in

the receiver in Radin (2004) was about 64 milliseconds, attributable to normal neural processing time delays. Radin proposed an experiment to measure the “speed of thought,” a difficult experiment which has not yet been carried out (Radin, personal communication, August 27, 2020). If the distance between sender and receiver were increased to the opposite ends of the earth, if the speed of thought is instantaneous, the delay between correlated brainwave peaks should remain about 64 milliseconds, instead of growing greater than 64 milliseconds if thought propagation were limited to the speed of light as found in all other physical communication paradigms. If such an experiment were to find that distance does not affect the *speed of thought*, this would support the idea that a conscious-related communication process occurs outside of, independent of, spacetime, and that consciousness itself has a nonphysical component.

DISCUSSION

Maharaj mentioned, “Awareness – mind – matter – they are one reality...” (p. 180). Even so, the three aspects Maharaj discusses are not ontologically at the same level. *Pure awareness* has special standing: “[we must] realise that immense ocean of pure awareness, which is both mind and matter and beyond both [...]” (p. 161). “[It is] entirely uncaused, independent, complete in itself, beyond time and space, mind and matter” (p. 36). In referring to the TAM model in terms of “three aspect monism,” the ontological difference between the aspect of pure awareness and the other two aspects is not obvious. Maharaj associates the non-neutral term, “Supreme” with the aspect of the source, the source of pure awareness. He regards consciousness, a property of the *mind*, as a manifestation of pure awareness, and matter as a manifestation of consciousness (Maharaj, 1981, pp. 33-34, 161).

The Western scientific paradigm is currently wedded to one aspect: the physical. Acknowledging the existence of a second, nonphysical aspect would not subtract from what is already understood, but would add a way to approach the rising tide of experimentally verified phenomena which are anomalous within a single physical aspect paradigm. Bohm’s powerful two-aspect theory of Implicate/Explicate Orders begs the question of how awareness or consciousness comes about. But Maharaj’s three-aspect framework brings the resources (pure awareness) that help explain conscious experiences in a way that Bohm’s more neutral monism framework cannot.

Many open questions fit within the framework of the three-aspect monism model. An important issue regards coming to a thorough understanding of the structure of

the “*expanse of consciousness*.” It is by now clear that a great deal of information is “out there.” Where is “there?” What is its format? What is the range of its content? Maharaj claimed, “In the ocean of the [*expanse of consciousness / universal mind*] all knowledge is contained; it is yours on demand. Most of it you may never need to know-- but it is yours all the same (Maharaj, 1981, p. 285).”

By what process does information generated neurologically transform into EC-information with its universal format? Does it need a special physical interface to be transformed into EC-information, an identifiable physical structure in the brain such as microtubules (Hameroff & Penrose, 2014)? Or is no special physical interface involved? Relevant to this is the question of anesthesia: How does general anesthetic work to switch off consciousness? Does it turn off processing in an electro-chemically mediated EC interface (e.g., microtubules) (Hameroff & Penrose, 2014)? Does it disrupt processing selectively in the brain (Kelz & Mashour, 2019)?

The TAM model assumes that the “neurological information” generated internally in the neural networks of a *brain-mind* dissociates from the physical substrate by the action of *pure awareness energy*, which frees the information from the structure that generated it, and a “*pure information image*” is produced. Is that enough to register it into the EC, making the format of EC-information the same as format of “*pure information*?” Whatever the format, the most parsimonious assumption would be that it is *universal* in that all conscious entities can make use of it. The model asserts that upon entry into the EC, the neurally-specified information binds with qualia, which are assumed to be permanently encoded as “subjective constants” in the fabric of the EC. Where else could qualia be encoded? The cluster of pure neurological information bound together (enhanced) with qualia as specified, and content structured by importance in terms of relative activation of information, comprises the *contents of consciousness*, referred to as the *mind* of an individual, and understood to be a *region* of the EC.

There is the question of *what information gets encoded into the EC*, and what is its lifespan in the EC? Since much computational information processing in the brain operates unconsciously, is all brain-generated information, including information used in the regulation of heartbeat, digestion, etc., available in the EC? What about structural information about the configuration of the body? Experiments have shown that a body can be physically affected by remote intention (DMILS-- direct mental interactions with living systems), which is a special case of mind-matter interaction (MMI) phenomena. What do these phenomena imply about the *data-handling functionality* built into the EC? And how can instantaneous holographic-like

distribution of information to all regions be achieved?

It is straightforward to assume that in telepathy the EC-information associated with a thought in one *mind* can correlate with a thought in another *mind*. But what encoding of information and its processing takes place in the case of clairvoyance, where there is no obvious active thinker in the region of the environment that a clairvoyant is successfully able to visualize? How is visual shape environmental information encoded into the EC? Is pure awareness energy involved in that process? Is visual environmental EC-information permanently encoded in some way, or is it transiently encoded when requested by a clairvoyant?

What is the data-structure of the information in the EC? Is EC-information encoded in a form analogous to the LTM/STM nodal network used by the human brain? Is the nonphysical encoding based on “information vibrations?” Radin proposed a scheme based on entanglement: “Minds are entangled with the universe [...]” (Radin, 2006, p. 270). What can be understood about the storage and retrieval of information in the EC? Is a form of holographic processing involved? Is storage/retrieval based on a form of *resonance*, as suggested by Sheldrake in his concept of “morphic resonance” (Sheldrake, n.d.)?

How is time encoded, given that experimental evidence has shown that psi information can be acquired with equal ease from different times (Targ, 2012)? If non-physical data items are encoded with what amounts to *time codes*, a psi retrieval process might access information from any time with some precision. But, data suggests that receivers of psi information may have difficulty specifying the time frame of information they receive (see, for example, Targ, 2012, pp. 61-62), which argues against time codes. In a participatory universe, the storage of information with or without time codes that will become manifest in the future would require some kind of predictive information processing capability. Or are past, present, and future already all encoded, removing a need for predictive information processing (and eliminating free will)?

What type of information is sent via telepathy? One type is certainly *sensory* information, which, as a form of *Shannon information* (Lombardi & Vanni, 2015), is devoid of meaning. For example, the *shape* of a tree. If *meaning* is also part of the message, what *meaning* is received-- that from the sender, that inserted by the receiver, or both? How does *emotion*, which makes for stronger effects, fit into this paradigm?

Is there a limit to *information capacity* of the *expanse of consciousness*? Maharaj noted, “There is enough space in a point for an infinity of universes. There is no lack of capacity” (Maharaj, 1981, p. 250). Did the *information han-*

dling capabilities of the EC evolve? Does the EC also contain all information about itself? Is the *universal mind* of the EC conscious? Is it intelligent?

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APPENDIX: MAIN ASSUMPTIONS OF THE TAM MODEL

1. **Three “Expanses:”** Reality consists of three “*expanses*,” the “*expanse of matter-energy*” (EM), the “*expanse of consciousness / universal mind*” (EC), and the “*expanse of the source*” (ES). These *expanses* are viewed as aspects of an organic whole. Hence the term, “*three-aspect monism* (TAM).”
2. **Experience is in The Mind:** The physical body is not capable of feeling. It is the *mind* alone that experiences. If there is a pain to be felt in one part of the body, this information is activated nonphysically in the *mind*, and the specific pain is felt in the specified body location.
3. **Contents of Consciousness:** The *contents of consciousness* is a product of (1) the operation of the brain in the physical *expanse of matter-energy* (EM), (2) the information structure of the total nonphysical *expanse of consciousness* (EC), which includes each individual *mind*, and (3) the energy of the source of awareness in the *expanse of the source* (ES). The result is the dynamic information structure of the *contents of consciousness*, also referred to as the *mind*, which contains qualia-enriched information from perception, information from thoughts, and nonlocal psi information. It is structured by an attention process into most relevant information, given the current contextual situation, and down in current importance to least relevant information, which receives no attention, and is considered the *subconscious* information portion of the *contents of consciousness*. *Consciousness* is *dimensionless*, existing outside of space and time. It is *informationally associated* with the body of an individual.
4. **Neurological Information:** Brains generate *neurally-encoded information* in the form of an *information specification for conscious experience*. Brain-generated information, termed *neurological information*, by itself is not conscious. When acted upon by *pure awareness energy*, the information present in neurological information is assumed to dissociate from the neural structure that generates it, becoming formatted as *pure information*. This information binds with qualia resident in the *expanse of consciousness* (EC) and updates the *contents of consciousness*.
5. **Qualia:** The *expanse of consciousness* (EC) contains information elements called *qualia* which are accessed by the expression of specific brain-generated *nonconscious information*. For example, the “redness of red” is a quale, stored as essentially a “subjective constant” in the EC, which is accessed by humans when looking at light whose frequency is approx. 4.6 THz. In vision, there are specific neurons in the brain that activate when detecting specific colors. Activation of these neurons generate the *neurological information* that specifies the presence of a specific color at a specific location in the visual field. When the *neurological information* dissociates and becomes *pure information*, the quale for the specific color is activated in the EC and becomes bound into the *contents of consciousness* in the *mind* of the individual.
6. **Attention:** Neurologically generated *nonconscious information* is produced by the *neural network activity profile* ranging from the subnetworks which are most active, most important and most relevant to the current situation to the subnetworks which are least active, least important and least relevant to the current situation. The most active subnetworks capture attention, which is a limited resource, while subnetworks with low activity are not attended. The process of attention can be described in terms of a neurophysiological mechanism.
7. **EC-Information** (EC=“*expanse of consciousness*”) The *expanse of consciousness / universal mind* (EC) is assumed to store and handle a large amount of nonphysical information. This information, termed EC-information, is accessible anywhere in physical spacetime by appropriately sensitive individuals. Although its format, referred to as “*EC-information format*,” is unknown, it is theorized to be distributed in a way analogous to a hologram, where all the information is available in each small region. Since thought information originating in one brain-mind can be communicated to a different brain-mind, the format of EC-information is hypothesized to be universal and independent of the structure that generated it. The *content* represented by EC-information can have various *scopes of universality* ranging from highly universal as in the case of a geometric shape, to limited universality such as the case of the color ultraviolet which can be seen by some species but not others. Content can include *meaning*, whose scope of universality is relatively very limited, or it can be devoid of meaning. *Awareness energy* from the *expanse of the source* (ES) transforms information produced in the EM (*expanse of matter-energy*) into EC-information, which manifests as consciousness in the individual who produces the information, and it becomes a part of the *knowledge base* of the EC.
8. **Hologram Structure of the Expanse of Consciousness:** The *expanse of consciousness* (EC) projects holographically into the *expanse of matter-energy* (EM): Like a hologram, every small region of spacetime contains a representation of the totality of information in the EC, which is nonphysical and nonlocal. The EC is based on *information*, and shares many attributes of Bohm’s notion of the “*quantum potential*” in the Implicate Order. This may be conceptualized as a non-electromagnetic field of information that does not change in intensity with distance or obstructions. The hologram may be conceptualized as a block that is everywhere and is full of information that has no discrete location, but is distributed throughout. Each small region of physical space supports instant read-write access to all the information in the hologram. Since all the information is in every piece of spacetime, a change in

one piece instantly affects the entire hologram.

9. **Low Power Information Correlation Events:** Spatial distance is not a factor in the nonphysical EC. Therefore, an energy-consuming physical carrier is not required for psi information correlation events. This allows for telepathic communication of psi information in the EC to require only the small amount of physical energy used to configure the activation profile of the neural networks in the brains of the sender and receiver. Information transfer in the EC is viewed in terms of “correlation,” the term used to describe behavior of particles in entangled quantum mechanical systems, rather than “propagation.”
10. **Noise-Free Information Correlation Events:** Psi Information correlation among elements is assumed to be noise free, as is the case in uncorrupted entanglement paradigms. Since psi information is rarely reported by a receiver to have high clarity, the loss of quality usually observed must be attributed to factors other than “a noisy channel” – e.g., ongoing information processing activity in the brain-mind.
11. **Bidirectional Correlation of Information:** There is *bidirectional correlation of information* between the brain of an individual in the physical domain (EM) and the information in the nonphysical *mind* of the individual in the non-physical EC. Information generated in a brain appears nonphysically in the *expanse of consciousness*; and nonlocally acquired information can correlate with the activation of neural subnetworks which generate associated information. Bidirectional behavior is also seen with entangled particles.
12. **Pure Awareness Energy:** The *source of awareness*, originating in the *expanse of the source* (ES), is assumed to be *fundamental*, to operate universally, and to exist everywhere in spacetime. It makes consciousness possible.
13. **Homunculus:** Consciousness is experienced by the *user* (alternate terms: *personal self*, *person*, *false self*, *persona*, *homunculus*) as distinguished from the *real self*. The *user* of the user interface can be modeled as an information structure associated with a unique high-level context, a unique belief system, which can be fully described mathematically and/or modeled by a complex AI neural network-based system. The *real self* is assumed to be unbounded and indescribable, associated with the source of awareness energy.
14. **Multi-User Connectivity:** The information resources in the EC comprise a multi-user information storage and correlation system. Each individual represents a collection of information in this system, analogous to a URL on the Internet. The EC interfaces with the *information input/output (I/O) of every brain*, providing subjectively experienced conscious information to each *user*, as well as remote psi information under appropriate conditions. When a thought occurs to a *user*, that thought is assumed to be available throughout the EC.
15. **Information has Substance:** *Information* is, in some sense, real, a *substance* that has the ability to cause an effect in the universe, for example, to interact with matter-energy. *Information* has some physical purchase. *Information* joins the list of concepts like space and time originally thought to be intrinsically lacking a dynamics of their own.
16. **Two Components of Consciousness:** There can be no consciousness without awareness, but there can be awareness without consciousness. Awareness is absolute; consciousness is always of something. Consciousness is changeful, awareness is changeless, calm and silent. And it is the common matrix of every experience. Since it is awareness that makes consciousness possible, there is awareness in every state of consciousness (Maharaj, 1981, p.29). Therefore, *two components* are involved in the phenomenon of consciousness, one, the *contents*, can be defined in terms of information, the other, *awareness*, cannot.
17. **User Interface:** Consciousness provides an optimized *user interface*. The feelings and sensory interface provided by consciousness are the basis for decision-making as an integral part of a continuous information processing loop in which the *contents of consciousness* are one step in that loop.
18. **When One Thing Changes, Everything Changes:** Although reality is experienced in three distinct aspects, there is an unbroken wholeness of the entire universe. “Everything affects everything. In this universe, when one thing changes, everything changes” (Maharaj, 1981, p.360). This is the essence of a participatory universe.



ESSAY

Vapor Phase Electrochemistry: The Missing Science

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HIGHLIGHTS

Evidence suggests that the atmospheric and earth sciences lack a correct understanding of the link between the electrostatic fields of ions and chemical processes in moist air and steam.

ABSTRACT

Several aspects of physics have been adversely effected by the fact that vapor phase electrochemistry has proved impossible to quantify. By the end of the 19th century, physicists had encountered several strange observations that appeared to involve chemistry. Eventually, it was realized that, in a moist gas, no rate process involving ions is quantifiable since we possess no valid relationship between the concentrations of electrolytes and their thermodynamic activities. There are both technical and societal reasons for this problem. Until both problems have been addressed, no reliable quantitative conclusions can be drawn for any system where ionic electrostriction in a moist gas is important. The most obvious consequences of the *missing science* are misconceptions concerning naturally contained air plasmas such as ball lightning, tornadic lights, and unpredictable flying objects (UFOs). None of these phenomena violates *any* known law of physics, but this only becomes clear once the absence of applicable, strictly valid theories is accepted. Fortunately, partial solutions to the problem exist if use is made of qualitative arguments. Using this approach, it can be seen that all the *apparently* anomalous characteristics of atmospheric plasmas result from a balance between different physical and chemical driving forces. A better understanding of the chemical consequences of electrostriction should have two long-term benefits. One relates to understanding the corrosive properties of high-pressure steam. The other concerns the specific chemical processes that stabilize air plasmas. If stable air plasmas could be simulated, a plentiful supply of carbon-free energy would become available.

KEYWORDS

Electrostriction, thermodynamics, condensation, air plasmas.



INTRODUCTION

In any current scientific study, it is usually unnecessary to investigate experiments from long ago. This is because scientific disciplines have become very specialized as they matured and all the most useful early studies are believed, by now, to have been incorporated into accepted paradigms. The implication of the material to be discussed is that disciplines exist where this process has failed. Exciting new facts are being discovered all the time, but a few long-known facts are still largely unexplained.

The present study resulted from the identification, beginning in the late 1970s, of a small area of physical chemistry, mainly chemical thermodynamics, that has never been developed. Some of the most serious consequences of the missing science were first identified at the Central Electricity Research Laboratory (CERL), a laboratory of the Central Electricity Generating Board (CEGB) in the UK.

Various different aspects of the problem were identified later, and by 2003, several different ways of describing them had been employed (Turner, 1980; Gates, Wood, & Quint, 1982; Wood, Smith-Magowan, Pitzer, & Rogers, 1983; Turner, 1983; Beysens, Straub, & Turner, 1987; Turner, 1987, 1988a,b, 1990a,b, 1992, 1994, 1996, 1998, 2003). The connection between steam-related problems in the electric power industry and the strange behavior of ball lightning was first seen in the 1990s (Turner, 1994), although the full significance of the relationship was not appreciated until much later. The most obvious manifestations of the basic problem concern the properties of air plasmas which erroneously appear anomalous because valid theories do not exist. The missing science will here be referred to as vapor phase electrochemistry.

The main problems of concern in what follows apply to *all electrolyte solutions in moist gases*. A linguistic problem that is closely related to the scientific one should be noted here. It is not normal to refer to *solutions* in gases, but it seems the appropriate word here because *ions at equilibrium* would not exist in the gas phase near room temperature (at any detectable level) were it not for solvation (electrostriction) in a moist gas.

One of the clearest ways of seeing the connection between the two phases of any fluid uses a concept known as the continuity of states. This expresses the fact that the properties of gases and liquids are very closely related. In fact, the thermodynamic properties of any sufficiently dilute room temperature solution can be changed (without suffering any change of phase) to those in the gas phase. This can be accomplished by pressurizing and heating the dense fluid above its critical point and then

de-pressurizing and cooling it (now in the gas phase) back down to room temperature. This fact implies that, in any system involving ions in a moist gas, it might prove necessary to accept the importance of *undetectable* quantities of ions *at equilibrium* (Turner, 2003).

In this context, the most crucial parameter of an electrolyte solution is its compressibility, this being infinite at a fluid's critical point. For the systems to be considered here, the simplest way of describing most of the basic problems is to refer to the missing science as vapor phase electrochemistry. The missing science as vapor phase electrochemistry - even though this description ignores lack of generality of the problem. In fact, exactly the same limitations apply to liquid phase solutions of electrolytes near their critical points as to solutions in steam and in moist air.

At present, it seems that studies in moist air are far more likely to receive support than any directly relevant study on high-pressure fluids. A summary of the scientific problems, all of which are basically thermodynamic, is provided later. The seemingly crucial societal problems are summarized in Appendix A (https://naturalplasmas.com/files/VPE1_AppendixA).

It will be argued that the wide failure of scientists to acknowledge the extent of our ignorance in this field is having a variety of serious consequences for science and society. One very inconvenient consequence for any scientist addressing these problems is that a wide variety of empirical facts need to be drawn together before arguments are clear. This can require publications of an unacceptably long length, and this tends to make it impossible to include all the relevant facts at once in any peer-reviewed journal. One result is that referees of papers on the subject have totally failed to understand the full significance of the missing science.

Water in Industry and the Atmosphere

We shall be seeing that one of the factors that has led to the overlooking of a crucial part of physical chemistry is specialization. The problem has, of course become increasingly difficult to address with time. By the end of the nineteenth century, much was already understood about the properties of electrolytes in water and a considerable number of experiments on moist air had been described. Several of the latter studies had been attempts to understand the role of ions in cloud condensation."

Among these were descriptions of incompletely explained phenomena that have long since been forgotten (Tyndall, 1868; von Helmholtz, 1887; von Helmholtz & Richarz, 1890; Thomson, 1893; Rutherford, 1898; Thomson, 1898; Townsend, 1897a,b, 1898, 1915; Wilson 1897;

Wilson, 1899a,b). Conclusions from a few of these studies were subsequently used to estimate the electric charge of the electron (Thomson, 1906; Townsend, 1915), but otherwise, they have been forgotten. All these studies were conducted by physicists, but many of the findings appeared to be complicated by chemistry.

These early observations and more recent studies of *apparently* anomalous phenomena, imply that our understanding of cloud condensation is very far from complete (Turner, 1998, 2002, 2003). For over a century, hardly anyone has felt the need to address the subject of vapor phase electrochemistry. Some of the reasons this situation has arisen are easily understood, and they will be indicated where appropriate. An important reason is fashion since both scientists and those funding science greatly value novel ideas. In addition, the vast quantities of new information now being collected can encourage the belief that interpreting this new data by modeling is more important than understanding basic principles. The need truly to understand how quite different pieces of information fit together seems particularly clear in the systems referred to here.

Fortunately, there are hints in the late 19th and early 20th-century literature of phenomena which, if followed up in new ways, might advance our understanding of how electrostriction influences chemical processes in humid air. In addition, a number of new experiments which support some of the arguments made here have been completed recently. They are described elsewhere. First, it is necessary to explain the connections that exist between relevant studies from the late 19th century and those of the mid-20th and early 21st centuries. A basically historical approach is used but not a strictly chronological one.

The electric power industry relies heavily on the use of high-pressure boiling water for driving steam turbines, whether the energy source is coal, oil, or nuclear power. There was (Staeble, 1977), and continues to be, a crippling shortage of relevant thermodynamic data on electrolyte solutions in high-temperature water under conditions where the liquid and vapor phases are in equilibrium. Electrolytes dissolved in boiling water can lead to serious corrosion and corrosion-related problems, while, in steam, the consequences of stress corrosion have occasionally proved catastrophic (e.g., Hearn & Jones, 1971). In neither case are the roles of electrolytes well understood. Our ignorance is even greater regarding the very low concentrations of electrolytes that are *always present at equilibrium* in moist air (Turner, 1994, 1996, 1998, 2002).

The main cause of all the modeling problems is electrostriction, through which immense numbers of water molecules are drawn into the electric fields of any ions present. Such conditions arise in highly compressible wa-

ter, in steam, and in moist air. Staeble's (1977) comments referred specifically to the thermodynamic data needed in studies of liquid phase corrosion, these data providing the driving forces for the processes that lead to corrosion. Related processes that have serious consequences are the transport and deposition of corrosion products in high-temperature water circuits. At the time of Staeble's comments, attempts to study the dissociation of electrolyte solutions near the critical point of water had only just begun, and reliable data from which dissociation constants might have been estimated were also unavailable.

Beginning in the 1990s, hints of serious mistakes in scientific and technological areas *other than electricity generation* began to be collected. They were from diverse reports in the literature, and all seemed to result from the same missing science (Turner, 2003). This realization followed an earlier, very unexpected conclusion: *no well-established property of ball lightning violates any known law of physics* (Chown, 1993; Turner, 1994; Matthews, 1994; Anonymous, 1994).

Later it was revealed that the same is true of the real objects (as opposed to psychological effects) usually called unidentified flying objects or UFOs (Turner, 2003, 2023a). These objects are sometimes more accurately described in other ways, such as unidentified aerial objects or UAOs. However, the more familiar term will be used here since the acronym also stands for unpredictable flying objects. One factor that probably perpetuates our ignorance in these fields is a difference in the kinds of systems that physicists and chemists are trained to study. There are always better supported, better understood, or more convenient problems to study. Furthermore, many people like to believe in the existence of perpetually unexplained mysteries.

Technical and Societal Difficulties

The sciences can be crudely divided on the basis of three very different concepts, which are, in effect, different articles of faith. Physicists tend to believe that mathematics controls everything of importance in physics.

Chemists believe equally firmly that atoms and molecules provide the basis for reality, while life scientists and those in the medical profession put their faith in the molecular processes that occur in cells. Electrochemistry fits poorly into such classifications because the concepts of *both particles and fields* are equally important, while physical or chemical fields are otherwise of little concern to most chemists. Both chemists and physicists seem to have difficulty believing in the importance of *chemical fields* at the boundary between an air plasma (or a normal flame) and ordinary moist air. In fact, they are very

important.

Electrochemistry is normally considered to be concerned only with the liquid phase. The practical problems with which it deals usually relate either to processes that occur at the electrode surfaces of batteries or with those associated with corrosion. In both cases, a state of kinetic equilibrium can be set up in which there is a stable concentration gradient. This can be considered a chemical field precisely analogous to the electric field, which will also be present at any metal-water interface. A chemical field is analogous to an electric field, where the concentration of a chemical species is thought of as separate from the electrical field (the spatial derivative of the electrical potential). In these systems, all the ions are in the liquid phase, and any differences there may be between concentrations and activities are not normally considered important. Crucially, we shall see that we have no idea how to calculate the activity gradients of any ionic species that are present at a gas-plasma boundary when water vapor is present (as it normally is in the open air).

Unfortunately, specialization is not the only societal problem involved. Chemistry can provide a wonderfully clear picture of the shapes of molecules and how these relate to the molecular orbitals predicted by quantum mechanics. In the present context, many of the difficulties seem to arise from a more primitive concept: that of a chemical bond (Pauling, 1945). Strong chemical bonds are the result of paired electrons in low-energy states. If a chemical entity has an unpaired electron, it can either remain in its unstable state, lose the electron or acquire an extra one. The result is the existence of the entities known as radicals, cations, and anions. The rates of numerous chemical reactions that proceed *through radical intermediates* are known, but there are hardly any published rates *when the intermediates are likely to be gas-phase ions*.

The relative magnitudes of the energies of these species and their consequences can easily be seen (if sought) in tabulations of thermodynamic properties such as those of Wagman et al. (1982) and of Chase et al. (1985). Apart from ions of the elements, whose properties are usually readily obtainable, the content of these tables is very revealing concerning the relative ease of obtaining different kinds of thermodynamic data. The great majority of data available are on stable compounds that are easy to obtain and purify, while information on radicals is far less plentiful.

By comparison, thermodynamic data on molecular ions are almost non-existent. It was, in part, frequent use of these tables that led me to appreciate how very poorly molecular ions in the gas phase have been characterized. One result that used data on some of the few ions that

have been characterized was the electrochemical model for ball lightning (Turner, 1994). Much later, I obtained an appreciation of what seem to be related areas of ignorance in other fields of science.

Electrostriction in Meteorology

There appear to be many areas of study that are adversely influenced by our quantitative ignorance concerning the effects of electrostriction. The associated phenomena include tornadic lights, the “hot towers” of hurricanes and the strange behavior of UFOs as well as some much better-researched meteorological phenomena. These are discussed at <https://naturalplasmas.com/>. The associated phenomena include tornadic lights, the “hot towers” of hurricanes, and the strange behavior of UFOs (Turner, 2023a,b), as well as some much better-researched meteorological phenomena (Turner, 2023d). Related problems also arise in explaining some aspects of planetary chemistry, the properties of molecular clouds, and the formation of stars and planets within them (Turner, 2023e).

A statement by members of the International Panel on Climate Change (Houghton et al., 1996) supports some of the more limited claims made earlier - though on completely different grounds. On page 345 It reads: “The single largest uncertainties in determining the climate sensitivity to either natural or anthropogenic changes are clouds and their effects on radiation and their role in the hydrological cycle”. The situation has not changed significantly since this statement was made (Rossow & Schiffer, 1999; Boucher et al., 2013). Were it not for the *long neglect* of some of the 19th-century findings to be discussed here, and the ignorance resulting from it, our understanding of cloud physics might by now be much better than it is. Important matters addressed here, and in Appendix A, are how this problem developed and what can be done to rectify it.

All the long-claimed anomalies in the reported properties of ball lightning (Arago, 1885; Flammarion, 1888; Brand, 1923; Singer, 1971; Charman, 1979; Stakhanov, 1979; Barry, 1980; Stenhoff, 1999) disappear once three facts are accepted: 1, that free ions necessarily exist *at equilibrium* in the air; 2, that the equilibrium levels of these electrolytes are always far too small to detect by conventional means; 3, that the reported properties of ball lightning can *only* be understood once it is accepted that a number of routinely used assumptions are not always appropriate.

These sometimes inappropriate assumptions include the following (Turner, 2002) :

1. That the *chemical* properties of ions can be safely ignored,

2. That chemical thermodynamics can be safely ignored,
3. That electrolytes in gases *only* become fully dissociated at very high temperatures,
4. That an electrolyte solution at equilibrium is inevitably homogeneous,
5. That the Earth can be treated as a near-perfect conductor of electricity,
6. That electric currents in the air can usefully be treated as homogeneous and
7. That the absolute electric potential of the Earth is zero.

Only items 5 and 7 from the above list are never adversely influenced by electrostriction. The diverse nature of these facts implies that there are likely to be other seemingly anomalous natural phenomena that violate no known law of physics, and there seems to be good evidence that this is the case (Turner, 1998, 2003; Bauer, 2003; Teodorani, 2004). As implied above, one of the main societal problems results from differences in the way physicists and chemists are trained to approach problems. Chemistry can be thought of as a branch of physics whose dependence on quantum mechanics is far too complicated to yield useful theoretical predictions. This is a significantly different situation from that in particle and nuclear physics, where a combination of theories based on centuries of mathematical discoveries plus decades of expensive experimental study has led to major advances (e.g., Penrose, 2005, 2016; Farmelo, 2019). It seems obvious that the success results from the close approximations to the reality of most of the relevant theories.

This *quantitative* ignorance in chemistry is the main reason that the rationalizations of chemical properties provided by the Periodic Table are still so important to chemists. Perhaps more importantly, it is the reason for the types of problems that most physicists *choose not to study*. When a system cannot be reliably quantified, it is more likely to be investigated by chemists than by physicists, but few chemists have seen any reason to study the basic physical chemistry of *electrolyte solutions in the air*. On the other hand, chemists working in the electric power industry worldwide slowly began to accept that there can be serious problems whose study is inhibited by aspects of the missing electrochemistry.

Societal and Political Influences

Unfortunately, almost all support for this kind of work ceased in the 1990s as politicians in all countries began putting their faith entirely in market-driven decisions based purely on profit rather than decisions based on science. Appendix A discusses many of the political

and other societal forces that seem to explain our current level of ignorance concerning vapor phase electrochemistry. When Staehle (1977) made his comments about the state of high-temperature aqueous chemistry, the situation was very different and there was growing support for studies aimed at trying to solve some of the very basic problems. In the electric power industry prior to 1970, considerably more attention had been given to fundamental studies of steam-water systems in the USSR than anywhere in the West, and whenever conferences on relevant matters were organized in Europe, one measure of success was frequently how many Soviet scientists had been allowed to attend.

It was very clear to most participants at these conferences that a very large and well-integrated industry was in the best position to support the needed experimental studies aimed at understanding power station problems. The electric power system in the Soviet Union was, at the time, very large and extremely well-integrated, and it employed many excellent scientists and engineers. For two decades, the large unified structure of the CEGB also allowed some progress to be made, while scientists in other countries, notably in the USA, Canada, and Argentina, continued to make important contributions with their own quite different ways of funding research. One mainstay of work in the USA was, from early on, provided by several groups of chemists at the Oak Ridge National Laboratory (ORNL) in Tennessee.

However, as illustrated below and in Appendix A, there is no longer much interest, either by academics or by engineers in the electric power industry, in conditions in the two-phase region near the critical point of water. As we shall see, this seems to be because it is currently quite impossible, on a realistic timescale, to interpret (validly) any experimental results where electrostriction plays an important part.

Currently, most studies of high-temperature electrochemistry now concentrate on solutions at far higher pressures than those of concern in the power industry (e.g., Palmer, 2004). The very slight disadvantages of working at higher pressures than those of saturated steam easily outweigh the interpretational problems that arise when there is no valid theory with which to interpret the experimental results obtainable. Some practical consequences of these facts are illustrated in Appendix A (https://naturalplasmas.com/files/VPE1_AppendixA).

It has *never* been realistically possible to claim a return on investment in less than two or three decades for the kind of work that used to be supported by, among others, the electric power industry in the UK. This fact also applied to the kind of basic stress-corrosion work once undertaken by corrosion scientists all over the

world (Staehle, 1977). Under present conditions, almost any proposal for basic studies that cannot rapidly lead to obvious economies or profits for engineering companies would seem doomed to fail.

However, the situation was very different when I, together with other more experienced colleagues in several different countries, started to identify some of the more fundamental problems discussed in this paper. This century, many experimental studies of equilibria in high-temperature water have been published (e.g., Tremaine et al., eds., 2000; Palmer, 2004; Tremaine, Zhang, Bénézeth & Xiao, 2004; Fernandez-Prini, Japas & Marceca, 2010) and the systems are by now fairly well understood up to about 300° C. However, this is by no means true for conditions within 50° C of the critical point of water (at 374° C) or under any conditions at all in steam.

In what follows, a wide variety of evidence will be drawn together showing why it is currently impossible (validly) to use any normally successful kind of modeling for predicting the behavior of electrolytes in the steam-water circuits of *high-efficiency* power stations (those that operate at or above about 350° C). Hardly any experimental study at high temperatures and pressures can produce results quickly. Despite this, there have been many revealing studies from several research groups. Some of these results were used in one very revealing analysis by Wood et al. (1994) - a study that is discussed later. Troubling though some of the problems are, our ignorance concerning electrolytes in moist air systems is even more limiting.

The ignorance to be described seems to have resulted from forces that are more societal than scientific. When anomalous observations are made, a valid explanation is unlikely to result unless a scientist can see a feasible path to making some progress and unless some funding agency is willing to support the work that has been identified as necessary. This does not need to be a serious limitation, even in very challenging areas of work, if the problems are *only* technological or financial. However, the situation can be very different if the problems arise at a very basic level, are generally considered boring, and are likely *only to be solvable on an extremely long timescale*.

Current Knowledge and Ignorance Concerning Electrostriction by Ions

Fundamental science can be thought of as an organized way to replace erroneous concepts with better ones. Physics, because of its dependence on centuries of work by mathematicians, has developed in the most fundamental ways. The result is the amazingly precise predictions that this combination of expertise can some-

times make (e.g., Penrose, 2005; Farmelo, 2019). However, very basic science can be expensive, and if it is both expensive and uninspiring to most people, it will receive little support *unless the needed work directly benefits some industry*. Commonly this will be a manufacturing or construction industry.

A very successful example of support by manufacturing industries was that aimed at understanding most aspects of *inorganic* chemistry during the 19th century. Apparently, most of our early knowledge of inorganic chemistry resulted from satisfying the specific needs of manufacturing industries (Mellor, 1928). Far less successful have been applications of the concepts of *solution chemistry* in an equally important industry: the electric power industry. One difficulty now is a general reluctance of most senior engineers in the industry to be at all concerned when, under specific conditions, computer models are demonstrated to be based on totally invalid science *but it would be far too expensive to do anything about it* (see Appendix A https://naturalplasmas.com/files/VPE1_AppendixA).

Specialization has obviously proved essential in advancing all of science. As implied earlier, the most fundamental advances have been in physics. General relativity and quantum mechanics are fields that best illustrate this, while studies in chemical thermodynamics have suffered from four major difficulties. 1: the field has never been fashionable. 2: the rates at which chemical changes proceed are often considered far more important than thermodynamics. 3: to be successful, assumptions need to be made and then tested and 4: the thermodynamic properties of only a tiny fraction of the compounds that exist have ever been measured. In this respect, chemical thermodynamics differs enormously from nuclear and particle physics.

Before the specific limitations of *vapor phase* electrochemistry are discussed, some much longer-known problems in treating ordinary, liquid-phase solutions of electrolytes need to be mentioned. Chemical thermodynamics controls most of the processes that occur in fluids, but the discipline has never been popular. Its unpopularity with research scientists is not difficult to understand if only because a single precise measurement of one thermodynamic property provides so little information compared with the normally relatively simple measurement of *changes* in solution compositions as a function of time.

Rates of chemical change (kinetic studies) fit easily into the normal three-year length of a Ph.D. research project, but most thermodynamic studies do not. Additionally, thermochemical properties of solutions are of little practical value unless a range of related properties *for other solutions* is also available. A typical chemical re-

action in solution involves at least three or four chemical species, and appropriate data on *all* of them must be available before *anything of practical value* can be calculated. Worse still, solution properties vary with concentration, so to be useful, it is necessary to provide some concentration-independent definition of a standard state for each electrolyte of interest.

With mixtures of liquid phase *non-electrolytes*, there are natural standard states: the pure fluids. For electrolyte solutions, however, one of the pure substances is normally a solid, so quantifying their standard state properties requires the extrapolation of experimental measurements on a number of solutions of different concentrations to infinite dilution rather than simply obtaining the properties of pure liquids. To be of practical use, the standard state for an electrolyte solution is taken to have the relevant properties of an infinitely dilute solution, but, *at the same time*, the solution is taken to be at a unit concentration. There is a related problem with electrolyte solutions that is, in some respects, only slightly less serious than the fact that their standard states are unreal. This is the tendency of solutions to change their degree of dissociation as they are diluted, becoming completely dissociated at infinite dilution (Arrhenius, 1887; 1903). Although the experiments leading to the discovery of this fact were much later described as “some of the most fruitful that have been advanced in the history of science” (MacInnes, 1961), this was not at all how the contemporaries of Arrhenius assessed his discoveries (Arrhenius, Caldwell & Wold, 2008). The complicated behaviors of electrolyte solutions on dilution still tend to be found unattractive to most chemists.

More importantly, compared with mixtures of non-electrolytes, electrolyte solutions have the obvious disadvantage of employing *standard states* that are *not physically real*. Only an industry feeling the need to plan many decades ahead would support work addressing the kind of uninspiring science that results from the above facts.

The electricity supply industry in the UK, along with a few companies in other countries, was once run purely as a public service - that is *basically in the public interest*. Thus the engineers and physicists who ran these companies once felt pressured to support clearly needed thermodynamic studies - *even if progress would inevitably be extremely slow*. This is no longer the case.

We shall see that the fact that the standard states of electrolytes are not physically real can result in serious conceptual difficulties. Decades of testing the utility of electrolyte standard states had been summarized by the mid-20th century (e.g., Harned & Owen, 1950; Robinson & Stokes, 1955). Among the practical problems in *obtain-*

ing these standard state properties were some long-known mathematical limitations of the basic Debye-Hückel model for ionic interactions, but these are not always the most serious difficulties.

Guggenheim (1929) early discussed some very basic electrostatic problems that are unavoidably involved in treating the thermodynamics of electrolyte solutions. One of them is the fact that *individual* ion activities cannot be measured - because they do not exist. Activities *only exist as real thermodynamic quantities* for complete electrolytes. The most frequently needed property of a solution is its pH which is nominally the logarithm of the hydrogen ion *activity* with its sign reversed. A pH informs us how acidic a solution is, and its knowledge can be important in assessing many systems, both biological and industrial.

Because a pH is only a property of convenience (not a real thermodynamic property) internationally agreed conventions are now used to define exactly what it means and how measured properties can be made to satisfy the needs of those scientists who study solutions, while still being reasonably consistent with the laws of thermodynamics. These conventions are periodically updated (Bates & Guggenheim, 1960; Covington, Bates, & Durst, 1985; Buck, 2002). Measurements of pH can be made in a variety of ways, the most precise of which measures the activities of electrolytes. In principle, pH values provide an unusually clear example of the differences between concentrations and activities, but frequently the differences are ignored.

These difficulties may have contributed to a long-standing antagonism between two eminent authorities on chemical thermodynamics: E.A. Guggenheim and G. Scatchard. In 1950, according to Edsall and Stockmayer (1980), Scatchard reviewed the first edition of Guggenheim's textbook on the subject and remarked that it might well have been subtitled “Pride and Prejudice”. To many currently practicing chemists, Guggenheim's concerns still seem excessively pedantic, but they are valid and can be important. The disagreements just referred to might possibly have resulted from the main interests of the two men and their students.

The majority of scientists who deal with solution properties, such as analytical chemists, environmentalists, bio-chemists, and biologists, tend to favor the less pedantic views of Scatchard, where such problems as the difference between a concentration and an activity are frequently ignored. This is probably because solution chemists normally only study systems fairly close to room temperature. However, those in other areas of science can be concerned with systems over a much wider range of temperatures - where the difference between a

proton's concentration and its activity can be considerable.

The Thermodynamic Properties of Aqueous Electrolyte Solutions

For a century, it has been generally accepted that, at least in sufficiently dilute solutions of electrolytes, the differences between thermodynamic activities and concentrations can be dealt with very easily, if only approximately, by using extended forms of the Debye-Hückel limiting law. So long as standard state Gibbs free energies of formation for all the components in a solution phase reaction are available, the pH of the solution can be estimated using such theories. Unfortunately, the vast majority of thermodynamic data on solutions has only been obtained at 25°C, so it is usually necessary (e.g., in geochemistry and the electric power industry) to *estimate* any free energies needed when data at other temperatures are required.

In estimating the free energy change of a reaction involving electrolytic solutions, it is usual to first calculate the standard state free energy change and then correct it for the non-ideal behavior of real solutions.

Because any errors introduced by faulty activity coefficient relations are normally far smaller than errors in the standard state properties, problems with the latter quantities are usually far more important than the effects of activity coefficients. Nevertheless, both types of contribution to a free energy change can be influenced by electrostriction.

The only simple approach known for estimating the standard state properties of ions in a solution is the use of the Born equation:

$$\Delta G = - \frac{(ze)^2 N}{8\pi\epsilon_0 r} \left(1 - \frac{1}{D}\right)$$

Here, ΔG is the change in Gibbs free energy for the transfer of a charged sphere from the gas phase to a solution whose dielectric constant (relative permittivity) is D . An ion is taken to have a radius r and a charge of ze (z being the number of electric charges on the ion and e is the charge on an electron), while N is Avogadro's number.

The right-hand side of the above equation was originally derived by Born (1920), and it has been discussed in numerous subsequent treatments of electrolyte solutions. A major problem with using this equation is that, although it is now usually *assumed* to apply to Gibbs free energies (as indicated in the above equation), this assumption has little to justify it. It is now generally taken

to be a reasonable assumption (Atkins & MacDermott, 1982), although there are still doubters over this point. When Born first developed his relationship, it seems he thought he was calculating internal energy, but it was later concluded that what he had actually calculated was a free energy change (Bjerrum & Larson, 1927). For decades, this energy was *assumed* to be the Gibbs free energy change for the relevant process.

Later, Frank (1955) used the differential equations that govern thermodynamics and electrostatics to study the free energy density in an idealized thought experiment. This employed a parallel plate capacitor filled with a liquid and fitted with devices for measuring pressures. He used the model to derive and discuss many equations that are obtainable from these basic laws. His study implied that neither of the above conclusions regarding the Born equation is correct. One implied conclusion was that the expression on the right-hand side of the above equation is more like a Helmholtz free energy than a Gibbs free energy.

Many unquantifiable terms are present in Frank's equations and presumably this is why his work is now largely ignored. At CERL, Peters (1984, 1985, 1987a,b) did begin a study of whether it is possible to make practical use of his equations, but the privatization of the CEGB and the closure of CERL put an end to this program before much progress had been made. Other related long-term projects, discussed later, were also abandoned. For two concerned opinions, by academics, over the closure of CERL - see Fells (1992) and Atiyah (1994). The latter's comments on the politics involved seem particularly relevant in the context of this paper and are briefly referred to in Appendix A.

In practice, many poorly understood contributions to the energies involved have to be accommodated when attempts to use the Born equation are made, and there are many ways of doing this. In the absence of better approaches, the equation's use has continued to this day despite its known limitations. An extensive summary of its uses and limitations in understanding the properties of electrolyte solutions at 25°C was given by Conway (1981). As previously mentioned, this temperature is important because it is *the only one* at which large quantities of really reliable aqueous phase data are available.

At 25°C, a wide variety of structural factors in an aqueous solvent contribute to the problems with the Born equation. They have been discussed and studied almost continuously for many decades (see, e.g., Harned & Owen, 1950; Roux, Yu, & Karplus, 1990; Yang & Lim, 2008; Izadi & Onufriev, 2016). The conclusion is still that all hydration models require empirical fitting parameters in order to enable over-simplified models (such as the Born



equation) to account for the properties of real ions of different sizes.

It was once hoped that, near the critical point of water, a simple electrostatic model, like the Born equation, might come into its own - because the huge effects of electrostriction would swamp any local structural influences. However, the difference between the Gibbs and Helmholtz free energies is a compressibility (PV) term, so it is arguable that serious problems could have been anticipated in any attempt to modify a Gibbs energy relationship by the addition of ad hoc parameters to account for local structural effects including electrostriction.

An idea of the magnitude of the problems near the critical point of water can be seen by comparing partial molar volumes obtained theoretically and experimentally. These are the thermodynamic quantities that are most obviously influenced by compressibility. An appropriate theoretical prediction for aqueous NaCl was that of Quint and Wood (1985), while an extensive set of experimental data on apparent molar volumes for the electrolyte had been made in the 1950s (Benson, Copeland, & Pearson, 1954; Copeland, Silverman, & Benson, 1954). A more recent and more extensive set of data has since been obtained. These densities, which were mostly obtained well above the critical point of water, in terms of both temperature and pressure (Majer, Hui, Crovetto, & Wood, 1991), will be discussed shortly.

Figure 1 shows the earlier (1954) measurements of apparent molar volumes for NaCl solutions in water at 385 °C and at a pressure of 243 bar. An apparent molar volume of - 24 l mol⁻¹ (for the lowest concentration studied) obviously represents a very high degree of electrostriction. Nearer room temperature, a similar plot would have been hard to distinguish from the x-axis of the graph. At 25 °C, the apparent molar volume is roughly +17 ml. mol⁻¹ (Harned & Owen, 1950). This is a little over half the value calculable from the density of solid NaCl (+27 ml. mol⁻¹). Thus electrostriction is actually significant even near 25 °C. The significance of these findings is discussed a little more fully in Appendix B (https://naturalplasmas.com/files/VPE1_AppendixB)

The data represented in Fig. 1 were for solutions roughly 11 °C and 43 bar pressure above their critical points so that sedimentation effects will be far smaller than they would have been at the critical point - since electrostriction is limited by compressibility and this is infinite only at the critical point itself. We will proceed by temporarily ignoring any effects of sedimentation in order to compare these measured values with those predicted by the thermodynamic model of Quint and Wood (1985).

From the apparent molar volumes of Fig 1, we can ob-

tain partial molar volumes (the graph's slopes). This exercise yields partial molar volumes close to - 41 l.mol⁻¹ for the two most dilute solutions. (It is not obvious that the results are of sufficient accuracy to allow this similarity to be considered significant). The model of Quint and Wood finds that, for a temperature 0.5 °C (compared with the experimental 11 °C) above the critical temperature and at a pressure about 0.7 bar (compared with the experimental 43 bar) away from the critical pressure, the predicted partial molar volume was - 31 l.mol⁻¹ (Quint & Wood, 1985).

The modeled value for infinite dilution was for a solution *far closer* to the critical point than the measured ones so that a prediction of -31 l.mol⁻¹ represents a *very considerable* under-estimate of the real degree of electrostriction. On the basis of the NIST (2021) density data, the compressibility of water 0.5 °C above the critical point is about 6.6 times greater than that where the experimental data had been obtained. Because the measured values refer to finite concentrations, which are much higher than for the standard state, the real discrepancy between the model and experimental results is far larger than between -31 l.mol⁻¹ and - 41 l.mol⁻¹.

To what extent sedimentation in the 1950s experimental study is responsible for the discrepancy is not known. It so happens that Wood et al. (1994) later concluded that the earlier estimate (Quint & Wood, 1985) might be unreliable. Hence sedimentation might not be the main cause of the discrepancy. However, the newer model of Wood et al. (1994) led to a *qualitatively more significant prediction*: that ions would be *more strongly paired* near the critical point than under conditions where the compressibility is neglected. This conclusion is the *exact opposite* of one drawn previously by Pearson, Copeland & Benson (1963) and of Monte-Carlo simulations by Peters (1987b) at CERL (see Turner, 1990a). Both these studies provide evidence supporting a *lower* degree of ion pairing as a consequence of high compressibility.

As we shall see later, in some of the experiments of Pearson, et al. (1963, p. 1049), conductances of NaCl solutions, unusually near to their critical points, had been measured. The authors' final conclusion was as follows: "In this region of high solvent compressibility, the attraction of ions for water molecules appears to exceed greatly the attraction of ion pairs". (Author, YR, Pg no) Similar conclusions seem also to be implied by the findings of Marshall and Quist (1967) and of Marshall (1969). This all casts doubt on the basis for the conclusions of Wood et al. (1994). The crucial importance of their results seems to be in clearly illustrating the complete inadequacy of normal methods of data treatment whenever compressibilities are high.

Clearly, our quantitative knowledge of electrostric-

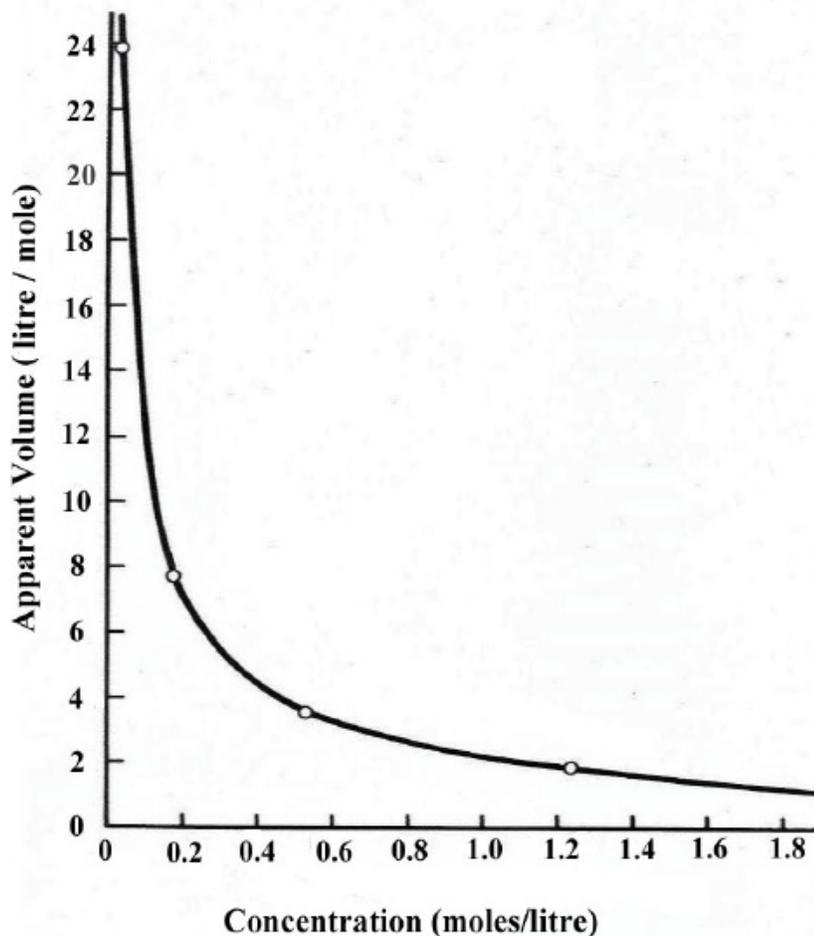


Figure 1: Apparent molar volumes of aqueous supercritical NaCl solutions (Turner,1983). The actual results were reported in two separate papers by Benson, Copeland, and Pearson (1954) and by Copeland, Silverman, and Benson, (1954).

tion is still grossly inadequate, although it seems almost certain that the conclusions of Pearson et al. (1963) and of Peters (1987b) are correct concerning how easy it is for a water molecule to replace a counter-ion close to the central ion in a very compressible solution.

At the very much lower solvent densities of moist air, the favoring of hydration over charge neutralization proved to be one of the key ingredients in the author's electrochemical model for ball lightning (Turner, 1994, 1998, 2002, 2003).

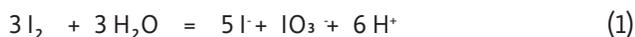
THE USE OF WATER IN ELECTRICITY GENERATION

In an operating power station boiler, whose temperature might be 350° C, understanding the degree of hydrolysis of salts in the water can obviously be important because hydrolysis reactions control the pH and because solutions of either very low or very high pH can significantly increase corrosion rates. The need to quantify

quite different kinds of hydrolysis reactions can also be important when nuclear power problems are involved. Both the reliability of the regulations imposed on the industry and their degree of conservatism clearly require testing. This can apply both to normal running conditions of the plant and to conditions under the kind of plausible accident scenarios that are needed in making safety cases for a new nuclear plant.

Two quite different kinds of problems that involve iodine chemistry will be illustrated here, the first relating to the solvent properties of *liquid water* and the second to those in *steam*. Detailed models for the release of radioactivity from different parts of a water reactor circuit need to take into account the fact that droplets are far more easily contained than volatile species. In a boiling water reactor (BWR), the most volatile of the radioactive species is molecular iodine, I₂, while in a pressurized water reactor (PWR), HI would be the volatile iodine species initially released from any leak (though it could then be

oxidized in the air to I_2). One of the most important equilibria, governing how much iodine can be in the gas phase is the hydrolysis of iodine according to the liquid phase reaction:



The main concern is, of course, how much of the iodine present can enter the gas phase. Unless the equilibrium constant for this reaction is known, the only safe assumption is that all the iodine released during the leak is in the gas phase (as molecular iodine) so that radioactive iodine can escape easily. For a PWR, this assumption is likely to be unnecessarily pessimistic, and, in the case of one of the most serious real accidents with a PWR, the predicted radioactivity release had indeed been greatly overestimated (Rogovin, 1979).

Unfortunately, the only data on Reaction 1, when the CEGB needed an assessment, were thermodynamic data at 25° C, which could be used in combination with methods for estimating high-temperature equilibrium constants from those at 25° C. Two such procedures were known: those of Cobble (1964) and of Helgeson (1967). Each is based on slightly different principles, the first being purely thermodynamic and the second explicitly allowing for some of the electrostatic forces. From what had already been learned about the properties of electrolyte solutions, Reaction 1 appeared likely to provide a very severe challenge for any estimation procedure because dissolved *ions* are far less well characterized than are uncharged molecules. In Reaction 1, twelve poorly characterized ions are obviously produced from six comparatively well-characterized neutral molecules.

When the estimation procedures were applied, a huge spread in predicted values for the equilibrium constant was found. By 90° C, the ignorance represented an uncertainty of *three orders of magnitude*, and by 150° C the uncertainty was *10 orders of magnitude* (Turner, 1978, 1980). In other words, the available data were totally useless. Later experimental studies (Ashton, Corti, & Turner, 1986) greatly improved the situation. The main difficulty in addressing problems like this is that industrial users of the information tend to be far more concerned over such ignorance than are most academics - but industrialists can be unwilling to fund the necessary research if it is expensive and slow.

Around the same time, data on Reaction 1 were needed in trying to understand some very strange observations made in a Swedish BWR (Lindén & Turner, 1983). A BWR employs high-purity water in a single fluid circuit so that any chemicals leaked from a fuel can have direct access to the turbines. On a few occasions, unexpectedly

high fractions of the iodine present in the circuit had been carried over from the boiler to the turbine. Normally the fraction carried over was between 3 and 8%. On one occasion, however, the highest carryover was 65%. In American BWRs, values between 0.2 and 2.5 % were more typical. It was eventually concluded that the very high levels of carryover arose *only after prolonged operation with water of unusually high purity*. This kind of finding indicates how very poor can be our current understanding of the solution chemistry of boiler water.

RELEVANT THERMODYNAMIC PROBLEMS

The matter of excessive specialization needs to be raised again here. In universities, the problems can often be minimized because of the frequent need for academics to lecture on a variety of subjects. Hence it is normally *assumed* that academia is the best place to minimize limitations due to over-specialization. One problem with this assumption is that lecturers usually have to rely, at least to some extent, on textbooks. As we shall see, it is all too easy for significant facts to be ignored in textbooks. If there are serious problem areas in basic science, an industrial laboratory could sometimes be the best place to discover them. However, when a company is run purely on a commercial basis, expensive attempts to avoid long-term problems by acquiring new basic information, are pointless - because all of a company's competitors are equally ignorant (see Appendix A).

The previously mentioned measurements of Majer et al. (1991) on the densities of aqueous NaCl solutions at high temperatures and high pressures used a completely new approach to density measurement under these conditions. It was a brilliant piece of innovation and proved to be a revelation. A vibrating-tube densitometer was used. This measures the masses of solutions (of known volume) that control the resonant frequencies of the tube containing them. The flow-through design of the system allowed measurements to be obtained at an unprecedented rate. This is a major advantage over traditional methods, and results were obtained over a wide range of conditions well above the critical point. Under the latter conditions, traditionally obtained data confirmed the reliability of the method, but *no results* could be obtained as close to the critical point as had been expected.

Most of the measurements were in excellent agreement with earlier measurements, but it was found that the resonant frequencies were so severely damped in the vicinity of the critical point of water that no densities in this region could be obtained. The failure was attributed by the authors to a phase change. Since a strongly sedimented solution can be considered to be an infinite num-

ber of slightly different phases, this explanation has to be correct, even if two distinct phases could never have been observed.

Comparisons with the results of earlier work revealed that the conditions where densities could *not* be obtained were far more restricting than when traditional methods for measuring densities had been used. It seems clear that the results of Majer et al. (1991) define, far more clearly than any other method, the region of phase space where sedimentation makes solutions *inhomogeneous at equilibrium*. In other words, the results clearly confirm that *the Earth's gravitational field significantly influences the physical properties of some salt solutions*. In an electric power station, far higher gravitational fields than the Earth's can be present where fast-flowing steam encounters sharp bends in the tubes containing it. Serious corrosion problems can and do result.

The routinely used assumption in the model of Wood et al. (1994), that any thermodynamic property *for an individual ion* has real significance, introduces its own limitations because of the unreality of the concept of an individual ion activity (see earlier). It seems likely, however, that most of the apparent discrepancies were due to the role of the Earth's gravitational field. That this can be important is also supported by a very much earlier study of Shröer (1927). Shröer used visual observations to measure the critical temperatures of pure water and of a number of electrolyte solutions, some of which were colored.

The significance of Shröer's (1927) observations on *colored* solutions seems to have been ignored by most subsequent investigators who have continued to ignore the obvious effects of sedimentation he reported. For pure water, his measurements show excellent agreement with the best currently accepted values of critical parameters, and his values for the apparent critical points for aqueous NaCl solutions mostly lie well within the (rather wide) range of values obtained in more recent studies. The agreement over the *pure water* data seems to be the only piece of evidence that has been used by later investigators (e.g., Marshall & Jones, 1974).

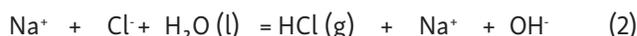
It should, perhaps, be noted that the effects just described are unrelated to the much-studied fields of near-critical study that discuss *critical exponents* and are common to all phase changes (Stanley, 1971). These effects are seen over a far smaller range of temperature and pressure than those that produce sedimentation. The neglected aspects of Shröer's work, with colored solutions, simply provide additional confirmation that the gravitational field of the Earth greatly complicates the physics involved. Such complications were, of course, what led the CEGB to support the collaborations with the ESA - the European Space Agency - (see Turner, 1983). The findings

of Majer et al. (1991) clarify the range of parameters over which the problems are serious.

It took sixty years before Shröer's observations could be independently confirmed by simple removal of the Earth's gravitational field with near critical NaCl solutions (Turner, 1987,1988a). Unfortunately, support for the collaborations between the CEGB and ESA, which had produced this confirmation, ceased well before any really important results had been obtained. These results were, of course, needed to test any better theories whose development was, at that time, still being attempted.

The small autoclave developed for this work would also have allowed a variety of optical studies, such as holographic interferometry, to be used in an orbiting space vehicle (Turner et al., 1991; Tremaine & Turner, 1993). Such studies might well have been able to help address the problem referred to earlier of trying to use Frank's (1955) very complicated relationships to better understand the inter-ionic forces that control very compressible electrolyte systems. However, neither industrial nor governmental support was ever found, and both proposals had to be abandoned.

There is, unfortunately, another potential complication that would have needed addressing before any *definitive* tests of future theoretical models could have been made. It has long been a concern with engineers and corrosion scientists in the electricity supply industry. It relates to a potential hydrolysis reaction which is generally *assumed to be unimportant by almost all academics*. Its (qualitative) occurrence has, however, frequently been invoked by power station engineers to explain the specific locations of corrosion damage found in boiler tubes. The reaction can be written thus:



The designations (l) and (g) refer to the liquid and gaseous phases. In this representation, the sodium ion is shown on both sides of the equation simply to indicate that the process considered occurs in a normal bulk liquid with *all the ions* assumed to inhabit the liquid phase - as they certainly do nearer to room temperature. If the reaction really does lie significantly to the right in high-temperature water, as it certainly seems to, then the reaction's occurrence would introduce a very significant difficulty in interpreting the properties of near-critical salt solutions.

If support for our micro-gravity studies had continued, the properties of aqueous HCl would have required study, ideally before those of NaCl. The need arises because HCl cannot possibly hydrolyze, while Reaction 2 is at least possible in principle. The autoclave system

which had successfully been used in the preliminary micro-gravity studies (Turner, 1988a) would have required much-improved seals because those employed in all the studies of NaCl solutions routinely failed when the much more corrosive HCl was substituted for NaCl. It is easy to see why support for this kind of experimental work could only come from an industry that clearly saw the need for solving the relevant theoretical problems and was prepared to plan seriously for the future.

AN INDUSTRIAL PROBLEM INVOLVING STEAM

The inadequacies of available estimation procedures referred to in connection with Reaction 1, reflect changes in the *solvating properties* of liquid water as temperatures increase. Our ignorance is much more serious when it comes to the solvent properties of *steam*. Experimental studies undertaken in the context of the operation of PWRs (Clinton & Simmons, 1987) demonstrated this fact very clearly. Unlike BWRs, PWRs normally operate under chemically reducing conditions, so the covalent form of HI was expected to be the only volatile iodine species present in the liquid phase under normal operating conditions.

The results of Clinton and Simmons (1987) were the only *directly* relevant data on iodine volatility that were available for use in PWR safety cases. The authors employed iodine concentrations close to 6.10^{-11} mol/liter in the liquid phase, using the radioactive isotope ^{131}I to determine the iodine fraction in each phase. Such levels (realistic in practice) represent a sensitivity many orders of magnitude greater than conventional methods for chemical analysis could possibly achieve. Because of the low iodine levels and because temperature gradients in the experimental system could not be avoided, it seemed fairly easy to understand why the reproducibility was much lower than the authors must have expected. Far less easy to explain was the *complete* lack of dependence of iodine volatility on pH and its *very clear* dependence on borate concentration (Turner, 1989). When the results were first reported, none of the groups of scientists wishing to use the data in safety cases could make any sense at all of either of these facts.

At the time, reasonably precise estimates of the dissociation constant of HI were available at the relevant temperature (285° C). On this basis, no suitably qualified person (of dozens pondering the problem) could explain why a change of 5 orders of magnitude in hydrogen ion concentration forced *no change whatsoever* in the iodine volatility. Even more strange was the matter of how boric acid could so systematically increase the iodine volatility.

The basic question raised was this: what is preventing the oppositely charged ions from annihilating each other's charges at low pH values, thus making HI behave like a normal acid?

A possible explanation for the lack of dependence on pH is that the ions are all present in a form that solution chemists refer to as solvent-separated ion-pairs. Ion hydration in such ion pairs can, it seems, prevent the process of *complete* charge neutralization of HI. However, this still leaves the clear dependence of the iodide on borate concentration unexplained. To the best of my knowledge, the only explanation for the findings ever offered depended on our almost total ignorance of what I now refer to as vapor phase electrochemistry. It seems that nearly all the iodine must have entered the vapor phase as an *ion pair* in which the iodide anion is *stabilized by the presence of boric acid* - through a fairly well-understood entropy effect (Turner, 1989).

This evidence was our first hint that solvent-separated ion pairs can exist *at equilibrium* in the gas phase at a moderately low temperature. Ionization in a dry gas (where there can be no such ion pairs) normally requires thousands of degrees Celsius. This ion pair explanation appeared to be the only reasonable (if surprising) one for the findings of Clinton and Simmons (1987). The explanation can be compared with the comment of Pearson, et al. (1963), quoted earlier, that high compressibility in an aqueous solvent causes the attraction of ions for water molecules to exceed the attraction of oppositely charged ions. The findings seem significant because the compressibility of steam is so very much lower at 285° C than it is near 374° C.

Later, the existence of solvent separated ion pairs in the gas phase was also supported by the behavior of a different pair of ions: those providing stability to ball lightning (Turner, 1994). Here there are additional reasons for believing that there need be *no driving force at all for complete charge neutralization* when ions are sufficiently heavily hydrated in the gas phase. It is the Gibbs free energy change on charge neutralization that determines whether or not a process can occur, and, *in the gas phase*, the entropy contribution to a free energy change can swamp that of the enthalpy change (Turner, 1994).

Attempts at Quantitative Studies of Ion-Water Interactions

There are many plausible explanations for the failure of simple relationships to permit satisfactory estimates of equilibrium constants in high-temperature water. Most can be seen to result from the still poor state of our understanding of ion hydration (e.g., Friedman & Krishnan,

1973; Vlcek & Chialvo, 2016). This field of study is still extremely active, but remarkably few new experimental data above 50° C become available each year, and even fewer in the two-phase region above 100° C, so there has been little incentive to investigate the kind of compressibility effects that seem to control processes at significantly higher temperatures.

It gradually became clear to those at CERL that, in a boiler at 350° C, ion pairing is controlled at least as much by the effects of electrostriction and compressibility of the solvent as by electrostatic relationships (Turner, 1988a). In fact, Tremaine and Goldman (1978) had much earlier recognized that our poor understanding of electrolyte solutions in high-temperature water was a direct consequence of solution compressibility. Later, the problem was also recognized by scientists at the National Institute of Standards and Technology (NIST) (Levelt-Sengers et al., 1992), but their proposals for new studies to investigate the problem came to nothing - presumably due to a lack of support.

A slightly later proposal (Tremaine & Turner, 1993) *definitely* failed for this reason (see Appendix A). As this Appendix seems to show, the political philosophy that drove the privatization of the CEGB, and the consequent closure of CERL, also led to the abandonment of most of the other work that had once been devoted (worldwide) to the study of aqueous systems that are highly compressible and strongly influenced by electrostriction and therefore by sedimentation. *I am not aware that anyone is currently studying systems in which gravitational sedimentation, of the kind referred to above, is considered to be important.*

It is now clear that very basic limitations apply to our understanding of the thermodynamic properties of all electrolytes in water in the two-phase region above about 250° C (Cobble & Murray, 1977), to their conductances at temperatures above 300° C (Turner, 1983) and to both these properties *in steam and moist air at all normal temperatures* (Turner, 1990a,b., 1998, 2003). Conventional treatments of *real* solutions (at finite concentrations) become *invalid* in any sufficiently compressible solution (Turner, 1983, 1990a). One of the *simplest* ways of seeing the nature of the basic problems relates to the use of any version of the Debye-Hückel theory (which *assumes* the solvent to be incompressible) in obtaining standard state properties from the measured properties of real solutions. As we have seen, the effects of compressibility can be huge. This problem is discussed in Appendix B (https://naturalplasmas.com/files/VPE1_AppendixB).

Based mainly on the relationships found by Frank (1955), the earlier mentioned modeling studies at CERL (Peters, 1984, 1985, 1987a,b) were begun. The last of these

studies involved a re-assessment of previous approximations for the radial distribution of charge in dilute, moderately compressible solutions of electrolytes at 325° C. A linear approximation for the dependence of dielectric constant on solvent density, used previously by Wood, Quint, and Grolier (1981), was employed together with other approximations used by these authors. Although these frequently used assumptions were found to be consistent with the Debye-Hückel theory when applied to normal aqueous solutions, it later became clear that there seemed to be much more serious problems in significantly more compressible solutions (Turner, 1990a).

There are two other modeling studies showing that the problems are serious. One comes from an earlier review of failures of the Debye-Hückel theory by Morrison (1988), and the second from much later studies using molecular simulations (Reif & Hünenberger, 2011). The limitations were again attributed to compressibility effects. It now seems very clear, from an uncompleted study of Peters (1990), that so many currently unquantifiable terms are involved in Frank's (1955) relationships that it is quite impossible to estimate any practically useful standard state-free energies for electrolytes anywhere near the critical point of water - at least if reliable conclusions are required.

If obtainable, only experimentally determined free energy changes would currently have *any* practical value at all. Unfortunately, even if reliable *experimental* data of this kind were to be available, there is still the problem of how to extrapolate the data obtained experimentally to infinite dilution using estimated activity coefficient relationships that are unavoidably invalid. Being able to relate measurements on real solutions to standard state properties is essential if experimental data are to be of any practical use. Usable knowledge concerning ionic equilibria within about 50° C of the critical point of water is almost completely lacking.

In the present context, the most instructive of the findings at CERL came from Monte Carlo simulations which were undertaken for a 10⁻² molar NaCl aqueous solution at 325° C (Peters, 1987b). A brief summary of the main conclusions was later discussed in an externally published paper (Turner, 1990a). As we have seen, comparison of these predictions with those of the Debye-Hückel theory showed that electrostrictive forces produce a major *reduction*, very near the central ion, of the concentration of the counter-ions that surround the central ion. This conclusion directly contradicts the conclusion of Wood et al. (1994) which was based on a conventional use of the Debye-Hückel theory so that the precise significance of the disagreements discussed earlier remains somewhat unclear.

Conductance Studies

Much of what is known about electrolyte solutions have resulted from measuring conductances as a function of concentration and interpreting the results as deviations from theoretical predictions. The theories used are normally modifications of the basic Debye-Hückel model as they apply to transport properties. Fortunately, conductance results can also be used in far simpler, though normally far less informative, ways. If solution conductances as a function of concentration are simply extrapolated to infinite dilution, without any attempt at interpretation, a *theory-free* property for the solution, known as the Walden product, can be obtained. This is the product of the limiting conductance (an extrapolation of the measurements to infinite dilution) and the viscosity of the solvent. Decades ago, Harned and Owen (1950) argued that, in an ideal *structure-free* solution, Walden products would be independent of temperature.

However, all aqueous solutions near room temperature are well known to be highly structured as a result of the strongly hydrogen-bonded nature of liquid water. Fig 2 illustrates this evidence in a revealing way. The lower temperature deviations from constancy arise from the structural effects of liquid water. As expected, these structural effects decrease with temperature. Above 300° C, the deviations are equally revealing - but in a totally different way. The critical temperature of water is close to 374° C. Significantly, the Walden products above 300° C seem to be heading for infinity - as they should be since water, like any other fluid, is infinitely compressible at its critical point.

The roughly horizontal portion of the line in Fig. 2 clearly implies a temperature-independent Walden product, as would be the case in any *ideal* solution. It certainly appears that the well-known abnormal structural effects of liquid water have been largely eliminated by about 100° C but a horizontal line between about 150° and 300° C is unlikely to be really justified because the arguments did not allow for electrostriction. It was mentioned in Section 2.1 that electrostriction is, in fact, significant in water even at room temperature, so there was really no justification for having believed that a horizontal line between 200 and 300° C should have been drawn. The results of Noyes (1907) were actually of very high precision, so it now seems that much greater weight should have been given to them than indicated by the line. Hence line should really have a negative slope over the whole temperature range between 100° and 200° C

It was partly on the basis of the data in Fig. 2 that our earliest experimental studies at CERL were justified. The original hope was that extrapolations of thermodynamic

data would be most reliable if they were to be made, both up and down in temperature, from new measurements obtained between about 200 and 300° C (Turner, 1977). Conductance methods would not, in practice, have been used since our need was for thermodynamic data, and the use of this method would have depended on the development of a far more reliable theory than those based on any simple Debye-Hückel model (see Turner, 1983). This planned approach had barely begun when a catastrophic accident with one of several recently purchased designs of steam turbines directed our attention, for several years, to steam phase problems rather than those in the boiler water.

At the critical point of any electrolyte solution, but also in steam, which is also highly compressible, very serious theoretical problems are to be expected. This is partly because a standard state is defined to be a solution of unit concentration but possessing the thermodynamic properties of one that is *infinitely compressible*. This would appear to make the appropriate standard state a totally meaningless concept since a real salt, in its standard state of zero concentration, must be attracting the *infinite* number of water molecules nominally present into the electric fields of its component ions and *not* the quantity of water present in a real solution of unit concentration. As we shall see in the following sub-section, this seems not to be the case.

Some Unexpected Characteristics of Moist Gases

A strong electrolyte in a moist gas represents a somewhat similar problem to those just discussed since it might also be expected to invalidate the use of a conventional standard state. In the air, no related problems have ever been observed since no directly relevant experimental tests have probably ever been devised. A reason for suspecting that this problem *might not be real* is that all standard state thermodynamic properties are *functions of state* that, in principle, do not depend on the path through which they were obtained. It has long been known that the non-existence of a physically achievable standard state *does not matter in practice*. Such states possess perfectly well-defined and practically useful values - provided only that consistent conventions are followed when they are used (e.g., Wagman et al., 1982).

One such convention, used in tables like those of Wagman, et al. (1982) and of Chase et al. (1985), is that the enthalpies and Gibbs free energies of formation for the *chemical elements in their stablest forms* are all zero. The tabulated properties of individual gaseous ions also use the additional convention that the electron is in

thermal equilibrium and has an enthalpy and Gibbs free energy of zero. A mole of dissolved ions, *all of the same charge*, is obviously not a physically attainable state, but the standard state thermodynamic properties of *separate* ions have long proved valuable despite representing totally unreal states. By analogy, the fact that solutions are highly compressible would not necessarily invalidate the use of standard states either.

The electrochemical model for ball lightning (Turner, 1994) was based on this expectation (questionable hope would have been a more accurate description at the time). Its ultimate success (Turner, 2002, 2003) supports the claim that consistently defined standard state properties of very compressible solutions and in moist air are indeed meaningful and very valuable quantities.

A fundamental problem in understanding many of the chemical reactions that occur with ions in moist air is a general belief, among both chemists and physicists, that solute activities and solute concentrations can be

treated as more or less identical and that, where differences are significant, an activity coefficient can always be used to estimate the really important *thermodynamic activities* from the concentrations which can always be reliably known - at least in principle. Concentration gradients are, in fact, *not directly* relevant in determining rate processes. The fact that no change of any kind can occur unless it *lowers some clearly defined energy* is *far more important* than any estimate of a collision frequency (which can normally be obtained from a concentration). This fact is almost always ignored in considerations of chemical reaction rates.

It should be stressed here that most of the important problems raised earlier apply only to real *electrically neutral solutions*. Such problems do not apply to the many fruitful thermodynamic studies that have been undertaken inside mass spectrometers (see Keesee and Castleman, 1986). In such studies, charge neutrality is obviously not constrained in any remotely similar way to that in a

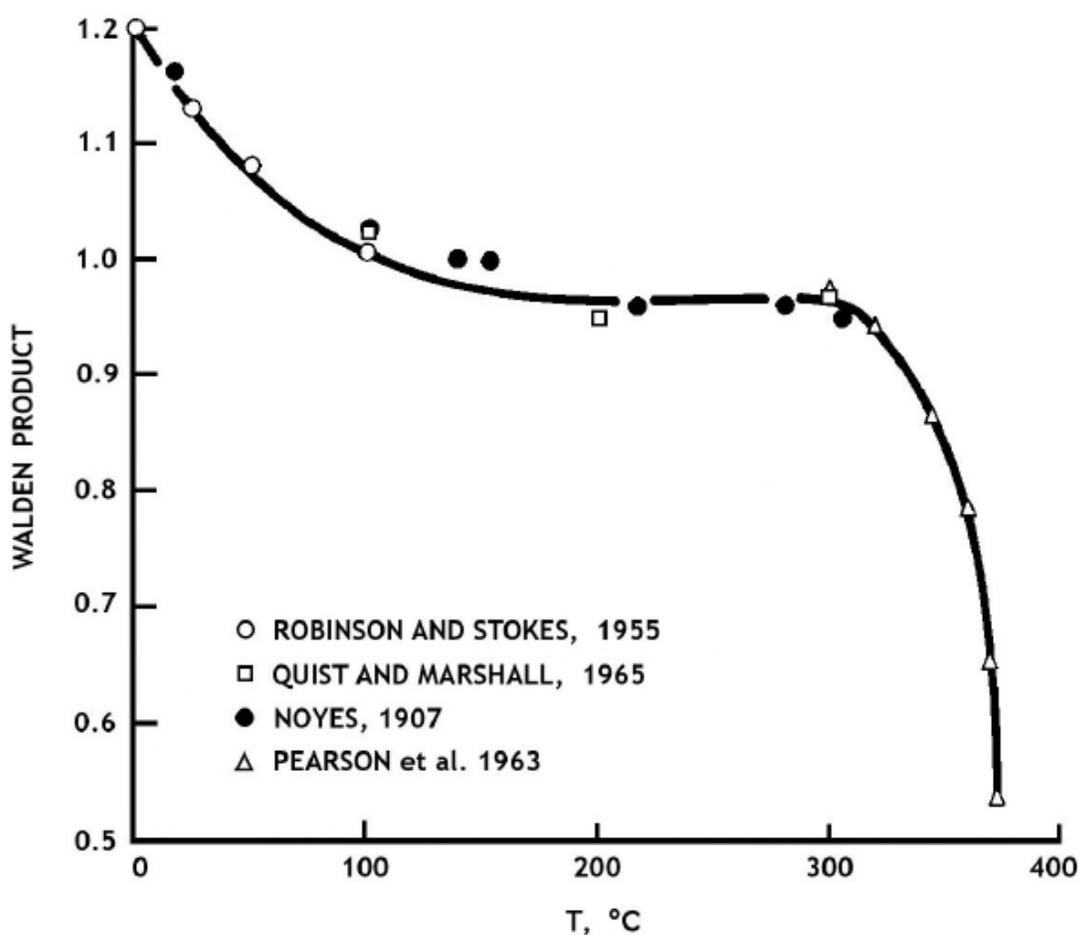


Figure. 2: Walden products for aqueous solutions of NaCl (Turner, 1983). Their units are those of the original investigators (cgs units). If the solutions were behaving ideally (no structural effects), the curve would consist of a horizontal line at a Walden product near 1.0. At best, this might be reasonably true for temperatures between 100 and 300° C

solution since no cloud of oppositely charged ions surrounds an isolated ion in a near vacuum. At first sight, it may seem surprising that standard state thermodynamic properties of hydrated gas phase ions correlate so well with their values in solution (Kebarle, et.al., 1967, Kebarle, 1974) but, as these authors have shown, they certainly do. Although standard states represent obviously unreal states, they are still, as we have seen, well-defined quantities. Such considerations were crucial in developing the basic electrochemical model for ball lightning (Turner, 1994).

In many other areas of study where charged species are involved, for example, in particle and stellar physics or in dealing with the mechanical forces produced by rocket engines, there is never any need at all to consider that concentrations and activities differ. In all these cases, if the fluid energies or momenta resulting from chemical or nuclear reactions need to be considered, the temperatures involved are always so high that hydration effects could never lead to detectable differences between concentrations and activities. It is obviously very convenient to be able to ignore these differences, and ignoring them has become almost universal. The problems discussed here *only* arise because *temperatures are so low that electrostriction is unavoidably huge*.

Some of the more successful kinds of study, for example, on formation paths of the elements in supernovae (Arnett, 1996), the aging of stars, or the pre-history of the solar system (e.g., Lugaro et al. 2014), are only possible because of the huge quantities of data that are available on *nuclear processes at extremely high energies (temperatures)*. In such cases, detailed arguments can be made perfectly validly. By comparison, our knowledge concerning the behavior of ions in real moist air (or in any other moist gas, such as the hydrogen from which stars are born) is comparable to that of a hypothetical eighteenth-century chemist who still believes in the reality of phlogiston and who tries to use the concept to make quantitative predictions.

At low temperatures, almost no one ever considers that there are, in principle, electrolytes *at equilibrium* in the air, or in steam at normal air temperatures. Such concentrations are always far too low to measure. But even if measurements were to be possible, the solutions would be so strongly sedimented on Earth that it would be nearly impossible to obtain direct information on the true equilibrium state for comparison with a conceivably valid new theory that realistically takes compressibility into account. The data illustrated in Figs. 1 and 2 were originally used to explain the need for new experimental studies as the CEGB's part in the so-called micro-gravity program of ESA (Turner, 1983).

The results of our first two experiments in sounding rockets (Turner, 1988a) merely confirmed that de-sedimentation does occur when the Earth's gravitational field is removed from supercritical steam solutions of common salt. They also showed that the rate of de-sedimentation was far too slow for any sounding rocket flight to reveal anything useful about the equilibrium state. Experiments in orbiting craft were obviously needed. Our third and final low gravity experiment measured near critical pressures (Turner, 1993) - in anticipation of such flights. However, by 1993, CERL had been closed, and no alternative source of support was found. Thus no *useful quantitative* data were ever obtained from the brief collaboration with ESA.

While the evidence from the work of Copeland, Silverman, and Benson (1954) and of Benson, Copeland, and Pearson (1954), as displayed in Fig 1, concerns the equilibrium state, other kinds of evidence that involved electrostriction had also been reported in much earlier investigations of ions in moist gases (Townsend, 1897a,b 1898; Thomson, 1906). By 1960, extremely large hydration numbers for atmospheric ions had been calculated from the transport properties of ions (Loeb, 1958). For example, ions classified in meteorological studies as "large" (of the order of 0.1 μm in diameter) can have hydration numbers up to $3 \cdot 10^8$.

Clues From Studies on Moist Ions

This crude separation of atmospheric ions into large and small have proved essential in most attempts to describe the electrical state of the atmosphere up to and into the stratosphere (Beard & Ochs, 1986; Levin & Tzur, 1986; Roble & Tzur, 1986). Naturally, several of these authors (among others) have understood the limited value of such approximations. It is obvious that most of what happens *chemically* with real atmospheric ions, whose hydration numbers lie between about 6 (where a few measurements have been made) and 10^9 , is *completely unknown*. It is in the context of this problem that several much earlier studies than those just mentioned are so revealing. Among the most important were those reported by von Helmholtz (1887), Planté (1888), von Helmholtz and Richarz (1890), and Townsend (1898), together with studies of Tyndall (1868), of Wilson (1897, 1899a, 1899b) and of Vincent 1904.

The much earlier experiments of Arden and Constable, described in the books of Priestley (1781) and Cavallo (1782), are also of considerable importance. However, many prominent physicists of the late 18th century tried, but totally failed, to reproduce these findings. A few other physicists later concluded that chemistry must be im-

portant in systems like these, but only the studies of von Helmholtz (1887) and von Helmholtz and Richarz (1890) *directly* demonstrated chemical effects due to the presence of ions. By the 1990s, it was becoming increasingly obvious that the missing science described here is largely responsible for our poor understanding of such rare natural plasmas as ball lightning (Turner, 1994, 2002). Similar conclusions were drawn for the larger relatives of ball lightning that include earth lights, tornadic lights, and UFOs (Turner, 1998, 2003; Teodorani, 2004). In the commonly used acronym, UFO, the word “unpredictable” now seems more appropriate than “unidentified” (Turner, 2023a).

My interest in the observations of Arden and Constable began to increase following a realization that our longstanding failures to address the problems of electrochemistry in the vapor phase might be responsible for their findings and for the total failures of others to reproduce them. The *most significant fact* is that Arden and Constable produced *the only two fully realistic simulations of ball lightning ever to have been created*. Crucial progress for me resulted when advice was sought from the Royal Society enquiring whether Constable had been a Fellow of the Society. In fact, he was, but it so happened that plans for opening his family home to the public were being made at the time of my inquiry. As a part of this project, Constable’s collection of science-related equipment was prepared for public display. I later learned (from Elizabeth Hall, who was researching the life of John Arden) that receipts for virtually all of Constable’s equipment had also survived.

The Deputy Librarian at the Royal Society, Alan Clark, kindly arranged for me to visit Constable’s home (Burton-Constable Hall in east Yorkshire) to see the collection. This seems to have included all the undamaged items that he (with Arden) would have been using when they produced their simulations of ball lightning. It appears that, in December 1757, Arden and Constable had performed two experiments, each of which they accidentally created a single, small, glowing ball of plasma (Priestley, 1781; Cavallo, 1782). The full account given in these books is now more readily available elsewhere (Turner, 2002).

Over the last three decades, I have spent thousands of hours conducting experiments that, in effect, were attempts to understand why it has proved so difficult to repeat the findings of Arden and Constable. These have employed experiments with different objectives, with systems of very different scales and designs, different materials of construction (and therefore different potential causes of chemical contamination), and employing different electric field strengths to produce sparks. Several of them taught me what seemed important lessons,

but none produced a simulation of ball lightning. The most important conclusion was that the observations of Arden and Constable were probably genuine and might eventually be repeatable and understandable. I also demonstrated that short-lived *spherical* plasma balls, with diameters as large as 1 cm, could be produced extremely rarely but *always unpredictably*.

Such balls were formed only three times out of many thousands of brief tests. They probably all had lifetimes of less than 0.02 sec., although this was only proved true (by cine-photography) in one case. Smaller *hemi-spherical* discharges could, however, be produced fairly *reproducibly* when air of very high humidity was maintained by arranging that the cathode comprised a vertical brass rod surrounded by wet filter paper. A coil of copper wire provided the anode, and it had a diameter somewhere between 20 and 30 mm. The copper wire itself had a diameter of 2 mm, and the anode that it surrounded was pointed with its tip roughly in the plane of the anode coil. Three examples of the short-duration hemispheres around the anode are shown in Fig. 3.

Because the voltages supplied by a van der Graaf generator are so high, no commercially available switches are available. Thus the sparks in all the tests had to be generated by bringing a large hollow metal sphere into contact with the sphere at the top of the van der Graaf generator. This process could not be replicated at all well. Consequently, the energy deposited during none of the tests is known. The brightness (and, to some extent, the shapes) of the discharges varied considerably, most having been considerably less bright and rather less symmetrical than those illustrated. The red color on the first spark illustrated is presumably a consequence of some contaminant on the cathode ring.

Apart from their short lives, the larger discharges of this kind resemble approximately half of the kind of lightning ball that typically seems to have formed in fairly clean environments. I was, therefore, somewhat surprised to discover that a lightning ball that had been recently witnessed by my mother looked, to her, very similar to the sort of spark shown in Fig 3. My initial surprise was caused by evidence that this ball had like many other reported lightning balls, been formed when a normal form of lightning hits some part of a tree. I later realized that because a lightning strike is so brief, there was probably too little time available for much apart from the surface moisture to combine with the components of the air and thus create the ball.

In the experiments of Arden and Constable, two plasma balls were formed during successive experiments inside large open-topped Leyden jars of nearly identical size, shape, and materials of construction. The tests were

being made to ensure that Constable's latest purchases operated satisfactorily. During the experiments, the balls destroyed the Leyden jars in which they had been formed, and they did this in very significant ways: circular holes were made in the glass jars, and they appeared to have had exactly the same diameter as the plasma balls. Unsurprisingly, the damaged jars are not in the collection but the machine used to charge them almost certainly is. This was only described in Arden's letter to Priestley as "a very good electrical machine". (technically needs citation and page number) Constable had possessed several of these. In fact, the actual device used in the experiments does not matter.

The detailed records of Constable's purchases might possibly clarify which of the machines could have been used in the experiments, but this is immaterial to the following arguments since the ways in which the machines were connected to the Leyden jar would have been virtually identical. Smaller items from the collection that date from the same period also still exist. Importantly, these include chains of the type that would have been used to connect any of the electrical machines to the inside of the Leyden jars inside which the air plasma balls were produced. The most noteworthy aspect of the two preparations was that they *immediately* followed one another and that preparations could not be repeated after that.

Simply seeing the actual objects that must have been used made it clear that it would have been very easy to replace the first damaged jar with the second one *without any disturbance to most of the heavy brass chain*. Its thick links would likely have been covered with a layer of oxide (naturally much thinner than they are now). If there had been some thin solid (possibly an oxide or sulfide) holding two links very slightly apart, and if the relevant part of the chain was not disturbed when the first jar was replaced, it seems likely that the spacing between the two links of the chain was identical for the two successive experiments. It may also be that the composition of the very thin solid separating them and the chemical composition and humidity of the air inside the jars happened to be optimal for the formation of lightning balls. I have assumed this to be the case ever since the equipment that Arden and Constable actually used was examined.

I never found any means for consistently increasing the size or duration of the small discharges shown in Fig 3, or of causing them to move away from where they were formed. The reason that any experiments of this kind were performed was that they seemed directly relevant to one of the ways in which lightning balls have been reliably observed to form. Once a spherical form of corona discharge, usually identified as St. Elmo's fire, has become reasonably stable, it has repeatedly, though

very rarely, been reported suddenly to free itself from the electrical conductor to which it was attached. Only a very small fraction of the sightings of ball lightning have described its actual birth, and among the clearest of these was the conversion of a spherical form of St Elmo's fire into lightning balls. These spherical forms of the "fire" can be thought of as tethered lightning balls.

On the Creation of Lightning Balls

So far, attention has concentrated on those areas of neglected science, whose neglect seems to be responsible for our long-term difficulties in understanding the strange characteristics of ball lightning. As will be shown in detail elsewhere (Turner, 2023a), lightning balls seem to be the building blocks of air plasmas with even more extraordinary characteristics than those of ball lightning itself. My basic ball lightning model (Turner, 1994) resulted mainly from improvements to Stakhanov's (1979) basically electrochemical model. This was the first model that seriously attempted to explain *all* of the confusing properties of lightning balls. The improvements also required a slowly increasing appreciation of problems raised by the limitations of the missing science referred to earlier.

One of the most detailed examples of the formation of lightning balls was described by Mattéat (1895). It will be briefly summarized once an important matter concerning St Elmo's fire has been addressed. Originally, the name was given to a phenomenon that used to be fairly commonly reported on the wooden masts and rigging of sailing ships (during thunderstorms) *before* the invention of lightning rods in the 18th century. Apart from one engraving in a popular meteorology book (Flammarion, 1888), I have rarely seen a picture purporting to be of St. Elmo's fire that does *not* show a thin electrical discharge pointing vertically upwards into the air.

However, a picture of what may have been more typical on very early ships can also be found on the website of ScienceFacts (2021, <https://www.sciencefacts.net/st-elmos-fire.html>). The difference in shape presumably arises from very different current flow.

It is difficult to believe that anyone would ever have referred to thin vertical corona discharges either as "fire" or used the alternative name of "corposant", which means *body of a saint*. Most current illustrations of the phenomenon show these thin pointed discharges, and they seem to have been first published in the mid-19th century. By this time, most ships would have been fitted with lightning rods of some kind. The point of these comments is that nearly all books on ball lightning state *categorically* that St Elmo's fire and ball lightning are quite different phenomena. Some of my reasons for believing otherwise

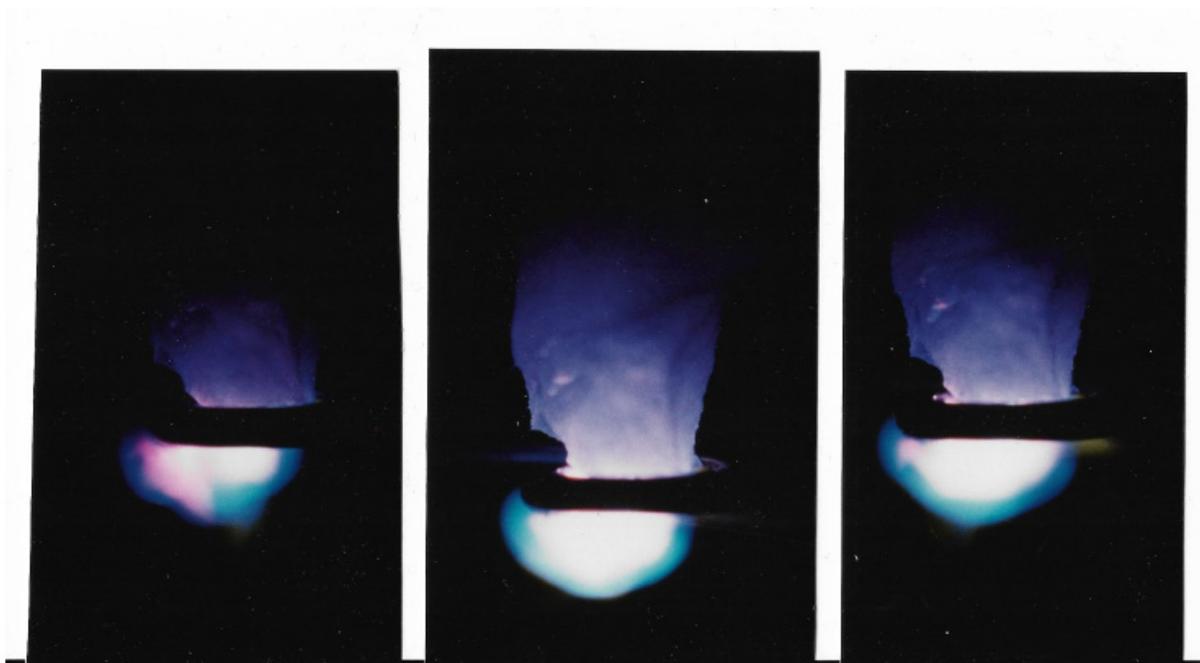


Figure 3: Three hemispherical discharges in very humid air. The sparks were produced using a small van der Graaf generator whose energy was discharged as efficiently as possible through the spark gap. This comprised a vertical anode and a horizontal copper coil surrounding it. The examples are three of the most powerful sparks obtained.

will now be illustrated.

The transformation witnessed by Mattéat (1895) occurred on the rooftop of a house, easily seen from the upper story window through which he was watching a prolonged and violent thunderstorm. He saw a “ball of fire” attached to an iron rod that supported a telegraph cable. The ball was expelling sparks downwards that resembled those produced when a power hammer is shaping a lump of white-hot steel. After about 40 to 50 seconds, the ball suddenly split into three smaller balls (each about the size of a child’s balloon) which left the iron rod, fell to the roof, and then rolled down it. They produced no sparks until just before their demise when they had reached the gutter and, a few moments later, vanished (without exploding). Almost immediately, a second plasma ball formed in the same way at the end of the same rod. It seemed to behave similarly at first but only lasted two or three seconds before it simply disappeared without leaving the rod.

The characteristics described for these plasma balls leave little doubt that the ones which rolled down the roof were typical lightning balls or that the large corona discharges at the top of the iron rod would have been called St. Elmo’s fire (though in a roughly spherical form) by many current physicists.

Mainly on the basis of this clear description, and similar less detailed ones, provisional approval, at CERL, was

given for an attempt to reproduce the phenomena that Mattéat had observed. It was agreed that there were to be at least two days of experiments and that they would be carried out at the facilities of the High Voltage Laboratory. This was, at the time of the proposal, still part of CERL. However, when the time came for the tests, the company was in the process of being split up in preparation for privatization, and I, having been “allowed” to retire early, was in the process of moving temporarily to Bristol University to complete the collaboration with ESA.

Obtaining approval for the proposal (Turner, 1988b) and assembling the required hardware took several months. By the time of the planned experiments, the High Voltage Laboratory (recently transferred to the National Grid Company) was owned by a different company from CERL (then a part of National Power). However, relations between the two companies were becoming increasingly complicated, and I was about to leave for Bristol. For these reasons, and for others to be described shortly, only one day of experiments was ever actually conducted. It should be explained that some lightning engineers have long been interested in ball lightning (e.g., Uman, 1984).

These balls have been reported ever since they were claimed to be thrown by the gods (Singer, 1971), but the main concern of physicists and engineers now is the connection between the *physics* of normal lightning and ball lightning - not the relatively minor damage that lightning

balls normally inflict. Although it is very rare for lightning balls to do serious harm to electric power transmission systems, damage has occasionally been reported, and several individuals transferred to the new National Grid Company were already interested in ball lightning.

When studies on ball lightning were first proposed (Turner, 1988b), the main justification had been in terms of what could be learned about the interactions between ions and water molecules. Although it was obvious that ball lightning studies might *eventually* lead to a new, plentiful source of carbon-free energy, it was equally clear - *from centuries of failed attempts to create artificial ball lightning* - that numerous questions needed answering if practical use of air plasmas was ever to be made.

A brief summary of the experiments needs to be provided here because the outcome influenced most of my interests after the collaboration with ESA came to an end, along with all hope for support for the basic electrochemical studies. The power supply used at the High Voltage Laboratory was a Cockroft-Walton four-stage voltage multiplier. For our experiments, it was decided to use a potential difference of up to 543 kV d.c. across a 1-meter spark gap. The current (of a few mA) was controlled by a large, high-purity water resistor that had much earlier been constructed in-house. The voltage could be varied during an experiment, as could the electrode separation.

The cathode consisted of a smooth hemispherical conductor suspended directly over an anode assembly that comprised two parts. In most experiments, a pointed central steel rod was surrounded by, and electrically connected to, a circular dish-shaped mesh of steel having a diameter of 1.2 m. The anode assembly was located partly in, but mostly above, a pool of warm, temperature-controlled, water through which a rapid flow of air could be bubbled through multiple nozzles. The purpose of the dish-shaped mesh was mainly to provide a healthy positive space charge between the electrodes before air breakdown was initiated (by increasing the field) but also to provide electrostatic stability to any ball that might be released from the anode tip.

High humidity in the air between the electrodes was maintained by enclosing the whole assembly within a humidified, wood-framed, chamber that was cube-shaped (with 4 m edges) and covered with sheets of polyethylene. This provided a relative humidity close to 100 % at the anode level. The relative humidity was probably also close to 100 % over much of the volume between the anode and cathode. The containment chamber had been constructed for and was kindly loaned by Dr. N.L. Allan of Leeds University. The mesh position was fixed, but the height of the central rod was remotely controlled hydraulically. Video cameras, operating at different wave-

lengths, recorded events near the anode and were placed inside the humidified enclosure. The voltages and hydraulics etc. were controlled from different positions, but it so happened that no one could see the cathode region during an experiment.

The most informative test was the 9th of 10 experiments performed that day and was the only one which did not use a steel rod as part of the anode. The first eight tests showed normal coronal glows and discharges at the tip of the pointed steel anode just prior to air breakdown, as the field was slowly increased. These glows were only a few mm in diameter, but their size depended reproducibly on the mean field strength. For the 9th experiment, a thick-walled, porous ceramic tube was substituted for the steel rod, and, on top of it was placed a piece of wet paper towel (roughly 12 mm per side) draped over the top of the tube. It was hoped that this might simulate the moist wood that is believed to be one of the most common supports for St. Elmo's fire in its spherical form.

The behavior in experiment 9 was totally different from all those observed with the metal rod. As the field was gradually increased, two bright spots were first observed on the paper and then what looked exactly like flames started to lap the whole length (about 15 cm) of the ceramic tube. My immediate reaction was that this behavior was clearly responsible for the name St. Elmo's fire and that, under slightly different conditions, a spherical plasma might well form at the top of the ceramic tube. However, the engineers in charge had become very concerned over some large and *completely unexpected* changes in voltage which could not immediately be explained. Nothing like them had ever been observed in years of previous experimentation.

As a result, it was decided to give the engineers running the experiment a little more time to consider the possible causes of the strange voltage behavior and that we should therefore delay further experiments with the ceramic tube until the following day. Since there was still time for one more test, the last one reverted to the use of a steel anode. There were two main differences from experiments 1 to 8. One was that, instead of using a sharp tip, a smooth metal ball was fixed to the top of the rod. The other was that the probably over-cautious limit of 543 kV was relaxed somewhat. Although it was clear that the quantity of water condensed on the polyethylene inside the enclosure had been increasing all day, no new risk from that cause was foreseen.

As the voltage was increased between 180 and 200 kV, a brush discharge started to surround the ball, the origins of the separate discharges being droplets of water on the ball. This is apparently normal in the period before a smooth metal surface has "conditioned itself". By

the time the voltage had reached 543 kV the discharges had become much larger, but they were still nothing like those witnessed by Mattéol (1895). It was then decided to apply a voltage a little above the pre-agreed maximum, in practice to a little above 600 kV. The electrical breakdown between the *cathode and the containment* chamber occurred almost immediately, and the latter burnt down. No one could explain exactly what happened since, during the test, no one present could see the cathode region where the breakdown occurred.

The breakdown probably resulted from the presence of a much larger than normal space charge, consisting of heavily hydrated protons, that had formed between the electrodes. Townsend (1897a,b,1898) had, nearly a century earlier, showed how very easy it is to move very large hydrated ions in a flow of moist gas. Later it was realized that the accident was probably somehow the result of forming the large space charge. The ions present were carried upwards with the water-saturated air (delivered through the anode mesh).

This positive charge would have slowly moved upwards and could have helped cause the breakdown (as well as the voltage anomalies of the previous experiment). The breakdown does not, of course, mean that the discharge resembled a short-lived lightning ball - although this might have been the case. We had such possibilities in mind for the next day's experiments but, clearly, the destruction of the containment chamber would cause delays.

The long-term objective had obviously been to learn how to simulate ball lightning. Clearly, the electrical breakdown at the cathode *might* have resulted from an early stage of forming a lightning ball. Hence the delay made necessary by the accident was initially seen as a potential *advantage* in that we had time to revise our detailed plans for the second day's experiments. Unfortunately, although the next few months were used to prepare a variety of new anode designs, it never proved possible to arrange the implementation of the revised plans.

This was partly due to the very preliminary status of our results on the first day of experimentation and partly to the ongoing management changes arising in the two companies involved. My absence in Bristol and at the launch site of the sounding rocket clearly made matters worse. Nevertheless, what was learned during that single day of high-voltage experiments largely determined my later scientific interests - once it had become clear that gravity-free studies of the missing electrochemistry were unlikely to be supported.

These experiments had obviously been a digression from our main concerns which were the studies we had

begun in collaboration with ESA. This work appeared to be needed by the industry, but it was unavoidably slow and boringly mundane in its objectives - at least compared with speculations on how to prepare artificial lightning balls. It was fully realized that anyone attempting such a preparation would be defying 240 years of failed attempts (see e.g. Singer, 1971; Barry, 1980). Thus, only attempts to *understand* a little more about the processes that can stabilize lightning balls seemed worth pursuing.

In this connection, a great deal was learned while at Bristol through reading some of the neglected 19th-century physics literature and from simple experiments I was encouraged to undertake during vacation periods in a teaching laboratory of the Physics Department. These experiments were designed to follow up on those that had been conducted in the High Voltage Laboratory at CERL. One important hint, obtained during the tests at CERL, implied that the large currents provided at any high-voltage testing facility might not be needed; in fact, they could be a disadvantage - in addition to the very constraining safety issues involved.

At this time, there seemed to be strongly conflicting evidence on how much current is needed to form a lightning ball. The birth witnessed by Mattéol (1895) was at one extreme while at the other was a case where a much more feeble ball was produced in the air immediately below the downward pointing finger of someone who was indoors and standing on a rug (Humphreys, 1937). Humphreys was, like many other physicists, very skeptical of even the existence of ball lightning, but he included this example in his summary of some of the 280 replies he had received in response to his request for claimed ball lightning sightings. He also referred to a much more typical account provided by the eminent physicist Leonard Loeb. It now seems clear that vastly different currents can feed a lightning ball because most of the energy needed to *support such a plasma*, once it has formed, is *chemical* and not electrical. In principle, ball lightning initiation resembles the lighting of a flame in that the process of igniting the flame has nothing to do with the chemistry of the fuel-burning processes that support it once it has formed.

Although it was not clear, at the time I left CERL for Bristol, that further experiments at the High Voltage Laboratory would prove impossible, from that time on, I started to take advantage of any available opportunity to work with very much smaller currents. Many hundreds of tests were carried out in the Physics teaching laboratory at Bristol (including those that produced discharges shown in Fig.3). Later on, hundreds more simple tests were undertaken at two different homes in the USA. These tests made use of a gradually increasing collection of instruments, tools, and materials.

OTHER STUDIES AND SOME IMPLICATIONS FROM THEM

Experiments from the 19th Century

Mention should be made of a set of completely different kinds of experiments, the first ones having been undertaken at the end of the 19th century. Any of them might be worth following up using more modern techniques than were available at that time. These were some of the early experiments of Townsend (1897a,b, 1898) in which he reported on the electrical properties of the gases released during the electrolysis of solutions of H₂SO₄ and KOH. In the second paper, he also reported briefly on the electrolysis of HCl solutions, but the results were so greatly complicated by the presence of chlorine gas that no useful conclusions could be drawn. The electrolysis cell normally reached temperatures in excess of 40° C by the end of an experiment. In his first two papers, Townsend (1897a,b) established that many of the gases produced by electrolysis carry with them significant electric charges. Most of the charge is maintained within these gases even after passing them through glass wool to remove any liquid spray carried with the gases and then bubbling them through a series of flasks containing various solutions - or pure water. For these experiments, short "tunnels" of paraffin wax were provided to insulate the electrolysis cell from the electric charge measuring region. In this region, the flasks were insulated from their surroundings using blocks of paraffin, and an earthed metal screen was provided.

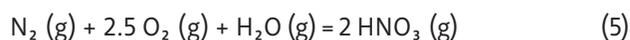
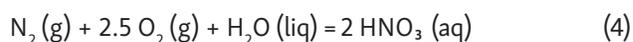
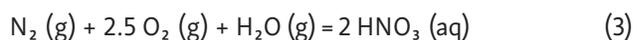
The vessels could be weighed before and after the passage of known quantities of charged gas so that the water content of the clouds and the charges on them could be determined. The temperature of the first vessel, through which the gases passed, could be cooled to temperatures between 0 and 15° C (Townsend, 1898). It was found that any hydrated ions carried with the gases could be *rapidly and reversibly* de-hydrated and re-hydrated and that in some experiments, *but not all*, the gases released by electrolysis rapidly formed clouds when they were bubbled through pure water. Condensation was found to be possible *only* if the gases were electrically charged (not all were). In other words, the electrolytically produced gases must have contained the kinds of aerosol that meteorologists now usually refer to either as charged Aitken nuclei or large ions.

One important implication of the last paragraph is that at least some of Townsend's experiments had *failed* to produce ions in the gases released during electrolysis. No result for the electrolysis of *nitric acid* was reported. Both Townsend and Wilson shared an interest in atmo-

spheric processes. It was therefore surprising to note that the electrolysis of nitric acid was not even mentioned in any of Townsend's studies. It is probable that the electrolysis of nitric acid *was in fact* studied but that it failed to produce charged clouds. Such a failure would not now be thought surprising since we now know that nitric acid *in the gas phase* is thermodynamically unstable (see Fig.4) with respect to the components of the air at the temperatures rapidly reached in Townsend's electrolysis cell.

This can be seen using available thermodynamic data on nitric acid formation from the principal components of the air. Fig. 4 illustrates the three most favorable Gibbs free energies of formation, for these reactions, as a function of temperature.

Since nitric acid might be formed from water in either the gas phase (g) or in an aerosol (liq) and the product can be either gaseous (g) nitric acid or an aerosol (aq) containing the acid, there are four reactions which, in principle, can lead to its production in the air. The Gibbs free energies of the three most favorable of these reactions are shown in Fig 4, the necessary data having been obtained from the tables of Wagman et al. (1982). The three lines in the figure refer to the following reactions:



Since these reactions could only proceed if they were to lower the Gibbs free energy of the system, it is clear from Fig. 4 that neither Reactions 4 nor 5 can produce nitric acid at any temperature. Very significantly, even Reaction 3 (which forms the aqueous acid from the three gaseous reactants in the air) is thermodynamically possible only at temperatures *below* 15° C.

Each of the reactions whose free energies are represented in Fig. 4 has an associated enthalpy which is given by the identity

$$\Delta G_0 = \Delta H_0 - T \Delta S_0$$

Here ΔG_0 , ΔH_0 , and ΔS_0 are, respectively, the standard Gibbs free energy, enthalpy, and entropy of the process, and T is the temperature. The enthalpies represent the quantities of heat that would be released *if* the reactions could be made to occur with each component in its standard state. They are somewhat temperature dependent but, for example at 10° C, they would be -168.2, -123.6, and -27.9 kJ.mol⁻¹ for Reactions 3, 4, and 5, respectively - again based on the NBS tables (Wagman et al., 1982). In

other words, the major chemical components of the air contain energy, but only Reaction 3 *can* proceed and release it.

It is clear that the above arguments refer to the reactions proceeding from left to right. At first sight, they say nothing about the reverse reactions, which would be the ones of practical importance in Townsend's electrolysis experiments. However, the energies involved do seem to be relevant even in this case. This is because, in an electrolysis cell that has a tendency to produce ions in the gases released at the electrodes, any ions formed will have very high energies and so would normally lead to a fairly *rapid approach to the equilibrium state*. Clearly, this does *not* favor the formation of nitric acid. In fact, Reaction 3 is very much more important in the context of ball lightning stability than it is in explaining why Townsend probably failed to obtain charged gases in his electrolysis experiments. Reaction 3 is only able to proceed because it can liberate heat (locally), and this heat is, in principle, capable of being transformed into more useful forms of energy, such as electrical energy or mechanical work. As was shown in my first paper on ball lightning (Turner, 1994), the air surface next to an air plasma needs to be initially refrigerated through the formation of a different oxyacid of nitrogen, nitrous acid which has to occur first. Part of the difficulty in producing long-lived lightning balls undoubtedly results from the need to establish a region around the plasma in which a strongly endothermic (heat removing) reaction, producing nitrous acid, is in very close proximity to an exothermic one producing nitric acid (Turner, 1997).

Whether or not the electrolysis of nitric acid was actually undertaken in Townsend's studies, a repeat and extension of his work should at least confirm that no charges are produced during the electrolysis of nitric acid solutions. It might also provide a way of discovering a little more about vapor phase electrochemistry - though vastly less than would have been likely from experiments on the International Space Station - as had once been expected. New studies like Townsend's are, however, unlikely to reveal very much more about nitrogen chemistry except, possibly, to confirm that the electrolysis of nitric acid liberates no charged gases.

More Recent Meteorological Studies

With respect to the ball lightning study, there are three very important implications from the data displayed in Fig. 4 and from the reactions which they represent. One concerns the fact that the oxidation of N_2 to nitric acid can only arise through Reaction 3; the second is that this reaction is only possible if the temperature is

below about $15^\circ C$; the third is that this reaction results in a significant *reduction in the number of particles* when it occurs (making 2 moles of the acid from 4.5 moles of the reactant gases). The reaction thus produces an inflow of air toward the reaction site at the surface of the plasma (Turner, 1994).

It should be noted that sites where Reaction 3 is possible *are not limited* to the surfaces of air plasmas. It is well known that nitric acid is present in clouds (Seinfeld & Pandis, 2006) and, as suggested decades ago (Turner, 1998), what might distinguish cumulus clouds, with their sharply defined edges, from other clouds is that, in them, there could be a more than usually rapid inflow of air - producing nitric acid through Reaction 3.

In principle, Reaction 3 can occur anywhere in the atmosphere where the temperature is below about $15^\circ C$, and this is true of practically all of the air in the troposphere above the Earth's surface (Seinfeld & Pandis, 2006). The endothermic (cooling) reactions that produce nitrous acid (Turner, 1994) can, probably only occur in the presence of sufficiently energetic electromagnetic radiation, or where population inversions are present. One cannot help wondering whether it is only a coincidence that the mean temperature of the Earth is so close to $15^\circ C$. Over the last 150 years, it had been close to $14^\circ C$ (Jones et al., 1999), while it was already about $0.5^\circ C$ above this by 2006 (Seinfeld & Pandis, 2006). Could it be that there is a direct connection between the thermodynamics of Reaction 3 and the much-feared tipping point for the climate? If air temperatures on Earth rise much above the current estimate for the maximum safe value, we might well be closer than we thought to beginning an *unstoppable* change towards an almost totally ice-free world.

Investigations of a Tornadic Storm

Shortly after arriving in the USA, I was invited to give a talk on ball lightning at the Naval Research Laboratory (NRL) in Washington, DC. A few days later, Graham Hubler, who had long been interested in ball lightning, but who was unable to attend my talk, began to plan for a collaboration with me on the subject. Unfortunately, a few months after that, the terrorist attack of September 11th took place. As a consequence, the NRL formally decided that it would only support new projects if they were terrorism-related. Thus our plan was never implemented. However, an event intervened before this decision had been made, which resulted in a single measurement being obtained at NRL that I firmly believed (and still do) was directly related to air plasma chemistry.

The measurement made at the NRL was of the mean concentration of nitric acid in a single large hailstone. This

hailstone was one of many I had collected when a tornadic storm passed fairly close to our house. The residents who had collected the hailstones were only too happy to offer them when they were assured (mistakenly, as it transpired) that they would be used in a detailed research project of the NRL.

The hailstones were obtained in the first place because I had previously found evidence (Turner, 1998) that some tornadic storms contain glowing air plasmas and because this particular storm appeared to be one of them. More details of the event and its study are described at <https://naturalplasmas.com/>.

The most important findings, summarized below, resulted from gradually melting three of the largest stones, as symmetrically as possible, from the outside toward the center and collecting samples of the melt-water during the process. The samples were then taken to the Chesapeake Biological Laboratory for chemical analysis of the anions present. Apart from the first few and the very last samples collected (where contamination from contact with the ground and from the initial hailstone nucleus might be expected), the analyses showed a remarkably consistent pattern of nitrate concentrations. They also showed the complete absence of nitrites, while chloride and sulfate concentrations varied greatly (*over many orders of magnitude*) with radius.

Large oxidation potentials were also observed, and they were found to be almost totally uncorrelated with nitrate levels. Apart from one fraction, taken from the center of one hailstone, all the potentials were very high. These results are summarized in Table 1. The table shows the nitrate concentrations and oxidation potentials found in the seven hailstones examined, together with similar results for distilled water and one nitrate analysis (HW) of rain which had accompanied the remnants of a hurricane. This had passed through the local area a few months after the tornadic storm.

The three samples identified as average (av) in Table 1 were those whose nitrate dependence on radial distance from the center is illustrated in Fig 5. The information on the locations from which the hailstones had been collected is only approximate, but it seems clear that the largest came from nearest to the center of the storm's path. This is to be expected from the findings of Browning and Foote (1976) on an apparently very similar supercell storm.

Much debris is always present in very large hailstones (see, e.g., Mason, 1971), and in our samples, grass was a major component. By the time the first hailstone was melted, the color of the grass had faded somewhat. It was distributed randomly through the hailstones so that the absence of a correlation between oxidation potential and nitrate levels is readily understood, with most organ-

ic materials (and any ammonium salts) being easily oxidized. It may be that the similarity in structure between water and hydrogen peroxide allowed a considerable quantity of this oxidizing agent to form a solid solution.

That slow reactions were occurring in the solid ice was confirmed 44 months after the first analyses, when two hitherto unexamined hailstones (MJ and SM3) were found to possess significantly reduced oxidation potentials. Also, the grass had lost even more of its color. Clearly, no correlation between nitrate levels and oxidation potentials should have been expected. The one exceptionally low oxidation potential was for the sample that had the atypically high nitrate concentration. This hailstone presumably had a particularly contaminated nucleus - possibly due to the presence in it of some originally solid ammonium salt (whose dissolution and oxidation would have reduced the sample's oxidation potential).

An important point, shown in Fig. 5, concerns the remarkably similar nitrate levels found throughout most of each hailstone. When hailstones are sliced and examined, it seems they always possess a clearly banded structure in which clear ice and cloudy ice alternate. This is believed to result from freezing at two very different temperatures (see, e.g., Mason, 1971). Presumably, the hailstones under consideration had passed through air that differed considerably in temperature but not very much in nitric acid concentration. In other words, the temperature gradient around the group of plasma balls was probably larger than the concentration gradient.

If, as is believed to be the case, the banded structures of our large hailstones were formed by the stones' passage through air close to a group of plasmas, the structures would have been the result of some kind of elliptical motion around the plasmas that had a significant component of their axes in the horizontal plane (Browning & Foote, 1976). If, as was also probably the case, the hailstones did not rotate very rapidly in the air near the plasmas, it would be expected that each spherical shell of melted ice would contain different levels of nitric acid around its circumference. For this reason, even if each pass of a hailstone near the plasmas was at an identical distance from them, the nitrate levels would not be expected to be identical. Clearly, they were not identical though they were very similar.

It is obviously very significant that *only* nitrates showed a smooth dependence on sample number (which represents the inverse of the radius), while chloride and sulfate varied by orders of magnitude. Taken together, the results imply that the nitric acid had formed from the air. The finding that all the samples were strongly oxidizing strongly supports the expectation (Turner, 1998) that some oxidizing agent was being produced just outside an

air plasma. Only oxidation reactions are likely to be induced by UV radiation in the air.

The only cation present in the cleaner parts of the ice will have been the H_3O^+ ion since no other cations can be formed from the air under oxidizing conditions. The absence of nitrites is, of course, fully consistent with the strongly oxidizing environment indicated by the oxidation potentials. In more usual kinds of meteorological investigations, low levels of nitrates, at roughly half the concentration listed for HW, are nearly always detected in rain and snow (Mason, 1971). In the samples from the three largest hailstones examined, the nitrate levels were at least twice as high as those in the hurricane sample (HW in Table 1).

The high levels of oxidizing agents support the claim that the stones were produced close to the plasma or plasmas that were known to be present (from several

sightings of the huge supercell cloud) somewhere deep inside the cloud. There is no obvious alternative to oxidation induced by the UV from an air plasma that can explain such high oxidation potentials or the surprisingly unchanging nitrate levels as a function of radius. It seems (Turner, 2023a) that the hailstones had been circulating around the plasma, their centripetal force being largely balanced by an inflowing wind. It is difficult to think of any explanation for the results provided in Fig 5 and Table 1 other than that oxidation of nitrogen to nitric acid was occurring somewhere close to an air plasma. This plasma would have been producing high-energy UV as a result of charge neutralization within the plasma.

Experiments on UV Produced Oxidation

A likely role for nitrogen oxidation by the kind of high energy UV that can be emitted from an air plasma has been

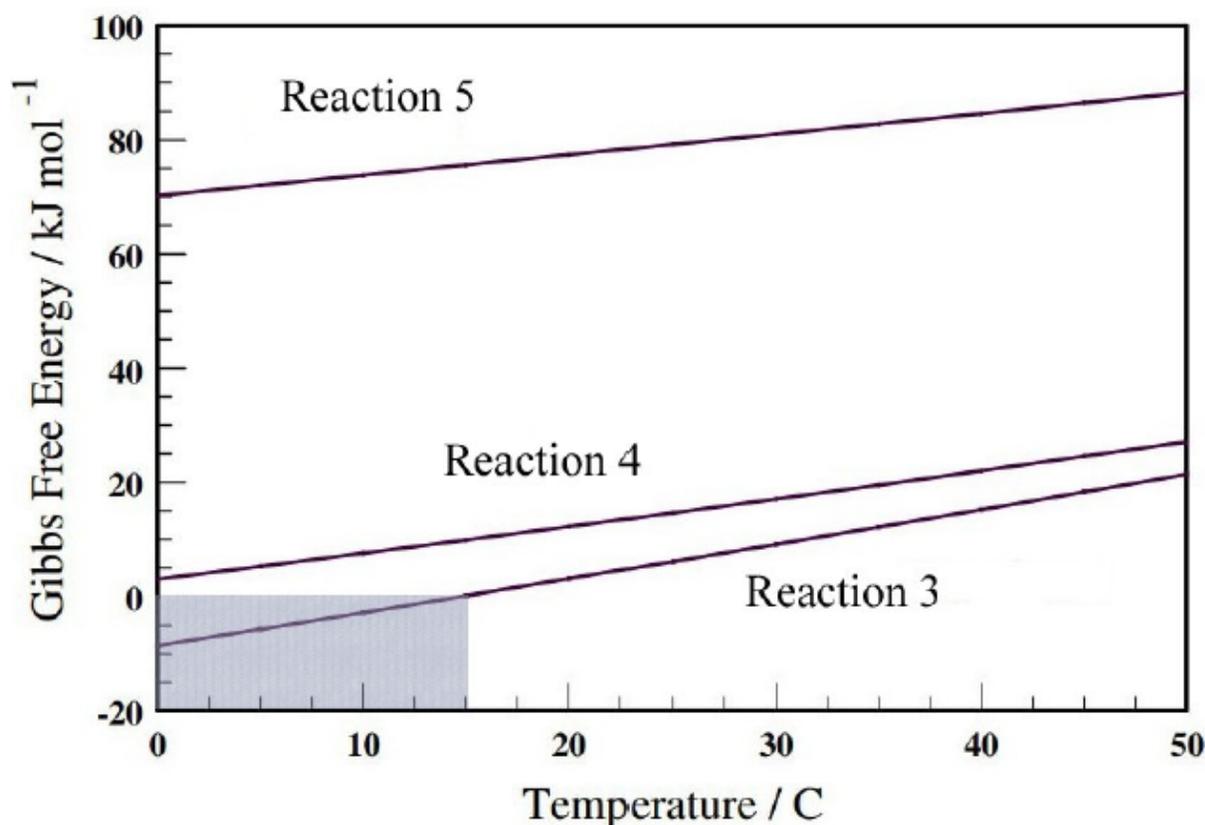


Figure 4: Standard free energies for the formation of nitric acid from the components of the air. The reaction numbers close to the three lines refer to the reactions listed in the text. Since reaction-free energy needs to be negative for the reaction to be possible, the only reaction of the three possibly concerned is Reaction 3, and even this one is only possible at temperatures below 15 °C. Only reactions with free energies within the shaded area are thermodynamically possible.

investigated much more recently. Here, only conclusions relevant to the present context will be discussed. We were attempting to repeat some findings of C.T.R. Wilson (1899a) that have been almost completely neglected for over a century. They involved the irradiation, by UV light, of water-saturated air that had been completely freed from dust particles.

Among these long-forgotten observations was a finding that condensation can be produced following prolonged exposure to UV radiation *at relative humidities near 90%*. This finding contradicts a *claimed fact* that is assumed in all current condensation models and meteorology textbooks: that *at least 100%* relative humidity is required before condensation is possible. Wilson had used zinc and cadmium arcs as sources of UV, and the aerosols produced had been shown to take approximately half an hour of exposure to grow to a size that was detectable by light scattering. However, our experiments with zinc arcs all failed completely to produce condensation in air at even 100% relative humidity and even if exposed to UV for an hour. The many possible reasons for this failure are not relevant here, but an accidental consequence of our attempts to understand the failure certainly is.

During these investigations, a miniature mercury vapor lamp was placed very close to the silica lens we were using to admit the UV to our cell. The electric power driving this lamp is minute compared with that driving the zinc arcs; thus we were amazed when the lamp was accidentally switched on and clouds were formed in the cell within minutes. Confusion reigned for several months since there seemed to be no combination of components or their relative positions that consistently predicted whether or not mists would form.

It was eventually noticed that a significant fraction of the anti-reflection coating on *one* lens had disappeared, and it became clear that this was the *only* component that had allowed mists to form. The coating had been partially removed in an earlier experiment where dilute hydrochloric acid had replaced the distilled water normally used. The coatings permit very low reflection losses above a wavelength of 200 nm, and I purchased only lenses and windows that were coated. The only *specified* wavelength of the mercury vapor lamp was 253.6 nm, so there seemed no obvious explanation for why this line produced mists so rarely.

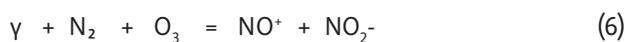
It was only when it was realized that mercury also possesses an emission line at 185 nm that any sense could be made of our accumulated observations. Once this had been appreciated, all the experiments made perfect sense. Removal of the coatings on the other components and the purchase of new uncoated ones demonstrated that, while some “pure” silica absorbs some of the

185 nm line, fairly thin silica components do not usually absorb very much. Significantly, we easily confirmed condensation at relative humidities below 90 % - in confirmation of what Wilson (1899a) had claimed. This 185 nm line of mercury lies well into the so-called UVC region of the spectrum, where air absorbs virtually all of the radiation. Hence this line could not have produced the mists that Wilson observed, fairly long path lengths having been used in his experiments.

The only stable ions in any experiment *before hydration* are likely to be NO^+ and NO_2^- (see Appendix C: https://naturalplasmas.com/files/VPE1_AppendixC). As we shall see, there is every reason to believe that these ions were formed in air that had been irradiated using the mercury vapor lamp. Of course, the detailed ion-forming *processes* in our experiments can hardly be the same as those that produced ions in Wilson’s experiments or presumably those that can form near the surface of a lightning ball. Nevertheless, the dry ions formed will be the same in all three cases because they are believed to be easily the most stable ones that are at all likely to be present (very briefly before hydration) in the air.

In cool, moist air, long-lived molecules of increased energy content, such as ozone, nitrogen oxides, and active nitrogen, are all likely intermediates in forming the ions that would have been responsible for Wilson’s findings. Very many lines in the UV will have been present in these experiments, and, almost certainly, some extremely complex chemistry must have been involved.

Fortunately, with mercury vapor emission, the system is much simpler, there being only two high-energy emission lines that could be important. The use of thermodynamic tables and conversion of wavelengths of these two lines into energy units readily shows that neither line of mercury can produce ionization in air from a *single* photon. However, among the likely intermediates involved, ozone is known to have a particularly long lifetime and it is also well known (by those dealing with health matters) to be produced from the 185 nm line of mercury. This suggested that the reaction:



could be important in ionizing the air. Here $\tilde{\gamma}$ formally represents a mole of photons, and all the chemical species are taken to be in the gas phase. As previously mentioned (and shown in Appendix C) NO^+ and NO_2^- are the only really likely ions to be formed from any of the main components of dry air. Reaction 6 is, of course, a more than usually symbolic process because the photon is traveling at the speed of light and so cannot be at equilibrium. Free energies clearly cannot be usefully compared, but enthal-

Table 1. Mean Properties and Locations of Hailstones from the La Plata Storm.

Hailstone Identifier	Hailstone Mass/g	Mean [NO ³⁻] ng N. g ⁻¹	Oxid'n Potential mV	Distance from La Plata / km.	Distance from storm path / km.
SS4b	5.63	72	232	-3.9	9.2
SS5b	10.61	77	213	-3.9	9.2
MJ (av.)	48.85	87.4	207	-1.9	2.7
JA4b	10.43	62	232	5.5	9.0
MO1b	13.28	65	197	8.7	8.5
SM2 (av.)	52.04	106.9	234	21.1	2.6
SM3 (av.)	44-97	86.7	205	21.1	2.6
Water	-	0	168	-	-
HW	-	40	-	-	-

pies can.

Both ions produced will rapidly become hydrated, but NO⁺ will be changed to H₃O⁺ during the process of hydration (Turner, 1994). However, the dry ions would need to be formed first. Reaction 6 appears to be uniquely important. This can be seen by adding (algebraically) the standard enthalpies of formation for the chemical species involved in the reaction. These values are 0, +142.674, +990.185, and - 202.715, respectively, for N₂, O₃, NO⁺, and N₂O⁻ according to the JANAF tables (Chase et al., 1985). The algebraic sum of these formation enthalpies is 644.8 kJmol⁻¹.

When converted to a wavelength, this energy is 185.5nm which is remarkably close to the wavelength of the more energetic mercury lines (184.9 nm). In all probability, the uncertainties in the tabulated data mean that Reaction 6 could equally well have indicated that the reaction was supplied with just too little energy.

Nevertheless, in view of the huge spread of the input enthalpies in the calculation of the energy needed, it is almost impossible to believe that the close similarity in the two wavelengths is a coincidence.

In providing photons of a single very high energy, we seem to have been extremely fortunate, not only in that the energies involved were so revealing but also that *our initial efforts to form mists all failed* and that a mercury vapor lamp happened to be at hand and then inadvertently switched on. This precise matching of the required energy to that from the mercury arc is presumably why, despite the low electrical power needed to run the mercury lamp

and the low intrinsic power of the 185nm line (compared with that specified at 253.6nm), the mercury lamp still produced clouds significantly more rapidly than did Wilson's arcs.

IMPLICATIONS AND APPLICATIONS

Historical Matters

Possibly the most important general conclusions, from the evidence assembled here, concern the *reasons* for our current, very limited, understanding of vapor phase electrochemistry. The reasons do not seem to be primarily scientific. In part, they have resulted from the order in which important discoveries happened to be made. One important matter arising from several of the studies discussed is why it has taken so long for some 19th-century findings to be repeated. A number of practical difficulties in repeating Wilson's experiments (on mist formation using UV irradiation) might provide a partial explanation. However, the main reasons are probably that most of those interested in the studies, being physicists, were not very interested in the chemical aspects. Wilson's later development of the cloud chambers that bear his name, plus the major discoveries that followed from them, would have seemed far more interesting than understanding how cloud condensation can possibly arise at a relative humidity of 90%.

At the time of Wilson's experiments, the difference between concentrations and activities had still to be

demonstrated because the crucial contributions of Gibbs (1878, 1928) to thermodynamics had still not been definitively proved by quantitative evidence. The fact that Faraday's (1839) studies preceded those of Gibbs by nearly four decades explains why Faraday was unavoidably mistaken when he expressed the view that ball lightning, although real, is not an electrical phenomenon. In 1839, there was no reason whatever for believing that oppositely charged ions in real (moist) air could avoid their charges rapidly annihilating one another. No strong evidence was found until 1994 that oppositely charged ions in the air do not need to annihilate each other's charges rapidly - if at all (Turner, 1994).

Attitudes to very basic science like this were much more positive toward the end of the 19th century than they are now. The question arises of how different the present perilous state of the Earth (through global warm-

ing) might be had Gibbs been born decades earlier and had more scientists realized the importance of his work. Of his famous contemporaries, only Maxwell seems to have fully appreciated his contributions to science. In this context, it is of interest to note that, according to the records of the Sloane Physics Laboratory, where Gibbs had worked, it seems that Einstein once described Gibbs as "the greatest mind in American history" (Panek, 2017, p. 5). Einstein's view would clearly have been justified on the basis of the latter's rarely consulted works (Gibbs, 1878, 1928). Very few currently active scientists would probably agree with this view, although those interested in black hole thermodynamics (e.g., Jacobson, 1995; Penrose, 2005) might at least include him as *one* of the greatest minds in American history.

Specialization

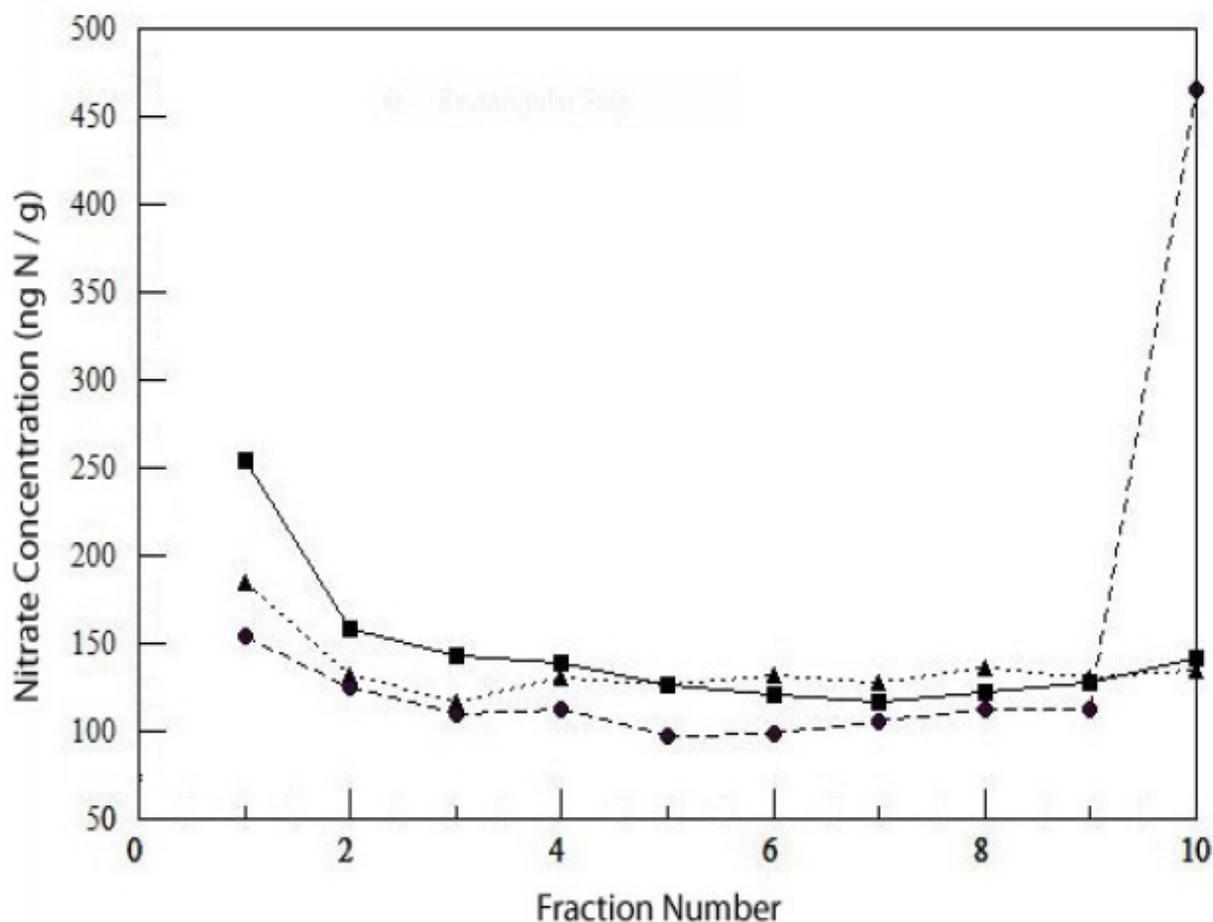


Figure 5: Nitrate concentrations of melted samples. Large hailstones are only approximately spherically symmetrical, although this symmetry can be achieved roughly by melting away the crystals of ice that protrude and so spoil the symmetry. The volumes of ice melted from the protruding crystals in fraction 1 were just sufficient to leave good approximations of spheres for the remaining samples taken. Nitrate levels are fairly similar for fractions 2 to 9, but for one of the fraction 10 samples, the nucleus must have been contaminated.

Specialization is another problem. It has proved invaluable in advancing science but, in excess, it can greatly inhibit progress. There are aspects of astrophysics, such as the formation of electric double layers in space, which attract little interest and are, in principle, closely associated with vapor phase electrochemistry (Turner, 2023c). They illustrate how very serious the problem of over-specialization can be. For decades, many such problems were repeatedly stressed by Alfvén, most of these concerns having been outlined in his book *Cosmic Plasma* (Alfvén, 1981).

A very obvious cause of surprise, encountered by any non-specialist who has read this book as well as a significant number of papers by conventional astrophysicists, is that, with the exception of so-called “Alfvén waves” and of “Alfvén critical surfaces” (the latter used in connection with the surface of the Sun), the role of plasmas in space itself is *completely ignored* by almost all conventional cosmologists - even though the Universe consists mainly of plasma (Uman, 1984).

Only electrical engineers (e.g., Peratt, 2015) and lightning specialists (e.g., Uman, 1984) seem to accept that plasma physics has importance in astrophysics. The basic problem for those studying the relevant science is, of course, that it is impossible to construct models that can make testable predictions without knowing details of the *distributions of electric charges and currents*. These cannot be measured remotely (only magnetic fields can), so models directly involving electrical influences are only ever used to describe processes fairly close to the Earth, for example, in studies of the behavior of solar wind particles.

One of the most frequently repeated claims of conventional astrophysicists is the need to invoke the existence of an unidentified substance known as dark matter. Little expense seems to have been spared over the years in trying to discover the nature of this hypothetical substance. The earliest and most convincing evidence for the existence of dark matter was the shape of spiral galaxies, but there are also several less convincing *claims* for evidence in the much more speculative field of cosmology.

These include explaining the expansion of the Universe and the web-like structures that are known to connect galaxies together. The latter studies usually make use of the extraordinarily precise data that are available on the cosmic microwave background. Clearly, such exercises need to involve assumptions, many of which are implicit and untestable. Once one accepts that most of the Universe actually consists of plasma (Alfvén, 1981; Uman, 1984) and that electrostatic forces are immensely stronger than gravitational forces, the ignoring of plasma physics should seem absurd to far more scientists than

Alfvén and other plasma physicists who accept the importance of electrical effects in space.

It must surely be highly relevant that *even explanations of the shapes of galaxies do not need to invoke dark matter*: they can be explained perfectly rationally using the concepts of plasma physics (Snell & Peratt, 1995; Peratt, 2015). Similar arguments apply to other concepts claimed to be necessary by cosmologists - even such unconventional ones as Hoyle, Burbidge, and Narlikar (2000).

Aside from the arguments used by Peratt, which mostly appear only in electrical engineering journals, other arguments (based on measurements of plasma density) have been made and have appeared in at least one scientific journal, *Nature* (The COSINE-100 Collaboration, 2018). These measurements also imply that there is no need to invoke mysterious dark matter in order to explain the shapes of spiral galaxies. To many scientists working in more mundane fields, the speculative interpretations of the fine detail in the cosmic microwave background can look like little more than interesting mathematical games.

Political and Societal Influences

There are also adverse societal and political influences that have magnified the historical influences. Of these, the most important ones were the political changes that resulted from the rise of neoliberalism following what has been called the Thatcher-Reagan revolution. This began in the 1980s. These influences seem irreversible because they are now strongly favored by the rich and powerful in every country. Thus any suggestions on how to solve the basic problem of the absence of valid theories are inevitably going to be limited in extent. This conclusion seems unavoidable and must be borne in mind if proposals to study the associated problems are to have any hope of being implemented in time to help solve the problem of global warming.

If we consider how scientific research is currently supported, it is clear that some areas receive very much more support than others. This disparity began to increase greatly following the prolonged competition that once existed between the USSR and the West. This led to competition in the fields of rocket engineering and to the enormous advances in space science that have followed from them. One very positive consequence has been the inspiring research now carried out by the world's space agencies in astronomy and in planetary science.

However, governments tend to be far less interested in advancing science than in the economic advantages to large construction companies that can be gained through

such work (see Appendix A). If there is to be any hope for future progress in the field of vapor phase electrochemistry, acknowledging this kind of reality is crucial. As seems clear from Appendix A, vapor phase electrochemistry is a sub-discipline of science whose advancement is now of *no perceived advantage to any individual or industry*. Fortunately, this does not necessarily imply that no scientists at all are likely to be interested in advancing specific aspects of the missing science.

The most obvious specific conclusions from the variety of studies discussed concern the extremely limited progress that has been made, over more than a century, in understanding vapor phase electrochemistry. The inevitable limitations have resulted in inadequate or invalid approaches to the following: the processes that lead to cloud formation and to charge separation in moist gases; also to our almost complete ignorance concerning exactly how air plasmas form and sometimes seem to survive for several hours.

On the basis of the findings represented in Fig 5 and Table 1, there seems to be strong evidence that either one large air plasma or, more likely, on the evidence discussed elsewhere (Turner, 2023b), there was an assembly of air plasmas present inside the La Plata supercell (NOAA, 2002) which was producing occasional tornadoes for an hour and a half. Long-lived air plasmas almost certainly need to use chemical energy in the air. In principle, this energy could be extracted and used. If, as seems to be the case, basic vapor phase electrochemistry is unable to advance at all rapidly, it would seem desirable, in the future, to investigate all the various *qualitative clues* available much more thoroughly than has proved possible so far.

A quite different problem is the need to accept that thermodynamics is a branch of science that is, and has always been, very unfashionable. In addition, it now seems clear that studies in the field of vapor phase electrochemistry that existed until the 1980s were abandoned purely for political reasons (see Appendix A). If more is to be learned about the role of electrostriction in compressible solvents, it seems clear that the *only real hope* for this generally boring subject is through new meteorological studies such as those suggested earlier regarding air plasmas in supercells. The need to quantify the very basic science by avoiding gravitational fields in experimental studies appears to be far too slow, boring, and expensive to attract any support at present.

One would think that meteorologists should be interested in better models for cloud formation while engineers in the electric power industry, even if they ignore the invalidity of some theories associated with the models they use (see Appendix A), should value a completely new way of producing electricity. A fairly obvious meth-

od for extracting the energy in the air to make electricity would be to surround an air plasma with solar cells. It is clear that if such energy extraction were ever to be used commercially, there would be concerns over such matters as how to hold an air plasma safely in a fixed position.

This should not be a serious problem assuming that the electrochemical explanation (Turner, 1998) for what used to be called "electrostatic guidance" provides the correct explanation for it. If the electrochemical model for ball lightning is basically correct and if air plasmas could ever be produced at will, the provision of a strong dc field should be able to hold such a plasma in a fixed position. There is clear observational evidence that this is possible (Turner, 1996, 1998). Producing electricity from air plasmas need have no harmful environmental consequences since the only chemical inevitably produced is dilute nitric acid.

Scientifically and Technologically Relevant Proposals

It is quite possible that all of the supercells that produce tornadoes contain large assemblies of air plasmas (which are normally hidden far too well to be observed) and that their presence is crucial to the development of the supercells themselves as well as of the tornadoes that can form within them. A fairly economical set of experiments would involve sending specially designed heat-seeking drones into a few large supercells to investigate the possibility that they all contain plasmas. Initially, an even more economical approach would be to investigate the likelihood that the very large hailstones expelled from large supercell storms *always* contain similarly smooth nitrate distributions and variable oxidation potentials to those shown in Fig. 5.

The large *power density*, implied by the measurements of Teodorani (2004) on one of the earth lights he studied, appears to be far greater than that available from arrays of solar cells or wind turbines. This would be very advantageous with respect to land usage. Unfortunately, although some details have been confirmed fairly recently concerning how air plasmas are stabilized and provided with their occasionally long lives, there are still numerous important questions to which answers are needed before it could be claimed that we know how to create them artificially or how to ensure long lives for such air plasmas once they have formed. Fortunately, any potential safety problems, in using air plasmas for producing electricity, should not be too serious because, if we could apply well-arranged electric fields of sufficient strength across any air plasma ball we might make, the ball would not move (Turner, 1996, 1998).

Concerning one of the experiments of Arden and Constable during which air plasmas were formed, Priestley wrote the following in 1781, "Could we repeat this experiment, there would not, I think, be any natural phenomenon, in which the electric fluid is concerned, that we could not imitate at pleasure." (Priestly, 1781, p. 383) The numerous failed attempts to achieve this objective have long acted as a warning that we do not yet know anything like enough to guarantee success in this field of study on any given timescale. Surely, however, *we should not give up on Priestley's perfectly valid hope.*

In this connection, an important point made earlier is that we are almost totally ignorant of the *chemistry* that occurs in those aerosols in which a central ion is surrounded by between about 5 and 10^9 water molecules. Recent molecular dynamics studies of intermediates in the reactions of organic compounds at water surfaces can usefully be mentioned here. They showed surprisingly large influences on reaction rates that clearly depend on the size and orientation of rather small organic molecules passing through the water surface (Zhang et al. 2018). In principle, similar kinds of modeling might begin to indicate at least how many water molecules need to surround an ion before the chemistry in an electrostatically charged aerosol starts to resemble that in a bulk water phase.

Going much further than this, using *molecular dynamics* simulations for any bulk solution would seem impractical. This is because of the large-scale non-homogeneity in any very compressible electrolyte solution and, consequently, the very large number of particles that would need to be tracked during a molecular simulation. Monte Carlo simulations would be much more efficient, but they cannot avoid the well-known limitations associated with the Debye-Hückel ion distribution function (see Appendix B) that we wish to understand much better - or somehow manage to avoid. It was these problems that limited what Peters (1987b) was able to demonstrate concerning the compressibility effects discussed in the earlier section entitled "Attempts at Quantitative Studies of Ion-water Interactions. Computer speeds have obviously increased enormously since the 1990s, but it is difficult to believe they are yet able to probe the properties of solutions that are very much more dilute and very much more compressible than those studied by Peters.

If the various non-technical problems, which seem to have led to the present issue with the basic science, have been correctly identified, then it might still be possible at least to resume some studies of the theoretical problems that limit our understanding of electrolyte solutions in water near to its critical point. At least a few theoreticians might be willing to address this problem since the

costs of any time needed on high-speed computers are likely to be small compared with those of long-term experiments carried out on orbiting space vehicles. Much could probably be learned by the (careful) use of Monte Carlo simulations.

A possibly important incentive to work on this problem is that there is one specific question that it might be possible to address using molecular dynamics simulations *without the need for any new experimental study.* This is to investigate the extent to which the apparent molar volume measurements near the critical point of water (Benson, Copeland, and Pearson, 1954; Copeland, Silverman, and Benson 1954) were influenced by gravitational forces.

It is also possible there might be a way in which valuable lessons could be learned about the weaknesses of the Born equation as it is normally used. It seems likely that some of Frank's (1955) thought experiments on the influences of electrostatic fields on liquids might well be amenable to *experimental* investigation. A sapphire windowed autoclave, possibly similar to those previously used in sounding rocket experiments (Turner, 1988a), could be used to study near-critical water at the tip of a sharply pointed metal electrode using Shlieren photography to investigate the density field near the tip. The proposal would be similar to that made by Tremaine and Turner (1993) for work under microgravity conditions, but *all measurements could be made on Earth* since no solution (complicating matters through sedimentation) would need to be studied - at least initially. This would make the experiments vastly less expensive than those originally proposed.

Finally, there are the previously mentioned proposals for studying the air plasmas that seem to reside in supercells. The most instructive investigations would use drones to locate and study such plasmas. Related studies could prove even more instructive if the (plasma-related) forces that seem to hold hurricane "hot towers" together could be investigated (Turner, 2023d). Several of the observed characteristics of hurricanes imply that they also contain powerful air plasmas, and seeking and studying them might be well worth the extra difficulties (compared with the tornado study) involved in working far from land.

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most clearly defined. His crucial contribution was planning the way in which research was carried out at CERL. One aspect was his encouragement of interdisciplinary approaches to all research whenever this was possible. In the present context, however, the most significant feature was the very unusual way research projects were authorized and carried out. Details of this feature are outlined in Appendix A.

Much advice and encouragement from the second individual also proved essential. It came from Sir Brian Pippard. He first became interested in the missing science when the UK government asked him to interview all UK scientists who were collaborating with the European Space Agency (ESA) as part of the Agency's Microgravity Program. Following lengthy discussions on our collaborative work with ESA, he agreed to read a draft paper of mine on ball lightning, a subject seemingly only remotely connected with power station chemistry.

This draft paper was far too long for publication in most journals. Sir Brian promised that if he could find nothing wrong with it, he would ensure it was published by the Royal Society - in *Philosophical Transactions* (where very long papers had once been accepted). He found he had to overcome several unjustified criticisms of the paper, but, in abbreviated form, it was eventually published - in 1994. He also tried to help me over the following few years and provided much-needed encouragement after CERL had been closed.

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tually added to the paper at his request. This made the paper roughly 50 % longer than the original submission had been!

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**RESEARCH
BRIEF**

The Ultimate Recycling? Positing the Effect of Past Life Belief on Fair Trade Consumption: A Preliminary Study

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HIGHLIGHTS

People who believe in reincarnation also tend to purchase sustainable and fair trade products.

ABSTRACT

As societal and environmental injustices are increasingly prevalent, expectations for organizations to implement sustainable practices, such as Fair Trade, have grown. Previous research has demonstrated that Fair Trade consumers have the emotional attribute of compassion and the educational trait of desire for sustainability awareness. This paper builds on prior research by introducing consumers' spiritual attributes of past life belief (PLB) and positing the effect of PLB on Fair Trade consumption (FTC). The article is novel as it is the first to introduce and link the spiritual attribute of PLB to FTC while addressing racism, religious discrimination, sexism, classism, societal and environmental stewardship, and nationalism. The sample size for this study is one hundred fourteen, N=114. Results were analyzed through hierarchical multiple regression. It was found that PLB is positively related to FTC.

KEYWORDS

Past life belief, fair trade, sustainability, societal and environmental stewardship, social identity theory.

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INTRODUCTION

The objective of this research is to determine whether individuals who hold PLB are likely to engage in FTC. The purpose of this paper is neither to prove/disprove the concept of reincarnation nor to analyze the reasons that cause individuals to accept this spiritual belief over other spiritual beliefs. While these topics are important, they are outside the scope of this paper.

This paper highlights literature which suggests that the attributes of individuals who hold PLB are compatible with those who consume Fair Trade products. Social Identity Theory and Self-Categorization Theory are fea-

tured as foundations in the theoretical framework. Belief in past lives is growing at approximately 30% of the U.S. population (Pew Research Center, 2021 and Kain, 2021) and over 20% of the European and South American populations (Moraes et al., 2021).

PLB Defined

In this article, PLB is defined as an individual's belief that they have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes in order to learn and evolve. This definition was derived from past life regression and



life-between-lives regression literature (Weiss, 1988; 1992; 1997; 2000; 2004; Newton, 1994; 2000).

Past life regression is a method that places subjects into a state of deep relaxation and enhanced focus to access memories that some individuals believe are from their past lives. Brian L. Weiss conducted hundreds of past life regressions (Weiss, 1988; 1992; 1997; 2000; 2004). For example, the past life regressions of one of his female patients revealed memories which she believes are from her past lives as a Parisian boy, a Native American woman, a Moroccan boy, an ancient Egyptian female, and a German male soldier (Weiss, 1988). Weiss (1988) states, “we change race, sex, religion, physical health or impairment, and nationality during our incarnations because we have to learn from all sides. We are rich and poor, powerful and weak, privileged and deprived. We learn by experiencing everything” (p. 220).

Michael Newton also conducted hundreds of life-between-lives regressions (Newton, 1994; 2000). His work helped found the Michael Newton Institute (MNI), which recorded more than 55,000 life-between-lives cases in over 40 countries (MNI, 2023). Newton (1994) states, “the essential purpose of reincarnation is self-improvement” (p. 41-42), and “souls do have the freedom to choose when, where, and whom they want to be in their physical lives” (p. 203). He documented cases where his patients believed remembering their between-lives intermission periods. For example, his subjects believed that in this intermission period, they would reflect on their prior lives before choosing to reincarnate into the next life (Newton, 1994; 2000). Newton (1994) states that “souls are not inclined toward life selections based on ethnicity or nationalism. These products of human separatism are taught in childhood” (p.218) and “by surviving different challenges, our soul identity is strengthened” (p. 230). He advises that the life between life “movement is designed to help human beings mentally become whole by connecting with the essence of Oneness in the life between lives” (MNI, 2023).

Social Identity Theory, Self-Categorization Theory, and Linkage to PLB

According to Bhattacharya et al. (2009), Social Identity Theory (SIT) “describes how individuals categorize themselves as members of social groups or organizations” (p. 264). For instance, “identification represents a sense of *oneness* between an individual’s self-concept and their concept of the group or organization with which they consider themselves a member. This overlap of values can be heard anecdotally when references to ‘I’ become references to ‘we’” (p. 264). Hornsey (2008) elabo-

rates further on SIT stating, “Tajfel and Turner [among the theory’s founders] argued that [as individuals strive] for a positive social identity, group members are motivated to think and act in ways that achieve or maintain a positive distinctiveness between one’s group [i.e., ingroup or intragroup] and relevant outgroups [i.e., intergroup]” (p. 207). Concerning Self-Categorization Theory (SCT), Hornsey (2008) states that “Turner and colleagues nominate three levels of self-categorization that are important to the self-concept: the superordinate category of the self as a human being (or human identity), the intermediate level of the self as a member of a social ingroup as defined against other groups of humans (social identity), and the subordinate level of personal self-categorizations based on interpersonal comparisons (personal identity)” (p. 208). Per Bohm et al. (2020), “cooperation with outsiders [i.e., intergroup members] is often impaired by prejudice, discrimination, and spite” (p. 947). Moreover, “intergroup conflict affects the perceptions (e.g., stereotyping, prejudice), emotions (e.g., fear, hate), and behaviors (e.g., discrimination, aggression) of the individual involved” (Bohm et al., 2020, p. 950).

A great deal of SIT and SCT literature has focused on negative intergroup dynamics (e.g., hostilities and prejudice). For example, according to Bohm et al. (2020), “there has been a steady increase in the number of research articles focusing on topics related to intergroup conflict in leading social psychology journals over the last 25 years” (p. 948). One can argue that this is due in part to ongoing societal injustices, including but not limited to sexism (Russo et al., 2011), racism (Matsuda et al., 2020), and religious discrimination (Scheitle & Ecklund, 2020). Scholars have also analyzed positive intergroup attitudes and dynamics, e.g. (Crisp et al., 2009, Dovidio et al., 2011, Mazziotta et al., 2011). In addition, Bohm et al. (2020) highlight ways “to de-bias intergroup relations” (p. 947).

In theory, PLB holders are expected to engage in positive intergroup relations. Since PLB holders believe that they may reincarnate into people of different social groups (i.e., different races, religions, social classes, genders, and nationalities) in a future life on earth, they may be less likely to hold hostility and prejudice towards these groups. In addition, they might be more likely to support societal and environmental stewardship, as they expect to occupy the earth again in another lifetime. Therefore, they would likely purchase Fair Trade products, as those products support the livelihoods of various social groups and the environment. In theory, individuals who hold PLB are also likely to pursue positive intragroup relations. Bohm et al. (2020) advise that SIT “proposes a direct link between a positive social identity and self-esteem...indi-

viduals can follow different strategies to achieve positive distinctiveness” (p. 952). SIT supports the notion that membership alone fosters self-esteem. In theory, PLB holders might also acquire self-esteem by taking actions that align with one of their ingroup identities, e.g., being part of a PLB group. For example, sharing news with their PLB peers about Fair Trade product purchases may be used to encourage other intragroup members to follow their lead and become engaged in causes that support societal and environmental stewardship. This paper contributes to the literature on SIT and SCT positive intragroup and intergroup dynamics’ literature by inferring and discussing how positive group relations may be applied to societal and environmental stewardship through the spiritual lens of PLB.

In addition, it is important to note that some scholars have used SIT and SCT to develop a higher-level global social identity construct, e.g., global human identification (Reese & Kohlmann, 2015). For example, invoking Social Identity Theory, Reese and Kohlmann (2015) conducted initial empirical research with a small sample (n=68) and discovered that “participants who identified strongly with all humanity would rather choose a Fair Trade product alternative over a conventional one, compared with low identifiers” (p. 98). Conducting a logistic regression analysis, the authors found that global identification was mildly and positively related to Fair Trade consumption. This relationship accounted for approximately 8% of covariance.

The global identification construct is gaining popularity in psychological discussions as it entails harmonious intergroup dealings and concern for all humans (Reese & Kohlmann, 2015). For example, “recent research findings in the tradition of social identity theory (SIT; Tajfel & Turner, 1979) suggest that identification with the largest human social group relates to a variety of desirable outcomes, such as concern for global human rights, humanitarian needs, or contributions for humanitarian relief (McFarland, Webb & Brown, 2012), intergroup helping and intergroup empathy (Reysen & Katzarska-Miller, 2013) as well as cross-national cooperation (Buchan, Brewer, Grimalda, Wilson, Fatas, & Foddy, 2011). Based on these findings, [Reese & Kohlmann (2015)] argue that global identification may also relate to consumer choices” (Reese & Kohlmann, 2015, p. 98). In addition, “a growing body of research suggests that identification with the world community is a meaningful psychological construct. McFarland (2010; McFarland et al., 2012) developed a measure of ‘identification with all humanity’ as a deep and positive concern for all humanity—a ‘belief that all humanity is “family”’ (McFarland, 2010; p. 1760, as cited in Reese & Kohlmann, 2015, p. 99). Furthermore, Buchan et al.

(2011) conducted a multinational study and found “that an inclusive social identification with the world community is a meaningful psychological construct that plays a role in motivating cooperation that transcends parochial interests” (Buchan et al., 2011, p. 821). According to Buchan et al. (2011), “global social identity is associated with a desire to maximize collective outcomes and motivates individuals to contribute to collective goods regardless of whether they expect a return on their investment” (p. 826). Moreover, Reysen & Katzarska-Miller (2013) examined “the antecedents and outcomes of identifying with a superordinate identity—global citizen” (p. 858) and found “the pathways to identification with global citizens, and the prosocial outcomes to feeling connected to the superordinate global category” (Reysen & Katzarska-Miller, p. 866). According to Reysen & Katzarska-Miller (2013), “global citizenship [identity] predicts prosocial values of intergroup empathy, valuing diversity, social justice, environmental sustainability, intergroup helping, and a felt responsibility to act for the betterment of the world” (p. 869). Hence, the empirical studies of Buchan et al. (2011), Reysen & Katzarska-Miller (2013), and Reese & Kohlmann (2015) support the notion that some individuals can and do identify as members of the largest human social group. The literature supports this paper’s assumption that PLB is related to global social identity.

SIT and the superordinate category of the SCT, i.e., identifying oneself as a member of the human family, is compatible to the PLB construct, as it is defined as an individual’s belief that they have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes in order to learn and evolve. Therefore, per the PLB definition, in theory, individuals are expected to also view themselves as part of the *human family*, as the PLB construct infers a sense of oneness or interconnectedness towards others.

Because societal and environmental injustices, due in part to racism, sexism, religious discrimination, classism, and nationalism, are increasingly prevalent (Matsudaet et al., 2020; Cosgel, 2020; Liu et al., 2004; Russo et al., 2011; Amadi, 2020), this paper incorporates SIT and SCT to address these issues through the lens of PLB. Regardless of continued attempts to eliminate racism, it prevails globally, leading to severe negative implications on mental health, education systems, economic development, and societal relations (Matsudaet et al., 2020). Persecution based on religion includes the genocides of the twentieth century and ongoing global attacks on minorities (Cosgel, 2020). Discrimination thrives under populist regimes, which acquire political support by dividing their populations into segments based on race, nationality, and religion while marginalizing immigrant communities

(Cosgel, 2020). Upward classism is discrimination toward people belonging to a higher social class, while downward classism is oppression towards people belonging to a lower social class (Liu et al., 2004). Lateral classism is manipulative behavior that keeps individuals within a social class (Liu et al., 2004). Sexism is discrimination towards individuals based on gender (Russo et al., 2011). Nationalism and protectionism are on the rise in America and Europe, which will increase discriminatory practices and decrease policies that promote inclusiveness (Amadi, 2020).

Hundreds of past life regressions (Weiss, 1988; 1992; 1997; 2000; 2004) and life between lives regressions (Newton, 1994; 2000) found that participants believed that they reincarnated in different races, ethnicities, genders, religions, social classes and nationalities to learn and evolve. Therefore, it is theorized that individuals who hold PLB can view themselves *in someone else's shoes* (i.e., the individual can imagine themselves as a person of a different race, ethnicity, gender, religion, social class, and nationality). Hence, PLB holders are likely to share a sense of oneness or interconnectedness with others and be able to empathize with them because of these beliefs, which is consistent with the tenets of SIT and SCT.

Fair Trade and the Possible PLB Connection

There is increasing awareness and expectations for firms and organizations to embrace sustainable practices and implement Corporate Social Responsibility (CSR) policies (Matten, Crane, & Chapple, 2003; Bhattacharya & Sen, 2004; Castaldo, Perrini, Misani, & Tencati, 2009; Harwood, Humby, & Harwood, 2011; Wicks, Keevil, & Parmar, 2012; and Craig & Allen, 2013). For example, Wicks et al. (2012) found that a growing number of customers believe that organizations should be mindful of the ecological consequences of their operations and develop environmentally sustainable business practices. In addition, McWilliams & Siegel (2001) define CSR as the "actions that appear to further some social good, beyond the interests of the firm and that which is required by law" (p. 117).

Fair Trade is a form of sustainable business which encourages entrepreneurial endeavors among communities in developing countries (Blowfield & Dolan, 2010). Fair Trade is defined as "an approach to business and to development based on dialogue, transparency, and respect that seeks to create greater equity in the international trading system. Fair Trade businesses partner with farmers and craftspeople in developing countries who are socially and economically marginalized in finding markets and customers for their goods" (FTF, 2023). Fair

Trade products include many commodities such as food, clothing, personal care, accessories, and home furnishing. Fair Trade organizations adhere to the following ten principles, which are approved by the World Fair Trade Organization (WFTO): "1) creating opportunities for economically disadvantaged producers, 2) transparency/accountability, 3) fair trading practices, 4) fair payment, 5) ensuring no child labor or forced labor, 6) commitment to non-discrimination, gender equity and freedom of association, 7) ensuring good working conditions, 8) providing capacity building, 9) promoting Fair Trade, and 10) respect for the environment" (WFTO, 2023).

Fair Trade products are often priced higher than conventional alternatives due to the inclusion of a Fair Trade premium cost, which is used to support programs that adhere to the above-referenced 10 WFTO categories. According to Doherty et al. (2013), "Fair Trade products in the mainstream are suggested to provide the opportunity for ethical/political consumers to exercise economic voting" (p. 177). Moreover, according to Witkowski (2005), "Fair Trade applies moral criteria to consumers' decisions" (p. 25). Therefore, Fair Trade consumers know they spend more money to purchase an ethical product which supports society and the environment.

Thus, the literature indicates that as an expectation for firms and groups to act sustainably grows, Fair Trade offers a path for customers to buy merchandise that positively impacts society and the environment. In addition, the sustainable manufacturing, merchandise lifecycles, and supply chains of Fair Trade goods may offer an opportunity for the empowerment of marginalized communities when these groups utilize their talents and artistry to create products that appeal to the characteristics of unique target markets (FTF, 2023).

Prior research suggests that Fair Trade shoppers have the emotional attribute of compassion for themselves, others, and the environment (COOE) (Musa & Gopalakrishna, 2022). The literature also suggests that Fair Trade consumers have the educational trait of desire for sustainability awareness (DSA) (Musa & Gopalakrishna, 2022). Benevolence and universalism are also qualities held by consumers of Fair Trade (Doran, 2009). This paper is novel as it dives deeper into consumers' traits by introducing and analyzing the spiritual attribute of PLB and positing that PLB is positively related to FTC.

Due to their unique manufacturing processes, Fair Trade products are advertised to highlight their positive societal and environmental impacts (Davenport & Low, 2012). Fair Trade ads typically include photos of the worker who manufactured the product and a summary of their background (Musa & Gopalakrishna, 2022). This is important to note because as a PLB consumer reviews

the Fair Trade worker’s photos and reads about the lives of these individuals from different races, ethnicities, religions, genders, nationalities, and social classes, the PLB consumer may feel inclined to purchase the Fair Trade product, which supports that worker and the environment. Because the PLB consumer believes that they have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes, they may be able to easily identify with the worker depicted in the ad. See Figure 1 for examples of Fair Trade ads (Novica, 2023). For instance, it is likely that the PLB consumer may experience a sense of *oneness* with the worker rather than a sense of *separation* from the worker, as the typical societal barriers of racism, religious discrimination, sexism, classism, and nationalism are likely less relevant to the PLB consumer (Weiss, 1988; 1992; 1997; 2000; 2004; Newton, 1994; 2000; Bhattacharya et al., 2009; Reese & Kohlmann, 2015).

The literature supports the assumption that individuals who hold the spiritual attribute of PLB are expected to have not only an awareness of interconnectedness towards others but also an interest in supporting society and the environment. Therefore, they are likely to seek out and consume Fair Trade products, as these products promote societal and environmental stewardship.

Photo of Fair Trade Worker	Photo of Fair Trade Product	Excerpt of Fair Trade Worker's Life Story
		Fernando Cano – Peru "I was born in 1973 in the district of Macate in Ancash. My parents were engaged in agriculture. I consider myself a very creative man, and very enterprising. One of my dreams is to continue growing as a textile artist, to be recognized not only locally but at the international level, and to give a better quality of life to my family."
		Khun Boom – Thailand "I have a passion for life, art and jewelry. I was born in 1979 and grew up in Chiang Mai. Being born into the varied and abundant culture of Chiang Mai, I was exposed to the world of traditional art and the customs from China and Southeast Asia. I am so proud to be Thai, and I hope to share some of that pride with you."
		Ila Suleyman – Ghana "I was born into a family of artists who have carved and crafted wood and leather products for several family generations. My favorite thing about my art is the way people react to it. I also work with other artisans who create handmade jewelry in order to highlight the positive impact it has in our lives when people support artisans."
		Rituu Agarwal – India "I was born in Jaipur, popularly known as the Pink City. I am greatly influenced by the ancient designs and I bring them to my work. I have also dedicated some of my time to an NGO in Rajasthan that works with school children and provides medical facilities to elderly people. The NGO is connected with a school where we provide education, books, uniforms and other necessities to the school children."

Figure 1: Example of Fair Trade Worker Ads All photos and quoted text in Figure 1 are from Novica.com-May 2023

Table 1. Sample Demographics

Characteristic	N=114	%
Income		
< \$30,000	17	14.9%
\$30,001 to \$60,000	23	20.2%
\$60,001 to \$90,000	39	34.2%
\$90,001 to \$120,000	24	21.1%
> \$120,001	11	9.6%
Political Ideology		
Conservative	15	13.2%
Somewhat Conservative	22	19.3%
Independent	39	34.2%
Somewhat Liberal	25	21.9%
Liberal	13	11.4%
Age		
Between 18 to 29 years	10	8.8%
Between 30 to 44 years	21	18.4%
Between 45 to 54 years	51	44.7%
Between 55 to 64 years	24	21.1%
65 years and greater	8	7.0%
Education		
High School diploma or GED	7	6.1%
Associates Degree	21	18.4%
Bachelor's Degree	52	45.6%
Master's Degree	20	17.5%
Doctoral Degree	14	12.3%

H1 – Past Life Belief (PLB) positively relates to Fair Trade consumption (FTC).

METHOD

Participants

For this study, an online survey was shared with 546 members of a Fair Trade organization’s social media group. One hundred fourteen members completed the online survey, which yielded a response rate of 21%. This response rate is comparable to the recommendations of (Malhotra & Grover, 1998). Table 1 displays the sample characteristics. Data was collected through an online Qualtrics survey. The population was instructed that the survey was voluntary, contained six questions, and would take approximately 5 minutes to complete. The survey was open for one week from October 24, 2022, through October 30, 2022, and one hundred fourteen participants completed the voluntary online survey.

Demographic Variables: The populations’ age, income, education, and political affiliation characteristics,



as shown in Table 1, were included as control variables. See Doran (2009), Magnusson et al. (2015), Tremblay-Boire & Prakash (2017), Taylor & Boasson (2014), Musa & Gopalakrishna (2022), and Antiel et al. (2014) for examples of similar measurements.

Measures

Fair Trade Consumption (FTC): was measured by an individual’s annual Fair Trade purchases as a percentage of their total annual purchases. Participants were asked to provide their approximate level of FTC via an eleven-point scale that ranged from 0% (1) up to 100% (11). Scholars have used comparable scales to measure their dependent variable in various business and sustainability studies (Barnes et al., 2016; Beaton & Tougas, 1997; Kuusela & Amacher, 2016; Mast et al., 2011; Musa & Gopalakrishna 2022; Perugini & Bagozzi 2004; and Zhang 2011).

Past Life Belief (PLB): Participants were asked to rate their level of agreement with the statement, “I believe that I have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes in order to learn and evolve” via a five-point Likert scale ranging from strongly disagree to strongly agree.

RESULTS

Statistical analyses were conducted on the data using IBM SPSS software version 28. A hierarchical multiple linear regression was used to test the hypothesis to **Table 2.** Hierarchical Multiple Regression Results – N=114

Variable	Hypothesis	Model 1 Control Variables		Model 2 Main Effects	
		β	<i>b</i>	β	<i>b</i>
Income		0.211*	0.551*	0.174	0.455
Age		-0.031	-0.095	-0.051	-0.155
Education		0.159	0.469	0.165	0.488
Politics		0.120	0.312	0.123	0.321
PLB	H1			0.252**	0.665**
Constant			2.054		0.313
R ²		0.084*		0.146**	
Δ R ²				0.062**	
F		2.514*		3.693**	
F of Δ R ²				7.786**	

Note: Standardized and unstandardized beta coefficients are presented with: * $p < .05$ ** $p < .01$ *** $p < .001$

Table 3. Descriptive Statistics and Correlations.

(N=114)	M	SD	1	2	3	4	5
1 - FTC	5.76	3.09					
2 - Income	2.90	1.18	.233*				
3 - Age	2.99	1.02	-.034	-.030			
4 - Education	3.11	1.05	.145	.052	-.207*		
5 - Politics	2.99	1.19	.094	.113	.301**	-.256**	
6 - PLB	3.18	1.17	.271**	.140	.076	-.031	.033

predict FTC by PLB while controlling for age, income, education, and political ideology. In addition, descriptive statistics, a Pearson’s correlations matrix, and tests for distributional normality were administered. Variance of Inflation (VIF) score for all variables in the multiple regression test ranged from 1.02 to 1.17, which is below the multicollinearity threshold of 10 (Fassoulis & Alexopoulos 2015 and Müller & Haase 2014).

A two-stage hierarchical multiple regression analysis was conducted using 2 Models in ANOVA. Hierarchical multiple regression is a common method used when scholars aim to identify the importance of a predictor variable after other predictor variables are entered into the equation (Cohen et al., 2013). The hierarchical multiple regression analysis was completed in SPSS in the following manner. First, all control variables were entered simultaneously into one block in SPSS. Next, the PLB main effect variable was entered separately into another block in SPSS. The results of this hierarchical multiple regression structure are depicted in Table 2. For stage 1, which had control variables, the regression was found to be significant ($F(113) = 2.514, p < .05$) with an R^2 of .084. For stage 2, which had a hierarchical structure of all the control variables (in one block) and then the PLB main effect variable (in a separate block), a significant regression equation was found ($F(108) = 3.693, p < .01$) with an R^2 of .146. The difference between Model 1 and Model 2 is the inclusion of the PLB main effect variable, which had a significant coefficient, with $\beta = .252$ PLB ($p < .01$) and resulted in an R^2 change of .062 between both Models, predicting FTC. These results supported H1 showing a mild predictive relationship between PLB and FTC. All control variables became non-significant when controlling for covariance. Thus, PLB is positively related to FTC when controlling for age, income, education, and political affiliation.

Table 3 shows the descriptive statistics and correlations. A normal probability plot (P-P) of the residuals was conducted, and because the points followed the diagonal line, it can be assumed that the data is normally distributed and that the model's assumption of normality is accurate (Morgan, 2017).

DISCUSSION

Interpretation of the Results

The results of this paper show that, as hypothesized in H1 and per previous findings linking global identity to Fair Trade consumption, that PLB is mildly and positively related to FTC. This relationship accounts for approximately 6% covariance. Therefore, it can be inferred that individuals who hold PLB are slightly more likely to purchase Fair Trade products to support societal and environmental stewardship. This is expected as literature and research support the importance of Fair Trade consumers possessing the traits of compassion, benevolence, and oneness or interconnectedness toward others (Musa & Gopalakrishna, 2022; Doran, 2009). These characteristics, according to the literature, might also be shared by individuals who hold PLB (Weiss, 1988, 1992, 1997, 2000, and 2004; Newton, 1994 and 2000; Woods & Baruss, 2004; Meyersburg & McNally, 2011; Johnson et al., 2021; Dhiman, 2016; and Rezapouraghdam & colleagues, 2017).

These results are unsurprising as the literature supports the notion that those who experience memories, which they believe are from a past life may change their view of life, e.g., worldview and/or meaning of life (Woods & Baruss, 2004; Meyersburg & McNally, 2011; Johnson et al., 2021). These newly acquired views may, in theory, motivate them to support societal and environmental stewardship through purchasing Fair Trade products. For instance, Woods & Baruss (2004) found that subjects with past life memories experienced altered "body image, time sense, [and] perception of the world" (p. 604). Meyersburg & McNally (2011) found that participants who experienced past life memory reported a "greater presence of meaning in their lives" (p. 1218). Johnson et al. (2021) "found that reincarnation beliefs were significantly positively correlated with high-involvement sustainability practices [and] general environmental concern" (p.7).

Aligned with the results of this paper and similar to Past Life Regression and Life Between Lives Regression, the Near-Death Experience (NDE) literature also documents comparable changes post-event to individuals' perception of worldviews and a sense of interconnectedness towards others. NDEs are defined as individuals who believe recalling the events that occurred when they had clinically passed away (van Lommel, 2010, as cited in

Dolsen-Groh & Sexton-Radek, 2018). Significant positive life changes have occurred in the majority of individuals who had an NDE (Dolsen-Groh & Sexton-Radek, 2018). For example, "major studies consistently reveal a pattern of positive [consequences] from those who have NDEs, which typically include but are not limited to: an increased concern or feelings of compassion for others; a greater appreciation for life; a positive self-attitude and clearer sense of self-identity; less concern with consumerism and materiality; less general anxiety; an increased 'thirst' for knowledge; and an enhanced sense of spirituality" (Atwater, 2008; Groth-Marnat & Summers, 1998; Greyson, 2003; Musgrave, 1997; Noyes, 1980; Schwaninger et al., 2002; Sutherland, 1995; van Lommel et al., 2001, as cited in Tassell-Matamua, 2014, p. 266). Thus, similar to past life regression and live-between-lives regression literature, NDE literature backs the notion that some individuals have memories, which they believe are of their soul surviving outside their current body. In theory, memories may lead to a change in the individual's worldviews and/or meaning of life, including but not limited to a) increased compassion, b) less materialism, and c) a sense of oneness towards others. These attributes may infer a relationship with Fair Trade consumption.

In addition, according to Mead (1912), the concept of reincarnation supports the idea that as the soul advances, it can develop the "all-attractive power of harmlessness and that positive power of [interconnectedness], of sympathy and compassion for all other souls and the whole creation" (p. 179).

The results of this study show a relationship between PLB and FTC. Per the literature, one may assume that individuals who hold PLB might be more inclined to have a unique spiritual view of life: a view that supports interconnectedness or oneness towards others and is inclusive and accepting of other races, religions, genders, nationalities, social classes, and mindful of societal and environmental stewardship.

Implications for the Theory

This article contributes to the Social Identity Theory and Self-Categorization Theory literature by linking the spiritual concept of PLB to these theories and inferring its applicability concerning Fair Trade consumption. For example, prior research by Musa (2015) and Musa & Gopalakrishna (2021) introduced and identified the association between Fair Trade consumer behavior and SIT. Musa & Gopalakrishna (2022) showed a potential relationship between SIT and Fair Trade consumer attributes of compassion for oneself, others, and the environment (COOE). This paper provides an example of how SIT may

be compatible to the PLB construct associated with Fair Trade consumption. For example, it is inferred that PLB consumers might be able to view themselves in someone else's shoes (i.e., the individual can imagine themselves as a person of a different race, ethnicity, gender, religion, social class, and nationality). SCT may also be relevant to this study, as the results of this research infer compatibility to the theory's superordinate category of human identity. For example, the empirical studies of Buchan et al. (2011), Reysen & Katzarska-Miller (2013), and Reese & Kohlmann (2015) support the notion that some individuals can and do identify as members of the largest human social group. Moreover, the correlation between PLB and FTC assumes that PLB consumers will likely view Fair Trade workers as part of the human family.

Possible Applicability for Academia and Practice

This article contributes novel insights for both academia and sustainable businesses, such as Fair Trade, in multiple ways.

First, the study adds to the literature that connects spirituality to sustainability. For example, Dhiman's (2016) work supports the concept that spirituality is intertwined with sustainability, and if a person's spirituality is underdeveloped, it can cause social conflict and the exploitation of nature. Therefore, sustainability cannot exist without spirituality (Dhiman, 2016). He also advises that sustainability "depends upon our deeper understanding of fundamental spiritual values such as interconnectedness and oneness, non-violence and compassion, contribution, and selfless service" (p.2). Moreover, asserting the association between environmentally sustainable behavior and spirituality, Rezapouraghdam & colleagues (2017) advise that connectedness to nature is understood to be a fundamental cure for the global environmental crisis. Second, scholars may build upon the framework of this study and the literature cited to conduct empirical studies analyzing the correlation between the PLB construct and attitudes toward societal and environmental stewardship, racism, sexism, classism, nationalism, and religious discrimination.

This paper also provides insight for Fair Trade companies to potentially modify their marketing campaigns and messaging to appeal to consumers who hold PLB, as according to Goworek (2011), consumer knowledge of the Fair Trade concept has grown in recent years. Furthermore, because there is scarce literature on PLB as a predictor of Fair Trade consumption, this article provides the opportunity for Fair Trade companies to explore and understand this potentially highly loyal segment of their consumer base and promote their products in a way to

increase sales, which would support societal and environmental stewardship.

Limitations and Suggestions for Future Research

The author would like to emphasize that the current work is a preliminary study based on a convenience sample. While supporting previous research relating to global identity and Fair Trade consumption (e.g., Reese & Kohlmann, 2015), additional research is needed to provide further insight and replicate the relationship between PLB and FTC.

As discussed earlier, PLB is defined as an individual's belief that they have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes in order to learn and evolve. Therefore, participants were asked to rate their level of agreement with the statement, "I believe that I have in the past and will in the future be born into different races, ethnicities, religions, genders, nationalities, and social classes in order to learn and evolve" via a five-point Likert scale ranging from strongly disagree to strongly agree. However, it is important to note that this PLB construct is not necessarily the definition of reincarnation subscribed to by *all* believers in reincarnation. Thus, this is noted as a limitation. Next, religion was not included as a control variable in this study. However, scholars may want to analyze an individual's religious beliefs a) pre and/or post-past life regression and b) pre and/or post-life between-lives regression in future studies. This type of research may provide insight into how well the individual accepts PLB. Furthermore, while SIT and SCT were identified as compatible to this study, based on the literature and other cited empirical research (e.g., Reese and Kohlmann, 2015), this study did not directly test the exact higher-level global identity constructs that were used by other scholars.

Future research linking reincarnation beliefs to societal and environmental stewardship is encouraged, as Johnson et al. (2021) proclaimed, "if people believe they will come back to the earth after death (albeit in a different form), they may be motivated to ensure the earth is habitable -- even flourishing" (p.8).

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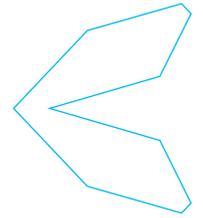
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**BRIEF
REPORT**

UnityGPT vs. ChatGPT: A Comparative Review for Frontier Scientists

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HIGHLIGHTS

A new AI-powered search and language tool gives researchers more informed and balanced information on frontier science topics than the popular ChatGPT software.

ABSTRACT

Artificial intelligence tools based on Large Language Models (LLMs), such as OpenAI's ChatGPT, are revolutionizing how we process and synthesize information. However, these tools can be anemic when applied to niche or unconventional domains, such as parapsychology. This is due to the fact that the input content used to train these LLMs draws predominately from mainstream internet sources (e.g., Wikipedia), and thus, the corresponding outputs inherit various biases surrounding heterodox subjects. This review introduces UnityGPT, a custom AI tool provided with a vast array of unconventional research from a plurality of disciplines, intended for use as a primary research tool in the frontier sciences. The article summarizes the technology approach of both ChatGPT and UnityGPT, and their relative strengths and weaknesses.

KEYWORDS

Artificial Intelligence (AI), Natural Language Models (LLM), ChatGPT, UnityGPT, Frontier Sciences, Parapsychology, Information Synthesis.

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INTRODUCTION

Recent advancements in artificial intelligence (AI) have catalyzed intense debate about their potential impacts on information dissemination and research dynamics (Dwivedi et al., 2023). One of the most notable developments in this domain is OpenAI's natural language model, ChatGPT, which has seen swift integration into various research contexts (Sallam, 2023). The model's

rapid adoption—illustrated by its growth from 13 million daily active users in January 2023 to 55 million by June 2023 (Brandl, 2023)—is a testament to its integration into diverse information-seeking contexts. However, its rapid adoption also raises timely questions about the balance between AI's potential for fostering novel insights and the significant challenges it presents, especially concerning authenticity, academic integrity, representation and bias, and broader ethical implications concerning hu-



man agency in decision-making processes (De Angelis et al., 2023; Eke, 2023; Momen et al., 2023; Ray, 2023).

Nevertheless, the capabilities of powerful large language models (LLMs) like that which powers ChatGPT open unprecedented research avenues, even in niche fields such as parapsychology. The strength of these models stems from the vast volumes of data on which they are trained. For instance, ChatGPT’s training draws from an extensive cache of internet textual data up to 2021 (Schade, 2023; Somoye, 2023). However, while the enormity of the training data enables the model to generate an impressive rendering of human language, opinions of the training data become opinions within the responses. For example, publication bias against marginalized scientific research results in that research being excluded as training data which affects the model’s responses. As tools like ChatGPT become research mainstays, there’s a concurrent risk of entrenching the current orthodoxy into the knowledge infrastructure of the future.

An alternative AI tool called UnityGPT was specifically developed for heterodox research. This review introduces UnityGPT and is co-authored with insights from its creator. The aim is to spotlight its usefulness as a research assistant for frontier sciences and to summarize its mechanics and relative advantages and drawbacks vs. ChatGPT. There is a focus on parapsychology as an example.

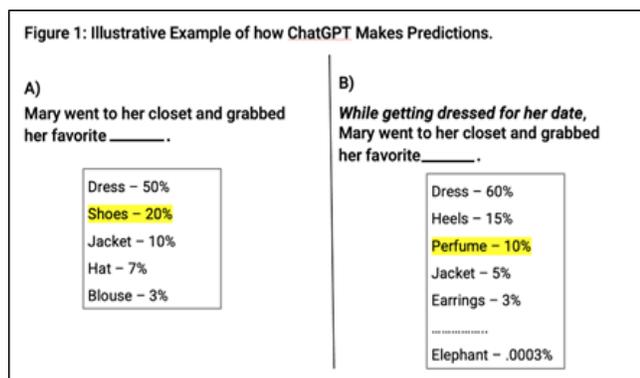


Figure 1: Illustrative Example of How ChatGPT Makes Predictions.

ChatGPT predicts sentence completions based on contextual cues, much like a human reader would.

- 1A). From cues like a woman’s name and “closet,” the model leans toward stereotypically feminine items typical of a closet.
- 2A). Additional context nudges the probabilities towards date-associated items found in a closet. Though syntactically fitting, words like “elephant” fit the syntax, they are also highly unusual given the context and, therefore, very unlikely to be selected.

Note: this is a hypothetical example for illustration, but the actual items and probabilities selected by GPT would likely differ from those shown.

ChatGPT

The potentially transformative power of ChatGPT is difficult to comprehend at this early stage. At best, we’re only scratching the surface of what this technology might offer, both as an asset and a liability. As an illustration and in the interest of transparency, while the content and ideas of this manuscript are original, ChatGPT was utilized extensively in formatting the structure of this document, rephrasing ideas, and proofreading of text to an extent that would ordinarily warrant co-authorship. However, since authorship traditionally implies accountability, prevailing ethical standards advise against such attribution (Flanagin et al., 2023; Stokel-Walker, 2023). Yet the creative facilitation and augmenting utility of ChatGPT as a writing accelerator cannot be easily overstated. While extensive literature dives deep into the multitude of applications and ramifications of ChatGPT (Sallam, 2023), it deviates from the primary focus here. Therefore, this review will succinctly address a couple of pivotal considerations.

At first glance, ChatGPT mesmerizes with its seemingly boundless reservoir of knowledge and information. Users can query on basically any subject, and the model instantly generates highly intelligible and seemingly credible responses. As such, more and more users are relying on the platform as an information source (Grigutyte, 2023). Even specialized platforms for domain-specific knowledge, such as Stack Overflow for software developers, have seen precipitous drop-offs of usage as more users turn to ChatGPT for rapid, comprehensive, and articulate solutions to challenging technical questions (Anderson, 2023). However, it’s crucial to dispel a common misconception: ChatGPT is not, in fact, a repository of knowledge. Fundamentally, it operates as an intricate prediction model, deriving its responses from patterns of word co-occurrence and thematic relationships within its training data (Roose, 2023). Therefore, the reliance on ChatGPT as an authoritative resource can be problematic as the platform is prone to produce unreliable information. For example, despite the uptick in user-preference for the model over traditional sources such as Stack Overflow, a recent analysis found ChatGPT’s solutions tended to be overly verbose and riddled with errors and inaccuracies (Kabir et al., 2023).

To grasp how ChatGPT responds to queries, consider its underlying mechanism. It discerns the semantic essence of a user’s input and crafts a response based on associative strength to that input. For instance, a query about “cats” won’t typically yield a response about “airplanes” unless contextualized, perhaps in a question about “traveling with pets” (see Fig 1.). This associative

mapping, or “semantic proximity,” hinges on word and topic co-occurrence patterns in its training data, which predominantly stems from the internet as of 2021. Instead of retrieving a definitive “correct” answer, ChatGPT probabilistically generates a response based on the frequencies of word patterns observed during its training (Roose, 2023). Due to this probabilistic nature (and adjustable parameters like “temperature.”¹), slight variations can emerge in responses to identical prompts. While often insightful, ChatGPT is far from infallible. Its predictions, though frequently accurate, can occasionally veer into the realm of unfounded conjecture, i.e., “hallucinations” (Bang et al., 2023).

Another prevailing misapprehension is the belief that ChatGPT’s output mirrors an objective external reality. In truth, it is a mere reflection of its training corpus—primarily, the internet—and, as such, is heavily influenced by prevalent biases and dominant thought patterns. While developers have invested significant effort into fine-tuning ChatGPT and placing guardrails to reduce these biases, achieving a comprehensive neutrality remains an aspiration (Hemmatian & Varshney, 2022).

This inherent bias represents substantial obstacles for parapsychological researchers hoping to source objective insights from ChatGPT. Given its foundational training data, the model will naturally be inclined towards the prevailing scientific orthodoxy and the material reductionist philosophy of the times. Many researchers, either implicitly or overtly, adopt this framework, which is inevitably reflected in the language in the works they produced (Butzer, 2020). Notably, discourse surrounding parapsychology often harbors a dismissive or patronizing undertone (See: Panel 1 of Appendix Fig. 3) (Cardeña, 2015; Carr, 2019; Mousseau & Méheust, 2003). As a result, ChatGPT’s responses concerning parapsychological subjects are likely to be marred by a biased, materialistic lens, leading to potentially skewed or incomplete insights. Notably, users can revise their prompts to request ChatGPT to offer a more impartial response that is less dismissive of parapsychological research, for example. However, this requires a degree of query savvy and places a higher burden on the part of the user. Likewise, as a strategy, it is unlikely to be employed by someone who is not already amenable to unconventional scientific approaches, etc.

In light of these concerns, one might ask: What are ChatGPT’s strengths, and how can they be leveraged for parapsychological research? Among LLMs, ChatGPT is unparalleled for crafting coherent, contextually-aligned responses to user prompts. Its strengths aren’t just confined to generating structured language; it can spur creative brainstorming, draw connections between seem-

ingly unrelated subjects, enhance text editing, facilitate proofreading, and adeptly rephrase user inputs, making it a useful tool for ideation. Moreover, by harnessing OpenAI’s API, these language capabilities can be utilized by other applications. This is the case with UnityGPT.

UnityGPT

Like ChatGPT, UnityGPT allows users to ask questions and receive answers that are the result of a sophisticated synthesis of large bodies of text. Unlike ChatGPT, UnityGPT utilizes a custom “library” of training data paired with OpenAI’s underlying LLM (GPT-3.5 Turbo) to generate responses. This library is composed of large quantities of published research into what is generally regarded as “unconventional” topics, ranging from parapsychology to ufology to medical research, amongst others (UnityGPT, n.d.). For example, every research article from the *Journal of Scientific Exploration* from its inception to 2023 (36 volumes) was included in this training library.

To understand how this system works, it’s necessary to understand vector embeddings. Domains of computer science that deal with semantics and natural language processing (NLP) have devised clever ways of representing direct and implied meaning between words and phrases. One such method is the use of vector embeddings. To create a vector embedding, a program is used to convert a chunk of text into a mathematical object, where each word (or unit of text) is represented as vectors between one another. The angle formed by two vectors is a representation of the semantic similarity between those words; the smaller the angle, the more semantically similar those words are. This angle is stored as a cosine value.

Each word introduces a new dimension in that object; a 500-word embedding is actually a 500-dimensional object (so called “high-dimensional space”). Although impossible to imagine, the embedding is easy to represent and store efficiently as a collection of cosines.

In this way, vector embeddings capture the semantic meaning between the words. Stated another way, the particular “shape” of the vector embedding is also the hidden meaning and concepts between the words from which it is composed (Çelik, 2022).

The research library utilized by UnityGPT is actually a collection of roughly 80,000 vector embeddings (each roughly the size of one paragraph), which is stored in a specialized vector database. The question-answer mechanism works as follows:

Step 1. User asks a question by typing it into a search bar using natural language. This text is itself converted to a vector embedding using the same codex

as that which was used for the training library.

- Step 2.** This user embedding is then used to query against the vector database, with the instructions to find those library embeddings that are the greatest cosine similarity (the more similar the geometry of the query and library embeddings, the more similar the semantic meaning).
- Step 3.** The top 10 embeddings from the library which are nearest in shape to the query are retrieved. These embeddings and the query are then translated back into English, and sent to OpenAI's GPT 3.5 Turbo LLM via API, along with a universal "system prompt" to utilize the context contained within the library source materials to synthesize a detailed response to the query.
- Step 4.** The answer is then returned to the user, along with the references to the source documents utilized as context for the response. (see Fig 2).

How does UnityGPT stand apart from popular platforms like Google Scholar or Wikipedia? Beyond the challenge that many unconventional research journals are overlooked by standard search engines, platforms like

Google Scholar, although invaluable, present users with an array of potential matches based on keyword relevance. This often results in researchers having to wade through numerous abstracts and papers to evaluate the applicability to their query. UnityGPT, however, is focused on searching within the "meaning space" which can be helpful both in finding relevant information that may not contain user keywords but also can efficiently surface unexpected connections between distinct silos. These connections are often useful clues to the frontier scientist, particularly those focused on building broader theoretical models.

In contrast to tools like Google Scholar, UnityGPT's source identification can dramatically reduce research hours for users. (For a practical illustration using the example of "remote viewing," please see the Appendix.)

Furthermore, the "synopsis" response provided by UnityGPT is without the potential interpretive bias of human sources of synopsis, such as those that can afflict Wikipedia. Wikipedia, in particular, is known to exhibit a strongly dogmatic stance against frontier sciences and has mischaracterized and undermined ideas falling outside of the scientific orthodoxy (Martin, 2021; Weiler,

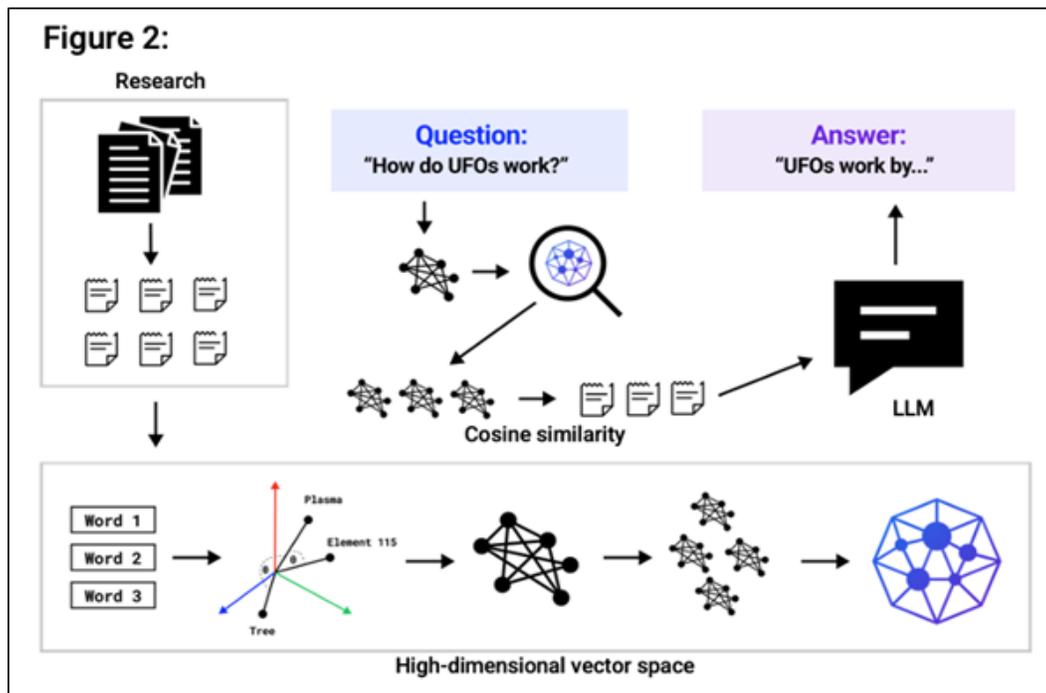


Figure 2. Schematic Illustration of UnityGPT's Mechanism for Generating Semantically Relevant Outputs. Initially, source documents are segmented into text blocks, which are then transformed into vectors within a high-dimensional space. These vectors capture semantic relationships between different text blocks based on cosine similarity. Upon receiving a user's query, it too is vectorized and matched to the most semantically relevant source documents using the same cosine similarity approach. The top-matching document segments, along with the user's original prompt, are then processed by GPT 3.5 Turbo. This produces a natural language response, accompanied by citations for the source material. **This figure was adapted from a presentation on UnityGPT delivered by its creator, Adam Curry to the 2023 Contact in the Desert annual conference.

2013). This is fueled, in part, by highly-organized groups of skeptical activists who police and edit content (Skeptical About Skeptics, n.d.).

DISCUSSION

With its intuitive interface, precise responses, direct citations to source materials, and continually updated knowledge base, UnityGPT is poised to become the go-to research tool within the frontier sciences. The simplistic design facilitates easy information retrieval, and the model's output includes a detailed synopsis of the relevant literature in plain and understandable language. Unlike conventional platforms, UnityGPT does not link users to semi-static pages of content based on a query but rather finds the most relevant content and generates a synopsis dynamically. This marks a marked improvement over traditional forms of search as it allows the model to return more targeted and digestible responses that remain closer to the original materials from which they are derived.

Moreover, the model's extensive and ever-growing library contains many rare and often unknown materials that lie far outside the purview of traditional search mediums. These materials span a range of esoteric subjects that are typically researched or discussed only in niche, discontinued, or otherwise obscure periodicals. UnityGPT, therefore, aims to deliver a more comprehensive and ideologically-balanced alternative for information on controversial or esoteric subjects.

These factors combined place UnityGPT in a position to better service even the conventional scientist who may be seeking direct access to an even-handed summary of the extant research on any arcane topic. However, this utility is also proving invaluable for citizen scientists and the broader populace seeking insights into unconventional scientific concepts devoid of the biases typically displayed in traditional mediums. UnityGPT acts as a portal into a vast network of nontraditional thought, fostering new perspectives and insights. It epitomizes how the overarching capabilities of large language models, like ChatGPT, can be tailored for niche applications, maximizing strengths and mitigating weaknesses. Predicting the future in this rapidly advancing domain remains intractable, yet it is easy to become enthusiastic about the promise of such tools for reshaping our information synthesis and scientific methodology.

ENDNOTES

¹ In large language models like ChatGPT, the 'model temperature' is a configurable parameter that influences the model's level of randomness when generating outputs (Marion, 2023). At higher temperatures, the

model is more likely to pick low-probability words, leading to more diverse but potentially less coherent outputs, as can be seen with the low-probability words in Figure 1

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APPENDIX

Comparative Outputs From ChatGPT, Google Scholar, and UnityGPT Based on the User Prompt “What is the leading research on remote viewing?”

Figure 3a:

Remote viewing is the claimed ability to obtain information about distant or unseen targets through extrasensory perception (ESP) or a form of clairvoyance. The idea gained traction in the 1970s and 1980s when the U.S. government funded research into it under programs such as Stargate Project. However, mainstream scientific opinion remains skeptical of remote viewing claims.

Here's an overview of research on remote viewing:

- 1. Stargate Project and Earlier Initiatives (1970s-1990s):** The U.S. government funded research on remote viewing, notably the Stargate Project, which ran from the late 1970s to the mid-1990s. The project aimed to determine if remote viewing could be used for intelligence purposes. While some of the participants claimed success, the project was eventually discontinued due to a lack of consistent verifiable results. The American Institutes for Research (AIR) conducted an evaluation and concluded that there was no evidence of the phenomenon's operational value.
- 2. Scientific Experiments:** Some parapsychologists have performed controlled experiments to study remote viewing. Notable among them is Dr. Dean Radin, who has published studies in peer-reviewed journals indicating statistical significance in remote viewing experiments. However, his findings, like those of many other parapsychology researchers, have been met with skepticism from the broader scientific community.
- 3. Skeptical Inquiries:** Many skeptics have researched remote viewing, including James Randi, who has offered a million-dollar prize for anyone who can demonstrate paranormal abilities (including remote viewing) under controlled conditions. To date, no one has claimed the prize by successfully demonstrating these abilities.
- 4. Meta-analyses:** Some meta-analyses of remote viewing experiments suggest that there might be a weak but statistically significant effect, while others have found no evidence of the phenomenon. Given the inconsistency in results, many researchers believe that the positive findings might be due to methodological flaws or biases in the experiments.
- 5. Publication Bias:** One criticism of the remote viewing research literature is that there could be a significant publication bias. Studies that find no evidence of remote viewing might be less likely to be published, leading to an overrepresentation of studies that do find positive results.
- 6. Later Developments and Continued Interest:** Despite skepticism from the mainstream scientific community, there remains interest in remote viewing. Various individuals and organizations claim to offer training in remote viewing, and there are forums and publications dedicated to its study and practice.

While there has been research into remote viewing over the years, the phenomenon has not been accepted by the mainstream scientific community as a real or proven capability. The results have been mixed, with many studies and evaluations finding no evidence of the phenomenon, and some suggesting possible effects that, even if real, are of unclear practical significance.

Figure 3a. ChatGPT’s response suggests a slight bias against the topic of remote viewing. Although it acknowledges some prior research, it tends to focus on critiques. The answer mentions previous studies but does not provide citations or direct links.

Figure 3b: Google Scholar

[PDF] What do we know about psi? The first decade of remote-viewing research and operations at Stanford Research Institute
 R Targ - Journal of Scientific Exploration, 2019 - espresearch.com
 ... that the accuracy and reliability of **remote viewing** is independent of distance up to ... **viewer** is helpful, but it is not necessary. **Remote viewing** is a nonanalytic ability; describing a **distant** ...
 ☆ Save 📄 Cite Cited by 25 Related articles All 4 versions 🔍

[PDF] The Location and Reconstruction of a Byzantine Structure in Marea, Egypt, Including a Comparison of Electronic Remote Sensing and Remote Viewing.
 SA Schwartz - Journal of Scientific Exploration, 2019 - academia.edu
 ... For this reason, prior to discovery, much of the **remote viewing** data ... of Alexandria to be the **leading** authority on Marea. ... by a member of the **Remote Viewing Research** Team. Fakharani, ...
 ☆ Save 📄 Cite Cited by 18 Related articles All 6 versions 🔍

Distant viewing: analyzing large visual corpora
 T Arnold, L Tilton - Digital Scholarship in the Humanities, 2019 - academic.oup.com
 ... **distant viewing** framework to our own **research** ... **leading** female actors function within the narrative arcs, and the role of the domestic space within each narrative, contrasts with **research** ...
 ☆ Save 📄 Cite Cited by 97 Related articles All 6 versions 🔍

Developing CIMA based cyberinfrastructure for remote access to scientific instruments and collaborative e-research
 IM Atkinson, D du Boulay, C Chee, K Chiu... - 2007 - researchonline.jcu.edu.au
 ... For the initial beamline experiments of interest, we are designing and developing a system to provide researchers with **remote access** to the experiment, real-time data download, ...
 ☆ Save 📄 Cite Cited by 28 Related articles All 11 versions 🔍

[BOOK] Limitless mind: A guide to remote viewing and transformation of consciousness
 R Targ - 2010 - books.google.com
 ... The data from **remote viewing research** show, without a doubt, that our mind is limitless and that our awareness both fills and transcends our ordinary understanding of space and time. ...
 ☆ Save 📄 Cite Cited by 87 Related articles All 2 versions 🔍

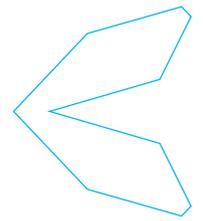
[BOOK] Behavioral biometrics: a remote access approach
 K Revett - 2008 - books.google.com
 ... levels, and researchers wishing to explore this fascinating **research** topic. In addition, this text will ... We tend to keep a rolling tally of the **latest** 10 successful login attempts, updating any ...
 ☆ Save 📄 Cite Cited by 99 Related articles All 5 versions 🔍

Figure 3b. Google Scholar displays multiple links to published articles. However, several of these seem unrelated to the specific query about remote viewing.

Figure 3c: **UnityGPT**

According to my training, the leading research on remote viewing was conducted at the Stanford Research Institute (SRI) in the 1970s. Physicists Harold Puthoff and Russell Targ initially focused on this form of psi at SRI, and their work was continued by physicist Ed May and colleagues. They conducted rigorous demonstrations of remote viewing, which were published in various papers such as Targ & Puthoff 1977, Tart, Puthoff, & Targ 1980, Tart, Puthoff, & Targ 1979. Additionally, Stephan Schwartz independently developed remote viewing technology for archaeological work, which further demonstrated the practical application of remote viewing (Schwartz 1978, 1983). The research at SRI involved several basic experiments, including psychokinesis, development of the remote-viewing method, remote viewing in an electronically shielded room, identification and selection of psi-gifted individuals, training of psi-gifted individuals in remote-viewing methods, and applications of remote viewing to national security problems. A meta-analysis of the SRI data from 1973 to 1988 concluded that remote viewing can provide operational settings. Experienced viewers were found to be significantly better than the general population, and remote-viewing ability did not degrade over time (Targ 1996). It is important to note that there is no quantitative evidence at this time to support a training hypothesis for remote viewing (Mumford, Rose, & Goslin 1995). However, the extensive research conducted at SRI and other independent laboratories, such as Bisaha & Dunne 1979, Dunne & Bisaha 1979, Jahn 1982, and Jahn & Dunne 1986, has provided considerable scientific evidence for the reality of remote viewing. The successful replication of remote viewing experiments and the discovery of individuals with high-quality remote-viewing abilities have further strengthened the evidence (Targ 1996). In recent years, a protocol known as associative remote viewing (ARV) has shown promise as a practical application of remote viewing. This protocol, developed by Stephen A. Schwartz and adapted by Puthoff and Targ, involves using remote viewing to predict the outcome of an event with multiple discreet possible outcomes. This new protocol has been referred to as ARV and has been explored in a limited number of published investigations (Katz, Grgi?, & Fendley 2018). However, further research is needed to fully explore the potential uses of ARV and remote viewing in general (Smith, Laham, & Moddel). In conclusion, the leading research on remote viewing was conducted at the Stanford Research Institute in the 1970s, and it has provided rigorous demonstrations of the phenomenon. The practical applications of remote viewing have been demonstrated in various fields, such as archaeology, and the research has shown that experienced remote viewers can provide valuable intelligence

Figure 3c. UnityGPT provides a comprehensive overview of the topic. A source link beneath the description (not shown here) offers direct citations to the referenced research



**STUDENT AND
CITIZEN SCIENCE**

The Jersey Devil: Examining a Phenomenon Obscured by Myth

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INTRODUCTION

The “Jersey Devil” is a strange and mysterious creature that is alleged to haunt the deep swamp of the Pine Barrens of New Jersey (USA). It is said to have the head of a horse, the wings of a bat, and the body of a kangaroo, with long talons, a forked tail, and glowing eyes. The appearance is often described as terrifying, and it is reported to emit bloodcurdling screams (Atlantic County Government, 2022). The modern history of the Jersey Devil can be traced back to the mid-1700s, with the first published reference to the Leeds Devil (Regal & Esposito, 2018). The

HIGHLIGHTS

Reports of this legendary creature involve an array of strange events that mirror some “paranormal” hotspots found elsewhere, suggesting there is more than a simple myth or biological mystery at work.

ABSTRACT

This descriptive study delves into the enigmatic nature of the “Jersey Devil,” an enduring legend of a cryptid from New Jersey (USA) while acknowledging its historical and folklore roots. The absence of tangible evidence regarding the alleged creature’s existence has often prompted explorations into metaphysical and supernatural explanations. Accordingly, three sets of theories about the creature’s origin are considered: terrestrial, interdimensional, and extraterrestrial. Events associated with the Jersey Devil compare well to, and might be linked with, documented flurries of accounts involving cryptids, UFOs, and high strangeness at alleged “paranormal” hotspots like Skinwalker Ranch in Utah and Point Pleasant in West Virginia. Caution is needed when considering esoteric theories, but the consistency of sightings over time might argue for the possibility of interdimensional or extraterrestrial entities. Finally, the paper discusses the notion of the Jersey Devil phenomenon serving as a control mechanism or a means of instilling fear of the unknown.

KEYWORDS

Citizen science, cryptid, Jersey Devil, folklore, monster, urban legend.

story goes that a woman named Mother Leeds gave birth to her 13th child on a dark and stormy night, and the child was born with wings, a forked tail, and hooves instead of feet. The creature supposedly flew up the chimney and has haunted the Pine Barrens ever since. However, earlier accounts of strange creatures in the area hint at a longer tradition (Atlantic County Government, 2022).

In 1909, the Jersey Devil achieved celebrity status with a wave of sightings fostered or recounted by newspapers so that the local monster became famous state-wide (and beyond) as the “Jersey” Devil. The newspapers fueled the hysteria by publishing sensational stories and

offering rewards for capturing the creature. The result was a spate of sightings and hoaxes, which helped to perpetuate the legend of the Jersey Devil. Over time, literature and a system of beliefs have grown up around the Jersey Devil, treating it as popular history, state history, scholarly history, folklore, anomaly, and cryptid. This literature highlights the different ways in which the creature is viewed and understood by different people.

This study argues that the Jersey Devil exists or may exist in several formats simultaneously. Firstly, it belongs to folklore, with local legend as a traditional monster and in an alleged event with a basis in religious belief. The legend may persist as a relic no longer believed, but the myth is adaptive and updates the monster with new and currently credible characteristics. The Jersey Devil is an iconic figure in New Jersey folklore and has become part of the state's cultural identity. Secondly, the Jersey Devil has a place in popular culture where hoaxes, newspaper yarns, humor, and local pride create a fictitious life that provides entertainment and sustains interest but does not depend on belief. The Jersey Devil has appeared in films, T.V. shows, comics, and video games and has become a popular Halloween costume. Finally, the Jersey Devil's appearance is an anomalous event that witnesses have experienced for hundreds of years and supports the reality of an objective cryptid for proponents, while for skeptics, the experience results from misidentification of conventional sights, with witnesses misled by expectations of a monster resulting from the influence of the tradition. Sightings of the Jersey Devil date back hundreds of years and make their way into the present; there have been reports of tracks, livestock deaths, and other signs attributed to the creature.

This paper explores these different perspectives within a detailed analysis of the Jersey Devil and its place in folklore, popular culture, and cryptozoology. By examining the history and various interpretations of the Jersey Devil, we can, therefore, address the question of whether or not the Jersey Devil is ontologically "real."

History of the Phenomenon

To understand the reality of all that has come to be known as the "Jersey Devil," it is necessary to separate the *Events* from the *Legend* and then separate the *Legend* from the *Folklore* (or *Myth*). Events are isolated incidents. Events matching the same description form a pattern. The pattern gives rise to Legend. The Legend becomes Myth. However, witness reports of the Jersey Devil are similar to a larger set of winged humanoid cryptid sightings that have no discernible beginning, end, or geographical boundaries. Legends and myths can both obscure and

explain patterns. In addition to being the number one suspect in all manner of high strangeness around the Pine Barrens area in New Jersey (Coleman & Hallenbeck, 2010), the Jersey Devil has become a trope. The creature is a pop culture icon, but it began with terror of the unknown, which has not yet stopped (Gillespie, 1993). To be sure, apparent sightings of "The Jersey Devil" continue to the present, so the question of whether the Jersey Devil is ontologically "real" also persists.

Gillespie (1993) described the definition of a Legend in relation to the Jersey Devil as follows:

By definition, a legend is a story in prose that has been handed down orally from generation after generation. It is generally regarded by its tellers as true. Unlike myth, which usually deals with something far away and long ago, legend is concerned with the immediate historical past. Legend is sometimes referred to as folk history, but, of course, it is history as changed by passing a story orally from person to person (p. 42).

In the case of the Jersey Devil, the exact pattern of events that inspired the legend is unknown. Yet, as Gillespie noted, the tellers of the original tale regarded it as true. It was not a ghost story meant for entertainment. The oral tradition predates printed references to the Jersey Devil by at least 100 years. Folklorists often trace the origin of the present-day myth to the mid-18th Century when it came to be known as "The Leeds Devil" (Atlantic County Government, 2022).

At this point, the creature became a myth. It was no longer a tale in which the teller regarded it as necessarily true. In fact, research points to newspapers and politicians blatantly sharing the tale as a form of anti-British propaganda. Despite this, the description of the creature of myth was solidified in the minds of the public. Thus, the legend and myth grew independently of the events. Sightings of a winged humanoid creature predated the "Leeds Devil" Legend (and therefore the myth). Sightings continued during the creation of the myth; while some witnesses to the Jersey Devil report a creature exactly like the one in the myth, other witnesses encountered a vaguely similar creature. Yet, the sightings continue into the present day, as does the question of the creature's existence.

Before the Legend to 1730

Prior to its appearance as "The Leeds Devil" in the 18th century (The "Jersey Devil" name would not become popularized until the 20th century), the name given to

flying cryptids encountered in the Pine Barrens is unknown. It was most likely referred to simply as “the devil” or “the dragon.” There are numerous references online and in print to this creature appearing in the oral tradition of the local Native American tribe of the Leni Lenape, as well as Swedish Explorers who named the area “Drake Kill.” For instance,

The first people to note the presence of a peculiar animal in the general area were the Native Americans, who said it originally appeared across state lines in what is now Bucks County, Pennsylvania (where alleged sightings of the Devil have been made in recent years), just north of Philadelphia. In fact, the local Indians named the creek Popuessing, meaning “place of the dragon” (Coleman & Hallenbeck, 2010, p. 6).

Local Jersey and Lenape oral traditions mention a strange creature in the Pine Barrens existing prior to the colonists’ appearance. There are similarities between the Jersey Devil and the ritual spirits of the Lenape. Authors James McCloy and Ray Miller draw comparisons between the legends of the Jersey Devil and a Delaware Native American deity known as the Mising (McCloy & Miller, 1998). In particular,

To the Native Americans, the Mising was a protector deity who had to be worshipped to prevent natural calamities such as storms or earthquakes, and its function with children took place throughout the year. If a Delaware child misbehaved or was sick, the family summoned the Mising impersonator for a visit...There are clearly certain parallels between the Mising and the Jersey Devil, who at times appeared as a hairy creature walking on its hind legs, reminiscent of the Mising ritual costume. Virtually the only god that the Delawares attempted to impersonate, the Mising represented the only strange creature fashioned by the Native Americans the early white settlers might have seen in an already alien culture. European settlers observing this creature would have been frightened, and because of the fear, the Mising ceremony was often called the ‘Devil Dance’ by whites” (McCloy & Miller, 1998, p. 26).

Parents passed the stories that they gathered down to their children, which kept them from entering the swamp at night. Gillespie (1993) pointed to this as a socio-psychological function of the Jersey Devil myth. It

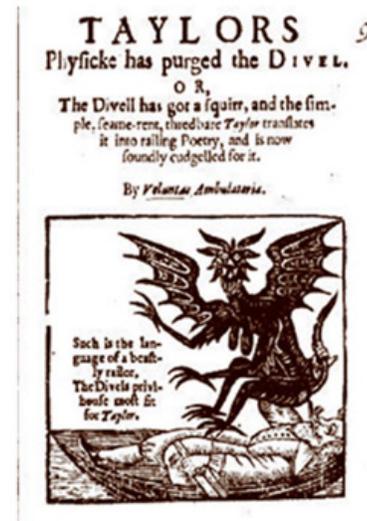


Figure 1. 1640’s Quaker Pamphlet - fair use

thus became an embodiment of terror and was thus ripe for myth. When confronted with a terror they could not identify, early American settlers developed their own set of myths surrounding the terror. Their perception of monsters and myths gravitated toward their cultural embodiment of evil. The Legend of the Jersey Devil calls back to America’s Quaker roots, and images of “The Devil” seen in Quaker pamphlets from the 1600s (see Figure 1) likely informed the description of the mythical creature found in the Leeds tale (Regal, 2013). These early images of the Devil (or Satan) —which themselves are reminiscent of images found in Fae religions and earlier Pagan traditions—are either the reason Quaker settlers imagined the creature as they did in the Leeds Devil or the creature



Figure 2. Basilica of Sant’Apollinare Nuovo (Ravenna, Italy) Showing Early depiction of Satan. [Wikimedia commons.](#)



Figure 3. Image of the Devil from the 13th-century *Codex Gigas* (Wikimedia Commons).

that inspired the images of grotesque humanoid animal deities and faeries in Europe, also occupied the Pine Barrens and was reinterpreted as the Jersey Devil.

This depiction of the Devil does not have its roots in the Christian Bible. It is an invention of the Medieval Christian Church. In the Bible, the Devil is not described as having horns or wings. He is said to take the appearance of an Angel of light. "And no marvel; for even Satan fashions himself into an angel of light" (2 Corinthians 11:14). The earliest image of Satan is thought to originate in a 6th-century mosaic. It imagines the Devil as a blue-winged angel (Denova, 2021).

Later images of the Devil would re-imagine him as more grotesque and animalistic, adding horns and a tail (see Figure 3). Hobgoblins, imps, and fairies were already established in English folklore during the Medieval period (Grollemond & Keene, 2022), and the Quakers were heavily influenced by Medieval superstition. The Church, therefore, incorporated these elements into its artistic interpretations of the Devil, and the Devil in some Quaker images came to be associated with an image very similar to the image of the Jersey Devil in folklore (Regal, 2013).

Mark (2021) summarized the synthesis of superstition and experience in his article: "Religion and Superstition in Colonial America:"

The Bible made it clear that the Devil and his evil spirits were as much a reality as God and his angels, and either – or both – could be at work in one's life at any given time. Superstitions, therefore, developed naturally from religious belief and confirmed the colonists' worldview (what is

known today as confirmation bias) and directed their responses to the events of their lives. As more superstitions were "confirmed" through experience, they became more deeply embedded in the cultural consciousness and periodically found expression through events such as witch trials, banishments, and various persecutions of marginalized segments of the population. Although people in the modern day may find many of the acts of the early colonists incomprehensible, they were a natural development of the superstitions encouraged by the religious beliefs of the time (para 4).

As Mark pointed out, it is not just the Devil but also his evil spirits that were part of Quaker reality. Medieval Christianity was influenced by forms of Paganism, which came before it. Paganism included many depictions of animal-human hybrids (many with wings). These images likely informed the grotesque images of the Devil and, subsequently, the Jersey Devil (see Figure 4). It is also possible the winged humanoids of Paganism were themselves representations of a larger winged humanoid phenomenon. Winged humanoids have been depicted in art and reportedly seen throughout history.

The Leeds Devil Legend Becomes Jersey Devil Myth

Around the end of the 18th century came the beginning of the modern version of the myth. As the most predominant story goes: Around 1735, a woman named Deborah "Mother" Leeds was about to have her 13th child. She was a Quaker woman and extremely poor. So, with 12 mouths to feed, she took her anger out on the child and the Lord. While pregnant, she shouted: "Let this one be the devil." When the child was born legend says it had a



Figure 4. 1909 *Philadelphia Bulletin* Sketch of the Jersey Devil (Wikimedia Commons)

horse's head. It grew wings, horns, and a tail, killed the attending midwife, then promptly flew up the chimney and into the night (Gillespie, 1993).

There are also alternate versions of the origin of the creature. The most predominant variants are listed on the official New Jersey Government website (N.J. Gov Staff., 2022): "A different story says that a town put a curse on a young girl who fell in love with a British soldier during the Revolutionary War. When she gave birth, it was to the Jersey Devil. Another story says a gypsy cursed a girl because she didn't give the gypsy food. The curse caused her to give birth to the Jersey Devil" (para. 2). They offer the most common description of the Legendary Creature as well:

Locals in the Pine Barrens call it the Leeds Devil. They say it has a horse's head, long legs with hooves, two short front legs, and a bat's wings. No one knows how tall it is. Some people think it's six feet tall, others think it's only three or four feet tall. The Devil has glowing red eyes and makes loud screeching sounds (para. 3)

The Leeds tale is the most popular myth of the origin of the Jersey Devil, and it may indicate where this particular myth originated as well — Leeds Point, New Jersey.

Modern members of the Leeds family do not seem to mind and are even having a little fun with it. Some have joked that the Jersey Devil is their cousin, and therefore, the Leeds family does not need to fear it. However, they are not the only family accused of being related to the Devil. Some locals of Leeds Point assert the name of the mother was Shroud, and the actual house the creature

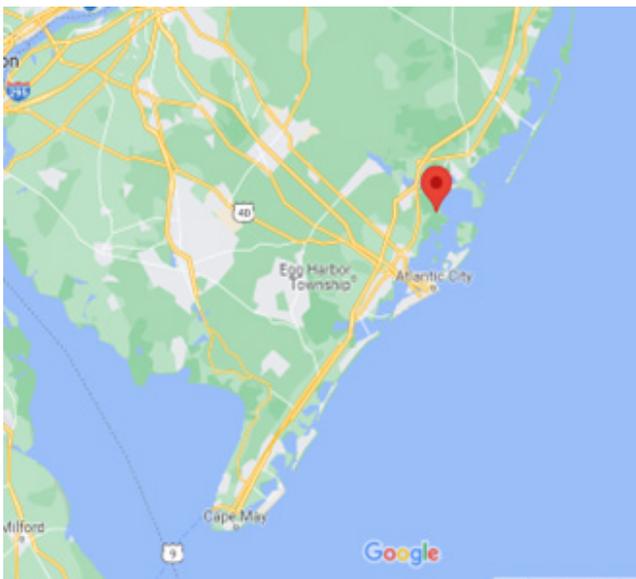


Figure 5. Map Showing Leeds Point, New Jersey



Figure 6. Japhet Leeds House, Moss Mill Road, Leeds Point, Atlantic County, NJ Photos from Survey HABS NJ-399 (Library of Congress).

was born in was the Shroud house. Both Daniel Leeds and Samuel Shroud lived near Leeds Point around 1735. Those who insist Samuel Shroud is the source of the legend claim the "Leeds" in "Leeds Devil" refers to Leeds Point as opposed to Daniel Leeds last name. Based on the work of noted Jersey Devil scholar Brian Regal (cf. Regal & Esposito, 2018), the most likely (and political) origin of the Jersey Devil / Leeds Devil "Legend" is that of Daniel Leeds.

Regardless to whom the "Leeds" in "Leeds Devil" actually refers, newspapers periodically reprinted the "13th child" story prior to 1909 and began to refer to the creature as the "Leeds Devil." The Legend became centered around Leeds Point. The arrival of the Leeds Devil in print during the 1800s, and the fact it was known as the "Leeds Devil" during the period, lends support to historians who consider the "Leeds Devil" portion of the Jersey Devil a creation of political propaganda and anti-British sentiment. The War of 1812 indeed laid fertile ground for a British devil of journalistic creation (McCloy & Miller, 1976, p. 18).

The most famous sighting prior to 1909 occurred when Naval Commodore Stephen Decatur allegedly shot a huge flying creature with a cannonball. Witnesses claimed the cannonball had no effect, which might suggest a supernatural character to the event. However, the creature in this incident was alleged to resemble a flying pterodactyl (Atlantic County Government, 2022). This is not the description of the Jersey Devil of pop culture and folklore, and so provides a notable example of a cryptid with a different description in the Jersey swamps being lumped into Jersey Devil folklore. Joseph Bonaparte, elder brother of the famous French emperor Napoleon Bonaparte, is said to have had an encounter with the Jersey Devil in 1820 during his brief residence in Bordentown,

New Jersey. According to legend, Bonaparte was hunting in the woods when he spotted the creature, described as having the body of a kangaroo, the head of a horse, and wings like a bat, among other strange features. Despite being armed, Bonaparte was said to have been too frightened to shoot the creature and fled the area. The historical veracity of the Bonaparte encounter is often debated, yet it continues to be widely circulated in folklore and mentioned in print (Aubrey, 2021).

1909

In early 1909, a wave of sightings of the Jersey Devil occurred, which garnered extensive newspaper attention (Library of Congress, 2023). The sightings included reports of mysterious tracks in the snow, the sound of flapping wings, and stories of the creature attacking a trolley car, seen by multiple witnesses, and law enforcement firing at it. "These sightings were reported in various newspapers in the region, such as the *Asbury Park Press*, the *Philadelphia Inquirer*, and the *Trenton Times* (Editors, 1909a, 1909b, 1909c, 1909d, 1909e, 1909f). Figure 7 shows the January 20th Edition of the *Asbury Park Press*, which published a photograph of cloven footprints with the headline: "What

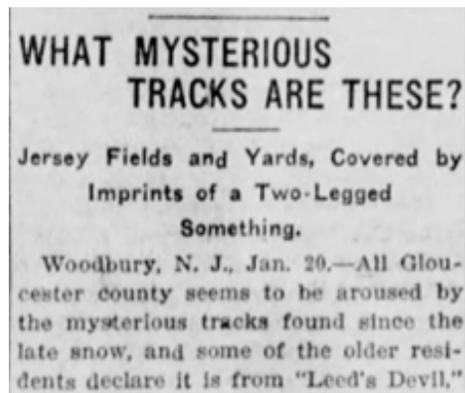


Figure 7. 1909 News Clipping About Mysterious Footprints (*Asbury Park Press*)

Mysterious Tracks are These?" The article went on to state some of the older residents claimed that the tracks came from the Leeds Devil, and the creature was seen everywhere. Newspapers competing for cash were willing to take reports from anyone. A showman went so far as to dress up as a kangaroo and claim he had captured the monster (Atlantic County Government, 2022).

The coverage of the Jersey Devil in the newspapers was significant, with articles printed daily, sometimes even twice a day. The newspapers were eager for a sensation to sell copies, and the Jersey Devil provided just that (Atlantic County Government, 2022). The articles printed included exposed hoaxes and printed jokes, but also printed images of the creature, and claimed that scientists were investigating (Philadelphia Inquirer, 1909). The sightings in 1909 were considered a high point of the Jersey Devil as an experienced anomaly. The wave of sightings was so intense that the scientific community was brought in to investigate. Newspapers reported that science professors from Philadelphia and experts from the Smithsonian Institution thought the Devil could be a prehistoric creature from the Jurassic period. The New York scientists thought it to be a marsupial carnivore, while others believed it to be an extinct fissiped. The Academy of Natural Sciences in Philadelphia, however, could not locate any record of a living or dead species resembling the Jersey Devil. According to the County of Atlantic City:

Reportedly, science professors from Philadelphia and experts from the Smithsonian Institution thought the Devil to be a prehistoric creature from the Jurassic period. Had the creature survived in nearby limestone caves? Was it a pterodactyl or a pelesaurus? New York scientists thought it to be a marsupial carnivore. Was it an extinct fissiped? However, the Academy of Natural Sciences in Philadelphia could not locate any record of a living or dead species resembling the Jersey Devil (Atlantic County Government, 2022, p.3 para. 3).

The newspaper coverage of the sightings varied in quality and accuracy. Some newspapers were more skeptical than others, and some even tried to debunk the sightings. For example, a 1909 *Trenton Times* article reported that a resident of the town had dressed up in a kangaroo skin and had gone out at night to frighten people. The article claimed that this was the source of the mysterious tracks that had been found. Another article dated 24 June 1909 in *The Columbian* stated that the Jersey Devil had crossed over into Spring Valley, New York, as well as referred to it as the "Jersey Bombat." These re-

ports, however, did not satiate the public's fascination with the Jersey Devil. The wave of sightings in 1909 was significant because it brought the Jersey Devil into the public consciousness. The extensive newspaper coverage of the sightings helped to spread the legend of the creature and fueled public interest in it. The coverage varied in quality and accuracy, with some newspapers trying to debunk the sightings. Nevertheless, the 1909 wave of sightings remains an important event in the history of the Jersey Devil legend, and its significance is still felt today.

1909 to the Present

Following the 1909 wave and the Philadelphia Academy of Sciences' statement that they could find no record of the creature, sightings slowed but did not stop (McCloy & Miller, 1976). A group of boys in Gibbstown, NJ, claimed to have seen the creature, and a hunt followed, though (other than tracks) no material evidence was found or visually confirmed by authorities (Coleman & Hallenbeck, 2010). However, several livestock killings in the 1840s, 1920s, and 1960s were attributed to the Jersey Devil:

An extraordinary mangling of dogs and livestock near the Mullica River in 1966, when Steven Silkotch found his poultry farm ravaged by a ghastly night intruder. To his astonishment, he found strewn about and cruelly mauled the carcasses of thirty-one ducks, three geese, four cats, and two large dogs, one of which was a ninety-pound German Shepard. The unfortunate Shepards thick collar was chewed to pieces, and his body dragged a quarter of a mile from the

scene of the attack. New Jersey State Police from the Tuckerton Barracks were assigned to the case. Trooper Al Potter came upon tracks that were larger than a human hand, but the tracks were not amenable to plaster (McCloy & Miller, 1976, p. 98).

The Jersey Devil was spotted outside of New Jersey numerous times in the 20th century. During the 1930s, a period of marked high strangeness, an incident occurred in Downingtown, Pennsylvania, which caught the attention of newspapers and the use of the Jersey Devil moniker to cover creatures of varying descriptions:

The strange monster was reported shortly after 9 p.m. by Cydney Ladley, who lives near Milford Mills, just north of here. Rushing into town...Ladley, his wife, and Mrs. Chester Smith, a neighbor, told of seeing the creature on a back road near their home just as dusk was settling... 'It leaped across the road in front of my car,' Ladley said. 'It was about the size of a kangaroo. And eyes! What eyes!'" (Clark, 2012, p. 283).

Rewards were offered for its capture in the 20th century, and groups ventured out regularly into the Pine Barrens to search for the creature. Sightings continue into the present day, but the descriptions often provided in the sightings vary wildly. Some accounts that are lumped in with Jersey Devil sightings do not even reference wings (Mullane, 2018). This has led some researchers to believe that many Jersey Devil sightings are misidentified as Sas-

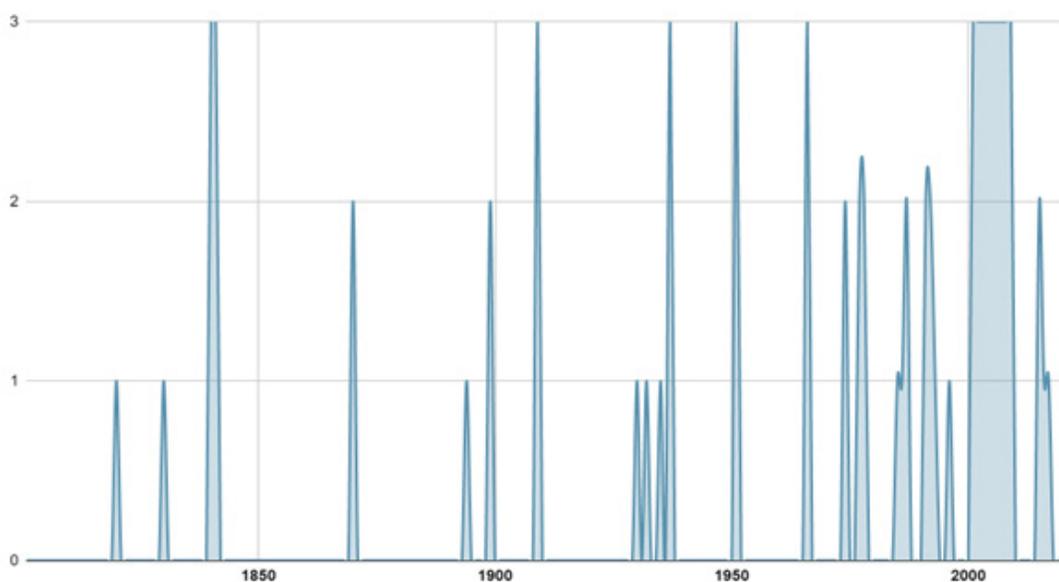


Figure 8. Known "Jersey Devil" Sightings by Year.

quatch or other cryptids.

Trend Analyses and Parallel Cryptid Sightings

The last two decades have seen a rise in reports of “paranormal” events (Kambhampaty, 2021; Lomas & Case, 2023), and the Jersey Devil is no exception. Figures 8 and 9 graph the most well-known Jersey Devil sightings by year since 1800. Furthermore, each year in which a sighting occurred; an activity level was assigned, i.e., “1” indicates a well-known, recorded sighting, “2” denotes either multiple witness encounters OR multiple livestock mutilations, and “3” refers to multiple witness encounters AND livestock mutilations occurring simultaneously, in the same time period. The result is a visual inventory of 120 years of Jersey Devil sightings categorized by their relative intensity.

We can see that the trend is clearly weighted to the modern era, with a marked increase in the frequency of sightings around the year 2000. Part of this is arguably attributable to the rise of the internet and ease of communication. Websites that tracked sightings of the Jersey Devil and other cryptids were launched in the 2000s, and this made it easier for reports to be recorded. As the volume of reports increased, misidentifications would certainly increase as well. Yet, this trend may point to an overall rise in events described as “paranormal” or a period of increased UFO sightings and high strangeness that the UFO research community typically refers to as a “flap.” Joel Hynek noted, “And what of the ‘flaps’? We have already mentioned the Air Force had three of them available for study, those of 1952, 1957 and 1966” (Hynek, 2020, p. 256). The graph prepared for this report revealed

distinct increases in Jersey Devil sightings in 1951 and 1966. Yet, the sample and chart in this report are not a complete record of Jersey Devil sightings, and the winged humanoid/ cryptid phenomenon is not confined to the Garden State (see Table 1).

For example, “Skinwalker Ranch” contains some of the most recent and well-documented, repeatable “paranormal” observations of the last 30 years. It is also the place that perhaps best demonstrates why cryptid sightings should be taken seriously at all. During the initial United States Government research of the Skinwalker Ranch site, the family of a Defense Intelligence Analyst reported seeing an upright canine (dogman, wolfman, etc.) in their backyard (Kelleher & Knapp, 2005). This cryptid experience follows a pattern of witnessing creatures at that particular location, which presumably do not exist in our reality. The activity at Skinwalker Ranch is further accompanied by UFO/UAP sightings that also occur in the Pine Barrens and around the New Jersey/ Pennsylvania areas. The events and descriptions of the creature at Skinwalker Ranch are relevant to the Jersey Devil, as they suggest a consistent trail of evidence pointing to the existence of a physical cryptid. Although the existence of a cryptid in another location and matching another description does not mean all Jersey Devil sightings are part of the same phenomenon, it does imply that a subset of Jersey Devil sightings could be a part of the same phenomenon which occurs at locations like Skinwalker Ranch, and those legitimate cryptid sightings are mistakenly attributed to a myth.

Prior to Skinwalker Ranch, well-documented cryptid sightings of the modern era occurred in 1966, 500 miles

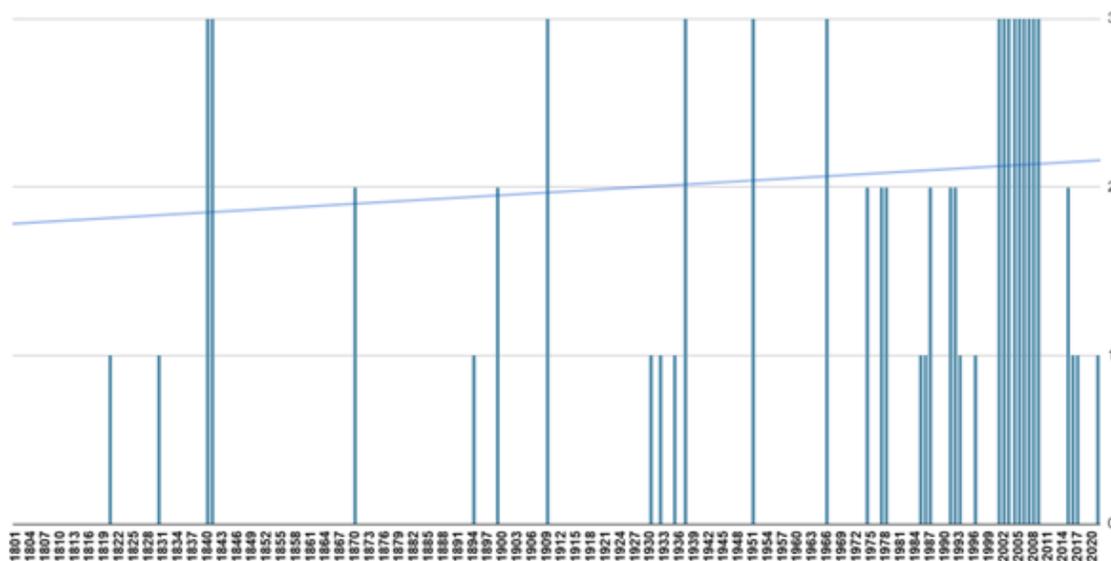


Figure 9. Trend of “Jersey Devil” Sightings Near New Jersey.



Figure 10. Local Names Given to Winged Humanoid Sightings Similar to the Jersey Devil

east of the Pine Barrens in Point Pleasant, West Virginia. At least some Jersey Devil sightings match the description of the so-called “Mothman” reported to the police and journalists. The original witnesses description of the Mothman from the *Point Pleasant Register* Nov 16, 1966, reads as follows:

The young men said they saw the creature’s eyes, which glowed red, only when their lights shined on it. And it seemed to want to get away from the lights. They said it looked like a ‘man with wings,’ but its head was ‘not an outstanding characteristic.’ Both were slightly pale and tired from the lack of sleep during the night following their harrowing experience. They speculated that the thing was living in the vacant power plant, possibly in one of the huge boilers. ‘There are pigeons in all the other buildings,’ Mallette said, ‘but not in that one.’ If I had seen it while by myself I wouldn’t have said anything,’ Scarberry commented, ‘but there were four of us who saw it.’ They said it didn’t resemble a bat in any way, but ‘maybe what you would visualize as an angel...’ (Sergeant, 1966, p. 1).

This period was rife with high strangeness (e.g., Mothman, UFOs, etc.), and here, during the same time period, comes a sighting that gets lumped into the Jersey Devil category with multiple witnesses who went to the police (making it more credible) and described a creature which apparently looked nothing like the 13th child myth. Specifically, toward dusk on May 21, 1966, a creature “at least

seven feet tall” ambled through the Morristown, New Jersey, National Historical Park and left in its wake four hysterical witnesses who had viewed it from a parked car. They said the creature was “faceless,” covered with long black hair, and had scaly skin. It had broad shoulders and walked on two legs with a stiff, rocking movement. The four drove to the park entrance and stopped approaching cars to warn people that a “monster” lurked inside. Raymond Todd, one of the witnesses, caught a ride with a young lady who took him to the Municipal Hall in Morristown, where he blurted out his story to the police. Oddly enough, the girl had seen a similar entity a year before. She told the police that she and several friends were in the park one night when a huge, broad-shouldered something had loomed up in their rear window and thumped on the back of the car. Her mother had asked her not to report the incident, she said (Coleman & Hallenbeck, 2010, p.16).

The “Mothman” has been seen dozens of times since the year 2000 and has seen an increase in sightings in the area around Lake Michigan during the same time period (Wayland & Wayland, 2017). The descriptions of the creature vary in the recent Chicago sightings, but many of the same general characteristics are present, i.e., leathery wings, red eyes, massive height, etc. The description of the so-called “Batsquatch” reported in the Mount Rainier region bears similarities to the Jersey Devil and Mothman experience. Importantly, it also bears hallmark traits of “paranormal” activity, such as the stopping and starting of a vehicle and a feeling of being haunted. The original article reported this as a close encounter. The *News Tribune* gave a good description in their article entitled “Mount

Table 1. Comparison of Features Among Various Flying Cryptid Reports.

	Jersey Devil	Mothman	Batsquatch	Wisconsin Man Bat
Height	4 to 8 feet	7 feet	9 feet	7 Feet
Wings	Leathery bat-like	Leathery bat-like	Leathery bat-like	Leathery bat-like
Facial Features	Animal or Indistinct	Indistinct	Animal or Indistinct	Animal
Eyes	Red or Yellow	Red	Red or Yellow	N/A
Feet	Animal, Cloven	Clawed	Clawed	Long toe-like Claws
Color	Dark	Grey, Black, Dark	Blue, Dark	Dark, Gray-Brown
Location	New Jersey, Tennessee, Pennsylvania	Pennsylvania, Chicago, West Virginia, Ohio, et al.	Washington, California	Wisconsin

Note: The characteristics of these cryptids that are similar to the Jersey Devil were drawn from a sample of prominent sightings and demonstrate that the phenomenon of New Jersey might extend to other geographic regions. Further, all these cryptids have had sightings reported by the news in the last 20 years.

Rainier-area youth has close encounters in the foothills:”

The engine died, and the dashboard lights fell dark. Although he hadn’t applied his brakes, the pick-up truck he was driving stopped suddenly, abruptly, square in the middle of the road there between the edge of the forest and a scrub-by clearcut field...Then he saw the feet descending. Bird feet. Claw feet. Then the legs, the torso, the wings, folded attached to the back of broad shoulders. The head. That face. The Creature nine feet tall... Its eyes were yellow and shaped like a piece of pie with pupils like a half-moon. The mouth was pretty big. White teeth. No fangs. The face was like a wolf...A few minutes later the truck just started” (Roberts, 1994, para 1).

These types of incidents underscore that other cryptid experiences often parallel the reports of Jersey Devil witnesses. The implication is that the Jersey Devil may be less of a 13th child or wild animal and more of a local myth interspersed with occurrences of a wider paranormal phenomenon.

Theories of the Jersey Devil

The events that supported the myth of the Jersey Devil began at least as early as pre-colonial times and continue today. This means that the phenomenon itself has 400 years of witness reports, although no material evidence has been produced in that time, making a biological explanation seem unlikely. The variance in the descriptions of the creature lends further credence to this

conclusion unless the Pine Barrens are filled with a variety of large undiscovered animals. On the other hand, the consistency and credibility of some reports might suggest that a “mass delusion” explanation is overly dismissive. Removing the myth also removes the limitations of the description of the creature placed on it by the myth, and therefore, accepts that descriptions may vary. It allows one to ask a different set of questions. Many of the witness reports bore similarities to reports of other cryptids. For example, if we ask how many of these witnesses perceived a creature with a “dark and formidable shape, over six feet tall, and glowing red eyes,” then the map begins to look very different. Such sightings spread out all over



Figure 11. News Tribune Batsquatch sketch. 1994 - Fair Use

the world to include reports of parallel creatures such as Mothman, Batsquatch, etc.

“Winged humanoid” sightings stretch beyond England and beyond the 1600s. Examining the Jersey Devil as the name given to sightings of “Winged Humanoids in the Pine Barrens” gives us a very different view. It indicates that the core phenomenon responsible for the Jersey Devil may extend elsewhere. That is, we might be dealing with the cultural interpretation of New Jersey residents who encounter winged humanoid creatures or a common set of sociocultural or environmental conditions that cause winged humanoid misidentifications and experiences (Coleman & Hallenbeck, 2010; Keel, 1975b). Amidst an unknown world and awash in superstition, Colonists encountered something unknown. If any of the reports are true, this creature was a winged humanoid. Any encounter with a winged humanoid among colonists would likely be attributed to the Devil of medieval times. Descriptions of encounters vary, but the religious myth does not. This view implies that experiencers may have encountered cryptids of varying physical characteristics, but that were nonetheless described in the cultural terms of the past. Witnesses fill in unseen characteristics and create an origin story for a cryptid based on their religious or cultural beliefs (Regal, 2013). By the way, this same cryptid phenomenon is still reported in the present. Thus, we might be dealing with a long history of people blaming the “Jersey Devil” for all manner of high strangeness in the Pine Barrens (Foster, Sickles, & Camp, 2023).

It would be easy to dismiss the Jersey Devil and similar sightings as a remnant of superstition or mass delusion. Yet again, the consistency of reports over time and the fact they continue into the present make this explanation seem untenable. The Jersey Devil either boils down to (a) psychosocial phenomena (including mass delusion), (b) an animal yet to be discovered, or (c) a genuinely “paranormal-type” event. Based on witness reports, all three explanations may exist simultaneously.

David Hufford’s (1989) work on the study of folk beliefs and supernatural experiences may offer insight into the psychosocial explanation of the Jersey Devil. His theories, particularly the concept of the “experiential basis of belief,” suggest that supernatural experiences are not necessarily rooted in objective reality but rather in the perceptions and interpretations of the experiencer. This perspective may help to explain the persistence of the Jersey Devil legend despite a lack of concrete evidence for the creature’s existence. Hufford’s work emphasizes the importance of subjective experiences in shaping beliefs about the supernatural. He argued that these experiences are not random but rather follow patterns that can be studied and understood. According to Hufford, these

patterns are based on a “cultural code,” which is a set of beliefs, symbols, and practices that shape how individuals perceive and interpret their experiences.

Applying Hufford’s concept of the cultural code to the Jersey Devil legend, it becomes clear that the creature is not simply a physical entity but rather a complex symbol with deep cultural resonance. Its legend has evolved over time, with different versions emphasizing different aspects of the creature’s appearance or behavior. However, despite these variations, the core elements of the legend have endured—the creature is always depicted as a monstrous, supernatural being with the power to terrorize and harm humans and animals alike. Given the fact colonists were unfamiliar with the flora and fauna that they encountered in the new world, it is likely some of the sightings inspiring the legend represented misidentified animals. For example, the sandhill crane is thought by skeptics to be a culprit in “Mothman” and “Batsquatch” sightings (Keel, 1975b). Sandhill cranes and other tall water birds are likewise found in New Jersey. This is one possible cause of Jersey Devil misidentifications. Sandhill Cranes grow to a height of three to four feet and have a wingspan of five feet. Thus, when looking for anomalous Jersey Devil sightings, one factor to weed out potential misidentifications is “height.” Witnesses who are sure they saw a creature over six feet tall are less likely to have seen a water bird if their descriptions are indeed accurate and not overestimations. Also, these cranes often have red around their eyes, and “glowing red eyes” is unquestionably an oft-reported feature of Jersey Devil sightings.

Many witness reports of the Mothman also reported “glowing red eyes.” The same description is often found in Bigfoot and “Batsquatch” reports. Oddly enough, one does not find many Mothman sightings in New Jersey. The Mothman incidents of Point Pleasant, West Virginia, in 1966 were well-publicized. There were numerous witnesses, material damage to a vehicle, and medical effects such as conjunctivitis reported and documented (Keel, 1975b). Dozens of Mothman-like sightings have also been reported in the Chicago area from 1980 to 2022 (Wayland & Wayland, 2017). The description of the creature is strikingly similar to reported sightings of the Jersey Devil. The sightings only vary slightly in that the feet of the Jersey Devil are alleged to be similar to a horse or a goat. Horns and a long tail are also unique features of the cryptid said to inhabit the Pine Barrens. In Mothman cases, witnesses often describe the head as being an indistinct feature. But the glowing red eyes, height taller than a human, and bat-like wings are too similar to ignore. A similar-appearing cryptid known as Batsquatch is reportedly in the area around Mt. Shasta, California, and Washington state. It is supposedly taller than a human and with a bat-like form

(or with leathery wings) and glowing red eyes. There are no Mothman sightings in these places, and yet the descriptions are much the same as both present-day Mothman reports in Chicago and the sightings in West Virginia during the 1960's. It appears that the name of this cryptid experience and its legend are merely localized.

Each characteristic added from the "Jersey Devil" myth to the description reduces the amount of sightings one samples from across the world. For example, if we add wings to the previous list, an interesting combination of sightings emerges that would include such well-known cryptids as Mothman, Batsquatch, and the Jersey Devil. Sightings of dark, red-eyed, winged humanoid creatures are reported worldwide and throughout history. Curiously, the list becomes significantly smaller if we add horns, but it remains global and ancient. This is potentially more relevant to research, whether or not one is studying the cultural similarities to, or the existence of, the "monster." However, we primarily rely on witness reports in the case of the Jersey Devil as material evidence is lacking. Despite numerous attempts over time to uncover it, there has been no definitive DNA or biological evidence of an unknown creature living in the Pine Barrens made publicly known (Regal & Esposito, 2018). Witnesses who were deemed reliable by authorities, as well as police witnesses, do exist in the case of the Jersey Devil. Strange tracks have been recorded. Odd livestock mutilations in the Pine Barrens have been attributed to the Jersey Devil. Images and video have been taken but are unverified. The lack of material evidence combined with consistent witness reports is a common theme in cryptid hunting and paranormal research (de Vos, 2012).

With the prevalence and ease of video effects, images, and video in paranormal cases are understandably scrutinized. Images and videos backed by witness reports who have proven reliable over time are more difficult to explain. A reliable report would constitute a witness of good character and reputation who did not change his/her story over time and did not engage in other hoaxes or erratic behavior in the years following the incident report. Such witnesses exist in the case of the Jersey Devil; police officers and politicians are among those reporting the creature. It is still possible that some of these witnesses were mistaken and attributed a sighting of something mundane to the creature of myth. It is also conceivable that these witnesses encountered an unidentified biological species occupying the Pine Barrens. However, the area is increasingly trafficked by the public and studied by researchers, and the scientific inquiry of the 20th century produced no tangible evidence to date. So, this logically becomes an increasingly less likely option.

This lack of material evidence, combined with the

consistency of reports over time, has led the public and researchers to seek alternative explanations in the realms of the metaphysical or supernatural. A third set of theories has been offered to explain the Jersey Devil's existence, which can be labeled as paranormal, high strangeness, unknown, or "question mark." These theories are provocative and provide opportunities for further research and hypothesis testing. However, they should be approached with caution, as paranormal theories require the same level of validation as the discovery of a new biological species. So, these theories are as of yet unproven even if they might fit the facts.

This third set of possibilities accepts that witnesses saw a cryptid that does not reside in our reality but appears in our reality at finite intervals and for unknown reasons. Within this view, the theories as to who, what, or why this creature would exist for finite amounts of time are less relevant as to whether or not it did exist and was able to affect witnesses and the physical space it occupied. However, the swamps of New Jersey may be representative of a paranormal hotspot similar to the one apparently at Skinwalker Ranch. Skinwalker Ranch has been studied by well-funded private research and government-funded research. Preceded by one major scientific study and followed by another, the U.S. Government spent time and money studying Skinwalker Ranch in Utah. Researchers, analysts, scientists, and soldiers ostensibly witnessed creatures that were unknown or previously ascribed to myth and legend.

A Skinwalker Ranch incident relevant to the Jersey Devil involves the repeated sighting of an upright canine creature. Several witnesses connected to the program studying Skinwalker Ranch saw a wolf-like creature which walked on two legs and stood over six feet tall. The sightings were documented and considered in the research of the ranch, making this a rare instance of a cryptid creature documented during scientific study and considered in the theories surrounding the ranch. The description of the upright canine was very similar to that of a mythical "werewolf" (Lacatski, Kelleher, & Knapp, 2021). Whether or not the phenomenon encountered at the ranch inspired the legend of werewolves or Skinwalkers in the area or the phenomenon at the ranch is playing on the expectations of the observers is unclear. Still, it is unsettling that upright canines are supposedly legendary (i.e., a werewolf, dogman, skinwalker, etc.), yet they were seen and documented by multiple witnesses as part of government-funded research (Kelleher & Knapp, 2005)

Skinwalker Ranch is also involved and continues to involve UFO sightings. Seen by multiple witnesses and filmed on camera. The family who lived at the ranch encountered UFO objects prior to encountering cryptid

creatures and other events typically termed paranormal. However, the evidence at Skinwalker Ranch (similar to the Jersey Devil) is primarily dependent on witness accounts. Numerous Jersey UFO sightings are reported to NUFORC every year (National UFO Reporting Center, 2022). Additionally, the association between the UFO phenomenon and what is commonly termed “high strangeness” (cryptids, poltergeists, humanoids) was identified by J Allen Hynek, the former head of the Air Force’s “Project Blue Book:”

There exists today a worldwide phenomenon... indeed, if it were not worldwide, I should not be addressing you and these representatives from many parts of the world. There exists a global phenomenon, the scope and extent of which is not generally recognized. It is a phenomenon so strange and foreign to our daily terrestrial mode of thought that it is frequently met by ridicule and derision by persons and organizations unacquainted with the facts. Yet, the phenomenon persists; it has not faded away as many of us expected it would when, years ago, we regarded it as a passing fad or whimsy. Instead, it has touched on the lives of an increasing number of people around the world (Knight-Jadczyk, 2006, p. 18).

A subset of credible “Jersey Devil” sightings may be a part of the high strangeness most often associated with the UFO phenomenon and apparently documented by the U.S. Government research into Skinwalker Ranch. While the origin of UFO objects and the energies they emit are undetermined, the effects of proximity to the objects and bizarre phenomena associated with these objects were identified by Dr. Hynek and further established at the Ranch. Additionally, author John Keel chronicled a year of high strangeness related to the UFO phenomenon in Point Pleasant, West Virginia, from 1966 to 1967. The events included cryptid sightings (similar in description to the Jersey Devil), sentient orbs of light, UFOs, and contact with non-human entities. The combined absurdity and strangeness of the events lead Keel (1975a) to question the idea that UFOs were from outer space and inspired his book on the paranormal, *The Eighth Tower*. Keel wondered if these beings were on a different “frequency” or from another “dimension,” rather than the theory that UFOs were extraterrestrial. His speculation was fueled by the consistency of the sightings juxtaposed with the lack of material evidence. The available data suggested to him that some cryptid sightings were materially real (i.e., credible witnesses, tracks, livestock mutilation) but not

a zoological animal, which leaves evidence of habitation. Ultimately, Keel (1975a) proposed an “ultra-terrestrial” hypothesis in which beings interacting with us are from another physical reality or dimension.

Several categories of theories attempt to explain the UFO phenomenon and may extend to the Jersey Devil. These are the interdimensional hypothesis, the extraterrestrial hypothesis, and the cryptoterrestrial hypothesis. In the interdimensional hypothesis or Ultraterrestrial Model (Puthoff, 2022), the Jersey Devil could be seen as a projection created by an intelligence from another dimension, frequency, or physical reality. These beings would live alongside us and be capable of materialization within our reality. The motives of such beings may be foreign to human thought, but the hypothesis fits with some of the evidence used to support the existence of the Jersey Devil. The variance in the witness’s description may indicate an entity which does not have a physical shape. The repeated appearance of the Jersey Devil could be part of a pattern of reinforcement, as posited by Jaque Vallee (1975) in his book *The Invisible College*:

Drastic modification of the behavior of an animal (including man) can be achieved by selectively reinforcing certain actions (for instance by giving food to a pigeon only when he presses a certain lever). However, certain ways of reinforcing behavior lead to better learning than others. If the training is too even and monotonous the subject may stop in its development or even return to an earlier state; the best schedule of reinforcement is one that combines periodicity with unpredictability. Learning is then slow but continuous. I lead to the highest level of adaptation. And it is irreversible” (p. 198).

Vallee wonders here if the phenomenon acts as a control mechanism. That is, a long-term effect on the learning of society might be the intention of the creature making itself known through a specific set of symbols and patterns. Vallee asserted that there was a pattern of reinforcement related to periods of increased UFO sightings and instances of high strangeness. As a control mechanism, the Jersey Devil phenomenon may act as a means of keeping the citizens of New Jersey afraid of the unknown and in awe of mysterious power. Such a belief may reinforce existing cultural superstitions and mythologies. If Jersey Devil sightings are part of the high strangeness related to UFOs, we would expect to see sightings of descriptions matching the creature increase during periods of increased UFO activity. If they are interdimensional in nature, a feature may be witness descriptions of portals

or non-physical entities. However, a portal could indicate wormhole technology used in interstellar travel, and an off-planet species might be invisible to our eyes. The extraterrestrial hypothesis is perhaps the most common theory for UFOs and associated strangeness (Radford, 2010). In this case, the Jersey Devil would be a creature from or created by an off-planet civilization. Possible motives may include a desire to keep UFO activity in the area secret or to study human reaction to an unknown terror. The motive could be the same as those of the interdimensional hypothesis (i.e., long-term social change).

In either the interdimensional or extraterrestrial hypothesis, the creature could be able to take a form based on the reaction it will produce (Knight-Jadczyk, L., 2006). In the case of the Jersey Devil, the preferred form may have been chosen prior to the arrival of European Settlers. The local Native American tribe Lenni Lenape's oral traditions include mention of the creature. The existence of credible anomalous tracks and witness accounts that include the creature interacting with physical reality (for example, seeing grass and shrubs move as it travels through foliage) would indicate the phenomenon is not an entirely visionary creation and is fully material for a period of time. While a conspicuous lack of material evidence may indicate the creature's existence in our reality is only temporary and (perhaps) functional. If material evidence found in or near a sighting was determined to be extraterrestrial in origin (materials and material composition not known to Earth), it may indicate the source of the phenomenon which creates the Jersey Devil (and the UFO phenomenon in general) is of interstellar origin.

Within the UFO phenomenon, a third set of possible origin hypotheses exists when one considers that the phenomenon might originate from Earth or is otherwise tied to humanity. This set of possibilities can be labeled as indigenous or "cryptoterrestrial." From this viewpoint, the phenomenon would be indigenous and controlled by something human or human-like (Tonnie, 2010). For example, an advanced or gifted set of humans could be capable of changing form or able to project whatever form they want. These sorts of abilities might derive from advanced technologies (including future or past humans) or shamanistic-occult practices. If such were the case, we might expect to see evidence of such advanced technology such as familiar energy signatures or ritualistic symbols and artifacts. Furthermore, we may expect to discern patterns in the sightings or behaviors that indicate familiar human motivations.

These all are sweeping and highly speculative (if not fantastical) explanations for a series of events, and evidence that can be interpreted as being consistent with all three categories of explanations exist simultaneous-

ly. Determining the origin of a legend and the myth does not dispel the cause of the legend or myth. It does not erase the events. However, examining the phenomenon in relation to a larger cryptid phenomenon presents a different and more holistic perspective. When the myth is removed, the "Jersey Devil" can be seen as simply one local, cultural interpretation of winged humanoid sightings.

Thus, the study of each sighting and whether or not it should be deemed as a legitimate cryptid or paranormal experience should be determined by the weight and credibility of physical evidence, as well as the witness and police reports. Scientists should take seriously any fully competent and rational adult—with no history of delusional ideations or other biomedical risk factors—who reports an eight-foot-tall, bat-winged creature. The idea that such a sighting is unheard of is simply false. The Pine Barrens have been filled with these stories for centuries, and the winged humanoid phenomenon is ancient, global, and reasonably consistent.

DISCUSSION

The question most often asked in this case is, "Does the 'Jersey Devil' exist as an actual physical entity?" The answer is "yes" if you count as evidence the credible (as described above) witness reports over time and associated livestock mutilations, but "no" if definitive material proof (DNA, biological samples, or unassailable video or photos) is required. And to reiterate, there has been a massive effort for over a century to find that physical proof. If witness sightings are acceptable proof, then we are still left with the issue of descriptions of the creature that vary wildly. Thorough folkloric research demonstrates that the myth of the 1730's "13th child (Leeds Devil)" is an invention of early American superstition and political in-fighting (Regal, 2013). Moreover, no material evidence supports the idea that the Jersey Devil is a single specimen or species of undiscovered animal (Regal & Esposito, 2018). The hoaxes (i.e., tracks) reported during the popularization of the Jersey Devil moniker during the 20th century further supported and created the myth of the 13th child. This makes the existence and description of the creature described in the 13th child (Leeds Devil) tale likely an invention of early American superstition.

However, if we accept that the Lennape witnessed the creature prior to the arrival of Colonial settlers, as well as the premise of credible witness reports into the present, then we are left to ponder how a creature which bears even a passing resemblance to the Jersey Devil (or other eight-foot-tall humanoid) could appear and leave no remains. The Pine Barrens contain a variety of alleged paranormal activity, including the Ghostly Black Dog,

White Stag, and UFOs (Martinelli & Stansfield, 2020). It is possible that the "Jersey Devil" is merely an extension of this broader activity, and the Pine Barrens is a hotspot similar to the one documented at Skinwalker Ranch and Point Pleasant, West Virginia. Comparing the pattern and trends of sightings over the last 200 years to the major categories of paranormal hypotheses may not explain what the Jersey Devil *is*, but it may help eliminate certain theories. For instance, as there are no objects of interstellar origin found near sighting locations, there is little reason to believe that this phenomenon is extraterrestrial in nature. The lack of occult or ritual artifacts and obvious human motivations might also make the phenomenon less likely to be explained by intentional or coordinated human activity. The variance in descriptions, sudden appearances and disappearances, and schedule of terror arguably make the interdimensional category of hypotheses most likely in the case of the Jersey Devil. Alternatively, a terrestrial or extraterrestrial species might accomplish this through the use of technology and science. However, the consistency of sightings over time suggests that the phenomenon is located or connected to the area around New Jersey. The core phenomenon could be interdimensional, extraterrestrial, or crypto-terrestrial, but the features it exhibits are the characteristics most often associated with the interdimensional hypothesis.

If the Jersey Devil phenomenon is indeed an interdimensional (or powerful extraterrestrial or unknown terrestrial) incursion, the question then arises as to what purpose or gain such an entity or intelligence would have in perpetuating this mysterious presence in our reality. While extremely speculative, several potential motivations can be considered. First, these events could serve as a means of observation and study. Just as scientists on Earth might observe and document wildlife in their natural habitats, an interdimensional entity could be conducting a form of research or exploration by observing human reactions, behaviors, and societal dynamics. The prolonged presence and reinforcement of the Jersey Devil phenomenon may offer insights into human psychology, belief systems, and the cultural impact of the unknown.

Furthermore, the interdimensional entity might seek to influence human thought and behavior through fear and uncertainty. By maintaining a state of heightened anxiety and apprehension it could manipulate the collective consciousness and limit societal progress. Fear has a powerful effect on human behavior, often leading to avoidance and a reluctance to explore the unknown. If the entity aims to impede human curiosity and expansion, the Jersey Devil phenomenon acts as a control mechanism to deter individuals from venturing into uncharted territories, both literal and metaphorical. Additionally, the

interdimensional incursion could serve as a means of reinforcing existing cultural superstitions and mythologies. By aligning itself with local legends and folklore, such as the Jersey Devil, the entity taps into deep-rooted beliefs and preconceived notions. This manipulation of cultural narratives strengthens the entity's presence and ensures a continued state of fear and awe among the population.

Gillespie (1993) similarly noted how the terror of the Jersey Devil myth served to reinforce terror of the unknown: "If we focus on the fact that parents passed the legend on to their children, we are pointed toward one possible set of conclusions. As untamed as they are now, the Pinelands of the 18th and 19th centuries were in many ways a truly perilous place. A parent who told a child to be home by nightfall or "the Jersey Devil will get you" was using the legend to serve a legitimate child rearing function - to protect the child from very real dangers of the Pines- getting lost or being attacked by wild animals, for example" (p. 43). This parental psychological protection mechanism strongly parallels the theory of behavioral modification performed by the intelligence behind the "paranormal" as posited by Vallee (1975). Specifically, Vallee proffered that there was an intelligence behind paranormal phenomena that seeks to produce long-term effects on society by employing specific symbols and patterns of reinforcement. Likewise, the parental psychological protection mechanism allows parents to utilize the legend of the Jersey Devil to safeguard children from real dangers in the Pine Barrens.

The correlation between the two proposals rests in the notion that both mechanisms aim to instill fear and caution. Parents warning their children about the Jersey Devil's potential harm creates a sense of anxiety and apprehension surrounding the unknown. Similarly, Vallee suggested that the paranormal phenomenon operates as a control mechanism by generating fear through a carefully orchestrated reinforcement schedule. This control mechanism may be intended to shape societal behavior and limit exploration (Vallee, 1975), much the same way that a parent may use fear to control a child. The parallel becomes more pronounced when considering the witnesses' descriptions of encountering the Jersey Devil and their experience of terror in the face of the unknown. Fear of the unfamiliar has the potential to restrict individuals and societies, hindering progress and fostering anxiety. The parental protection mechanism and the paranormal reinforcement pattern intersect in their ability to produce anxiety-inducing effects. Both theories imply that the Jersey Devil (or larger winged humanoid phenomenon), whether originating from psychosocial, interdimensional, or extraterrestrial sources, has a purpose beyond simple existence. It arguably suggests a deliberate orchestration

of fear and anxiety, with potential implications for societal behavior and cultural superstitions. Both mechanisms aim to shape individual and societal behaviors, either to safeguard against tangible dangers or to control human thought and exploration. This parallel highlights the complex interplay between folklore, psychology, and the influence of the unknown on human consciousness.

IMPLICATIONS AND APPLICATIONS

The Jersey Devil remains a mysterious creature that holds a prominent place in local culture, history, and cryptozoology. While conventional explanations such as folklore, expectations, psychology, and human error may explain some sightings of the creature, it is clear that there are still many questions about its existence and its relationship to other cryptids. The existence of paranormal hotspots such as Skinwalker Ranch and Point Pleasant, West Virginia, suggests that the Jersey Devil may be an extension of such activity in the Pine Barrens. However, this does not mean that all Jersey Devil sightings are part of the same core phenomenon. Rather, it indicates that a fraction of Jersey Devil sightings may be mistakenly attributed to the myth. The fact that the sightings of the Jersey Devil are so varied adds to the difficulty of explaining its existence.

The trend in sightings of the Jersey Devil has shown a significant increase in the modern era, especially around the year 2000. This may be attributed to the rise of the internet and ease of communication, which has made it easier for reports to be recorded. As the volume of reports increased, the likelihood of misidentifications and false reports increased as well. It is important to note that this trend may also point to an overall rise in events described as “paranormal” or a period of increased UFO sightings and high strangeness. The existence of the Jersey Devil remains shrouded in mystery, but it is clear that its aura of mystery has not diminished with time. In conclusion, the Jersey Devil is a fascinating and elusive “creature” that has captured the imaginations of many for centuries. While conventional explanations may offer some insight into its existence and nature, it is clear that there are still many questions to be answered. The paranormal explanations of the Jersey Devil, while unproven, should neither be readily nor entirely be dismissed. However, they should be approached with caution, as invoking unproven theories that can be stretched to fit the mystery may not offer a satisfactory explanation. The Jersey Devil retains its aura of mystery and serves as a reminder of the enduring power of folklore and the unknown in our culture.

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**SPECIAL
SUBSECTION**

Model-Building and Theory Formation on “Nonlocal Perception”: Introduction to the Special Subsection

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The 41st Annual Meeting of the Society for Scientific Exploration (SSE) at Indiana State University (July 23–26) included a lively slate of scheduled sessions, with some even livelier discussions on controversial topics behind the scenes. A cursory reading of the corresponding *2023 Abstracts of Presented Papers* (<https://shorturl.at/zIOR1>) reveals some curious trends—namely, one instance of a talk or poster with a title about “nonlocal perception/ consciousness,” three titles that specifically mention “psi,” one referencing both these terms, and finally four titles about parapsychological-type phenomena using alternative phrases like “remote viewing.” This linguistic diversity actually broadens when perusing the abstracts, i.e., two write-ups spoke of nonlocal perception/ consciousness, three of psi, one using both terms, and 14 with alternative names for potentially the same or related phenomena as discussed in many of these other summaries.

There is certainly strong interest in phenomena that frontier scientists typically describe as an “anomalous process of information transfer” (e.g., Cardeña et al., 2015), but seemingly much confusion, debate, or liberality exists over the most accurate definitions or terminology to apply. This could reflect theoretical differences among researchers, attempts to exchange nominal monikers for ones that convey underlining mechanisms, or maybe the differences are simply sly attempts to reframe or repackage controversial topics as more acceptable or mainstream topics (e.g., Braude, 1998; Cross, 2004). Whatever the motivation(s), the SSE Conference raised important questions that fortuitously coincided with three accepted *JSE* submissions. This happenstance (or synchronicity?) presented the opportunity for a special subsection about issues of model-building and theory formation with anomalous information transfers in various guises.

David Acunzo, Ph.D.—a cognitive neuroscientist with a background in telecommunications engineering—eagerly accepted our formidable challenge of digesting and exploring these selected papers for links or insights among their results and conclusions, as well as potential connections or contradictions to the latest conventional thinking in neuroscience. His qualifications are well suited to this task and involve research on visual perception, attention, and suggestibility, along with an interest in anomalous experiences and experimental parapsychology (e.g., Acunzo et al., 2013, 2019, 2020, 2022; Acunzo & Terhune, 2021). The eventual goal is to graduate from superficial or descriptive labels for certain anomalous phenomena to monikers representing suspected or established causal mechanisms. *After all, what are we dealing with here...poorly understood but conventional human capabilities that manifest under particular psychological or physical circumstances, new or extraordinary sensitivities or cognitions displayed by a privileged few, or perhaps experiences or events at the crossroads of quantum mechanics and whatever mechanisms produce or regulate human consciousness?* Readers are therefore encouraged to study this small set of papers, consider their results and

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interpretations, and finally to ponder Dr. Acunzo's unique insights that aim to get one step closer to reaching answers to these and other tantalizing questions.

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**SPECIAL
SUBSECTION**

Remote Viewing: A 1974- 2022 Systematic Review and Meta-Analysis

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HIGHLIGHTS

Statistical analysis of the available evidence suggests that remote-viewing is the most efficient way to study “extrasensory perception” for experiments and practical applications.

ABSTRACT

This is the first meta-analysis of all studies related to remote-viewing tasks conducted up to December 2022. After applying our inclusion criteria, we selected 36 studies with a total of 40 effect sizes. Both frequentist and Bayesian meta-analyses revealed a strong average effect size of .34; 95% confidence interval: .22 - .45, after the exclusion of outliers, without signs of publication bias and a minimal decline effect. In terms of raw scores, these average results correspond to a difference in hits score of 19.3%; 95% confidence intervals: 13.6%–25%, above the expected chance. Among the meta-analyses of moderators, a small nonstatistical difference emerged between the precognitive and clairvoyance tasks, particularly for those with an outbound agent. A comparison among meta-analyses results observed with other experimental protocols testing extrasensory perception showed the clear superiority of remote viewing. After more than 50 years of investigation into extrasensory perception, remote-viewing experimental protocols appear to be the most efficient for both experimental and practical applications.

KEYWORDS

Remote viewing; meta-analysis; clairvoyance; precognition; extrasensory perception.

Remote viewing is a novel perceptual discipline for gaining information that is not available to the ordinary physical senses. Used extensively by so-called ‘psychic spies’ during the Cold War for classified military projects, it has a long history both as an intelligence gathering tool and as the subject of research and applications in the civilian world.

– *International Remote Viewing Association Website*

INTRODUCTION

The central objective of this study is to discover how

remote viewing differs from other types of approaches aimed at testing the possibility of extrasensory perception (ESP) in terms of its results with experimental designs. A secondary objective is to identify and compare the central design components and themes of remote viewing studies spanning the past 50 years.

To achieve this, we first present definitions, then a historical overview, and then a comparison of remote viewing to other free-response studies, which will lead us to an operationalization of remote viewing from which our methodology for a comprehensive meta-analysis of remote viewing related projects flows. This will be followed by inclusion criteria, a presentation of our meth-



ods results, and finally, a discussion aimed at identifying further moderators to explore.

Definitions of Remote Viewing

Remote viewing *“pertains to the acquisition and description, by mental means, of information blocked from ordinary perception by distance or shielding and generally considered to be secure from such access”* (Targ et al., 1980; see also Targ & Kantra (2000): *“remote viewing is the acquisition and description by mental means of information blocked from ordinary perception by distance, shielding, or time.”*, p.4). Thalbourne (2003) later described remote viewing as *“a neutral term for general extrasensory perception... especially in the context of an experimental design in which a percipient [perceiver/receiver] attempts to describe the surroundings of a geographically distant agent [sender]”* (p. 107). However, Ingo Swann (1993), who coined the term in 1971-72 with Janet Mitchell at the American Society for Psychical Research (ASPR), in cooperation with Karlis Osis and Gertrude Schmeidler, wrote, *“there can be no doubt at all that remote viewing originally referred to a particular kind of experiment, not a particular kind of psi ability... It is very difficult to define a psychic ability. But it is not hard to define an experiment”* (p. 75). He explained that an important aspect of remote viewing methodology is that it includes blinding and feedback protocols.

The International Remote Viewing Association (IRVA) provides the most current definition on their website:

“Proper RV is done within a strict science-based protocol. As mentioned, the viewer is kept unaware of either the nature or identity of the target until after the session is completed. Except in training situations, the monitor (a sort of remote viewing “guide” or facilitator that may assist the viewer during the session) is also unwitting, and external clues or data about the target are carefully excluded. Sessions are conducted in a setting that prevents knowledge of the target “leaking” to the viewer. These measures are important to ensure that the viewer does not receive hints or clues about the target in any way other than what would be considered “psychic.”

IRVA’s description continues:

“Despite the “viewing” part of the term, remote viewing is only partly about experiences associated with what might be visible about a target. It also involves mental impressions pertaining to the other senses, such as sounds, tastes, smells,

and textures, as well as limited telepathy-like effects and, in some cases, just plain intuitive “knowing.”...In RV, the viewer not only verbalizes what he or she is perceiving but usually also records in writing, in sketches, and sometimes even in three-dimensional modeling the results of the RV episode or “session.”

Early History of Remote Viewing & Its Development

Although the history of remote viewing has been well documented (Puthoff & Targ, 1974, 1976, 1980; May, & Marhawa, 2018), a few noteworthy developments are addressed here. To understand the etiology of remote viewing, one might take a time capsule back to the late 1960s, when ASPR researchers began a series of Out-of-body (OBE) experimental trials designed to explore whether a subject could intentionally perceive objects placed on a shelf, about 10 feet above the subject’s head. Mitchell (1987) tracked the development of Swann, whom she stated was their most talented subject, even though he would later tell an interviewer *“Initially I was not very good at this kind of ‘perceiving’, but as the months wore on, I grew better at it.”* (Swann, 1993, p. 76). Mitchell recorded ‘learning curves’ by adding each new target type. Later, she explained that this helped her and her colleagues shift their predominant view from psychic functioning, being purely an inherent ability, to the view that it is something that can be learned.

Initially, Swann voiced his descriptions out loud according to the researcher’s instructions. However, having studied the ‘picture drawing exercises’ of Warcollier (1948) and Sinclair (1930) and being an artist, he began sketching his perceptions of the target materials. This led to what he would go on to describe as the biggest discovery of his life: that in addition, or in place of the visual imagery he would receive (clairvoyance), at times, his hand could know what to draw, with remarkable detail, and similarity to the object, while his conscious mind remained completely unaware of its features or nature. (Swann, 1996). This awareness would eventually play an important role in the development of controlled remote viewing methodology (CRV), which will be discussed below (Smith, D., 2014; Smith, P. 2015).

After becoming bored with their target pool of objects, Swann convinced Osis and Mitchell that he could use his intuitive perceptions to describe people and activities located outside the building. They tasked him with describing unusual weather conditions at distant locations and then had him track the activities of a pair of researchers who visited a museum. When the research-

ers discovered that the main exhibits they intended to visit were closed, they thought the experiment failed. However, they returned to the lab to discover that Swann tracked their movements in remarkable detail, reporting that the museum exhibits were closed (Mitchell, 1987). This could be considered one of the first attempts to use an 'outbounder' approach, as the outbound agent was believed to serve as a mental beacon, providing a necessary anchoring or bridge to a distant and unknown location. These early experiments directed the viewers' awareness out of the lab, to their surrounding neighborhood, then to different states, then to different countries, and eventually to distant planets, demonstrating that distance was not an inhibiting factor in information retrieval at a distance. (Targ & Puthoff, 1974; Puthoff, 1996).

Outbounder Experiments With an Interviewer

In the early 1970s, Swann was recruited by Harold (Hal) Puthoff to serve as both a psychic and a research consultant in the developing psychoenergetics program at Stanford Research Institute (SRI), which was initially funded by various governmental agencies. Building on the earlier efforts of the research at the ASPR and Gertrude Schmeidler's laboratory at the City College of New York, co-directors Puthoff and Targ further developed the 'outbounder' experiment. This involved having a team select and randomize numerous location choices, which were then sealed in envelopes. For each trial, an 'agent' would then select one envelope that he/she would physically go to. The person acting as the 'percipient' (aka remote viewer) would be 'interviewed' by an experienced researcher, often the experimenter, who was blind to the target location. The viewer would be led through a relaxation exercise and then directed to move their attention first to the agent and then to different vantage points around that agent. The aim was to observe the physical characteristics and ambiance of the location, along with any activity happening there. For example, if the viewer described a door, the interviewer would next invite him to walk through the door. If they described a bridge, the interviewer suggested that they walk across the bridge, look down, or on the other side. Using this process, it was reported that remote viewers accurately described buildings, landscapes, objects, and people (Targ & Puthoff, 2005).

These experiments were carried out with select subjects, non-psychic control subjects, and even first-time governmental visitors and agency contract monitors who had input on whether SRI programs would continue. Through informal memos, government agency reports, continued contract renewals, and formal articles, Puthoff

and Targ (1976) reported that the results were significant across all groups. Some sketches of the newer subjects were said to be "exceptional". However, the results of the newer participants were found to be less consistent than those of the experienced participants." (p. 345).

Coordinate Remote Viewing - Leave the Outbound Agent Behind

In 1973, Swann pushed researchers to start a new series of experiments called 'Project Scanate.' This design was notable because it did not require an agent to be at a location; instead, viewers were given geographic coordinates, latitude, and longitude in degrees, minutes, and seconds, respectively. Initially, there was resistance from the SRI directors because there was a predominant belief that an agent provided a telepathic connection that was essential for the percipient's psi-based attention to be directed to the correct location. There have also been concerns about designing protocols to eliminate the possibility of a combination of geographic coordinate memorization and photographic memory (Puthoff, 1996). However, they found workarounds for these challenges and started a series of trials reporting significant results (Puthoff & Targ, 1974, 1976).

While Project Scanate used National Geographic photographs as feedback for the coordinates, real-life targets were now given to viewers. These ranged from small objects in nearby light-tight canisters, to remote technical facilities at intercontinental distances; from letters and numbers generated at random by a computer, to nuclear tests in a foreign country. To address some of the concerns mentioned above for repeated trials, a procedure was utilized to use random numbers as coordinates rather than latitude and longitude.

Operational Remote Viewing

Essentially, remote viewing had two separate but interconnected tracks. One was research efforts performed at the SRI, SRI-International, and Princeton Engineering Anomalies Research (PEAR) laboratories. Their efforts were aimed at testing psychic functioning, developing both experimental and training protocols, and discovering/demonstrating how it could be useful for intelligence and military gathering purposes. The other track was a highly classified military remote-viewing program located primarily at Fort Meade Army base, where under the initial direction of operations and training officer Capt. Fred Atwater, both enlisted men and officers, along with some civilians, were recruited, trained, and eventually put to work as remote viewers for intelligence collection purposes.

The operational programs had many project names. For the Army: Project Gondala Wish (1977-1979), Grill Flame (1979-83), and Center Lane (1983-85); for the Defense Intelligence Agency: Sun Streak (1986-90), and Star Gate (1990 - 1995). The Air Force sponsored a program from 1975 to 1979, headed by civilian intelligence analyst Dale Graff. The National Security Agency (NSA) reportedly had its own program as well.

A DIA-classified briefing report on Project Sun Streak (1986) identified several advantages of remote viewing as an intelligence-gathering tool, including that it was inexpensive to use, remote viewers could do their work undetected, and there was no known defense against it. The report found that remote viewing has been successfully used for *“penetration of inaccessible targets; science and technology information, cueing of other intelligence collection systems, immanent hostilities, determination of nuclear from non-nuclear targets, human source assessments, and accurate personality profiles.”* (p. 39).

Training Methods for Both Experimental & Operational Purposes

A formerly classified 1984 Star Gate Science Panel Report (Marwaha & May, 2019) mentioned the value of training:

“A considerable variety of material was presented with photographic evidence to support the validity of the perceptual method. Much of this was highly impressive. The data showed the effects of training on the success rate, which typically reached a sustained plateau at a level higher than before training, both for groups of subjects and for individual trainees” (p. 4).

The DIA. Sun Streak report indicated that training was considered an important part of remote viewing success and mentioned two different training methods: *extended remote viewing (ERV)* and *controlled remote viewing (CRV)*.

Remote Viewers who first entered the military operational unit were largely trained in and practicing ERV. ERV has been defined as *“a system in which the remote viewer prepares through a method of deep relaxation and focused attention. In the early 1970s, the consensus was that the remote viewing process seemed to be facilitated by relaxation and enhanced internal attention or paying attention to one’s own mental imagery and impressions.”* (DIA Sun Streak report, 1986). It was heavily influenced by the teachings of Robert Monroe (1977) and the Monroe Institute, which focused on intentional Out of Body Experiences and intentional manipulation of brain wave states through the use

of sound and visualization techniques. (Atwater, 2001).

Controlled Remote Viewing (CRV) was developed by Ingo Swann, under the supervision of Hal Puthoff, in the late 1970s through the early 1980s. In many of his writings, Swann discusses how the stage-based, structured CRV methodology was designed to build on lessons learned by himself and others at Stanford Research Institute and, namely, to reduce perceptual and analytical errors in psi performance. Williams (2023) defines CRV as a *“process designed to help the viewer distinguish between imagination and true intuitive perceptions in order to extract the information they seek. The structure and methodology of the CRV process is introduced step by step by guiding the student through actual sessions, using real and progressively more complex targets.”* (p. 1).

An additional method of remote viewing described as a hybrid of both channeling and automatic writing was called *“written remote viewing”*. It was used by a small number of remote viewers in the operational unit, although it was not formerly developed by SRI researchers. One of the primary remote viewers, Angela Ford, utilized it during the nine years she worked for the unit and had the ongoing support of her supervisors, who indicated she often came up with details and correct names of locations that defied all logic until cases were solved (Graff, 2000). Ford explained that when she came to the unit, she was told to use other methods that did not work so well for her personally. She felt that only once she decided she would rather leave the unit than continue to hold back on using the method, she felt worked best that her remote viewing data really became impressive (Katz & Ford, 2022).

It should be noted that even with the advent of new training protocols, both viewers trained in CRV and ERV continued to work with interviewers to conduct their session work up until the disbandment of the governmental remote viewing programs. Today, some viewers continue to work with monitor, but the majority seem to work on their own.

FINAL PROGRAM REVIEWS

SRI International - Science Applications International Corporation Reviews

In June 1995, the CIA’s Office of Research and Development (ORD) contracted with the *American Institutes of Research (AIR)* to perform a comprehensive evaluation of the Star Gate program. However, only ten primary studies were evaluated. Utts (1996), a visiting scientist at SRI International who had already coauthored a 1989 meta-analysis of the SRI research, wrote:

“Using the standards applied to any other area of science, it is concluded that psychic functioning has been well established. The statistical results of the studies examined are far beyond what is expected by chance. Arguments that these results could be due to methodological flaws in the experiments are well refuted. Effects of a magnitude similar to those found in government-sponsored research at SRI and SAIC have been replicated in a number of laboratories throughout the world. This consistency cannot be readily explained by claims of flaws or fraud” (p. 657).

However, her counterpart, Hyman, a known skeptic who was not familiar with the work at SRI beyond the limited reports sent to him, asserted:

“Although I cannot point to any obvious flaws in the experiments, the experimental program is too recent and insufficiently evaluated to be sure that flaws and biases have been eliminated... The statistical departures from chance appear to be too large and consistent to attribute to statistical flukes of any sort... I tend to agree with Professor Utts that real effects are occurring in these experiments... However, the occurrence of statistical effects does not warrant the conclusion that psychic functioning has been demonstrated.” (p. 681).

Multilab Involvement & Conceptual Replications

Over the years, other laboratories and parties have attempted to replicate SRI results, although there were always slight alterations that made these more conceptual than direct. Allen et al. (1975) attempted an unsuccessful conceptual replication at the University of California at Santa Barbara. Their protocols differed in three ways from those used at the Stanford Research Institute (SRI): 1) Rather than using select subjects, they used college students who were involved in criticizing experimental designs; 2) they did not bring viewers to the location to view their own feedback; and 3) students had a tight time schedule in which to complete their session work.

In 1976, Hastings and Hunt reported a successful replication when, during a single trial, 20 out of 36 teams chose the correct photo out of six locations. They referred to the interviewer as a ‘coach,’ who not only assisted the viewer during their session but had full permission both to use their own intuition and to help select the target. This was a departure from SRI protocols, in which only the viewer selected the target in the judging phase.

In 1979, Karnes et al. attempted another replication

but did not fare well. In two trials, one with a visit to feedback and one without, students were used as participants, 20 as ‘receivers’ and 120 as judges, and found ‘no support for the psi hypothesis’, attributing some successful trials to differences in judging. They noted deviations in protocols from the original SRI experiments, which included dividing viewers into two groups: an experimental group where the viewer, referred to as a “receiver” and an outbinder, referred to as a “sender,” were introduced before the trial, and the control group, where there were no introductions. In reviewing their instructions, it appears that they placed a stronger emphasis on telepathic communication between the viewer and the receiver than the SRI researchers did. Instead of encouraging direct perception through clairvoyance of the target locations, instructions to the experimental group directed the receivers to passively receive the thoughts of the senders who were to project their own impressions about the location, as they sketched these onto the paper later used in judging.

PEAR Labs - A Precognitive Remote Perception Focus

The longest-running replication attempts of remote perception research were carried out at the Princeton Engineering Anomalies Research (PEAR) laboratory, beginning in 1978 and spanning the next 25 years. Most of their studies had a ‘precognitive’ focus, operating under the assumption that participants may be able to describe targets selected at a future date, as well as targets already selected at the time of session work.

Although some studies did involve sending out an agent (aka ‘outbinder’) prior to session work, Dunne and Jahn (2003) surmised that a substantial subset of trials have been executed in a retrocognitive mode, where perceptions are generated after the agent has visited the target and a smaller number have been carried out in real-time. They found many perceptions that were virtually photographic in accuracy and produced an overall statistical yield that was well beyond chance expectations. Most of these studies demonstrate a sufficient degree of anomalous information acquisition to justify the continued scholarly exploration of this mystifying process.

Despite the overall success of their research, PEAR researchers saw a declining effect in the final years, which they attributed to an increase in project designs involving modes of analysis designed to increase efficiency and rater reliability, but then narrowed free response options into forced choice options. They also noted that, unlike SRI, where most participants work with interviewers who help guide them during their sessions, in most of their

studies, participants were self-guided, they had both less supervision and training than those of SRI.

Remote Viewing Studies: The Present Situation

In 1996, government remote viewing related programs were disbanded and declassified. At this time, a variety of books, films, and training programs were offered to the public, first taught independently by those who had been involved with the programs, followed by their students, and recently even by a third or fourth generation of students. Some have attempted to follow Swann's teachings closely, while others have modified the original forms and created derivatives of the original training (Knowles, 2018).

Today, formal remote viewing studies continue mostly by individuals or groups of researchers in the private sector. Those trained in remote viewing participate in these studies in RV-themed organizations and utilize them for a variety of applied purposes, including crime solving, helping to find lost objects and pets, and financial forecasting. (Katz & Tressoldi, 2022; Katz, 2021).

Exploratory and formal remote viewing studies in recent years have focused on judging and analytical methods and considerations (Storm, 2003; Kruth, 2021; Katz et al., 2020); predictive and timing considerations (Brown, 2012; Fendley & Atwater, 2021) atmospheric conditions (Spottiswood, 1997), target materials (Katz et al., 2021), and states of consciousness (Ballati et al., 2020). Some have taken a mixed-method approach, incorporating dreaming (Katz et al., 2019) or use of the Random Event Generator while remote viewing (Smith & Stahler, 2008).

Several of the more recent RV studies in this meta-analysis are related to a specific remote viewing design, referred to as *Associative Remote Viewing* (ARV) (Schwartz, 2020; Bierman & Rabeyron, 2013; Katz & Knowles, 2022), which is a precognitive approach to making predictions. This is one of the most active areas of remote viewing in terms of both applications and research. It is a precognitive approach to making predictions designed to take limited potential outcomes and turn them into unlimited possible targets by pairing the potential outcomes with photos, objects, or videos. This allows for answering questions such as which of the two teams will win a football match? Which of the five horses will come in first place at a particular race? In which direction will a particular stock go at the end of the closing today? Interest in this methodology may be attributed to the publicizing of past formal studies in which researchers demonstrated they earned substantial winnings from this (Harary & Targ, 1985; Puthoff, 1984) and other large-scale efforts that did not fare so well but involved many

viewers, predictions, and investors (Katz et al., 2018).

Further popularization efforts of ARV would include the marketing and promotional activities of a variety of organizations, such as the Applied Precognition Project, which is devoted largely to this methodology through encouraging those who participate as viewers, judges, and project managers within a social and fun learning environment (Rosenblatt, Knowles, & Poquiz, 2015); Social media platforms devoted to remote viewing, companies sharing ARV-based technologies that offer predictions for traders of cryptocurrencies (Katz & Knowles, 2022), and remote viewing online apps that continue to grow in participant size and activities (Spickett, 2020).

Remote Viewing Comparison With Other Free Response Protocols

Free response is a descriptive term for studies that involve any ESP test in which the range of possible targets is relatively unlimited and is unknown to the percipient [perceiver/receiver]' (Thalbourne, 2003, p. 44).

Free response experiments include collections of studies like the Ganzfeld experiments (Storm et al., 2010; Storm & Tressoldi, 2020; Tressoldi & Storm, 2023a), dream ESP experiments (Storm et al., 2017), and remote viewing studies, which could further be divided into laboratory experiments (Utts, 1996), fieldwork (Schwartz et al., 2000), operational projects (McMoneagle, 2000; Smith, 2005), and applied precognitive projects of both formal and informal nature (Katz et al., 2018).

Although remote viewing, Ganzfeld, and dream ESP approaches possess their own general characteristics, there is variety within each design in terms of participant type, target materials, ways in which participants report their impressions, outcomes, and methods of analysis.

Judging and Analysis Protocols in Remote Viewing

The standard judging/analysis protocols for these studies fluctuate as well, but most include a 'matching' task in which *someone is tasked with matching the remote viewer's perceptions with a series of photo images, one of which is an image of the actual target, chosen at random with both the remote viewer and rater blind to the actual target. These matching tasks can follow three main types: 1) the remote-viewing percipient attempts to match their own intuitive impressions to the correct photo in a set of two or more photos (self-judging), 2) an independent rater attempts to choose the closest match from the remote viewer's mentation or written impressions, or 3) an independent rater rates each photo in a set of photos from best-matching to worst-matching, ranking the photos for example from 1 (best-matching) to 4 (worst-matching).*

These ranks are then combined across the trials in a study to create a statistical measure called the ‘sum of ranks.’”

These procedures do fluctuate between studies in terms of the number of photos placed in a target set, but as more photos are used in the set, it becomes more challenging to ensure that they are orthogonal (i.e., different) enough from each other. If two photos in the set are similar, it is difficult to distinguish which photo best matches the viewer’s comments. Some experiments involve more careful structuring of target/judging sets to ensure each photo is different from each other in all features and also balanced as far as potential interest and appeal, while others opt for randomized procedures that may increase a project’s validity but may make judging much more difficult.

Matching tasks are considered the gold standard across all free response-type experiments because they allow for easy statistical computations. However, they have been criticized for their minimalist nature. The result is that the rich and varied data, which in some trials may be a remarkable match to a highly unique photograph or video clip, often get crunched into a single data point representing a ‘hit’ or ‘miss’. Also, many psi researchers, beginning with Whately Carington in 1925, have noted a phenomenon that occurs when targets are placed within “decoy” sets, which he coined “displacement”. This is thought to occur when a psi participant seems to have an extremely strong description of another photo in the judging set (“single trial displacement”) or to the target in the next trial (“out of sequence” or “temporal displacement”). (Tart, 1980; Brown, 2012). However, Milton’s (1986) dissertation attempting to test whether this is a real phenomenon (rather than simply an excuse for missing a target) found results to be inconclusive.

Analysis and Scoring Methods

Some remote viewing projects utilize more refined scoring methods than other types of free response studies so that rather than simply choosing the best match between a transcript (which contains the viewer’s words and sketches) and the photos in a judging set, actual scores are given to each data point, based on a predetermined scale. Once scoring is completed, the highest-scored match is the one selected as the target by either the rater or an independent judge. Scoring includes the SRI 7-point Confidence ranking scale (Targ et al., 1995); A 3-point scale utilized by Smith, Laham, and Moddel (2014); the McMoneagle method of scoring, which involves adding up major attributes (gestalts) and characteristics; and the Poquiz method (Katz & Knowles, 2022), which involves adding up all correct perceptions and subtracting incor-

rect to arrive at a hit-rate.

In 1990, May et al. published a theory of “fuzzy set analysis and figures of merit” which attempted to advance analysis in remote viewing experiments through the use of computer technologies that would address issues in rater reliability and efficiency and provide a means to ensure orthogonality of photos within judging sets. This required the use of a specific target pool, which had been in development for decades at SRI, consisting of *National Geographic* photographs, in which life forms, animals, and vehicles were deleted to make the photos, consisting of natural landscapes and man-made structures, more homogeneous in content while diverse in shapes, patterns, and contrasts.

Positive results were reported (May et al., 1995). Additionally, and in conjunction with this work, May and colleagues considered related theories, such as *Shannon entropy* (May et al., 2000), and another concerning *thermodynamic limits* (May, 2011) in attempts to define what makes a target easier to perceive and also to produce equivalent target types within judging sets.

In 1994, Lantz et al. set out to utilize the above system and concepts while testing both static (a still photograph) and dynamic targets (video) and the value of telepathic sender and receiver. Researchers found that a sender is unnecessary for extrasensory perception to occur in free-response studies and that dynamic targets seem to be more perceivable than static.

To date, the May et al. (1990) computerized system of targeting and figure of merit has only been utilized for remote viewing studies, and his original research has not been widely replicated by others, although his research is often cited. The downside to this automated system is that it allows for a rater to remain blind to the target choices, but a coder is still needed to read over the viewer’s transcript and fill out a spreadsheet that lists a variety of types of structures and environmental aspects. Sometimes a coder has very clear information to go on within the session (such as when the viewer writes the word “bridge” which is one element on the coding sheet), but there is a lot of room for interpretation by the coder, such as when there is simply a sketch with no words, that could resemble both a bridge, or a street, or a path or a river. So, the success or failure of any given trial is dependent on the coder’s performance as well as the viewer’s.

States of Consciousness

Like remote viewing protocols, percipients within the Ganzfeld collection of studies perform their sessions in a waking or semi-awake state. At the core of the Ganzfeld procedure is “a noise reduction, psi-conductive

approach, which is thought to reduce irrelevant background noise." (Storm, 2010, p. 472) Here, the subject reclines in a darkened room, with halved translucent ping-pong balls placed over their eyes while they stare at a red light and listen to white, stereophonic noise. The autoganzfeld, invented by parapsychologist Rick Berger and Charles Honorton as an error reduction method, uses a computer system that allows automated target selection, randomization, and judging techniques (Honorton et al., 1990).

Remote viewing protocols do not use the formal Ganzfeld setup, although some viewers who employ the 'extended remote viewing' methodology may listen to similar audio recordings before or during their session. Many remote viewers do not utilize white noise (although some do) but will sit or lie down and engage in a series of relaxation exercises that involve the tensing and releasing of muscles, slowing down of the breath, and self-guided imagery that moves their attention from their physical body to a 'sanctuary', to a vortex that then brings them to the target location and allows them to move around to different vantage points (Morehouse, 2004).

Remote viewers who utilize controlled remote viewing methodology or derivatives vary more widely from the Ganzfeld approach in that they often sit in a room with the lights on, using structured stage-based writing and drawing and modeling techniques that require them to be in a more alert state of mind. The paper that a viewer writes on is not simply a recording device, but with each stage, it serves as a tool for dowsing or psychometry in a sense.

Using an Interviewer/Monitor

Another departure from other free response methods is that remote viewers are sometimes assisted by "interviewers" (also known as monitors). Studies that were conducted within SRI or within the US operational remote viewing programs used viewer-interviewer teams, who were almost always blind to the targeting task or project objective. For formal studies, interviewers would be blind to the target but, as discussed above, would be there to give the viewer suggestions of where to direct their attention or how to get "unstuck." Sometimes, viewers and monitors, such as Joe McMoneagle and Skip Atwater, worked together for years. Viewers who use both ERV and CRV relied heavily on the help of monitors until the declassification of the government programs in the mid 1990's.

Some researchers have suggested that the interviewer/monitor may be employing their own psychic abilities during a session, such as when, in a double-blind context, the interviewer/monitor nevertheless correctly

directs the viewer to explore just the aspect of a target that is necessary to provide the necessary information sought after by the experimenter that the viewer would otherwise not have focused on.

It has also been raised that the interviewer acts as a mentor to the viewer, so even if the viewer doesn't attend a formal training, through this intimate, one-on-one experience, a newer viewer may be receiving more in-depth training than others who take a group class and receive less attention from a teacher. (Katz & Bulgatz, 2019).

However, there are often pitfalls to working with a monitor. Just as viewers in the process of a session may develop a false idea of the nature of the details of a target, monitors may themselves fall prey to this. Even a monitor blind to a target may develop a "guess" as to what the target might be and inadvertently convey such false impressions to the viewer through non-verbal cues. Thus, it is possible that not just viewers' successes but also their misses could at least partially be attributed to having a monitor (Williams, 2017).

Despite the popularity of using interviewers at the SRI and within the operational programs, there has been a lack of exploration into this partnership within the formal research literature. Today, many viewers tend to work solo. (Katz & Bulgatz, 2019). Still, Muller et al. (2019) demonstrated success with pairing novice viewers with researchers acting as monitors. Rather than being blind to the target and photo options, monitors were aware of both photo options but not which one would actualize as the target. For a follow-up study testing timing effects (Mueller, 2021), researchers used experienced viewers who sometimes worked with a partner. Results were still above chance levels. Also, Ballati et al. (2020) paired remote viewers with hypnotists to bring them into a deeper trance state. *'During the RV session, the hypnotist's only task was to help the participant accurately describe all the different characteristics of the target and find as many of them as possible'* (p. 2).

Primary Acquisition of Psi Data vs. Secondary Movements or "Probings"

In comparing remote viewing with other free response type studies, an important difference is in the ways in which psi participants follow up on initial impressions through intentional imagined movements or interactions with the earlier data. As noted above, a sole viewer does this on their own, while one working with a monitor may be guided in this way.

Structured remote viewing methodologies, such as Controlled Remote Viewing (CRV) and its derivatives, provide devices for further exploration of information, which

are thought to be helpful when an interviewer/monitor is not present to provide these prompts. This is done using “matrixes,” which remind the viewer to probe for additional characteristics.

Other categories prompt the viewer to discover whether there are any items or living beings found in the location. This is achieved by placing the tip of the pen or the viewer’s finger into the field of the matrix (table) and waiting for further impressions that pertain to the particular category being explored to come. CRV also allows viewers to draw, sketch, and use 3-D modeling on occasion. These actions are not simply designed as ways to report data but as tactile exercises by which to extract further details. For example, viewers might sketch the shape of a building and move their pen or finger inside the shape of the paper, or they might write a word such as “purpose” and touch that word. When touching a specific part of the paper or word, a new flow of data may emerge. In recent years, remote viewers have started using larger canvases, such as whiteboards, which get them on their feet using their entire bodies. While there are no formal studies documenting the use of the entire body, Vivanco (2016) informally demonstrated that while standing up and letting the body express itself, the body will essentially begin to pantomime key movements, such as making quick, erratic motions as if steering a wheel for a photograph of a race car.

This following up on earlier perceived data is unique to remote viewing and is used across most RV methodologies, although the means of doing so vary widely. In Ganzfeld studies, even though a researcher may be present to assist the percipient in sharing their impressions, he/she does not guide the percipient to obtain further details about bits of data already perceived. Rather, the researcher may encourage the percipient to continue to deepen their relaxation or invite them to verbalize all they are sensing through a stream of consciousness. In Dream ESP, the dreamer awakens from the dreaming phase and reports the data without attempting to access more information about the target.

Experience And/Or Training in How to Mitigate Analytical Overlay

Participants who are monitored, trained in, or experienced with remote viewing approaches may be better able to mitigate the challenges of psi tasks related to “analytical overlay”, that is, the impulse to identify immediately the target with a name or a precise identity, than participants in other types of projects because they have a greater awareness of this concept and are given approaches intended to decrease its negative impact on an

overall session. Analytical Overlay was noted by early SRI researchers and in the military-controlled remote viewing training manual, which were based on the teaching of Ingo Swann and documented his teachings (Smith, D, 2014).

Percipients in other types of free-response studies are not typically provided with the above model or given strategies for mitigating it. Remote Viewing methodology encourages viewers to focus on smaller target characteristics rather than trying to “name” or identify the target. Drawing is emphasized because, even if the target is mischaracterized, the shape may still look identical to the shapes found within a photo or object. Even if an experienced viewer describes the distorted overlay rather than the actual target (i.e., calling a red ball a tomato or falsely describing a train as a fire engine), an experienced viewer may be less likely to put all subsequent impressions into the same context as the false picture.

Timing and Length of Intuitive Information Retrieval About a Target

The timing allowed for participants to engage in a remote viewing session can vary widely based on the type of experiment and the philosophy behind it. For example, some forced choice-type experiments in which the goal is to guess a card by pressing a corresponding button may allow for only a second or two before a response must be made. Juxtapose this with remote viewing, which could potentially require several hours of work.

However, in most remote viewing trials involving the description of photos, the typical time taken by experienced viewers might be 10 minutes to an hour, particularly for those trained in methods designed for further probing of the initial data, as mentioned above. In Ganzfeld studies, induction times usually fluctuate between 5 and 30 minutes.

Furthermore, whereas Ganzfeld participants may not be able to interrupt their sessions and return later, remote viewers are taught to take breaks during their sessions as needed, especially when getting stuck in a concept or feeling stressed. They may return immediately after a break or wait several hours or days before finishing the session, particularly when doing session work at home and emailing or mailing it to a researcher. Swann taught that such breaks were essential and once told his students that if they were not going to take breaks when they felt emotional or stuck in an idea, they might as well “go home” and stop their training (Swann, 1986). Targ (2019) also recounted using breaks as an approach to monitor viewers. However, not all studies have recorded the actual time allowed or taken across all types of free

response studies.

Mixed State of Consciousness-Psi Approach Methods

There are some remote viewing studies that occasionally require a remote viewer to adjust the ways in which they have been trained or typically operate to test a particular variable. This was the case when Krippner et al. (2019) set out to test whether remote viewing is impacted when the percipient does their session in a light compared to a dark condition. The viewers were required to wear a blindfold, which reduced their ability to write and sketch during their session since they could not look at their paper. Meanwhile, several studies in recent years have set out to pair remote viewing with Ganzfeld induction approaches, determining that there was evidence that novice subjects seemed to perform better with this pairing (Baptista et al., 2015; Storm et al., 2010; Roe & Flint, 2007).

Most intriguing was Roe et al. (2020) found that novice participants who used a method that combines the advantages of Ganzfeld-type induction with a location-based feedback mode, such as used in remote viewing studies, performed *‘significantly better than chance expectation in all three experiments, demonstrating a degree of replicability that is relatively unusual in parapsychology where novice remote viewers in the remote viewing mode performed only at chance levels.’* (p. 56). It should be noted that in reviewing the instructions given to participants, it appears participants in the Ganzfeld condition were invited to relax and allow images to appear to them about the distant location as targets and record these. Meanwhile, before attempting their session, those in the remote viewing condition were instructed to try out stages one and two of CRV only. Stage 1 refers to the perception of the basic, overall nature of the site or target (usually referred to as the “major gestalt”). Examples of these major gestalts might be “land,” “structure,” “water,” “event,” etc.; Stage 2 refers to basic sensory perceptions, tastes, sounds, colors, qualities of light, textures, temperatures, etc.) before attempting their session. In CRV methodology, it is really stages 3, 4, and 6 in which imagined movements around the location and further exploring of sketches and initial impressions happen. Furthermore, it is not until the viewer passes from stage 2 to 3, signified by more integration into the target location, that a viewer is believed to move into a deeper connection with the ‘signal line’ (Swann, 1983; Smith, D. 2014). Therefore, in Roe et al.’s experiment, the CRV methodology may not have been utilized in a way it was intended and thus may not be comparable to studies in which the full methodol-

ogy has been applied.

Selected Participants

What exactly does “selected participants” mean? In remote viewing, this may mean that they are highly trained, experienced at similar or comparable tasks, previously tested by researchers, and may have been originally selected for indicators suggesting they would do well with intuitive tasks. In other free-response studies, “selected” subjects may be chosen for backgrounds in meditation, music, reporting of prior spontaneous experiences, or successfully participating in other experimental trials. Some remote viewers have participated in hundreds or even thousands of targets over the course of many years (Katz & Tressoldi, 2022; Katz et al., 2021). Swann and Puthoff discussed how Swann may have completed close to a million trials during his time working at SRI, although this included both forced choice and free-response trials. (Swann, 1986). Furthermore, many viewers have noted that they have attended years of training in various RV modalities (Katz & Tressoldi, 2022). This is not to say that some participants in the Ganzfeld study or the ESP Dream study ‘selected’ are not experienced in various aspects of intentional psi practices, but they may not have as many social, training, or practice opportunities available to them as remote viewers.

Across all types of parapsychological studies, the term ‘selected’ is often poorly defined, with little more than one sentence or two dedicated to this topic.

In summary, there appear to be several differences between remote viewing studies and other free-response-type designs. These include differences in induction methods, physical setting, the time provided for session work, and possible pairing of a trained monitor or interviewer with both seasoned viewers and novices. Other differences include the level of training of select subjects, which involves an expanded awareness of an analytical overlay model, and the ability of remote viewers to follow up on initial bits or streams of information through learned visualization and kinesthetic approaches. Some viewers employing CRV may use materials that are not used in other free-response studies, such as paper, larger canvases, and modeling tools. Many viewers today conduct their sessions from home and have greater flexibility in terms of when they conduct their sessions and how often they can take breaks. This may allow them to wait until they are more focused.

Differences in analytical models may also include more refined scoring procedures in RV so that not only is a photo chosen from a set of photos, but a score is given that could be on a 7-point, 3-point scale, or other

methodology, and then the photo with the highest score is chosen by the viewer or an independent rater. (Katz & Knowles, 2022).

THE META-ANALYSIS

With the foregoing as background, we will now turn to the meta-analysis of extant remote viewing experiments and evaluate what the data tells us.

Aims of This Meta-Analysis

The main aim of this meta-analysis is to offer a quantitative systematic review of all available evidence obtained with RV protocols up to December 2022. We also planned to compare studies with respect to some potentially relevant moderators, e.g., ‘selected’ participants, defined as trained or experienced with some kind of record, with non-selected subjects (novice, untrained, inexperienced, etc.); studies utilizing an agent versus those without an agent. Another objective was to compare the results of our meta-analysis with those related to extrasensory perception in a Ganzfeld environment, dream and forced choice protocols to discover which have had the strongest results.

Main Hypotheses

1. Based on previous meta-analyses (i.e., Tressoldi & Storm, 2023), selected subjects will outperform non-selected ones.
2. Given the successful results of earlier ‘outbounder’ studies involving an agent sent to a location, as well as the apparent success of ‘Project Scanate’ that used coordinates instead of an agent to focus the viewer’s attention, we do not expect to find a difference between these agent / non-agent protocols.

Previous Review

Although RV protocols have been used since 1974, there are no dedicated systematic reviews or meta-analyses. In her review, Utts (1996) considered only the SAIC and SRI results. In Milton’s (1997) meta-analysis, RV studies were included in the larger category of free-response studies without altered states of consciousness. The same decision was applied in the two meta-analyses of Storm and Tressoldi (2020) and Storm, Tressoldi, and Di Risio (2010). Only Baptista, Derakhshani, and Tressoldi. (2015) presented a summary of RV evidence up to 2014, but it was not a formal meta-analysis.

METHOD

Reporting Guidelines

We adopted the APA Meta-Analysis Reporting Standards (MARS, Appelbaum et al., 2018) and the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA) guidelines (Page et al., 2021).

Search and Inclusion Criteria of Studies

The search of papers using open access scientific databases, such as Google Scholar, using the keyword ‘remote viewing AND (logical operator) extrasensory perception’ yielded 673 results. We also refined the retrieval of the papers by checking all references related to the studies included in the cited meta-analyses and in all more recent papers.

Inclusion Criteria

We adopted the following inclusion criteria: a) the term ‘remote viewing’ should be made explicit in the title or abstract; b) the papers must be published in English in peer-reviewed scientific journals or in scientific conference proceedings; c) the papers must be related to experimental studies and not theoretical or methodological issues; d) the total number of trials and hits counts should be available in the results; e) The studies may be of an entirely experimental nature or may have been conducted for both experimental and applied/operational purposes (such as for ARV studies, which tracked statistical results per trial but also earned income from wagering). f) The experiments should be truly free response, rather than forced choice tasks in which experimenters simply used the term “remote viewing” as a modern synonym for clairvoyance. By free response, this means that the participants had to be granted at least some period of time to perform a session and report their impressions for unknown targets that are part of a larger pool they have minimal knowledge of, before being shown judging sets to choose from. g) As long as the above criteria were met, all studies fitting the definition of remote viewing provided at the top of this paper by the International Remote Viewing Association were included. These represented a diverse collection of remote viewing designs, approaches, and participants, as discussed above. We included 36 studies with a total of 40 effect sizes. The PRISMA flow chart is presented in the Supplementary Material.

Variables Coding

The following variables were included in the database: a) Authors’ name; b) Year of publication; c) Participants category: 0 = unselected, 1 = selected; d); publication type: 0 = conferences proceedings, 1 = peer-reviewed

journals; e) judges of participants' data: 1 = participants; 2 = independent judges; f) task type: Clairvoyance, Precognition; g) Outbound agent: 0 = no; 1 = yes; h) Interviewer: Yes = 1; No = 0; i) number of participants; l) number of trials; m) number of correct responses (hits); n) proportion of hits; o) number of choices in the judging phase; p) proportion of hits expected by chance or Mean Chance Expected (MCE); q) proportion of hits and proportion of hits expected by chance difference.

Effect Size Measures

Taking the number of trials, the number of hits, and the MCE as raw data, the standardized effect sizes, similar to Cohen's *d*, were estimated using the formula Z/\sqrt{N} of the trials. The *Z* values were obtained using the normal approximation to the binomial distribution. Under the null hypothesis of no psi, the number of hits in each study has a binomial distribution with *n* = the number of sessions and *p* = 1/number of choices in the target set used for judging. Because there are differing values of *p* across studies, it makes sense to convert the exact binomial values to z-scores using the normal approximation. This calculation can be obtained online at this site: <https://www.omnicalculator.com/statistics/normal-approximation>.

The corresponding standard errors were estimated using the formula:

$$\frac{(\text{hits proportion}) * (1 - \text{hits proportion})}{\sqrt{(\text{MCE}) * (1 - \text{MCE}) * (N \text{ of the trial})}}$$

Meta-Analysis Models

We applied a frequentist random effect model using the metafor package v. 3.8 (Viechtbauer, 2010), adopting the restricted maximum likelihood (REML) to estimate the heterogeneity variance (Langan et al., 2019) and the Hartung method to control effect size nonnormality (Rubio-Aparicio et al., 2018) and corresponding confidence intervals estimation.

To test the results' robustness, we also applied a Bayesian random effect model using the MetaBMA package v. 0.6.7 (Heck et al., 2017). As priors for the average effect size, we used a normal distribution with mean = 0.1, considered as the minimum expected effect size; SD = 0.03, positive constrained, lower bound = 0 (Haaf & Rouder, 2023), given our expectation of a positive value. For the tau prior parameter, we used an inverse gamma distribution with shape = 1, scale = 0.15, suggested as the default option.

Outliers Detection

We identified as outliers the effect sizes whose 95% confidence interval lies outside the 95% confidence interval of the average effect using the function `find.outliers` of the `dmeter` package (Harrer, Cuijpers, Furukawa, & Ebert, 2021).

Publication Bias Tests

From an empirical point of view, 13 *Z* values (34.2%) resulted below 1.65, the statistical threshold corresponding to a *p*-value of .05. Furthermore, following the suggestions of Carter, Schönbrodt, Gervais, & Hilgard (2019), we applied two further tests to assess publication bias:

The 3-Parameter Selection Model (3PSM)

The three parameters model, implemented by Curn and Vevea, (2019) in the package 'weightr' v.2.0.2, represents the average true underlying effect, δ , the heterogeneity of the random effect sizes, τ^2 and the probability that there is a nonsignificant effect in the pool of effect sizes. The probability parameter is modeled by a step function with a single cut point at *p* = 0.025 (one-tailed), which corresponds to a two-tailed *p*-value of 0.05. This cut-off point divides the range of possible *p*-values into two bins: significant and nonsignificant. The three parameters are estimated using maximum likelihood (Carter et al., 2019).

The Robust Bayesian Meta-Analysis Test

The Robust Bayesian meta-analysis (RoBMA) test implemented with the RoBMA package v.2.3.1 (Bartoš, Maier, Wagenmakers, Doucouliagos, & Stanley, 2022) is an extension of the Bayesian meta-analysis obtained by adding selection models to account for publication bias. This allows model-averaging across a larger set of models, ones that assume publication bias and ones that do not. This test allows us to quantify evidence for the absence of publication bias estimated with a Bayes factor. In our case, we compared only two models: a random-effects model assuming no publication bias and a random-model assuming publication bias.

Meta-Regression

To test the so-called 'decline effect', that is, if the average effect size declines with further data accumulation, we estimated the overall effect size by taking the variable 'year of publication' as a covariate and the effect size of each study as a dependent variable using a meta-regression model.

Moderators' Effects

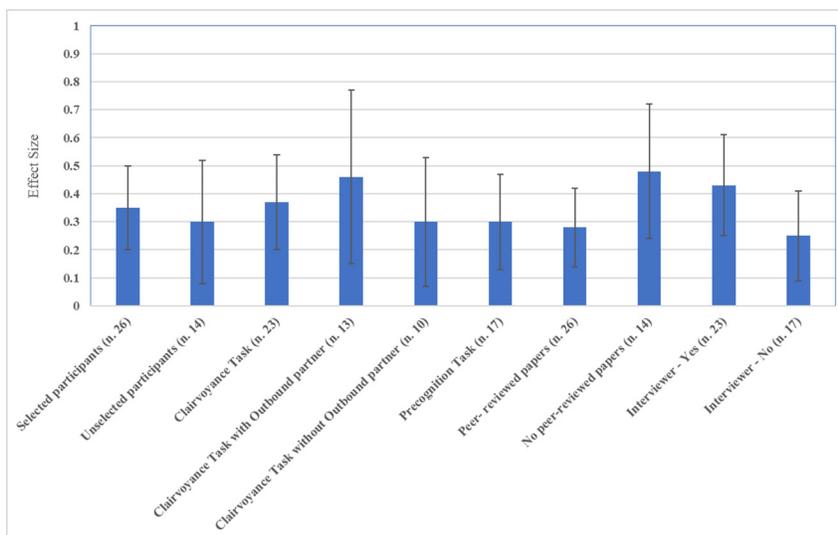


Figure 1: Effect size and corresponding 95% confidence intervals related to the different moderators.

We compared the difference of the following four moderators: (a) Type of participant, (b) Type of task, (c) Publication type, and d) Interviewer presence. As described in the Variable Coding paragraph, the variable Type of participant has been coded in a binary way: selected vs. unselected; Type of task has been coded as Clairvoyance or Precognition; Publication type = 0 for studies

published in conference proceedings or = 1, for the studies published in scientific journals with full peer-review; Interviewer = Yes (1) or No (0).

The entire database and the code used for all statistical analyzes are open access available at <https://doi.org/10.6084/m9.figshare.22298266.v1> for independent reproducibility and analyses.

Table 1: Descriptive Statistics of the Main Variables

Type	Count (Percentage)	Mean - Median (SD)	Range
Participants type	Selected= 26 (65) Unselected=14 (35)		
Publication type	Peer-reviewed= 26 (65) No peer-reviewed= 14 (35)		
Judges type	Participants= 6 (15) External = 34 (85)		
Tasks type	Clairvoyance= 23 (57.5)		
	Clairvoyance with agent= 13 (32.5)		
	Clairvoyance without agent= 10 (25)		
	Precognition= 17 (42.5)		
Interviewer	Precognition with agent= 3 (7.5)		
	Precognition without agent= 14 (35)		
	Yes = 23 (57.5) No = 17 (42.5)		
Participants number		50.6 – 7 (139.46)	1 - 770
Trials number		242.1 – 38.5 (897.5)	5 - 5677
Hits % above MCE		19.3 – 13.2 (17.9)	-2.8 – 55.6



Table 2: Frequentist and Bayesian Meta-Analytic Results

Meta-analysis	n. effect size	Effect size	95% Confidence/Credible Intervals	p/Bayes Factor H1/H0	Heterogeneity I ²
Frequentist	40	.36	.23 - .48	8.7 ^{-e10}	100
Frequentist without outliers	39	.34	.22 - .45	2.94 ^{-e9}	100
Bayesian without outliers	39	.33	.23 - .42	530209	

RESULTS

Descriptive Statistics

The descriptive statistics of the main variables are presented in Table 1.

Average Effects

The results of the frequentist and Bayesian average effects meta-analyses are presented in Table 2. The outliers detection identified Husting & Hurts (1976) as an influential outlier. The results of both the frequentist and Bayesian meta-analyses are in close agreement. The level of heterogeneity among studies is very high, as expected by the wide variability of participants and experimental designs. The forest plot is available in the Supplementary Material.

Publication Bias Analysis

The results of the 3-parameter selection model and the robust Bayesian meta-analysis are reported in Table 3. From both an empirical and a simulated point approach, there is no sign of publication bias.

Moderators' Analyses

The results of the meta-analyses related to the main moderators are presented in Table 4.

Table 3: Effect Size and Corresponding 95% Confidence / Credibility Intervals of the 3PSM and RoBMA Publication Bias Tests

	n. effect size	Effect size	95% Confidence/Credible Intervals
3PSM	39	.31	.16 - .47
RoBMA	39	.32	.23 - .42

Among the more relevant results, there is a small difference between the conditions requiring a clairvoyant or a precognitive activity, particularly when there was an outbound partner. Given the low number (2, 5.4%), we did not estimate studies that require precognitive activity with an outbound partner. Another difference is between peer-reviewed and no peer-reviewed studies, with a larger effect size for the latter ones, and between protocols with and without an interviewer, even if their confidence intervals overlap. Given the low number of studies (5, 13%) that used self-judging, we did not compare them with the studies using independent judges. However, these differences in the means do not correspond to a statistical difference, given the wide range and overlap of their confidence intervals, as shown in Figure 1, for a better visual comparison of these statistical parameters.

Decline Effect

To check if there was a decline effect, that is, a decrease in effect size since 1974, we performed a meta-regression analysis using the variable 'year' of publication as moderators. The results were the following: effect size = -.008; 95% Cis = -.015 - -.002, suggesting a minimal statistically significant decline, $z = -2.43$; $p = .015$

Differences with Other ESP Protocols

In Figures 2a and 2b, we compared the average standardized identical effect size with the corresponding 95% confidence intervals of selected and unselected participants with those obtained with other protocols, all aimed at detecting extrasensory perception. Results related to forced-choice protocols with participants in a normal state of consciousness are obtained by Storm and Tressoldi (2023); those related to free response protocol with participants in a Ganzfeld environment are obtained by Tressoldi & Storm (2023), and those obtained from presentiment protocols by Duggan & Tressoldi, (2018). For this protocol, there are no data related to selected participants.

Table 4: Results of the meta-analyzes related to the main moderators.

Type	n. effect size	Effect size	95% Confidence Intervals	p	Heterogeneity I ²
Selected participants	26	.35	.20 - .50	3.5 ^{e-7}	100
Unselected participants	13	.30	.08 - .52	.01	99.9
Clairvoyance Tasks	22	.37	.19 - .54	.0003	99.8
Clairvoyance Tasks with Outbound partner	12	.46	.15 - .77	.007	93.7
Clairvoyance Tasks without Outbound partner	10	.30	.06 - .53	.01	99.8
Precognition Tasks	17	.30	.13 - .47	.001	100
Peer- reviewed papers	26	.28	.14 - .42	.0002	99.9
No peer-reviewed papers	13	.48	.23 - .72	.001	99.6
Interviewer - Yes	22	.43	.25 - .61	3.02 ^{e7}	99.7
Interviewer - No	17	.25	.09 - .41	.003	100

DISCUSSION

The results of this first meta-analysis related to all RV studies carried out in almost 50 years are quite encouraging, even if they are few, approximately one per year. The observed average effect size was confirmed by both frequentist and Bayesian meta-analyses. Furthermore, no signs of publication bias and a minimal decline effect were observed.

The average size of the RV effect was the strongest with respect to all other protocols used to investigate extrasensory perception.

In terms of raw percentage of hits difference from chance, RV protocols obtained 19.3%, 95% confidence intervals: 13.6% - 25%, much higher than that obtained with

the Ganzfeld protocol of 6.8%, 95% confidence intervals: 4.7% - 8.9% (Tressoldi & Storm, 2023).

Among the meta-analyses of the moderators, it is interesting that we did not observe differences between selected and non-selected participants. This result is quite unexpected given the importance given to training in RV. We will see if this finding will be confirmed in future studies. However, from a statistical point of view, this small difference did not turn out statistically significant ($t(37) = .15; p=.88$) given the small number of studies, the large variability of effect sizes, and, consequently, the lower statistical power.

Furthermore, we observed a small difference between the precognitive and clairvoyance tasks, particularly with those with an outbound agent, but without reaching a

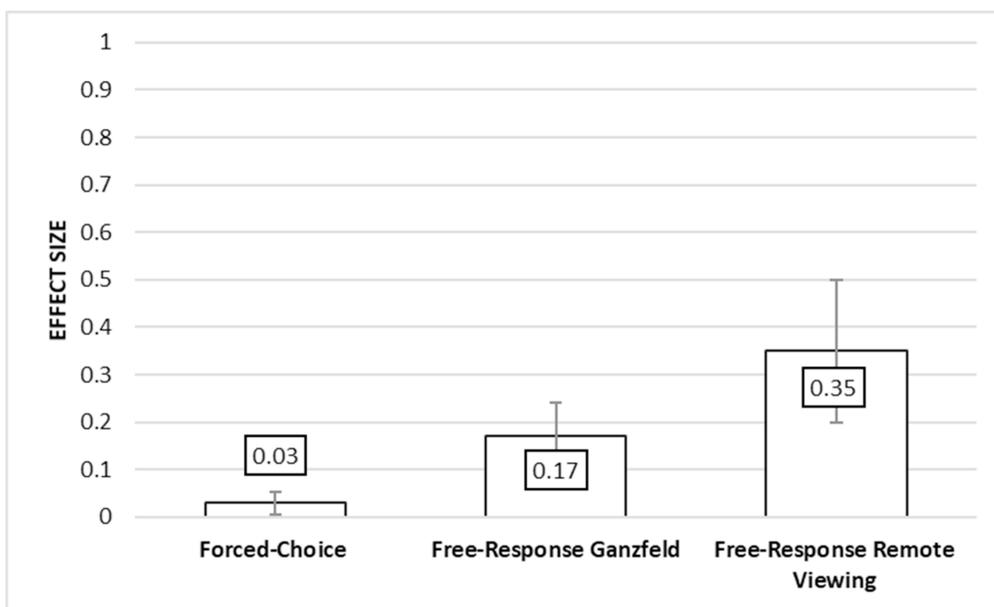


Figure 2a: Average effect size with corresponding 95% confidence intervals obtained by selected participants



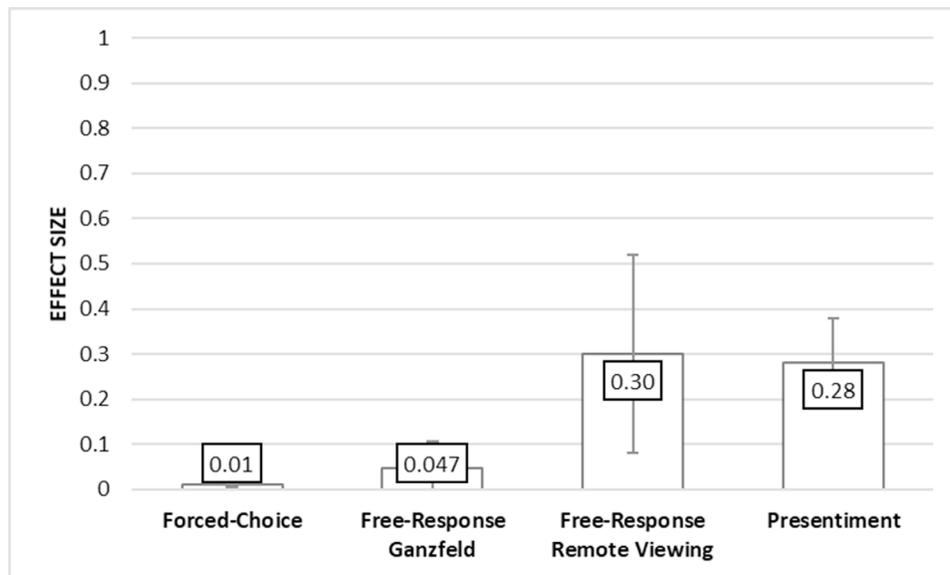


Figure 2b: Average effect size with corresponding 95% confidence intervals obtained by unselected participants.

statistical difference given the wide confidence intervals of the means.

Participants in studies in which remote viewers were paired with interviewers who helped guide them through their session work performed slightly better on average than those in which they worked independently. While many viewers today tend to perform their work solo (Katz & Tressoldi, 2022), our findings may encourage some to revisit this practice. In the research and military arms of the RV programs, viewers almost always worked in partnership with an experienced interviewer (Katz & Bulgatz, 2019; Puthoff, 2023). Although we can only speculate here, this might also account for the only very slight differences between studies using select vs. unselect subjects, as it is possible that utilizing an experienced interviewer could make up for the lack of experience in an unselected subject.

In this meta-analysis, we did not have enough studies with descriptions of their methods to analyze potential differences among the different RV techniques, for example, ARV and CRV; ERV and CRV, or stages 1-6 of CRV vs. studies using only stages 1 & 2 (Roe et al., 2020). Such an assessment is certainly warranted.

Similarly, we did not have enough studies to compare self-judging with independent judging protocols, another relevant characteristic worth investigating.

As indicated in Figure 2b, our findings corroborate what previous meta-analyses have found: remote viewing is an actual phenomenon in the human experience; however, forced-choice designs may be limited in capturing it. Our statistical findings suggest that remote viewing protocols may have stronger results than the collection of other free response protocols, which are already found to

have stronger results with respect to forced-choice ones.

Our literature review suggests that a mixed-method approach, such as pairing a Ganzfeld set up with remote viewing (Roe et al., 2020) or hypnosis (Ballati et al., 2020), may hold potential. We recommend that such pairings be further explored with experienced remote viewers.

Implications and Applications

Our results, paired with previous findings, suggest that the use of RV if properly applied by experts, can have wide practical applications, from military and intelligence applications to archeological investigations (Schwartz, Mattei, & Society, 2000) to finance (Katz, Grgic, & Fendley, 2018), as documented by Katz and Tressoldi (2022).

Another interesting finding was the almost identical outcome of studies related to precognitive or clairvoyant tasks, particularly when there was an outbender (agent). This finding suggests that the future may be as easy to describe as the present.

Study Limitations

The main limitation of this study is similar to all other available meta-analyses related to ESP. That is, studies were not pre-registered, allowing the possibility that the researchers may have engaged in so-called questionable research practices (John, Loewenstein, & Prelec, 2012). However, the percentage of 34.2% non-statistically significant z scores observed in this meta-analysis suggests that these practices were not widely applied.

Although Spitzer & Mueller (2021), speaking to psychological research in general, found that ‘pre-registering studies is still not the norm in the field’ (p. 1), our rec-

ommendation for all future studies is that researchers pre-register methodology and data analyses and make their raw data open access for independent reproducibility of results.

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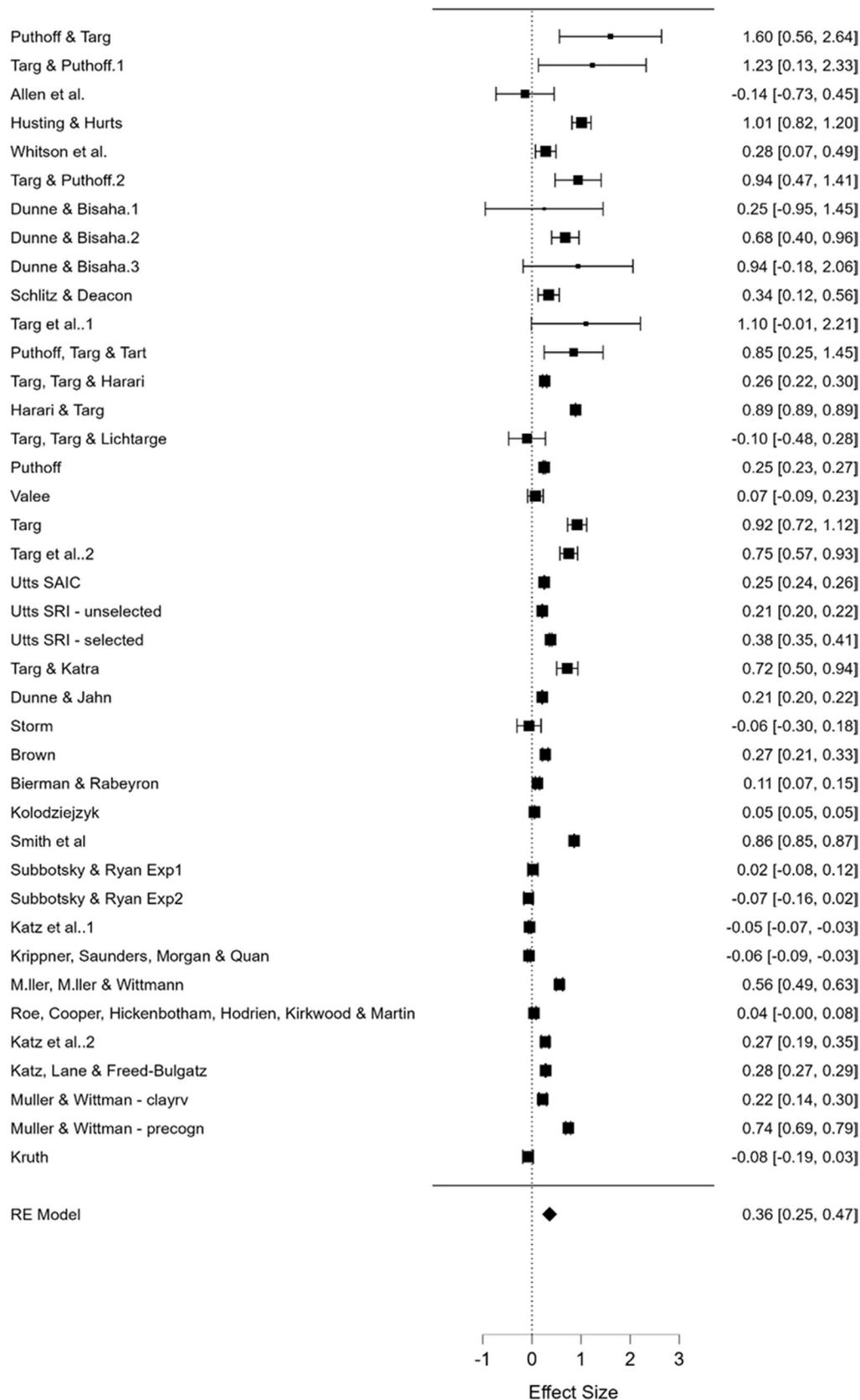
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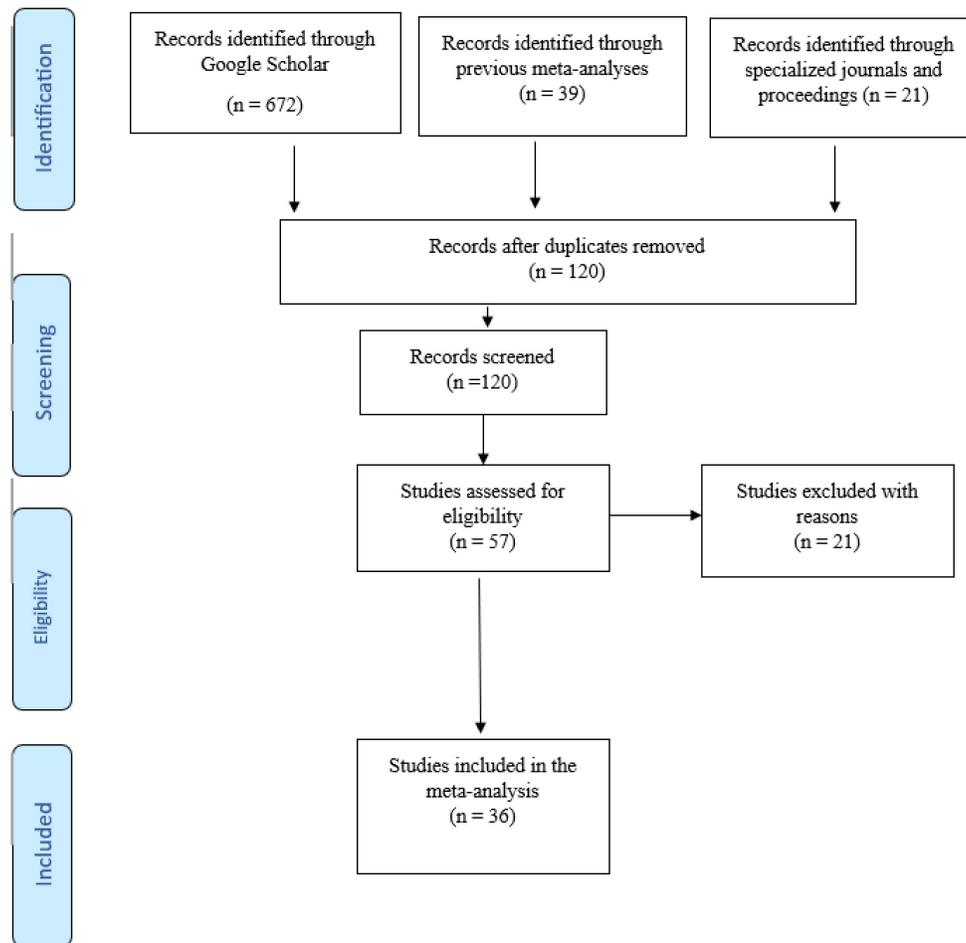
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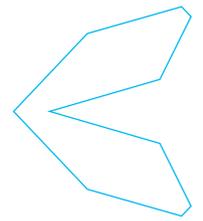
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APPENDIX A: Forest Plot



APPENDIX B: Prisma Flow Chart





**SPECIAL
SUBSECTION**

On the Band-Limited Information Throughput of Free-Selective and Free-Responsive Spatially Non-Local Perception

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HIGHLIGHTS

Extrasensory perception possibly involves tangible and intangible types of information that are filtered during transmission.

ABSTRACT

A single-blind experiment was conducted on free-responsive spatially non-local perception of free-selective simple photographic targets. One author (the tasker) chose a photographic target not subjected to *a priori* compiling, and the other author (the perceiver) attempted to unconventionally perceive the target. Feedback was expected prior to a new target being selected. A hundred trials were completed over 11 months. Thirteen judges offered gradings that collectively projected an apparent information requisition yield (AIRY). The AIRY refers to two aspects of the matching of a taskette (a target's counterpart) with respect to the target based on fuzzy scales from 0% to 100%, graded with an increment of 10%. The type-I or "tangibility" aspect of matching assessed the extent of the resemblance of a taskette to the target in terms of the shape or structural details of the primary physical entity/event. The type-II or "intangibility" aspect of the matching assessed the degree of the reconstruction of a taskette to the target in terms of the feature or functionality of the predominant physical entity/event. A total of 6 taskettes received >50% grades in both type-I and type-II aspects of matching with their respective targets. This outcome may correspond to an effect size of 1.47 if the chance-expectation may give a benchmark proportion of 3 out of 100 trials producing >50% grades in both type-I and type-II aspects of matching. Patterns indicating target interference associated with two trials entail further investigation. The approaches offer new insights to quantifying the band-limited information throughputs of spatially non-local perception.

KEYWORDS

Psi, remote viewing, non-locality, spatially non-local perception, modulation transfer function, point-spread function, impulse response, filter, apparent information requisition yield, partitioned undulation net transfer.

INTRODUCTION

What is a camera used for? For acquiring information of an object (whether being static or dynamic) to be registered on a physical material that can hold that informa-

tion. How is it different between a high-quality camera put to space travel and a toy-quality camera played by a toddler? What differs, in terms of the outcome, is the quality of information transmission, or the quantifiable degree of the details of the object or target that will be transmitted



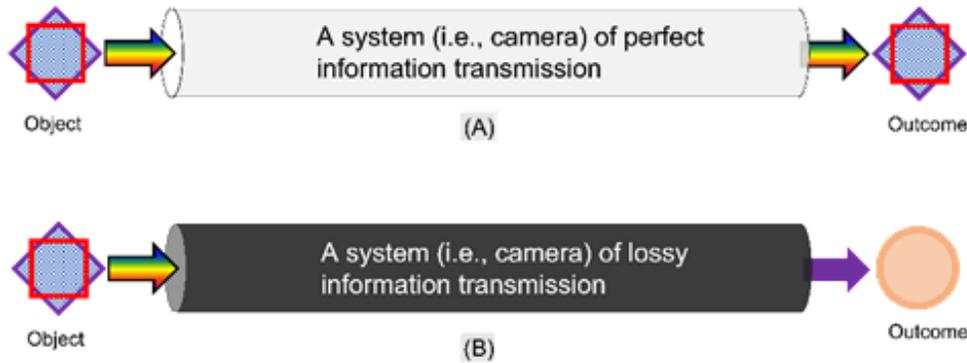


Figure 1. Any physical means to produce/relay/restore the information of an object has a quality of merit akin to the characteristics used for quantifying the fidelity or robustness of information transmission. A perfect system transmits every detail of the object or target. A practical system will lose some details of the object or target in the transmission.

through or processed by the camera to appear as the output when compared to the input. As is conceptualized in Fig. 1, a high-quality camera, which in essence is a system of information transmission, will allow the fine details of an object to appear on the outcome side. Comparatively, a low-quality camera, also acting as a system of information transmission, will lose the fine details of an object and have only partial features of the object to appear at the outcome side. Likewise, any sensory response has a limitation, just as what is inferred by the visible spectrum of light and the audible range of sound.

Regardless of how the information may be relayed through or accessed via a system or means of physical channel, there is always an object or target as the origin of the information, against which the information produced/appeared/relayed/reconstructed at a different spatial location and later in time can be compared. This also applies to the information that may be transmitted non-locally or unconventionally when involving human perception, as is conjectured in Fig. 2. In the cases of the information of an object appearing to have been relayed or reconstructed at a different spatial location and later in time, even if the means of information transmission may not be accountable by known physical principles or verifi-

able technological access, there is the input side of the information-transmission being a physical object or entity and there is also the output side of the information-transmission being another physical object or entity. Comparing the detail of the information contained at the output versus that at the input shall inform the quality of the unknown or unspecified route of information throughput.

Then a fundamental question arises: How to objectively assess the quality of the information relay if the process seems to engage human perception in ways that are unaccountable by known physical principles or verifiable technological access? The answer to this question depends greatly upon the property of comparison between the two physical entities existing at both ends of the information relay, specifically the object being targeted for the information relay and the outcome of the information relay.

We may then ask, to what degree is a McIntosh like a Fuji if an unconventional perception has mistaken a Fuji as a McIntosh? To what extent does an orange resemble an apple if an unconventional perception has made up an apple as an orange? How much similarity is there between a papaya and a banana if an unconventional perception has modeled a banana as a papaya? How can the outcome of

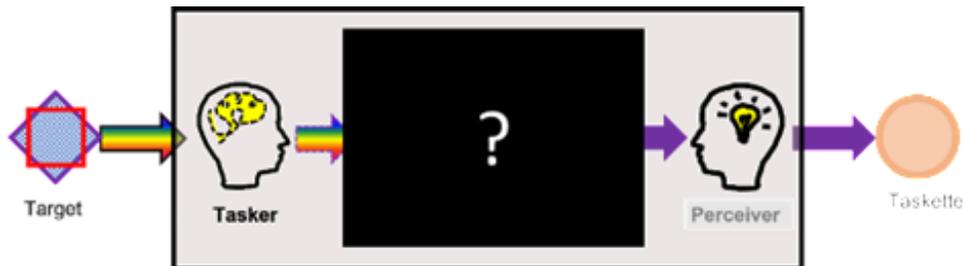


Figure 2. If partial information of an object as a target has appeared in a different location, there is the issue of the quality of information transmission of the route engaged in relaying the information, regardless of whether it involves human perception or not. The counterpart of target, with respect to how the information may be relayed, is referred to as taskette for convenience as well as the inferring to the objectivity of the two opposite ends of the information throughput over a yet-to-be-recognized mechanistic channel of perception.

unconventional perception be assessed in ways that are more objective to facilitate investigating specific factors that may influence the outcome?

A McIntosh may be perceived as being very much like a Fuji in terms of being an apple. But if the finer shape or delicate taste is up for comparison, one would be able to distinguish a McIntosh from a Fuji. An orange may resemble an apple based upon the gross shape or being fruit. But if the surface texture or internal compartmentalization is what one is concerned with, an orange is not like an apple. A papaya could be argued as being not much different from a banana as they both grow high on the tree in a clustered pattern to become fruit. But if the shape and size of the individual piece are scrutinized, a papaya apparently differs from a banana. Then, how much similarity, in percentage or on a scale spanning 0 to 1, can a McIntosh be said to be like a Fuji? How much dissimilarity, in percentage or on a scale spanning 0 to 1, can an orange be said to be unlike an apple? And how analogous or disparate in properties, in percentage or on a scale spanning 0 to 1, can a papaya be said to resemble or match a banana?

We may be inclined to recognize the ambiguity or uncertainty that multiple aspects are intertwined in our awareness or perception when comparing one physical object to another physical object (Dunne & Jahn, 2007), particularly when assessing the outcomes of unconventional perception. One perceptible aspect of the comparison between two physical objects may lie in the geometric properties such as shape and structural details. These properties can be referred to as “tangible” since they are measurable by physical means of objective reproduction or reconstruction, such as a camera. Another perceptible aspect of comparing between two physical entities may pertain to the usage of the object, such as featural and functional characteristics. These features or functional properties may be considered “intangible” because of the requirement of an awareness to abstract the specifics of information that cannot be said to be purely physical or exclusively objective. Then, what about comparing two packages of physically documented information conveying properties that are subjective and intuitive, in addition to the objectivity associated with any documented information, that makes them difficult to process by means of objective approaches alone? Will such comparison be weighted more towards the intangibility than the tangibility of the properties of the target entity? And if so, how? For example, what amount of “perceivable” information is matched to a photograph of an astronaut on the moon in a pitch-black background by a poor drawing of a human figure in a spacesuit-like outfit while illuminated by sparse starlight? How much “tangibility” and “intangibility” of the target entity can be said to be present in the

poor drawing? How much does the poor drawing match the target in terms of the key information defining the most important message of the object/event?

The inherent vagueness of human perception in affiliating one object or concept to a definitive realm of information, more concisely called the fuzziness, has been well-established in social sciences (Ragin, 1999) for objectives including uncovering complex causal relationships (Fiss, 2011) and assigning causal credits (Kogut et al., 2004), and in imaging applications for spatial pattern matching (Leung, 1983). The significant burden of data analysis associated with the perceptual uncertainty in the STAR GATE program (Marwaha & May, 2017; Puthoff & Targ, 1976; Targ & Puthoff, 1975; Tart et al., 1980) prompted May et al. to apply the fuzzy set approach to computerize the target information to quantitatively assess the outcomes of non-local perception, or the perception via unconventional means (May et al., 1990; 2012). It is, however, worthy to note that the fuzzy set developed by May et al. enumerates all properties of the targets that were considered perceivable, regardless of being tangible or intangible, including both the objective shape (rectangular, square, box) and the subjective type of scenery requiring intelligent judgment (urban, rural) (May et al., 1990; 2012). This approach pioneered the understanding of the odds that are unambiguously attributable to the chance-expectation to determine the effect size. However, to shed light on what might underlie the information transmission by spatially non-local or unconventional means (Chatel-Goldmna et al., 2013; Tressoldi, 2011), it may be imperative to differentiate the type of information that can hardly be processed without the engagement of human intelligence (Targ, 1994), from the kind of information that is objective and thereby unambiguously quantifiable by applying physical-mathematical metrics. Differentiating between the two types of information that could be processed unequally or passed differently by whatever process the unconventional perception may engage may help foster more robust strategies of target selection or other aspects of protocol control necessary to improving the understanding of unconventional perception, whether that is spatially non-local or temporally acausal.

What more needs to be done to facilitate a more objective and further quantifiable assessment of the outcome of unconventional perception? We felt it was convenient to use the term “*inforception*” to abbreviate “information transmission by anomalous perception”. We also felt compelled to use the term “*inforception*” on the speculation that the spatially non-local perception resulting in some information of the target appearing at the outlet of the transmission does not seem to engage

any physically tractable channel, thereby leaving only the perception to be attributable to the manifested level of information throughput that can be traced towards the true information of the target.

Regardless of the mechanism involved or engaged or associated with the perception of unconventional means, two physical entities do lie at both ends of inforception; one is the target being the ground truth, and the other is a counterpart of the target reconstructed or retrieved by the inforceptive process, as is illustrated in Fig. 2. We hereafter call the counterpart of the target “taskette” for brevity and objectivity. In any inforceptive event, regardless of whether it is being performed under a single-blind protocol or with stricter control, there must be someone who willingly or volitionally determines a target, and correspondingly, there must be another one who exercises some level of perceptive means to produce the taskette. Therefore, the process of an unconventional perception may be put as one that involves a target, a tasker, an unknown path of information transmission or relay, a perceiver, and a taskette as the result.

This process linking a target with a taskette by any unconventional means, in terms of the result, is not much different from a system of conventional information transmission, as is depicted in Fig. 1(B). As is conceptualized, the consequence is that the target information is being processed by a channel/means capable of transmitting the information that practically cannot let pass 100%, and the outcome is a taskette carrying information that, at best, is as good as what the target represents, should the information transmission channel have no additional source of information inlet to interfere with the process. The outcome or the throughput of such information transmission process shall be standardizable by means of objective metrics such as transfer function or modulation transfer function (MTF), which is the amplitude of Fourier transform of the so-called point-spread-function (PSF) that is specific to relaying visually discernible information through a system designed to acquire the spatial details (Coltman, 1954; Judy, 1976; Rossmann, 1969). The general principles of MTF or PSF in defining the quality of information throughput are referred to in Appendix 1. These metrics, which are standard for assessing the relay of information in physical sciences, may be relied upon to develop a new understanding of the quantifiable outcome of non-local perception.

A motivation of this experiment has been to assess the relative information throughput of spatially non-local perception attempted by an unexperienced percipient to understand if the non-local information transmission may differ between the tangible and intangible aspects of the information. Furthermore, the assessment of the

information throughput using a new but mathematically viable function may enable further transformation to be implemented for applying the model approach to other data sets bearing similarity in terms of the interplay between objective (tangible) and subjective (intangible) aspects of information.

It shall, however, be noted that the results of this work may not indicate the existence of spatially non-local perception but rather elicit the need to address that the band-limited information throughput that may be unavoidable in a process seemingly conforming to spatially non-local perception may have two aspects differentiated by whether the information may be tangible or intangible. An understanding specific to the throughput of the “intangibility” aspect of the information will be an advancement over the prior pioneering approaches treating all information perceived unconventionally as likely “tangible”. The initial understanding gained from this experiment, based on an alternative information perspective to the spatially non-local perception, could help develop better experimental protocols upon the accessibility to greater researchable resources by applying more specific control of the spectrum of information that must be engaged in the unconventional channel of perception and introducing specific interference to the targeting process to isolate factors that have been previously unattended to.

This present experiment has been conducted in line with a very limited and narrowly specific aim: to apply the spirit of MTF that is standard for assessing the transmission of tangible information to interpreting the degree and type of information associated with photographic objects that seemed to have been non-locally perceived. The inherently fuzzy information throughput associated with non-local perception is analyzed in an exploratory perspective referred to as apparent information requisition yield (AIRY). The partition of the information seemingly transmitted via the means of unconventional perception to tangible (purely objective) and intangible (primarily subjective) aspects makes it imperative to assess AIRY in two aspects or directions according to the indices of the information complexity: one is of the tangibility, and the other is of the intangibility. The combined pattern is referred to as a two-way AIRY. A Fourier transform-like operation onto the two-way AIRY further leads to a partitioned undulation net transfer (PUNT) function, which is analogous to but not the same as MTF. The PUNT function, which may be considered a relative MTF, will be helpful for quantifying the relative throughput of the transmission of both tangible and intangible aspects of information. The approach may enable additional mathematical treatments for a more comprehensive analysis of

the outcome and process to inform the possible mechanism of spatially non-local perception.

APPARATUS AND METHODS

Theoretical Apparatus

In Appendix 2, we outline the principles leading to the partitioned undulation net transfer (PUNT) function via the apparent information requisition yield (AIRY) when the information of a target is modeled as being processed through a fuzzy channel of information transmission. Those theoretical formulations are hypothesized to be applicable to spatially non-local information transmission.

Terminology. Some ideas are inherently crisp or binary, but others are naturally fuzzy. For example, a person has or has not been a world champion in a single-player sport. That “championship”, if classified as a membership, is crisp, being either zero for NO or one for YES. The membership of a person in terms of that “championship” can be called “crisp-membership”. But what about a person who has been a world-renowned player in that sport but not necessarily a title-earner? If what is to be classified is “sportsmanship” or “skill-ship”, there is no crisp definition of where the person stands, and as such, the “membership” of the person to the classifiable property such as “sportsmanship” or “skill-ship” may be called “fuzzy-membership”.

Hereby, we speculate on the correspondence be-

tween fuzzy-membership (referring to the ambiguity or subjectiveness of associating a specific concept to a category, e.g., is today’s temperature hot or not hot?) characterizing the degree of matching (the matching-ship) or missing (the missing-ship) and a relative level of modulation transfer of the informational complexity of the target. We define the following terms for the benefit of streamlining the subsequent descriptions pertaining to the objectivity of information throughput to facilitate future mathematical implementation, irrespective of what mechanism may govern the information throughput. (1) Target: the objective-entity documented permanently by means of physical information storage such as print, digital photograph, or electronic memory. (2) Taskette: the individual result of the fuzzy information transmission that has been documented permanently by means of physical information storage such as a drawing or a script of descriptive words and sentences in a hard copy or electronic medium of perpetuity. The “taskette” serves as the output of the target through an inforcement process. (3) Tasking: the action or process of relaying the information of a target to a taskette. (4) Feedback: the access to the target by an individual upon production of a taskette. (5) Trial: the completion of the process from making a target available to completing feedback specific to a taskette. (6) Tasking-duration: the time registered between the selection of the target and making the taskette accessible to the individual who selected the target. (7) Inforealm: the “information realm” referring to the entirety of in-

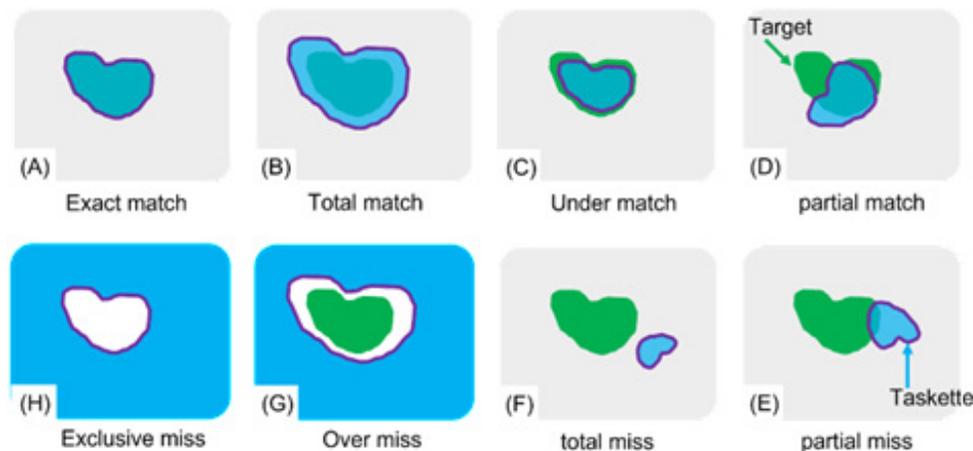


Figure 3. The matching or missing conditions between a taskette and its corresponding target. The eight sub-figures are ordered clockwise as (A) to (H). The round-cornered base rectangular area in each subfigure denotes the entire domain of information for defining all physical objects. The free-form area in (D) pointed by an arrow, which appears in the other seven subfigures with identical position, orientation, and size, specifies the exact sub-domain information or inforealm for a target (i.e., the true condition or the ground truth). The thick-free-form framed area in (E) pointed by an arrow, which appears in the other seven subfigures with differing position, orientation, and size, designates the exact sub-domain information or inforealm for a taskette (the estimated condition or the reconstruction) corresponding to a target. (A) corresponds to 100% matching of a taskette to its target. (F)-(H) together corresponds to 100% missing of a taskette from its target, however, the patterns or aspects of the missing may be arguably different among these three conditions.

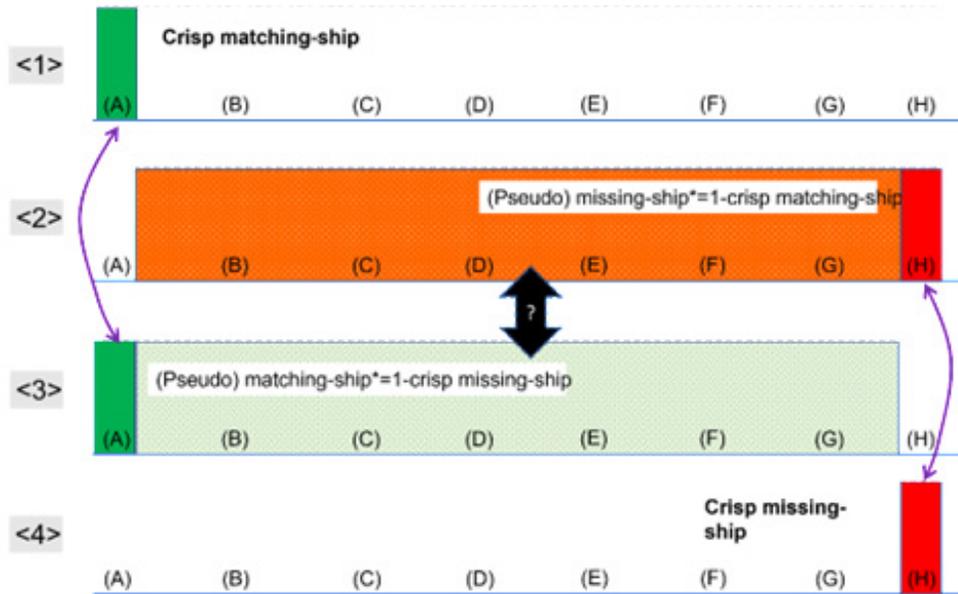


Figure 4. The crisp grading of the eight conditions shown in Figure 3 concerning the matching or missing of a taskette with respect to its target. Panel (1): A crisp matching-ship of 1 is assigned to ONLY the exact match of condition (A). This will assign (B)-(H) a crisp matching-ship of 0. Alternatively, a crisp matching-ship of 1 is assigned to (A) and (B) due to the recovery of the entire information of the target. This will assign (C)-(H) a crisp matching-ship of 0. Panel (2): The conjugate of the crisp matching-ship constitutes the pseudo-missing ship. This will give (A) a pseudo-missing-ship of 0, and (B)-(H) a pseudo-missing-ship of 1. The alternative of (1) will assign (C)-(H) a pseudo-missing-ship of 1. Panel (4): A crisp missing-ship of 1 is assigned to ONLY the exclusive miss of condition (H). This will make (A)-(G) receive a crisp missing-ship of 0. Alternatively, a crisp missing-ship of 1 is assigned to (F)-(H) due to the absence of any target information in the taskette. This will make (A)-(E) receive a crisp missing-ship of 0. Panel (3): The conjugate of the crisp missing-ship constitutes the pseudo-matching-ship. This will give (H) a pseudo-matching-ship of 0, and (A)-(G) a pseudo-matching-ship of 1. The crisp membership will cause contradictory pseudo memberships for conditions that likely are the most practical and common outcomes of any spatial non-local perception conducted.

formation needed to completely and non-redundantly characterize one physical entity. (8) Matching-ship: the degree of matching, as the abbreviation of matching membership. (9) Missing-ship: the extent of missing, as the abbreviation of missing membership.

Regardless of the means taken for relaying the information via spatially non-local perception, there is the need to determine the degree of matching or missing of a taskette against the corresponding target to assess the information throughput. By referring to Fig. 3, we illustrate the following inclusive conditions of matching/missing of a taskette with respect to a target in the formats permitting future mathematical representation. (A) Exact match: the inforealm of the taskette is identical to that of the target. (B) Total match: the inforealm of the taskette is a super-set of that of the target. (C) Under match: the inforealm of the taskette is a sub-set of the inforealm of the target. (D) Partial match: the common set of the inforealm of the taskette and that of the target is greater than 50% but less than 100% of the inforealm of the target. (E) Partial miss: the common set of the inforealm of the taskette and that of the target is less than 50% but greater than 0% of the inforealm of the target. (F) Total miss: the

inforealm of the taskette has no overlap with that of the target, and the complement-set of the inforealm of the taskette in the entirety of the information domain is the super-set of the inforealm of the target (off the target). (G) Over miss: the inforealm of the taskette is a sub-set of the complement-set of the inforealm of the target in the entirety of the information domain (missed more than the target). (H) Exclusive miss: the inforealm of the taskette is the exact complement-set of the inforealm of the target in the entirety of the information domain (missed only the target).

In the following, we address how the crispness or fuzziness of matching or missing may impact the consistency of the grading of the conditions shown in Fig. 3.

Crisp Membership [0 or 1] of the Matching or Missing. Figure 4 details the crisp grading of the eight conditions shown in Fig. 3 when concerning a binary (ALL or NONE) matching or missing of a taskette with respect to its target. Panel (1): A crisp matching-ship of 1 is assigned to ONLY the exact match of condition (A) of Fig. 3. This will assign all conditions of (B)-(H) of Fig. 3 to a crisp matching-ship of 0. Panel (2): The conjugate of the crisp matching-ship constitutes the pseudo-missing ship.

This will assign (A) of Fig. 3 to a pseudo-missing-ship of 0, and all (B)-(H) of Fig. 3 to a pseudo-missing-ship of 1. Panel (4): A crisp missing-ship of 1 is assigned to ONLY the exclusive miss of condition (H) of Fig. 3. This will assign all conditions of (A)-(G) of Fig. 3 to a crisp missing-ship of 0. Panel (3): The conjugate of the crisp missing-ship constitutes the pseudo-matching-ship. This will assign (H) of Fig. 3 to a pseudo-matching-ship of 0, and all (A)-(G) of Fig. 3 to a pseudo-matching-ship of 1. As a result, the crisp membership will cause contradictory pseudo memberships for intermediate conditions appearing in panels (2) and (3), which likely are the most practical and common outcomes of any spatially non-local perception conducted. The incongruence of the pseudo-membership is undesirable.

Fuzzy Membership [0-1] of the Matching and Missing. Figure 5 outlines the continuous-fuzzy grading of the eight conditions shown in Fig. 3 by considering the continuously varying degrees of the matching or missing of a taskette with respect to its target. Panel (1): A continuous-fuzzy matching-ship of 1 and 0 are assigned to the exact match of condition (A) of Fig. 3 and exclusive miss of condition (H) of Fig. 3, respectively. The conditions bounded by (A) and (H) are then assigned a fuzzy

matching-ship distributed between 1 and 0. Panel (2): The conjugate of the continuous-fuzzy matching ship constitutes the pseudo-missing ship. This will assign (A) and (H) of Fig. 3 to a pseudo-missing-ship of 0 and 1, respectively, and the conditions bounded by (A) and (H) of Fig. 3 to a fuzzy pseudo-missing-ship distributed between 0 and 1. Panel (4): A continuous-fuzzy missing-ship of 0 and 1 are assigned to the exact match of condition (A) of Fig. 3 and exclusive miss of condition (H) of Fig. 3, respectively. The conditions bounded by (A) and (H) of Fig. 3 are thus assigned a fuzzy missing-ship distributed between 0 and 1. Panel (3): The conjugate of the continuous-fuzzy missing-ship constitutes the pseudo-matching-ship. This will assign (A) and (H) of Fig. 3 to a pseudo-matching-ship of 1 and 0, respectively, and the conditions bounded by (A) and (H) of Fig. 3 to a fuzzy pseudo-matching-ship distributed between 1 and 0. The pseudo-matching-ship and missing-ship for the intermediate conditions appearing in panels (2) and (3) now accord with each other. Because the matching of a taskette with its target will unlikely be crisp, and the target may contain information that may be intangible, interpreting the taskette-target matching may require assessing the matching-ship not only in a fuzzy-scale but also considering the difference between

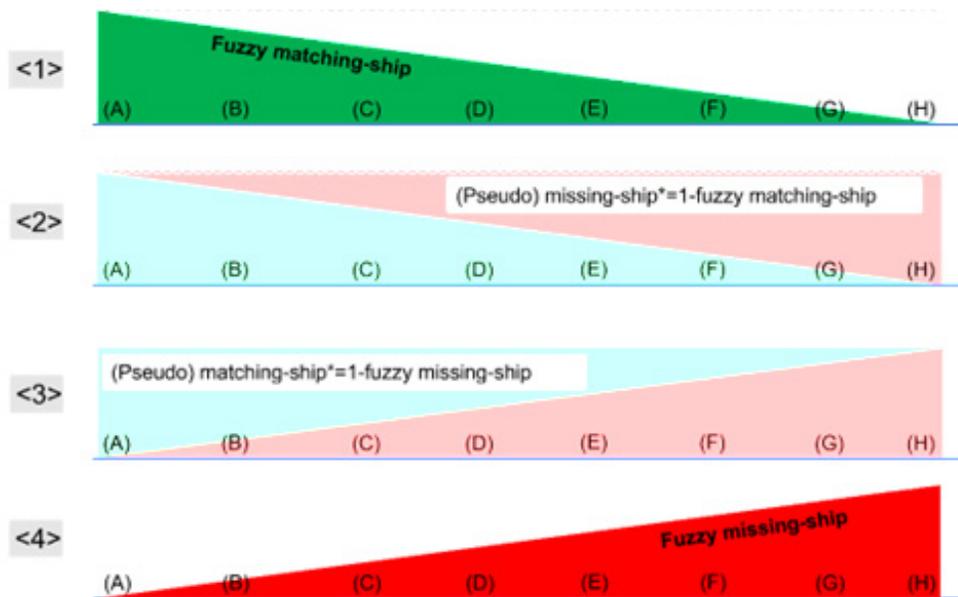


Figure 5. The continuous-fuzzy grading of the eight conditions shown in Figure 3 concerning the matching or missing of a taskette with respect to its target. Panel (1) A continuous-fuzzy matching-ship of 1 and 0 are assigned to the exact match of condition (A) and exclusive miss of condition (H), respectively. The conditions bounded by (A) and (H) receive a fuzzy matching-ship distributed between 1 and 0. Panel (2): The conjugate of the continuous-fuzzy matching ship constitutes the pseudo-missing ship. This will cause (A) and (H) to have a pseudo-missing-ship of 0 and 1, respectively, and the conditions bounded by (A) and (H) receive a fuzzy pseudo-missing-ship distributed between 0 and 1. Panel (4): A continuous-fuzzy missing-ship of 0 and 1 are assigned to the exact match of condition (A) and exclusive miss of condition (H), respectively. The conditions bounded by (A) and (H) receive a fuzzy missing-ship distributed between 0 and 1. Panel (3): The conjugate of the continuous-fuzzy missing-ship constitutes the pseudo-matching-ship. This will cause (A) and (H) to have a pseudo-matching-ship of 1 and 0, respectively, and the conditions bounded by (A) and (H) receive a fuzzy pseudo-matching-ship distributed between 1 and 0. The pseudo-matching ship and missing-ship now accord with each other.

the tangible and intangible aspects of information.

Experimental Methods

This section details the methods implemented for the experiment. The methods are discussed regarding the following aspects of the experimental study: (1) tasking, (2) chronology, (3) judging, and (4) analyzing. The tasking concerns a consensus-based protocol ensuring single-blind control and traceability, agreed upon by the two individuals conducting the experiment, that constitutes target selection, tasking, taskette keeping, and feedback rendering. The chronology documents milestones over the duration of the experiment. The judging details the composition of the judges and the metrics of grading administered. The analyzing formulates the primer for PUNT of AIRY of the two types (Appendix 2) and the approaches for evaluating one special aspect of inter-judge variations notable to be discussed.

A Protocol for Single-Blind Spatially Non-Local Perception of Photographic Targets. Protocols ensuring adequate control of spatially non-local perceptions have been proposed since the 1930s (Rhine, 1946). Protocols of double-blind, triple-blind, and specific to the tasker/perceiver control have also been formulated [6, 7]. The two authors were concerned that a double-blind approach would be prohibitive with the intellectual and material resources and time that were accessible and manageable for conducting this unfunded explorative study. The two authors, however, had agreed to proceed with a single-blind protocol outlined as the following. (1) One author acts to guard the target information (designated as tasker) responsible for controlling the target to be blind to the perceiver until the perceiver obtains the corresponding taskette. (2) The other author (designated as perceiver) acts to acquire the information of the target held by the tasker that is blocked from any capable means of technological access. (3) The target is a photograph of real physical objects. And the target sets are not compiled in advance. (4) The target will be simple and straightforward to interpret while being interesting. This has been necessary to minimize no-hits to encourage the unexperienced perceiver to continue and complete the laborious experiment. Such an arrangement could have reduced the randomness of the target selection. However, considering a novice and unexperienced perceiver who may have low (if not zero) quality of information throughput, it is desirable to use simple and interesting targets to make the contrasts of the information greater to increase the likelihood of an outcome that would encourage the continuation of the experiment. The target selection could certainly be completely randomized in terms of complexity and

interest, should this process be tested with experienced perceivers. However, target information presented with a photograph can never be completely random because not all targets may be photographed, and not all useful information of a target (the intelligence) may be present in the photograph. (5) A cloud-based electronic file folder will be used to register a taskette. (6) The perceiver will receive feedback for each taskette recorded. (7) A new target will not be chosen by the tasker until the feedback has been rendered to the perceiver for a taskette. (8) Direct communication between the tasker and the perceiver for matters pertaining to the study will be conducted via email only to timestamp any informational interference or procedural breach for post-hoc analyses.

This single-blind protocol aimed to facilitate the experiment on free-response spatially non-local perception of free-selective photograph targets with feedback-rendered was finalized to the following procedures to be abided to. (1) The tasker chooses a digital photograph of physical objects from any sources he has deemed appropriate. Should the photograph be available on an online site, the URL of the site containing the photograph would be marked (retrospectively tracked, when possible, for the images published with this study). (2) The tasker transfers the electronic file of the digital photograph to a local folder that is unknown to the perceiver. Note: the perceiver does not have the technical know-how to hack into the tasker's electronic device. (3) The tasker notifies the perceiver via email that a target has been chosen. (4) The perceiver attempts to acquire information of the target by retracting to a secular room, calming down, closing eyes, and engaging in a simple meditating procedure presumed to be conducive of non-local access. (5) Immediately after a conclusive attempt, the perceiver hand-draws a simple illustration and hand-writes short descriptive scripts on a single-side of an A4-size paper. The drawing is to take roughly the upper half section of the paper, and the script is to occupy roughly the lower half section of the paper. The paper is to be headlined (handwritten) with the number of the trial in a form of "PK #0XXX", where the XXX ranges from 001 to 100 for the 100 trials, and the date of the completion of the taskette. (6) The perceiver scans the sheet of taskette to a pdf file (scanner model, HP MFN127n) identified with a name of PK0XXX_2022_MMDD (MM for the month and DD for the day) and then uploads that pdf file to the Dropbox folder shared between the tasker and the perceiver. (7) Immediately after procedure 6, the perceiver notifies the tasker via email of the availability of a taskette in the shared folder for examination. (8) The tasker examines that the taskette in the shared Dropbox folder has the same identifier as "PK0XXX" as the target stored in the

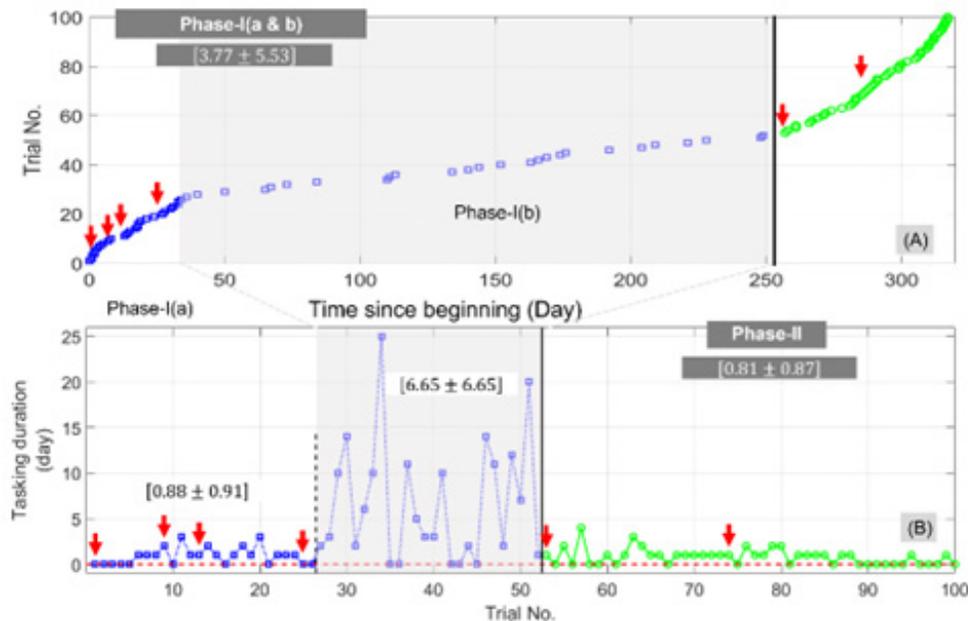


Figure 6. (A) The time of completion of the trials counted from day 0 of determining target #1 to day 317 of completing the feedback of taskette #100. (B) The tasking duration of each trial. Three phases of tasking may be observed: Phase I(a), Phase I(b), and Phase II. The six short downward red arrows designate the trails resulting in taskette grading of greater than 0.5 in both Type-I (tangible) matching-ship and Type-II (intangible) matching-ship. The unshaded numbers in (B) denote the mean and standard deviation of the tasking duration in the phase positioning the numbers. The two unshaded numbers correspond to phase I(a) and I(b). The shaded numbers at the left are averaged for phase I(a) and phase I(b) combined. The shaded numbers at the right are averaged for phase II only. The solid vertical line between Trial No. 52 and 53 indicates a presentation given to SSE.

local folder of the tasker. (9) The tasker uploads the target with the identifier "PK0XXX" to the shared Dropbox folder. (10) The tasker notifies the perceiver via email that the target of the identifier "PK0XXX" is available in the shared Dropbox folder. (11) The perceiver accesses the target of the identifier of "PK0XXX" now available in the shared Dropbox folder to receive the feedback. This completes a trial. (12) The tasker and the perceiver exchange via email assessment of the degree of matching/missing for the trial with the identifier "PK0XXX". Regardless of the outcome of the discussion, no alteration is allowed to a taskette that has already been scanned to pdf and uploaded to the shared Dropbox folder. (13) Only after a trial is registered to be complete by the presence of both the target and the taskette of the same identifier "PK0XXX" in the shared Dropbox folder can the next trial begin with the selection of the next target by the tasker as is defined by the procedure #1 heretofore.

The Chronology of the Tasking of 100 Trials. An experiment of such nature, being agnostic to the conventional understanding of information transmission, perceivably requires a significant commitment in the mentation of both the tasker and the perceiver. The tasker and the perceiver initially were quite uncertain of the prospect of the experiment. Encouraged by the first three

trials, the tasker and the perceiver agreed to carry on with the experiment. In total, it took approximately 11 months in the year 2022 to complete the tasking of 100 taskettes. The initial phase of importance and the milestones of the experiment are chronicled in Appendix 3.

Figure 6 tracks the time of completion (A) and the tasking duration (B) of each trial. When applicable, the numbers are presented as $XX \pm YY$, where XX is the ensemble average, and YY is the standard deviation (STD) of the ensemble averaging. Counted from day 0 of determining target #1, the feedback of taskette #100 was completed on day 317. Three phases of tasking may be observed from both (A) and (B): Phase I(a) containing trials 1-26, Phase I(b) containing trials 27-52, and Phase II containing trials 53-100. The tasking duration of Phase I(a) for trials 1-26 is $[0.88 \pm 0.91]$ days. The tasking duration of Phase I(b) for trials 27-52 is $[6.65 \pm 6.65]$ days. The trials 1-52 may be combined as Phase I, considering that a mid-term report on the experiment was given to the *Society for Scientific Exploration* at the completion of 52 trials, as was indicated by the solid vertical line between No. 52 and No. 53. The tasking duration of Phase I(a) and (b) combined, for the trials 1-52 in total, is $[3.77 \pm 5.53]$ days. The tasking duration of Phase II for trials 53-100 is $[0.81 \pm 0.87]$ days. When counted for the total of 100 trials, the tasking-du-

Table 1. Demography of the individuals who completed the grading.

No. of The Judge	Gender (Male if blank, checked if Female)	Education Level (PhD if checked)	Country of Present Residence (USA if blank)	Nationality at Birth/ Ethnicity by Birth	Open to Psi or Not Antagonistic to Psi Based on Career Training (YES or blank)
01		PhD		Chinese	
02				American	
03			UK	Korean	Yes
04	Female	PhD		Chinese	Yes
05		PhD		Chinese	
06				American	
07		PhD		Chinese	Yes
08				American	
09	Female			American	
10				Japanese	Yes
11		PhD		Chinese	Yes
12	Female			Chinese	
13				Korean	Yes

ration ranged from 0 days to 25 days, making an average of 2.35+4.28 days and a median of 1 day.

The six short downward red arrows designate the trials resulting in taskette grading of greater than 0.5 in both Type-I (tangibility) matching-ship and Type-II (intangibility) matching-ship, as would be shown in a subsequent sub-section.

Judging. After the completion of the 100 trials, invitations for judging were relayed to 18 individuals. Among these 18 individuals, five didn't respond to the invitation. Gradings were returned from the other 13 individuals, among whom 11 were anonymous to each other. The judges consented to have their first initials acknowledged upon the publication or presentation of this work. The judges also agreed to have no disclosure of any targets or taskettes until this work becomes publicly presented. Table 1 displays the demographic information and educational level of the 13 individuals who responded with the grading. Table 1 also includes the likely openness to the phenomenon upon which the judging would be concerned based on the solicitor's personal knowledge of the individual. Table 2 displays the demographic information and educational level of the five individuals who declined to respond. Table 2 also includes the likely openness to

Table 2. Demography of the Individuals who did not Respond to the Solicitation of Judging.

No. of the Judge	Gender (Male if blank, checked if Female)	Education Level (PhD if checked)	Country of Present Residence (USA if blank)	Nationality at Birth/ Ethnicity by Birth	Open to Psi or not Antagonistic to Psi Based on Career Training (YES or blank)
01		PhD		Korean	
02		PhD		Chinese	
03	Female	PhD		Indian	Yes
04	Female		Canada	Chinese	
05	Female	PhD		Chinese	

the phenomenon upon which the judging would be concerned if the individual would agree to judge based on the solicitor's personal knowledge of the individual.

The 100 taskettes were scanned into a single pdf file, and the 100 targets combined make an electronic file size of approximately 42 MB. Due to the size of the file, cloud storage (Dropbox or Google Drive) was used to transfer the data to the judge and collect the completed judging sheets. The judges were advised to look at each taskette first, then the target, but no control over this was mandated. The judging spreadsheet has checkboxes for two aspects of the trial (a sample is given in Appendix 3). The judges were asked to grade each taskette against the respective target according to the following metrics:

Check-box Row 1:

Shape/structural degree of matching, 0%---100%, at an increment of 10%

To which (what) extent does the information in the sketch resemble the shape/structure of the target?

Check-box row 2:

Feature/functional degree of matching, 0%—100%, at an increment of 10%



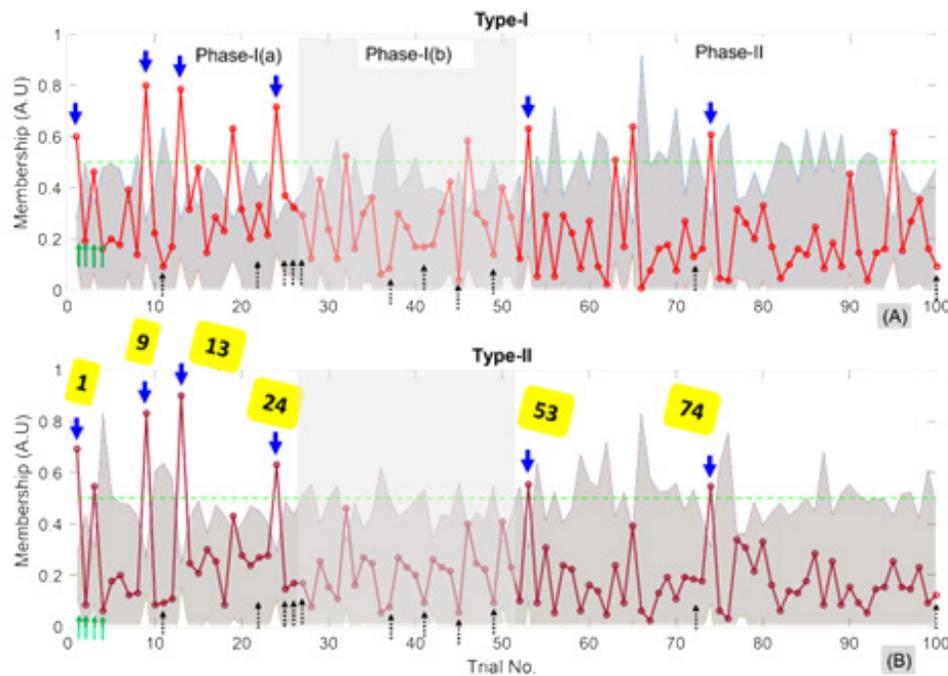


Figure 7. (A) The type-I (tangible) matching-ship of each taskette averaged for all judges (solid line with markers) shaded by the standard deviation of the judging. (B) The type-II (intangible) matching-ship of each taskette averaged for all judges (solid line with markers) shaded by the standard deviation of the judging. The downward red arrows designate the trials resulting in taskette grading of greater than 0.5 in both Type-I (tangible) matching-ship and Type-II (intangible) matching ship. The grade of each trial averaged for the 13 judges. The marker-decorated line is the mean value, and the shade represents the range corresponding to the STD. The six blue downward solid arrows: 1, 9, 13, 24, 53, 74. The four green upward solid arrows: the first four trials-----photos taken by K. The 11 dashed upward dashed arrows: 11 non-real objects, drawing, or computer artifacts. The four green arrows: the first four trials-----photos taken by K. The 11 upward arrows: the non-real object, drawing, or computer artifacts.

To which (what) extent does the information of the script describe the feature/function of the target?

Post-Judging Analysis. The grades on the WORD formatted spreadsheets returned from the judges were transferred into an EXCEL spreadsheet. The numerical values of the EXCEL spreadsheet were then imported to MATLAB (R2022a, Natick, MA) for data analysis. Statistics analyses, including calculating the powers for a two-sample t-test and ANOVA, were conducted using the commands available in MATLAB or GraphPad Prism 6 (La Jolla, CA). The effect size or z-score was calculated (Ragin, 2000) using the formulae of $z = [(P-p) - 1/(2/N)] / \sqrt{pq/N}$, where P is the observed proportion, p is the benchmark proportion, q equals $(1 - p)$, and $N = 100$ is the number of cases displaying the causal combination. Despite the unknown degree and complexity of the causality of the process engaged in the inforcement, the production of a taskette following the generation of a target cannot be treated as entirely non-casual due to the consequentiality. This target-to-taskette causality or sequential occurrence, whatever channel of information transmission it might have engaged in, determines that there is a chance probability for a given amount of information throughput.

RESULTS

The Mean and Standard Deviation of the Grades of the Two Types Received by Each Trial When Averaged for the 13 Judges

Figure 7 displays the gradings of each trial when averaged for the 13 judges. The top panel is for the type-I or the tangibility aspect of the matching. The bottom panel is for the type-II or the intangibility aspect of the matching. On each panel, the solid line marked with circles denotes the mean value of the grade of that trial averaged over 13 judges, and the shaded area represents the standard deviation of the grade of that trial by the averaging. The lightly shaded segment marks Phase-I(b), containing trials 27-52.

The six downward blue arrows designate the trials resulting in taskette grading of greater than 0.5 in both Type-I (tangibility) matching-ship and Type-II (intangibility) matching ship, as would be shown in a subsequent sub-section. Those six trials are also observed to have much smaller STD compared to the mean value, indicating that consensus was reached among the judges in terms of the taskettes of those six trials receiving relatively high-

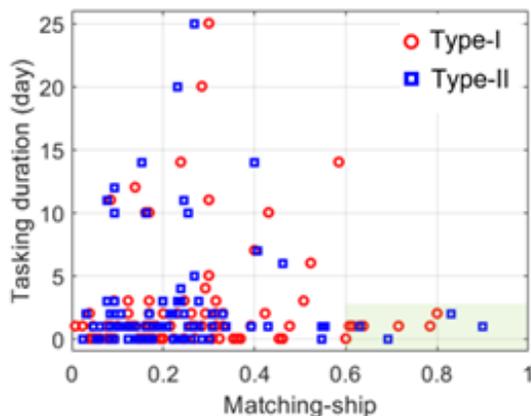


Figure 8. The scatter plots of the targeting duration versus membership of each trial. The small, green-shaded area contains trials receiving matching grading greater than 0.6 of type-I or type-II matching-ship.

er grades in both types of matching to their respective targets. The four small solid upward green arrows point to the first four trials, of which the targets were the photograph taken by the tasker of items of his own possession. The eleven small dashed upward black arrows are the trials of which the targets were either simple artistic drawing or computer-rendering, making the trial non-compliant with the protocol requiring photographs of real physical objects as the target.

The Type-I and Type-II Grade-Average Versus The Duration of Tasking

Figure 8 scatter-displays the duration of tasking of each trial and the corresponding grades received in type-I (red circle) and type-II (blue square) matching. The small, green-shaded area contains trials receiving a grade of matching greater than 0.6 in either type-I or type-II. Five trials (9, 13, 24, 53, 74) received >0.6 grading in the type-I matching. Four trials (1, 9, 13, 24) received >0.6 grading in the type-II matching. None of the trials receiving matching-ship greater than 0.6 had a tasking-duration of longer than two days.

The Correlation Between the Mean Grade of Type-I Matching and the Mean Grade of Type-II Matching for All 100 Trials

Figure 9 scatterplots the mean grade of type-I matching versus the mean grade of type-II matching of each of the 100 trials. The dashed diagonal line corresponds to a perfect correlation between the values of the abscissa and ordinate, or the identical number for the two types of matching-ship. A linear regression running through the origin resulting in the solid line corresponded to a correlation coefficient of $R = 0.82$, indicating a nota-

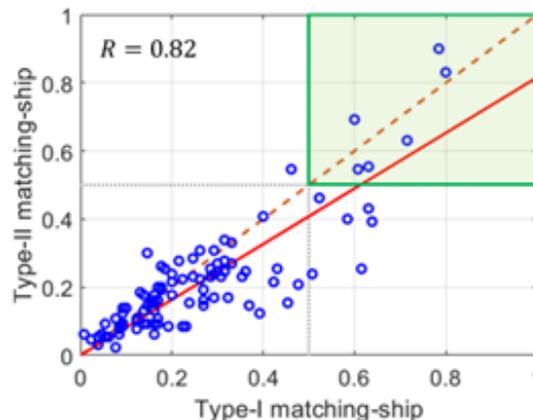


Figure 9. The correlation between type-I and type-II matching. The dashed line running exactly diagonal corresponds to a perfect correlation. The red solid line is a linear regression to the scatter plots that results in an R -value of 0.82, indicating a strong correlation.

ble correlation between the two types of matching-ship graded on each trial. The upper right quadrangle isolated six taskettes that have received a grading of higher than 0.5 in both types of the matching-ship. They are trials 1, 9, 13, 24, 53, and 74. Because the targets were freely selected, despite being simple, it would have been impractical to estimate a benchmark proportion because the pool was arbitrarily large. Should the process be random but pertain to a fixed number of permutations or probability, the benchmark proportion or chance expectation can be the number of taskettes making higher than 50% grades in both type-I and type-II aspects of matching. Instead, if assuming a benchmark proportion (chance-expectation) of 3 out of 100 trials ($p=0.03$), having six taskettes in the first quadrangle, as is shown in Fig. 9, giving $P=0.06$ corresponds to an effect size of 1.47 for a sample size of $N=100$. If the benchmark proportion (chance expectation) is 2 out of 100 trials ($p=0.02$), having six taskettes in the first quadrangle, as is shown in Fig. 9, giving $P=0.06$ corresponds to an effect size of 2.5 for a sample size of $N=100$. If the benchmark proportion (chance expectation) is 1 out of 100 trials ($p=0.01$), having six taskettes in the first quadrangle, as is shown in Fig. 9, giving $p = 0.06$ corresponds to an effect size of 4.52 for a sample size of $N=100$.

The Six Trails Receiving > 0.5 Grading in Both Type-I and Type-II Matching-Ships

The taskette and the corresponding target of the six trials receiving >0.5 grading in both type-I and type-II aspects of matching are presented in **Fig. 10.** (A) to (F) present respectively the trials 1, 9, 13, 24, 53, and 74. The following details the trials and the grading outcomes.

(A). Target #0001 was set on Jan. 30, 2022. Taskette #0001 was available the same day. The target was a digital photograph of an image from the screen display of the computer monitor of the tasker. The original image of this target was an image accessible from (Amazon.com, 2023). The script of the taskette reads “some kind of monument, round base, tall point peak”. The taskette received a type-I grading of $[0.60 \pm 0.23]$ and type-II grading of $[0.69 \pm 0.29]$.

(B). Target #0009 was set on Feb. 04, 2022. Taskette #0009 was available on Feb. 06, 2022. The target was a digital photograph obtained from (Art.com 2023). The script of the taskette reads, “A sense of human-like figure keeps coming in, a feeling of vastness and emptiness, and floating. An astronaut in space or somewhere?”. The taskette received a type-I grading of $[0.80 \pm 0.27]$ and type-II grading of $[0.83 \pm 0.30]$.

(C). Target #0013 was set on Feb. 14, 2022. Taskette #0013 was available the next day. The target was a digital photograph similar to the one in (Sutton, 2020) and obtained from an open source (intractable retrospectively). The script of the taskette reads, “Some kind of “extruded” elliptical structure on top of a long-haul base. --- Submarine?”. The taskette received a type-I grading of $[0.78 \pm 0.29]$ and type-II grading of $[0.90 \pm 0.21]$.

(D). Target #0024 was set on Mar. 04, 2022. Taskette #0024 was available the next day. The target was a digital photograph obtained from (Skyshed-Observatories, 2023). The script of the taskette reads, “A radiating pattern, blueish, something like the star-wars movie when the spaceship speeds up to cross the speed-barrier or a sonic-boom type pattern (Cerenkov radiation), something radiating (atomic nuclear reactor), a clear boundary of regular shape.” The taskette received a type-I grading of $[0.72 \pm 0.21]$ and type-II grading of $[0.63 \pm 0.30]$.

(E). Target #0053 was set on Oct. 14, 2022. Taskette #0053 was available the next day. The target was a digital photograph obtained from (Facebook.com, 2023). The script of the taskette reads, “Felt like waterfall, long, wide, curved sheet, plane of moving stuff, fluidic, turbid.” The taskette received a type-I grading of $[0.63 \pm 0.21]$ and type-II grading of $[0.55 \pm 0.28]$.

(F). Target #0074 was set on Nov. 17, 2022. Taskette #0074 was available the next day. The target was a digital photograph obtained in open resources (intractable retrospectively). The script of the taskette reads, “A large (gigantic) oval, elliptical shape like a rim upon a flat surface, like an open mine, that recedes to deep but smaller platform.” The taskette received a type-I grading of $[0.61 \pm 0.27]$ and type-II grading of $[0.55 \pm 0.30]$.

Type-I and Type-II AIRY Averaged for all Judges

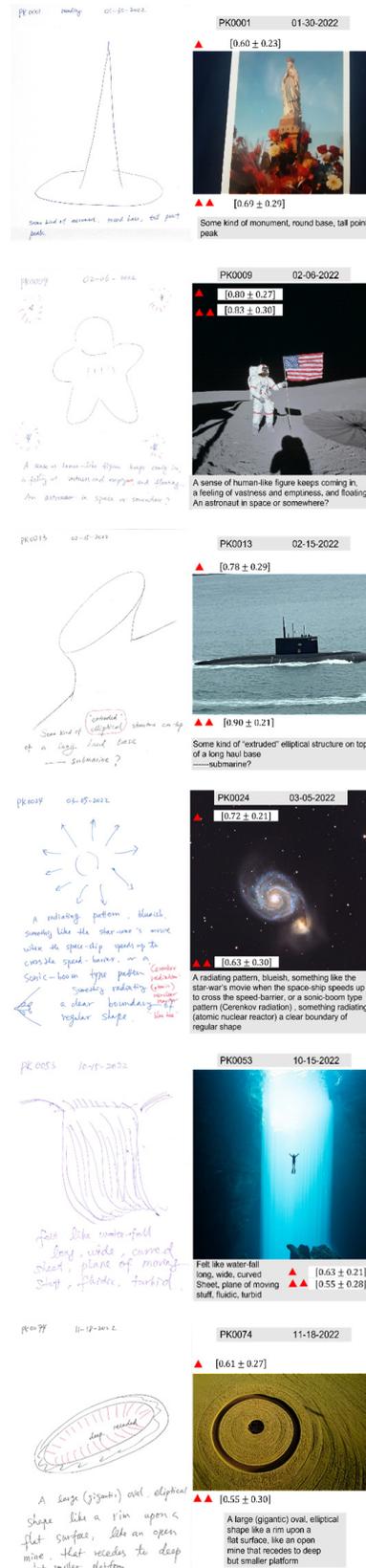


Figure 10. The target and taskette of six trails, 1, 9, 13, 24, 53, and 74.

Figure 11 (A) displays the histogram of the grades of type-I and type-II matching. The histogram of the

grades of type-I matching over $[0, 1]$ at a tick of 0.1 is displayed with respect to an abscissa of the matching-ship at the right lateral to the middle line. The histogram of the grades of type-II matching over $[0, 1]$ at a tick of 0.1 is displayed with respect to an abscissa of the negated matching-ship at the left lateral to the middle line. Since the middle line marks a matching ship of 0 or complete miss, the pattern shown in (A) is a **missing-centric** AIRY that is also referred to as an **agonistic** AIRY. In (B), the histogram of type-I grades over $[0, 1]$ at a tick of 0.1 is displayed with respect to an abscissa of the complementary of the matching-ship of 1 (i.e., the missing-ship) at the right lateral to the middle-line. The histogram of the grades of type-II matching over $[0, 1]$ at a tick of 0.1 is displayed with respect to an abscissa of the complementary of the negated matching-ship of -1 (i.e., the negated missing-ship) at the left lateral to the middle-line. Since the middle line marks a matching ship of 1 or exact match, the pattern shown in (B) is a **matching-centric** AIRY that is also referred to as an **antagonistic** AIRY. The two lines present in (C) are the smooth-line or monotonically continuous approximation to the two profiles in (B). The peak amplitudes of the two lines are identical to the peak amplitudes of the two profiles to which they are approximated ($A_{max} = 0.3662$ for type-I and $A_{max} = 0.4623$ for type-II). The two lines are fitted by $(A_{max} - A_{min}) * \exp(-K&) + A_{min}$, where $A_{min} = 0.04$ and “&” represents the variable of the abscissa. The damping rate and the minimal values ending at the middle line were manually adjusted to make

the monotonically smooth curve approximative to the respective lines of (B). The two lines in (C) are called the smooth antagonistic AIRY. The magnitude of the Fourier transform of the respective AIRY lines of (C) are displayed in (D) by taking the logarithm over a base of 10 and then multiplied by 20 to render dB as the scale along the ordinate. The resulting profile of (D) is then the PUNT. Of the PUNT, the P refers to “partitioning” in two ways: the U stands for “undulation” considering that mainly low-frequency information would be transferable, and NT specifies “net transfer” in referring to the relative throughput of the information complexity of the target in both type-I and type-II aspects.

Indication of Target Interference

Accidentally, two trials turned out to have one taskette be compared against two effective targets due to the mishandling of the target selection by the tasker. The two trials, however, differ in terms of how the two targets could have been associated with the trial.

Indication of Target Interference Due to Switching of One Target to the Other While Meant for the Same Trial. Target #0011 was set on Feb. 10. 2022. Taskette #0011 was available on Feb. 13, 2022. The target was an artistic rendering of an automobile (source intractable retrospectively), as shown in **Figure. 12** (A). The script of the taskette reads, “what keeps coming in is a kind of spiral feeling, one end smaller, the other end greater, like

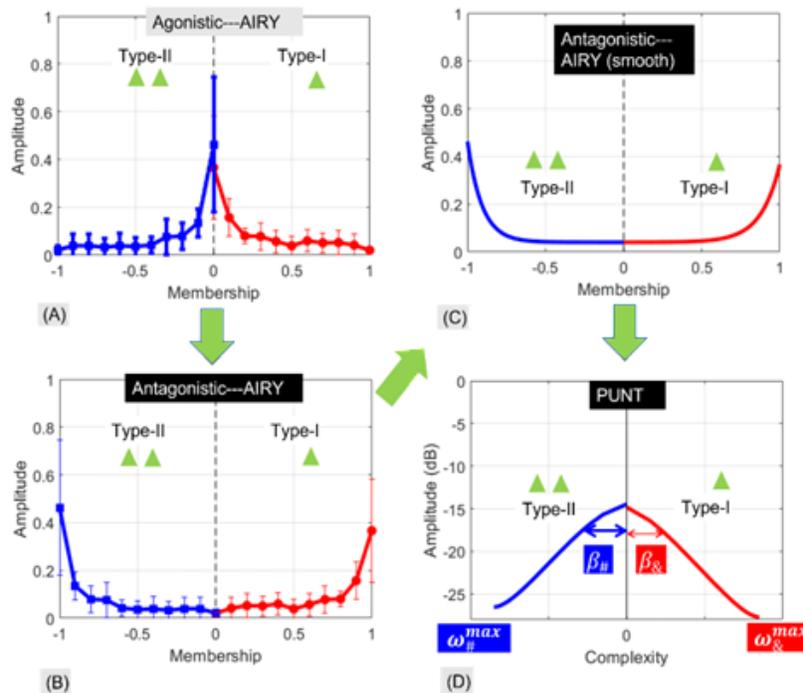


Figure 11: (A) Agonistic AIRY. (B). Antagonistic AIRY. (C) A smooth (monotonically continuous) approximation of the antagonistic AIRY. (D) PUNT.

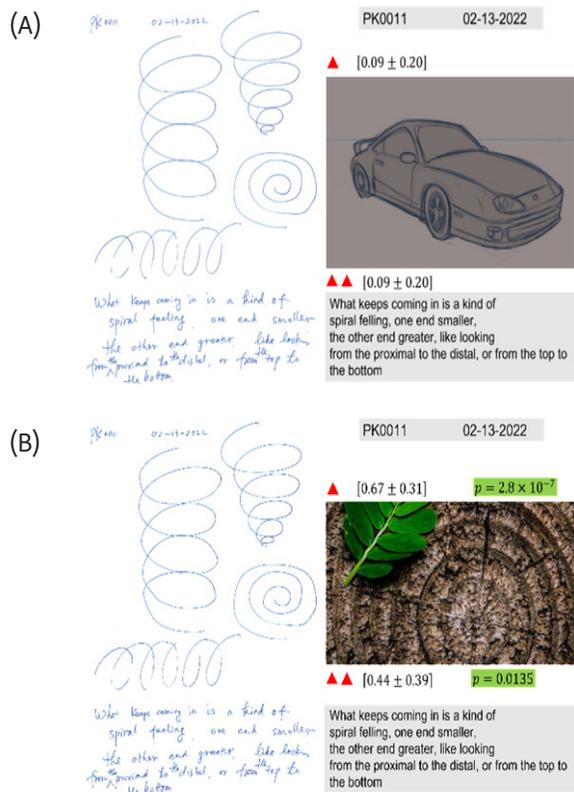


Figure 12. Target interference occurring to trial #11.

looking from the proximal to the distal, or from top to bottom.” The taskette received a grading of type-I matching-ship of $[0.09 \pm 0.20]$ and a grading of type-II matching-ship of $[0.09 \pm 0.20]$.

However, during the post-trial discussion between the perceiver and the tasker, it was revealed that the target #11 was switched from a previously chosen one (Cyclewand.com, 2023), as shown in Fig. 12(B), for the same trail #11 as was meant by the tasker. This would correspond to the presence of two sequential targets chosen for the same trial by the tasker when the perception task was performed. In comparison to this earlier target, taskette #11 received a type-I grading of $[0.67 \pm 0.31]$ and type-II grading of $[0.44 \pm 0.39]$. The type-I grading of the taskette #11 with respect to this target chosen earlier is substantially higher than that with respect to the later chosen target, with $p = 2.8 \times 10^{-7}$ (sample size 13). The type-II grading of this taskette #11 with respect to this target chosen earlier is substantially higher than that with respect to the later chosen target, with $p = 0.0135$ (sample size 13). The better matching of the taskette to the target chosen earlier is statistically significant.

Indication of Target Interference Due to Pre-Mature Selection of a Target for the Next Trial While the Previous Trial was Incomplete. Target #0079 was set on Nov. 24, 2022. Taskette #0079 was available on Nov. 26,

2022. The target was a large cross structure (Walmart.com, 2023), as shown in **Figure 13(A)**. The script of the taskette reads, “Two circular spaceship like structure that however, seems to have a cross-section, or like two wheels that cross each other. The crossing-feeling is at odds with the circular feeling”. The taskette received a type-I grading of $[0.20 \pm 0.26]$ and type-II grading of $[0.22 \pm 0.31]$.

However, during the post-trial discussion between the perceiver and the tasker, it was revealed that targets #79 and 80 were mixed due to the tasker not following the protocol of not selecting the target for the next trial until the completion of the present trial with feedback. Target #80 (Pinterest.com, 2023), as shown in Fig. 13(B), was chosen shortly after target #79 was chosen and meant for using as the target for the next would-be trail #80 prior to the perceiver being informed of the selection of target #79 and unaware of the presence of the target for the next would-be trial #80. This could correspond to the presence of targets for two consecutive trials when the perception task for the former of the two was incomplete. This was a violation of the protocol, dictating that the feedback be given before the selection of the target for the next trial. And because of the discordance to the protocol of trial #79, the perceiver did not complete task-

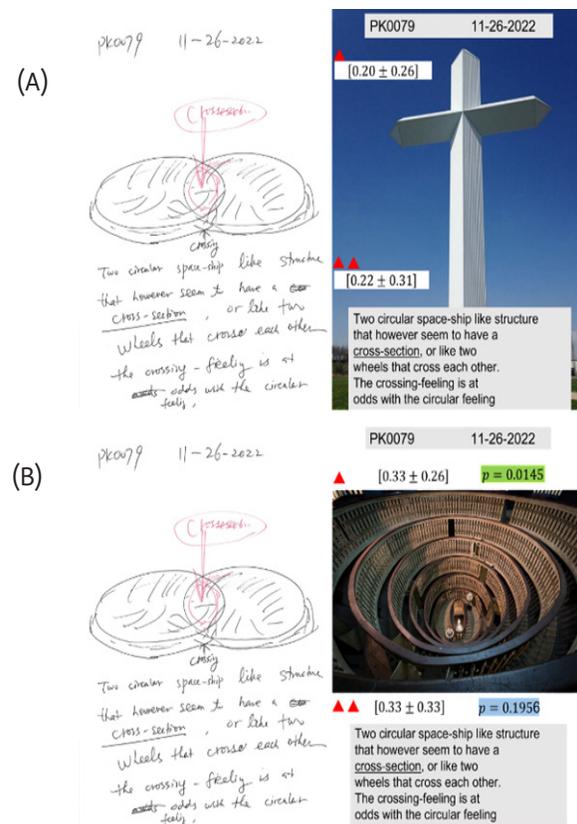


Figure 13. Target interference occurring to trails #79 and #80.

ing #80, but taskette #79 was graded against both target #79 and the target meant for #80.

When compared to the target #80, taskette #79 received a type-I grading of $[0.33 \pm 0.26]$ and a type-II grading of $[0.33 \pm 0.33]$. The type-I gradings of taskette #79 with respect to the two targets differ by $p=0.0145$ (sample size 13). The type-II gradings of this taskette #79 with respect to the two targets differ by $p=0.1956$ (sample size 13).

Inter-Judge Variation Based on the Openness to Inforception. Among the 13 judges, six can be said to have significantly different and open views on the matter of inforception compared to the other seven judges. These six individuals have either a career in an inforception-relevant program or had written communication expressing openness to phenomena like inforception in the forum that the authors have access to. These six judges may be separated from the other seven judges in terms of their openness to inforception. The comparison of the averaged grading of the same pool of the 100 trials by the judges of two groups, as displayed in **Figure 14**, reveals a statistically significant difference in the overall scores they graded on the same pool of 100 trials, based on 2-way ANOVA of a null hypothesis on the openness to inforception. The difference between the grading of the two groups is quite appreciable for the number of trials receiving a 0 matching-ship or complete-missing. More than 55% and 60% of the trials were graded as total miss in, respectively, the type-I and type-II aspects of the matching by the group of agonistic judges. In comparison, less than 20% and 25% of the trials were graded as a total miss in, respectively, the type-I and type-II aspects of matching by the group of judges that may be open to inforception.

DISCUSSION

A transmission system cannot be reconstructed to full

capacity in the absence of its transfer function or MTF being fully and completely identified. Likewise, the uncanny channel of spatially non-local perception, if it does exist, is hardly comprehensible unless its effect on the transmission of information sensible by human perception can be characterized. The inforception in a system perspective can be argued to resemble a black box, of which the input can be controlled, and the output can be measured to allow characterizing the transmission characteristics of the black box using well-established principles of system identification. System identification is done by quantifying the response of a system at various levels of information complexity that can be precisely controlled at the input and accurately measured at the output. Such a requirement that is routine to the identification of a physical system of information transmission, however, does not seem to apply to the channel thought to be responsible for spatially non-local perception, likely due to two factors. One factor is that the information transmission by inforception is quite poor in terms of objectivity. The other factor is that the information transmissible might have the subjectivity that interplays with the low-quality of the objectivity. This experiment has attempted to understand if any input-output relationship associated with information transmission by an unexperienced perceiver expected to produce little or no throughput of information would be inconsistent with the present knowledge of **spatially local and temporally causal channels**.

Some Thoughts on the Band-Limited Information Throughput of Inforception

The Physical Implications of AIRY and PUNT Functions. It is worth noting that neither of the authors is unfamiliar with the literature reports of non-local information requisition. However, both authors are cautiously skeptical of the properties or mechanisms of non-local

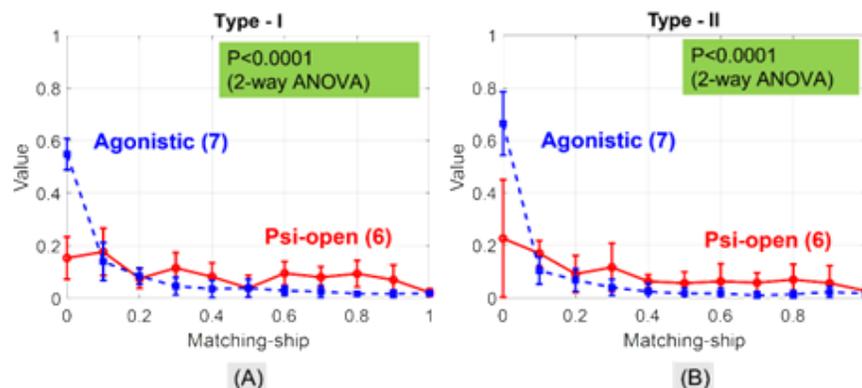


Figure 14. Comparison of the gradings by six judges who may be open to inforception versus that by the seven judges of likely skeptical of inforception. (A) Grading of the type-I matching of the 100 trials. (B) Grading of the type-II matching of the 100 trials.

information requisition seemingly having been demonstrated by several studies (Jahn, 1980; Puthoff & Targ, 1976; Targ & Puthoff, 1974; Targ, 1994). The non-local or anomalous information requisition shall refer to the outcome of acquiring information that is inconsistent with any known path of physical or instrumental or informational channel allowed by the current technology (Piao, 2022) and the technical capacity of the perceiver. Regardless of the anomaly of the information transmission, the information available as the outcome of the transmission makes an apparent amount of information throughput. The apparent information requisition yield (AIRY) introduced refers to the relative amount of information of the taskette over that of the target.

Any channel of information access or transmission is constrained by an inherent passing bandwidth of the channel. If the information transmission of the geometrical properties is concerned, the limiting quality of the transmission is routinely characterized by the MTF. The MTF specifies the resolution-limit of the spatial pattern or the smallest sharp pattern that is visually discernible, that can be retained, or equivalently, the smallest point object that can be resolved. The MTF of a system of transmitting visually discernible information is the spatial Fourier transform of the PSF of the system of transmission, which is practically the image obtained for an ideal point-target - one that is infinitely small in the size but infinitely large in the contrast over the background. The lower limit of the details of a real target that can be resolved by a visual-information transmission system like a satellite camera corresponds to an upper limit or maximum bandwidth of the information pattern that can be contained by the information transmission system.

Since the MTF of a visual-information transmission channel determines the target information that can be resolved, there are two apparent implications of this band-limitation of information transmission. The first implication concerns which target may be resolved by a given visual-information transmission channel or, equivalently, the upper limit of the target's complexity that can be resolved by a visual information transmission channel. For example, a satellite camera at a given orbiting altitude that has a ground resolution of 0.1 meters may be able to distinguish two adults standing closely next to each other but will be unable to separate two ants crawling closely next to each other. The two ants crawling closely next to each other are more complex than two adults standing closely next to each other, in the sense of the spatial pattern or the "busy-ness" that is transferable onto the satellite imagery. The second implication concerns which visual-information transmission channel can resolve a given target, or equivalently, the lower limit of the max-

imum bandwidth of the visual information transmission channel that is needed to retain a target's full complexity for complete recovery of the target information. For example, to resolve two adults standing closely next to each other, one would use the satellite camera having a ground resolution of 0.1 meters over a satellite camera that has a ground resolution of 1 meter at the same orbiting altitude. The MTF or the resolution of the satellite camera characterizes whether the tangibility or the physical processability of the information of a target can be resolved on the imagery. But what about the transmission or the retainment of the "intangibility" of a target onto the imagery? For example, how does one tell if the two adults or two ants on the ground are engaged in picking a fight with no weapons other than their bodily extremities? Isn't that intangibility intelligently more significant or interesting than the tangibility of the information transmissible by the satellite camera channel?

In a system for information transmission, the spectrum of the information at the output is the production of the spectrum of the information at the input multiplied by the spectrum of the transfer function or the MTF. Given a spectrum of the output that is lower in the maximum complexity of the information than that of the input, the degradation of the information must be caused by the transfer function whose maximum passible complexity is lower than the maximum complexity of the information of the input. The PUNT, as is discussed, may be treated as comparable to, but not the same as, an MTF whose maximum passible frequency is no greater than the maximum information complexity of the input such that the output will have an information complexity no better than that of the input. PUNT, thus, may be treated as relative MTFs assessed for the combined passage of both tangible and intangible aspects of the information by normalizing the absolute MTF of the information passage with respect to the uniform transmission up to the maximum complexity of the pool of targets.

We note that this present study may be extended in the future towards other data generated in similar or somewhat variant ways. This idea of AIRY, which is mathematically equivalent to a relative modulation transfer function, may be what is needed to facilitate future analyses. The authors do not see the existence of a currently agreed terminology in this community that will carry all the parametric features that this term seems to offer. The mathematical viability of this function may be tapped upon towards more quantitative analyses, leading to a more objective understanding of the subjective aspect and the fuzzy feature of the spatially non-local perception.

What Might Be in Play for the Band-Limited Infor-

mation Throughput of Spatially Non-Local Perception?

Regardless of the means of information transmission specific to a physical object with visually discernible details, it may always be viable to compare the complexities of the information contained between photographic imagery and the physical scene or object from which the photograph was taken. Similarly, whatever has been in the process to produce a copy of a photographed object, the faithfulness of the information contained by the copy with respect to the original object from which the photograph was taken can be assessed. In the case of spatially non-local perception, although the mechanism of the non-locality is unknown or unacknowledgeable at the present, the existence of the spatially non-locally perceived outcome can be subjected to comparison against the target. For the sake of simplicity of referring, we have introduced a new objectivity-informed term of “taskette” to denote the individual result of the spatially non-local perception that has been documented permanently by means of physical information storage such as a drawing or a script of descriptive words and sentences in a hard-copy or electronic medium of perpetuity. The “taskette” can serve as the counterpart of the term “target”, which has hereby specified the objective-entity documented permanently by means of physical information storage, such as digital photograph or electronic memory, with which the spatially non-local perception could be tasked.

The relative amount of information retained on a taskette infers that if the information is complete, the bandwidth of the information transmission must not be smaller than that of the complete information of the target. If the information of the taskette is incomplete with respect to that of the target, the useful bandwidth of the information transmission must be smaller than that of the complete information of the target.

Among several theories proposed for any mechanism that could have been involved in spatially non-local perception, one hypothesized that what could have affected the outcome is the gradient of the Shannon entropy (May et al., 2000), which may help explain why targets of strong interest appeared to have led to higher AIRY outcomes. Whereas this present experiment could have shown that the more interesting the primary object or concept or event portrayed in the target photograph was, the more likely the inforception would receive a higher score in both the type-I and type-II aspects of information. Conversely, the duller the primary object, concept, or event portrayed in the target photograph was, the more likely the inforception would receive a lower score in both the type-I and type-II aspects of information. The gradient of the Shannon entropy may be a viable metrics to quantify the changes of the information in the target in the field-

of-view of the photograph, which, however, will unlikely indicate the aspect of the interest that would be difficult to perceive. It may be wise to project that there is likely another aspect of the information relaying in the inforception or spatially non-local perception, that cannot be reliably perceived without the engagement of conscious awareness in anomalous states. The path to understanding what underlies the spatially non-local perception may not be clear until the anomalous state of conscious awareness could be at least qualitatively incorporated into the conditions to be controlled, possibly according to another appropriate fuzzy scale. Only after all conditions indispensable to the development of a measurable event are counted on can the cause of the measurable event be accounted for.

How May the Target Interference be Interpreted, and What Improvement of the Protocol May Help Test That Hypothesis? What might this simple single-blind experiment unveil? Whereas the six trials receiving a grading higher than 0.5 in both type-I matching and type-II matching may be intriguing, the trials that have had target interference could be more informative as to what might or might not have been in play with the inforception. One would argue that the two trials indicating target interference were not much different in terms of the process. However, it may be intuitive and imperative to conjecture how the indicated target interference may be unique to only the single-blind protocol, should there be a telepathic overlay interfering with the unconventional perception. Unfortunately, only two trials showing any indication of the target interference cannot be conclusive.

How is it possible for one’s conscious awareness to access information blocked by ordinary sensory transmission? What underlies non-local conscious awareness specific to remotely, non-locally perceiving the present-day targets inaccessible to conventional or normal sensory means, including technology-assistance? A major limitation of this experiment is the control of being single-blind. The protocols proposed in Appendix 4 may be implemented to introduce additional controls in target selection to help identify or reject possible factors of inforception based on the correlation with target interference. Additional controls in target selection require the engagement of a moderator to moderate the tasker’s access to the target and the perceiver’s knowledge of the tasker’s accessibility to the target. With the additional controls leading to 4 groups of various levels of control, the taskette-target matching/missing can be compared between the two targets presenting target interference. The outcomes of these four groups of approximately equal size (~100 trials per group) can be analyzed using statistical approaches such as ANOVA to deduce which mechanistic

path may be more probable in producing statistically significant different matching of the taskette versus the two targets presenting interference. The outcomes may help determine if the information throughput of the inforception experimented in this exploratory single-blind test has had any correlation with the awareness of the tasker of the target. That may help assess if a telepathic overlay could have been a factor in the single-blind protocol practiced in this study to have caused the target interference and the differences in the comparisons between the two associated targets in the two trials.

CONCLUSIONS

A single-blind experiment has been carried out between the two authors for the purpose of examining the tangible and intangible aspects of information that may be presented on the taskettes with respect to the corresponding targets in spatially non-local perception. The experiment of 100 trials was conducted as free-responsive spatially non-local perception of free-selected simple photograph targets. One author acted as the tasker who chose a photograph target, and the other author acted as the perceiver who attempted to gain information about the target. Feedback was provided to the perceiver prior to selecting a new target by the tasker. Thirteen judges completed gradings based on a metric that profiles apparent information requisition yield (AIRY). The AIRY refers to the two aspects of the matching of a taskette with respect to a target based on fuzzy-scale grades over 0% to 100% with an increment of 10%. The type-I or “tangibility” aspect of matching assessed the extent of the resemblance of a taskette to the target in terms of the shape or structural details of the depicted primary physical entity. The type-II or “intangibility” aspect of the matching appreciated the degree of the reconstruction of a taskette to the target in terms of the feature or functionality of the depicted predominant physical entity. A total of 6 taskettes received higher than 50% grades in both type-I and type-II aspects of the matching with their respective targets. This outcome corresponds to an effect size of 1.47 when assuming an arbitrary hypothetical chance-expectation, giving a benchmark proportion of 3 out of 100 trials to produce higher than 50% grades in both type-I and type-II aspects of matching. The complement-set of the two-way missing centric AIRY becomes a two-way matching-centric AIRY. The two-way Fourier-like transform of the two-way matching-centric AIRY converts to a partitioned undulation net transfer (PUNT) function that may be useful in characterizing the information throughputs of the yet-to-be-understood channel manifesting spatially non-local perception. Among the

observations that may bear further interest the presence of target interference and what may have caused the target interference warrant investigations.

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APPENDICES

Appendix 1: General Principles of Point-Spread-Function (PSF) or Modulation-Trans-Function (MTF) in Quantifying the Quality of Information Relay

An ideal system of information transmission is one relaying 100% of the information of the target at the output. For a system relaying structural details, the ideal transmission corresponds to the taking-in of an infinitely small and infinitely sharp point as the target, then producing an equally infinitely small and infinitely sharp point as the output. Any practical system, however,

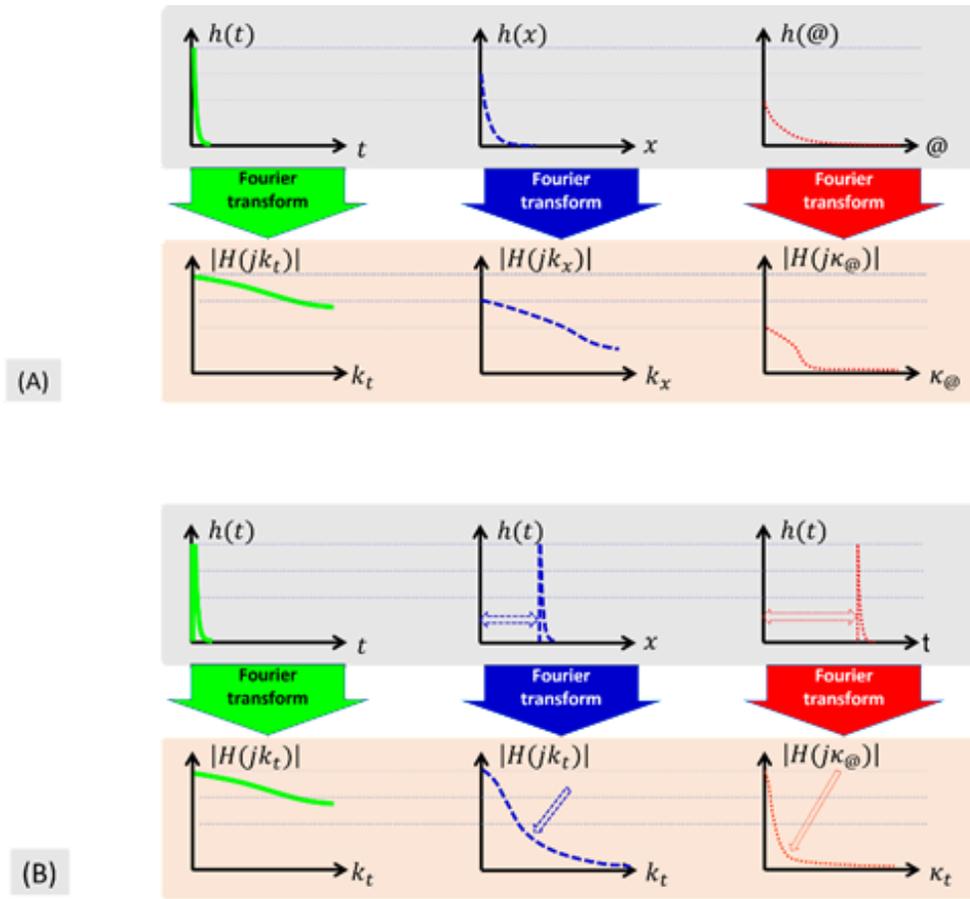


Figure A1. Two associations that are well-known between the PSF and MTF and projectable to any pairs connected by Fourier transform. (A) A very narrow PSF at the origin (left column) corresponds to a near-flat MTF as a function of the complexity of the information. A reduced- amplitude and wider PSF at the origin (middle column) corresponds to a smaller and more damped MTF as a function of the complexity of the information than that of the left column. An even lower-amplitude and wider PSF at the origin (right column) corresponds to MTF that is further smaller and damped over higher complexity of the information than the one at the middle column. (B) demonstrates the effect of positive shift of the PSF on the pattern of MTF as is also common to the three types of indices of (A). A very narrow PSF at the origin (left column) corresponds to a near-flat MTF as a function of the information complexity. A same-amplitude and positive-shifted or delayed PSF (middle column) corresponds to an MTF damped more at the higher information complexity. A sample-amplitude even more delayed or shifted PSF (right-column) corresponds to an MTF that is further damped at the greater information complexity.

having to afford the loss of the information throughput, when taking in an infinitely small and sharp point as the target, produces a spread-point as the output that has a finite size and finite sharpness. The greater the spread of the point and the lesser the sharpness of the point at the output, the greater the loss of the information with the throughput. The degree of the information loss, or equivalently the extent of the information carry-through of a system that relays structural information, is quantified by functions such as point-spread-function (PSF).

The MTF is mathematically the amplitude of the Fourier transform of the PSF. What Fourier transform does is like what a music conductor analyzes when conducting a symphony----knowing exactly the types and skills of instruments played. The conductor distinguishes a very subtle difference of music that may make no difference to

ordinary ears. Likewise, Fourier transform breaks a signal or pattern apart to its delicate components that collectively characterize the pattern. An ideal PSF representing an ideal information throughput or zero-loss information passage corresponds to an MTF of equally unattenuated transmission of the patterns of any complexity. The PSF of a practical channel representing lossy (i.e., less than 100%) information throughput corresponds to an MTF of unequally attenuated transmission of the patterns of different complexity, most commonly lesser transmission of more complex patterns.

The MTF or the PSF of a system of information throughput in relaying an ideally sharp point can also be considered as characterizing how the system responds to a localized stimulation. Localization means that an entity can be defined at a fixed index of something that other-

wise varies. That index obviously contains the moment of time or temporal index and the spatial coordinate or the spatial index. Whereas for a process that cannot be explained by excluding an effect somehow associated with conscious awareness, an index of consciousness as a simple indicator of the complexity of the neuronal activities that will be ultimately responsible or represented for the awareness may be considered on a model-perspective [18]. The inversion of any of the indices of localization will then confer a complexity of the information associated with that dimension of the index [18]. For example, the temporal frequency is the inversion of the time-index, and the spatial frequency is the inversion of the spatial-index, which may be factored by a ratio of 2. Likewise, one may attribute the inversion of an index for consciousness to represent the complexity of conscious awareness that may span over zero to infinity, with zero specifying no involvement of conscious awareness and infinity designating the maximal scale of conscious awareness that is meaningful only mathematically.

Figure A1 exemplifies two associations between the PSF and MTF, with the patterns indistinguishable among the three types of indices considered. (A) demonstrates how the width of the PSF relates to the pattern of MTF. A very narrow PSF at the origin (left column) corresponds to a near-flat MTF as a function of the complexity of the information. A reduced-amplitude and wider PSF at the origin (middle column) corresponds to a smaller and more damped MTF as a function of the complexity of the information than that of the left column. An even lower-amplitude and wider PSF at the origin (right column) corresponds to MTF that is further smaller and more damped over higher complexity of the information than the one at the middle column. The width of the PSF thus dictates the sharpness of information transmittable by the system. A broader PSF results in a blurrier information transmission, which appears as a greater loss at the higher information complexity depicted as the reduction of the amplitude of the MTF at a greater value of the complexity of information. And (B) demonstrates the effect of positive shift or delay of the PSF on the pattern of MTF, as is also common to the three types of indices of (A). A very narrow PSF at the origin (left column) corresponds to a near-flat MTF as a function of the information complexity. A same-amplitude but positively shifted or delayed PSF (middle-column) corresponds to an MTF that is damped more at the higher information complexity than the former one. A same-amplitude and even more delayed or positively shifted PSF (right-column) corresponds to an MTF that is further damped at the greater information complexity. The degree of damping at higher information complexity corresponds to the amount of positive shift-

ing or delay of the impulse of the information index from the origin. Any delay corresponds to a memory of the past of the system output, resulting in distortion of the ideally sharp response to the current value of the input. The MTF thus specifies the relative throughput of the information between the input entity and the output entity. And comparing the spectrum of the output versus that of the input helps identify MTF. A distortion of information by transmission can be caused by either attenuation but without delay or no-attenuation but with delay.

Appendix 2: Apparent Information Requisition Yield (AIRY) and Partitioned Undulation Net Transfer (PUNT)

A loss-less information transmission will have all information of targets of any level of complexity transmitted with no distortion. Whereas an information transmission channel with a bandwidth narrower than the maximum information bandwidth of the most complex target will have the information throughput band-limited with respect to the true bandwidth of the target information. In the context of spatially non-local perception, the degree of information transmission regarding a single complex target shall be consistent with the extent of information transmission of many targets with random levels of complexity. This is analogous to the equivalence between tossing 1 million coins at once and tossing one coin a million times in producing the same permutation-associated chance probability of 50% of head or tail. The ensembled probability assessed over a large population or sample size translates to the chance probability of an individual.

To understand the quantitative need to assess the information throughput pertinent to spatially non-local perception that is extremely unlikely to be exact or loss-less and most likely to be highly lossy if passing anything, we first consider conditions of all (assuming 100 for convenience) taskettes receiving an identical grade as is shown in **Fig. A2** for either the type-I or type-II property. (A) The thick solid arrow represents that all 100 taskettes match exactly their respective targets, thus earning a fuzzy-scale matching-ship of 1.0 for both type-I and Type-II. This would correspond to the information of the target being inforced without any loss, or what is involved is a distortion free inforcement. Distortion free transmission is characterized by a PSF of Dirac delta function of an amplitude of 1 at the origin, or equivalently a flat MTF of an amplitude of 1, as a function of the corresponding frequency of the information, as is shown in (B). The dashed arrow represents that all 100 taskettes have the same exact degrees of a partial match to earn a fuzzy-scale matching-ship of <1.0 but >0.5 in both type-I and type-II.

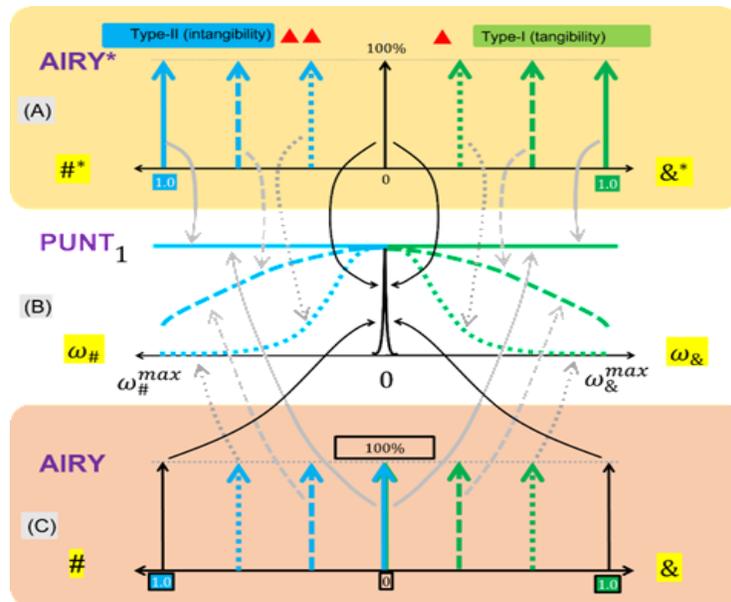


Figure A2. (A) Missing-centric grading of two types of matching between a taskette and its target. The thick solid arrow represents that all 100 taskettes are an exact match to their respective targets, earning a fuzzy-scale matching-ship of 1.0 for both type-I and Type-II. The dashed arrow represents that all 100 tasketts have the same exact degrees of partial-match to earn a fuzzy-scale matching-ship of <1.0 in both type-I and type-II. The dashed arrow represents that all 100 tasketts have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <0.5 in both type-I and type-II. The solid black arrow at the origin represents that all the 100 tasketts contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0 in both type-I and type-II. (B) is the Fourier transform of the functions of (C). (C) are the counter-function of (A) formed by subtracting the membership from 1.

This would correspond to the information of the target being inforced with loss. Lossy inforcement must have the MTF attenuated compared to the distortion-free case, and for generality, it is reasonable to assume that the finer details are more easily lost than the global information, and that would grossly correspond to low-pass filtering. The dashed arrow represents that all 100 taskettes have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <0.5 in both type-I and type-II. This would correspond to the information of the target being inforced with more loss than the partial-match case. This more lossy inforcement must have the MTF attenuated even more compared to the distortion-free case, and that would grossly correspond to a low-pass filtering with the passing band even narrower than the partial-match case. The solid black arrow at the origin represents that all the 100 taskettes contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0 in both type-I and type-II. This would correspond to the information of the target being completely blocked, or what is involved is a full-spectrum complete-rejection inforcement. A full-spectrum complete-rejection inforcement may be represented by a ZERO MTF, however, if one considers that the MTF corresponding to this case must be the limiting case of the MTF by evolving the matching condition from the exact match, partial-match, and partial-miss, down to complete miss,

the MTF as the limiting case shall be a Dirac delta like function at the origin of the frequency. And the MTF of (B) can be made by Fourier transform of the functions of (C) with respect to the index of the matching scale. What would result from such Fourier-transform are the counter-function of (A) formed by subtracting the membership from 1, or the complement membership of it, which may be termed the conjugate or pseudo membership. (A) can be viewed as that the two types of grading are distributed laterally with respect to a middle line that corresponds to 0% matching or complete missing. (A) is thus called a **missing-centric profile** because the center axis represents complete-missing. Comparatively, (C) can also be viewed as that the two types of grading are distributed laterally with respect to a middle-line corresponding to 100% matching. (C) is then called a **matching-centric profile** because the center axis represents exact matching.

We will then be interested in the conditions of not all taskettes receiving an identical grade, as illustrated in **Fi. A3**. Like that in Fig. A2(A), the thick green solid arrow in Fig. A3(A) represents that 100% of all 100 taskettes match exactly their respective targets in Type-I only, earning a fuzzy-scale type-I matching-ship of 1.0. This would correspond to the type-I information of the target being inforced without any loss, or what is involved is a distortion free inforcement of type-I information. This distortion free inforcement is characterized by a PSF of

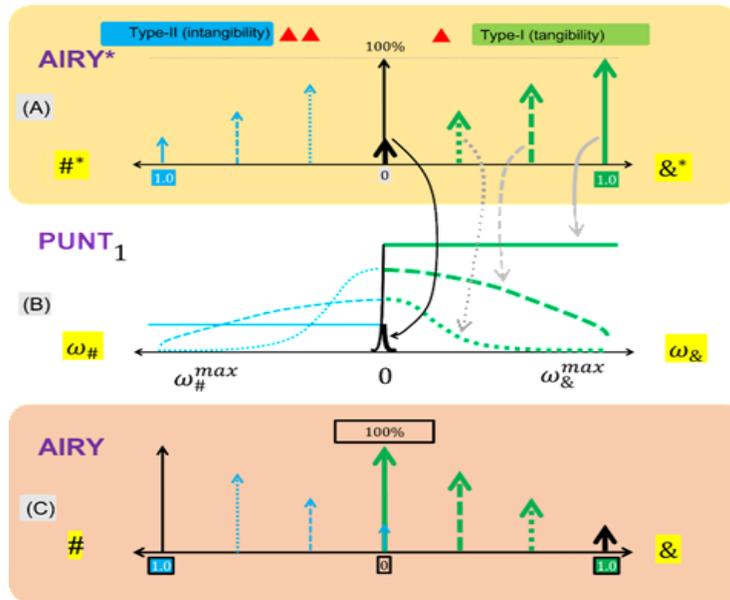


Figure A3. (A) The thick green solid arrow represents that 100% of all 100 taskettes are an exact match to their respective targets in Type-I only, earning a fuzzy-scale type-I matching-ship of 1.0. The thick dashed green arrow represents that 67% of the 100 taskettes have the same exact degrees of type-I partial-match to earn a fuzzy-scale matching-ship of <1.0 in type-I. The thick dotted green arrow represents that 33% of the 100 taskettes have the same exact degrees of partial-miss of type-I to earn a fuzzy-scale matching-ship of <0.5 in type-I. The thick solid black arrow at the origin represents that all 25% of the 100 taskettes contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0. (B) is Fourier transform of the functions of (C). (C) is the counter-function of (A) formed by subtracting the membership from 1. The thin blue solid arrow represents that 25% of the 100 taskettes have the same exact degrees of type-II partial-match to earn a fuzzy-scale matching-ship of 1.0 in type-II. The thin blue dashed arrow represents that 33% of the 100 taskettes have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <0.5. The thin blue dotted arrow represents that 66% of the 100 taskettes have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <1.0. The thin black arrow at the origin represents that 100% of the 100 taskettes contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0. (B) is Fourier transform of the functions of (C). (C) is the counter-function of (A) formed by subtracting the membership from 1.

Dirac delta function of an amplitude of 1 at the origin, or equivalently, a flat MTF of an amplitude of 1, as a function of the corresponding frequency of the information, as shown in (B). Unlike that of Fig. A2(A), however, the thick dashed green arrow in Fig. A3(A) represents that 67% of the 100 taskettes have the same exact degrees of type-I partial-match to earn a fuzzy-scale type-I matching-ship of <1.0. This would correspond to a lossy MTF like the one in Fig. A2, denoted by the same line pattern but with the peak amplitude of it reduced to 67%. And the thick dotted green arrow of Fig. A3(A) represents that 33% of the 100 taskettes have the same exact degrees of partial-miss of type-I to earn a fuzzy-scale type-I matching-ship of <0.5. This would correspond to a lossy MTF like the one in Fig. A2, denoted by the same line pattern but with the peak amplitude reduced to 33%. This more lossy infocaption has the MTF corresponding to a low pass filtering with the passing band as narrow as that one of Fig. A2 but smaller in amplitude. The thick solid black arrow at the origin represents that all 25% of the 100 taskettes contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0. This would correspond to

the MTF of an impulse at the origin with an amplitude of 0.25. The MTF of (B) can be made by Fourier transform of the functions of (C), which are the counter-function of (A) formed by subtracting the membership from 1, or the complement membership of it as the conjugate or pseudo membership. The right lateral sides of (A) and (C) are the more realistic profiles of the missing-centric and matching centric distributions of the type-I membership when comparing a taskette to a target.

The amplitude distribution of the type-II membership shown at the left lateral side of the middle line in Fig. A3 is complementary to the amplitude distribution of the type-I membership at the right lateral side of the middle line. The thin blue solid arrow represents that 25% of the 100 taskettes have the same exact degrees of type-II partial-match to earn a fuzzy-scale type-II matching-ship of 1.0. This would correspond to a loss-less flat MTF but with the peak amplitude of it reduced to 25%. The thin blue dashed arrow represents that 33% of the 100 taskettes have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <0.5. This would correspond to a lossy MTF like the one in Fig. A2, denoted

by the same line pattern but with the peak amplitude of it reduced to 33%. This more lossy inforcement has the MTF corresponding to a low pass filtering with the passing band as narrow as that one of Fig. A2 but smaller in amplitude. The thin blue dotted arrow represents that 67% of the 100 taskettes have the same exact degrees of partial-miss to earn a fuzzy-scale matching-ship of <1.0 but >0.5 . This would correspond to a lossy MTF like the one in Fig. A2, denoted by the same line pattern but with the peak amplitude of it reduced to 67%. This more lossy inforcement has the MTF corresponding to a low pass filtering with the passing band as narrow as that one of Fig. A2 but greater in amplitude. The thin blue dashed solid black arrow at the origin represents that 100% of the 100 taskettes contain 0% of the information of their respective targets, earning a fuzzy-scale matching-ship of 0. This would correspond to the MTF of an impulse (Dirac delta function) at the origin with an amplitude of 1.0. The MTF of (B) can be made by the Fourier transform of the functions of (C), which are the counter-function of (A) formed by subtracting the membership from 1, or the complement membership as is termed the conjugate or pseudo membership. The left-lateral sides of (A) and (C) may be the more realistic profiles of the missing-centric and matching centric distribution of the type-II membership when comparing a taskette to a task.

Appendix 3: The Chronicle of the Tasking of 100 Trials

The time was registered according to the central time zone: (1) Target #0001 was set on Jan. 30, 2022. Taskette #0001 was available the same day. The feedback rendered the target to be a digital photograph taken by the tasker from the screen display of his computer monitor. (2) Target #0002 was set on Jan. 31, 2022. Taskette #0002 was available the same day. The feedback revealed that the target was a digital photograph taken by the tasker of a personal object of his. (3) Target #0003 was set on Jan. 31, 2022, after the completion of trail #0002. Taskette #0003 was available the same day. The feedback identified the target as being a digital photograph taken by the tasker of a decorative object of his home. (4) Target #0010 was set on Feb. 08, 2022. Taskette #0010 was available the same day. (5) Target #0050 was set on Sep. 09, 2022. Taskette #0050 was available on Sep. 16, 2022. (6) Target #0052 was set on Oct. 06, 2022. Taskette #0052 was available the next day. (7) The preliminary results of the 52 trials were presented in a virtual full-member workshop of the Society for Scientific Exploration (SSE) on Oct. 14, 2022. (8) Target #0090 was set on Dec. 08, 2022. Taskette #0090 was available the same day. (9)

Target #0100 was set on Dec. 14, 2022. Taskette #0100 was available the same day.

Trials that did not abide strictly to the protocol to have likely caused target interference were recorded as the following. (1) Target #0011 was set on Feb. 10, 2022. Taskette #0011 was available on Feb. 13, 2022. However, after informing the perceiver of the setting of the target #0011 and before informed by the perceiver of the availability of taskette #0011, the tasker changed target #0011. The perceiver was unaware of the change of target #0011 at the time of tasking #0011. Taskette #0011 thus has two targets to compare against, and the set of lower grades between matching against the two targets was counted toward the main body of the analysis. (2). Target #0079 was set on Nov. 24, 2022. Taskette #0079 was available on Nov. 26, 2022. However, after informing the perceiver of the setting of target #0079 and before informed by the perceiver of the availability of taskette #79, the tasker made a selection of target #0080. The perceiver was unaware of the target #0080 having been selected at the time of tasking #0079. Taskette #0079 thus has two targets, #0079 and #0080, to compare against. The two sets of grades by comparing the same taskette #0079 to the two targets were counted toward the main body of the analysis. Taskette #80 was, therefore, unavailable, and the next trial started with the selection of target #81.

Additionally, the following trials registered two taskettes resulting from two attempts that were put into the record. (1) Target #0030 was set on March 23, 2022. Two taskettes of the same identifier, #0030, were registered on Apr. 6, 2022. (2) Target #0087 was set on Dec. 5, 2022. Two taskettes of the same identifier, #0087, were registered by the next day. (3) Target #0092 was set on Dec. 9, 2022. Two taskettes of the same identifier, #0092, were registered on the same day. (4) Target #0094 was set on Dec. 11, 2022. Two taskettes of the same identifier, #0094, were registered on the same day. For these cases of two taskettes being available for one target, the lower matching grade received between the two taskettes were counted toward the main body of analysis. Other notable information regarding the targets may include the following: (1) Target 4, like the first three targets, was a photograph of the personal items of the tasker; (2) None of the targets selected after the first 4 were the photograph taken by the tasker; (3) Targets 11, 22, 25, 26, 27, 37, 41, 45, 49, 72, and 100 were artistic or computer-generated graphics, making them non-real objects that are discordant with the protocol requiring real physical objects portrayed in the photograph.

Appendix 4: The Instructions and Consent That the Judges Received for Grading

Check-box Row 1:

Shape/structural degree of matching, 0%---100%, at an increment of 10%

To what extent does the information in the sketch resemble the shape/structure of the target?

Check-box row 2:

Feature/functional degree of matching, 0%—100%, at an increment of 10%

To what extent does the information in the script describe the feature/function of the target?

Targets 30, 87, 92, 94: Of these targets, there are two perception results to check:

*: First trial

**: Second or alternative trial

Targets 79 & 80: These two targets were mixed up, and there is only one perception result (PK0079) available to

check.

Volunteering to score the degrees of matching is greatly appreciated.

The volunteer agrees that his/her name's initials can be acknowledged in any public presentation/publication. The volunteer agrees to have no disclosure of any target or precepted results of this experiment until a public presentation or publication is made.

Appendix 5: A Protocol to Introduce Additional Control to Target Selection or Interference

A key to additional control is the inclusion of a third individual to act as a moderator (denoted as C) who determines the target that can be concealed to the tasker in addition to the perceiver. With the addition of a moderator, the protocol of spatially non-local perception could take the following steps. (1) The moderator chooses a photograph of a primary physical object from any sources

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
1	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
2 (K's)	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
11a	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										
11b	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
30 *	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										
**	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
79 *	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

No.		0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
80 *	Shape/structure	<input type="checkbox"/>										
	Feature/function	<input type="checkbox"/>										

Figure A4. Judges response checklist. First two row groups equals Targets: 1---10 (target 2 has an additional photograph after the feedback). Remaining row groups equals Targets: 11---20 (target 11 was switched).



he/she deemed appropriate. (2) The moderator transfers the printed photograph to a local physical box that belongs to the moderator only and is inaccessible to both the tasker and the perceiver. (3) The moderator notifies the tasker via email that a target has been chosen. (4) The tasker notifies the perceiver via email that a target has been set by the moderator. (5) The perceiver attempts to acquire information of the target said to have been chosen. (6) Immediately after a conclusive attempt, the perceiver hand-draws a simple illustrating sketch and hand-writes short descriptive scripts on a single side of an A4-size paper. The drawing is to take roughly the upper half section of the paper, and the script is to occupy roughly the lower half section of the paper. The paper is to be headlined (handwritten) with the number of the trial in the form of "PKC #0XXX", where the XXX ranges from 001 to 400 for a total of 400 targets (roughly 100 targets per group for a total of 4 groups), and the date of the completion of the taskette. (7) The perceiver scans the sheet of taskette to a pdf file identified with the name of PKC_0XXX_20YY_MMDD (YY for the year, MM for the month, and DD for the day) and then upload that pdf file to a cloud-storage shared among the moderator, tasker, and perceiver. (8) Immediately after the previous procedure, the perceiver notifies the tasker via email of the availability of a taskette in the shard folder for inspection. (9) The tasker notifies the moderator via email of the availability of a taskette in the shard folder for inspection. (10) The moderator examines that the taskette in the shared cloud-storage has the same identifier "PKC0XXX" as the target stored in the local storage of the moderator. (11) The moderator uploads the target (electronic file or the scanned file of the physical print) with the identifier "PKC0XXX" to the shared cloud-storage. (12) The modera-

tor notifies the tasker and perceiver via email that the target of the identifier "PKC0XXX" is available in the shared cloud-storage. (13) The perceiver accesses the target of the identifier of "PKC0XXX" now available in the shared cloud-storage to receive feedback. This constitutes a trial. (14) Only after a trial is registered as being complete by the presence of both the target and the taskette of the same identifier "PKC0XXX" in the shared cloud-storage, can the next trial begin with the selection of the target by the moderator as is defined by the procedure specified heretofore.

The following methods may be chosen randomly by the moderator to introduce target interference of four difference levels to uncomplicate the causal complexities concerning the factors that can be controlled and the outcomes that can be assessed in spatially non-local perception. (1) Target interference level 1 (~100 trials): The moderator picks one target only, and the tasker is blind to the condition that only one target is chosen. This makes the trails double-blind in the absence of target interference. (2) Target interference level 2 (~100 trials): The moderator picks two targets, and the tasker is blind to the condition that two targets are chosen. This makes the trails double-blind in the presence of target interference by the moderator. (3) Target interference level 3 (~100 trials): The moderator picks two targets, and the tasker knows that two targets are available. This makes the trails one-and-a-half blind, with the true source of target interference being the moderator. (4) Target interference level 4 (~100 trials): The moderator picks two targets which are shown to the tasker. This makes the trails single-blind, with the true source of target interference being the moderator and tasker combined.



**SPECIAL
SUBSECTION**

Assessing 36 Years of the Forced Choice Design in Extra Sensory Perception Research: A Meta-Analysis, 1987 to 2022

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HIGHLIGHTS

Statistical analysis shows that forced-choice experiments successfully demonstrate potential extrasensory perception, yet only to a small degree.

ABSTRACT

This meta-analysis is an update of Storm, Tressoldi, and Di Risio (2012); a meta-analysis on forced-choice ESP studies (1987 to 2010), which use targets such as card symbols, pictures, and letters. We formed two datasets: New Studies #1 (studies that included actual hit rates) and New Studies #2 (Reaction Time ['RT'] Studies; which are studies that measured only reaction time, not hits, as indicators of psi responses). New Studies #1: For the period 2011 to 2022, a homogeneous dataset of 38 studies yielded a mean effect size (*ES*) of 0.02 (Stouffer $Z = 5.55$, $p = 1.43 \times 10^{-8}$). New Studies #2 ('RT' Studies): For the same period, a homogeneous dataset of 23 studies yielded a weaker mean *ES* of 0.01 (Stouffer $Z = 5.50$, $p = 1.90 \times 10^{-8}$). The two databases were combined. In this dataset, telepathy, clairvoyance, and precognition studies were not significantly different from each other. Nor were target types. We updated the forced-choice database by combining our revised original database with the new studies to form a homogeneous database ($N = 141$): mean effect size (*ES*) of 0.02 (Stouffer $Z = 8.52$, $p < 10^{-16}$). Effects did not vary between investigators or laboratories, and we found a near-significant incline in *ES* values over a 36-year period (i.e., no evidence of a decline). These results confirm that the forced-choice design adequately tests extra-sensory perception (ESP). We compare the overall results with those obtained in other domains, focusing on 'selected' participants (meditators, psychics, psi-test experienced) and 'unselected' (i.e., untrained, naïve) participants.

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KEYWORDS

Consciousness, ESP, extra-sensory perception, forced-choice, meta-analysis, psi.

INTRODUCTION

Biologist J. B. Rhine was one of the first empirical investigators of alleged paranormal phenomena. He is most famous for his card-guessing studies (Rhine et al., 1940/1966), first using the standard 52-card deck of playing cards, and then switching to so-called Zener cards (consisting of five symbols: star, wavy lines, square, cir-

cle, and cross) named after perceptual psychologist Karl Zener (see Figure 1). The problem with the 52-card deck is that extra-sensory perception (ESP) effects can be determined statistically in a number of ways (i.e., by suit, by face value, by color), giving skeptics the opportunity to accuse experimenters of "hypothesis saving" (Irwin & Watt, 2007, p. 52).

Rhine's various kinds of card-guessing experiments



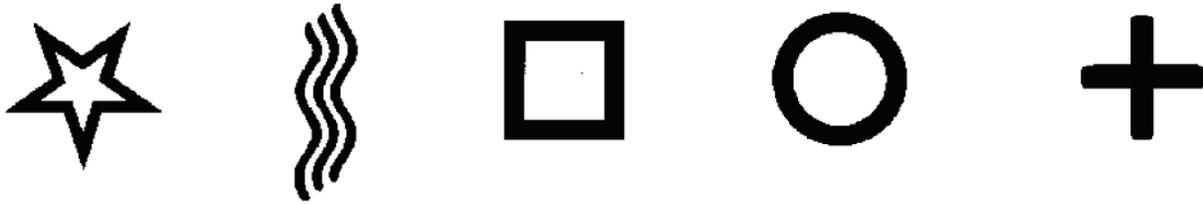


Figure 1. The Zener card symbols: star, wavy lines, square, circle, and cross. The deck of 25 cards has five of each symbol.

came to be known generally as the ‘forced-choice’ design, which soon produced impressive findings (Rhine, 1934). In the typical forced-choice ESP design, the target to be ‘guessed’ (i.e., identified without sensory clues) is “one of a limited range of possibilities which are known to [the participant] in advance” (Thalbourne, 2003, p. 44). The advantage of card-guessing is that outcomes are unambiguous, so independent judging is not required, but the long runs of multiple trials were tedious and boring for participants, which saw declines in hit rates. Rhine’s forced-choice design also came under criticism for its methodological flaws, such as sensory leakage due, for example, to subtle tell-tale folds on cards or poor-quality printing that leaked information through to the reverse sides of the cards. Although these problems were rectified by Rhine, card testing ultimately fell out of vogue over the decades with the introduction of computers and the adoption of more interesting, ecologically valid targets. These target types still include card symbols, but also used nowadays are pictures, alphabet letters, words, shapes, and so forth. Studies in recent decades now include fractal images, SMS messages, and Chinese characters.

As the number of forced-choice studies accumulated from research conducted around the world and the technique of meta-analysis came to the fore, it became possible to evaluate large datasets of studies. A number of forced-choice meta-analytic studies are extant in the literature, and these have generally confirmed a consistent so-called ‘psi’ (i.e., paranormal) effect independent of experimenters/laboratories worldwide. The forced-choice psi effect, however, has varied in strength and tends to be weak (see Honorton & Ferrari, 1989; Steinkamp et al., 1998; Storm, Tressoldi, & Rasio, 2012; Tart, 1983).

A major aim of the present meta-analysis is to evaluate the performance of forced-choice studies conducted since our last meta-analysis, and thus, we planned to cover the period 2011 to 2022. This evaluation may provide statistical evidence that there is an anomalous sensory modality that can manifest as either ‘telepathy’, ‘clairvoyance’, or ‘precognition’. Telepathy refers to the “paranormal acquisition of information concerning the

thoughts, feelings or activity of another conscious being” (Thalbourne, 2003, p. 125), but in the case of the forced-choice design, the agent (sender) is sensorially shielded from the percipient (receiver), and the agent’s thoughts are confined to ESP targets. Clairvoyance is defined as “paranormal acquisition of information concerning an object [or ESP target suitable for a forced-choice design] or contemporary physical event” (Thalbourne, 2003, p. 18). Precognition is “a form of extra-sensory perception in which the target is some future event that cannot be deduced from normally known data in the present” (Thalbourne, 2003, p. 90). The ‘future event’ may include an ESP target suitable for a forced-choice study. The following section is a review of ESP forced-choice studies with a focus on modalities.

Forced-Choice Telepathy, Clairvoyance, and Precognition

Tart (1983) found 85 forced-choice studies but discarded studies if they did not reach independent significance nominally set at a critical $\alpha = .05$. He found that real-time ESP (i.e., clairvoyance/telepathy) outperformed precognition. Steinkamp et al. (1998) argued that Tart’s selection criteria introduced a bias which may have put the precognition studies at a disadvantage.

Honorton and Ferrari (1989) only looked at precognition forced-choice experiments from 1935 to 1987. Participants had to “predict the identity of target stimuli selected randomly over intervals ranging from several hundred milliseconds to 1 year following the subjects’ responses” (p. 281). Out of 309 studies, 92 (30%) showed significant hit-rates at the 5% level. The authors noted that experienced participants performed better than naïve participants. They also found that precognition, although weak, produced “very robust” and highly significant results across a time span of more than 50 years, with the quality of studies remaining stable, or even improving, in that time. Honorton and Ferrari’s meta-analysis revealed that the largest effect sizes were found in experiments using (a) experienced (i.e., selected) participants and (b) trial-by-trial feedback. These are important factors for future psi researchers to consider in their designs, and we

will assess the influence of both in our post hoc analyses.

The meta-analysis by Steinkamp et al. (1998), for the period 1935 to 1997, was a comparison of 'matched' (procedurally similar) clairvoyance and precognition studies in order to test for a phenomenological difference between the two modalities. They found 22 comparable study-pairs, but tests showed no difference. They concluded that the burden of proof rested with those "who argue for a difference between effect sizes under real-time and future ESP" (p. 209).

For the very comprehensive expansive period 1880 to 1989, Steinkamp's (2005) review of forced-choice studies showed that there were few variables that correlate with psi success, partly because the variability in study designs made it difficult to discern clear patterns due to conflicting outcomes. Nevertheless, she found "low neuroticism, extraversion, and good social adjustment may be positively related to forced-choice ESP scoring" (p. 158). She also found some support for the notion that 'selected' (i.e., meditators, psychics, previously psi tested) participants performed better than unselected participants in precognition tests, whereas those who did not believe in psi scored lower than those who did (see also the meta-analysis on paranormal belief by Storm & Tressoldi, 2017).

Storm et al. (2012) reported the following in their meta-analysis covering the period 1987 to 2010: For a homogeneous dataset of 72 studies, there was a very weak but significant mean effect size (*ES*), calculated from the formula z/\sqrt{n} (where *z* is a standardized score with a mean of 0.00 and *SD* of 1.00; and *n* is the number of studies). *ES* did not correlate with study quality, and there was no evidence of selective reporting. Clairvoyance and precognition studies were not significantly different, as was found previously by Steinkamp et al. (1998). Also, *ES* did not vary between investigators. Storm et al. also found that target type did not make a difference to effect size, but they did find suggestive evidence that the number of choices per trial was inversely related to the *p*-value. Evidence of a linear incline in *ES* values was also found over the period 1987 to 2010.

The most recent meta-analytic treatment of forced-choice studies was by Zdrenka and Wilson (2017). They meta-analyzed 55 studies dating from 1945 to 2016 but evaluated precognition studies only. They found that psi performance correlated significantly with six individual difference variables: "luck belief (the belief that luck is primarily controllable), perceptual defensiveness, openness to experience, belief in psi, extraversion, and time belief as dynamic" (p. 9). They did not present an overall effect size value for the 55 studies. However, of the 23 measures in their Table 2, effect-size values (*r*) ranged be-

tween -0.006 and 0.14, with 17 (74%) of them positive.

In conclusion, the general findings are that (i) forced-choice effects are very weak (i.e., small) but consistent and suggestive of psi; (ii) extraversion is a significant correlate of psi (found twice); (iii) selected participants perform better than unselected participants (found twice), and (iv) there is some evidence that no psi modality (telepathy, clairvoyance, or precognition) is superior to any other. However, with the noted exclusion of the study by Storm et al. (2012), little attention has been given in these meta-analyses to the influence on psi of target types, the experimenter effect, the number of choices in the target set (i.e., *k*-choices), and the decline effect. These factors are considered next. However, our main aim in the present study is to see if we can replicate the results of our original six hypotheses (see Storm et al., 2012, p. 248). Tests on other variables are relegated to the section, *Post Hoc Analyses*.

Target Types

As mentioned above, target types are now quite varied. Most trials are conducted on-screen using computer monitors rather than with decks of cards or other physical objects. Apart from conventional images such as photographs of faces, Zener cards, pictures, drawings, letters, and numbers, ecologically valid targets are also being used, such as racing-horse images as targets on simulated racetracks (e.g., Roe, Davey & Stevens, 2003), fractal images (Luke, Delanoy, & Sherwood, 2008), and Chinese characters (Vernon, Hitchman, & Roe, 2021).

Previously, we argued that there is no consensus on whether some target types are "uninteresting and/or meaningless (e.g., Zener cards, numbers, letters) compared to others that may be emotionally stimulating and/or meaningful (e.g., divinatory readings, real pictures, video clips)" (Storm et al., 2012, p. 246). In that paper, it was shown that target type did not make a difference to effect size, although there were significantly stronger mean effects for word/letter targets and for objects in the telepathy condition compared to the other two modalities (clairvoyance and precognition). In the present study, we once again test whether target type has an influence on effect size.

Experimenter Effect

Experimenter-psi (or E-psi) becomes a problem when parapsychologists want to know that participants are exclusively responsible for psi; not the experimenter. However, E-psi has not been found across a broad range of investigators in various meta-analyses (Bem & Honorton, 1994; Honorton et al., 1990; Storm, Tressoldi, & Di Risio,

2010). Indeed, pertinent to the present study on forced-choice studies only, Storm et al. (2012) found “no single group that produced effects significantly different from any other group” (p. 259; see also Honorton & Ferrari, 1989). The same effect will be tested in the present study.

High *k*-Choice Designs

Parapsychologists are also interested in whether or not declines in effect size might be due to the number of choices *k* (i.e., the number of target choices) in a target set. Timm (2000) argued that effect size measures have limited use if they do not adequately account for *k*. He argues that “the significance of ESP experiments must increase not only with *n* but also with decreasing hit probability *p* (or with increasing number of target alternatives $k = 1/p$)” (p. 253). The values of *k* have been quite variable over the decades in the forced-choice domain, ranging from 2 to as many as 26. Empirical support for Timm’s claim is minimal for forced-choice, but worthy of note. Specifically, Storm et al. (2012) found a significant positive correlation between *k* values and *z* scores. That is, *z* scores tended to increase as *k* increased. If this finding indicates a valid effect, researchers may wish to consider using high *k*-choice designs. In the present study, we will again test whether the number of target choices per trial is related to *z*.

Decline Effects

It is thought that significant declines in effects over the long-term (i.e., decades) indicate some kind of artifact due to, say, improvements in study quality over the years or deliberate changes in experimental design (from simple and fun to complex and tedious). These changes are made because theoretically oriented experimenters want to understand the *psi* process rather than merely prove the presence of a so-called communication anomaly. While lengthy (chronological) declines have been noted on occasion in the parapsychological literature, generally, these declines are spurious, as shown in a large collection of meta-analyses reviewed by Storm (in press). For forced-choice studies in particular, researchers have not found declines (Bierman, 2001; Honorton & Ferrari, 1989). And for the period 1987 to 2010, Storm et al. (2012) noted that *ES* values in the forced-choice domain actually increased significantly in their database of 72 studies.

General Aims of the Present Study

As of 2022, ten years have passed since forced-choice studies were last meta-analysed (see Storm et al., 2012). The general aim of the present study was to conduct a

meta-analytic review of the new forced-choice studies (dating from 2011 to 2022) to determine if a comprehensive, up-to-date database is still significant, as was the case with the Storm et al. meta-analysis. Further to that, we aim to see if we can replicate the results of our original six hypotheses (see Storm et al., 2012, p. 248), in addition to testing the difference between the ‘old’ (1987-2010) and ‘new’ (2011-2022) datasets. Tests on other variables (feedback, participant type) are relegated to the section, *Post Hoc Analyses*. The following hypotheses were thus proposed:

1. Forced-choice studies produce statistical evidence of a communications anomaly known as ESP;
2. The mean *ES* values for telepathy, clairvoyance, and precognition are different;
3. *ES* values vary in strength according to target types;
4. *ES* values vary between experimenters/laboratories;
5. Number of choices (*k*) per trial is positively related to *z*;
6. *ES* values increased over the period of analysis (i.e., 2011–2022);
7. The original database (1987 to 2010), and the new database (2011 to 2022), are not different and can be combined to form a larger dataset.

Should Hypothesis 7 be supported, we will conduct additional (post hoc) analyses on a single combined database to further test the validity of the forced-choice paradigm.

METHOD

Meta-Analysis Reporting Guideline

We followed the APA meta-analysis reporting standards guideline (MARS, Appelbaum et al., 2018).

Study Retrieval

- The period of interest was January 2011 to December 2022. Full-text studies were retrieved from the following sources:
- The meta-analyses by Bem, Tressoldi, Rabeyron, and Duggan (2016); Google Scholar, PubMed, Scopus databases by using the keywords ‘forced-choice AND extra-sensory perception’;
- Specialized scientific (peer-reviewed) journals, including the *Australian Journal of Parapsychology*, *Consciousness*, and *Cognition*, *Explore: The Journal of Science and Healing*, *Heliyon*, *Journal of Anomalous Experience and Cognition*, *Journal of Consciousness Studies*, *Journal of Parapsychology*, *Journal of Scientific Exploration*, *Journal of Personality and Social Psychology*, *Journal of the Soci-*

ety for *Psychical Research*, and *NeuroQuantology*;

- Proceedings of the Annual Convention of the Parapsychological Association and the Society for Psychical Research.

The meta-analysis by Storm et al. (2012) provided the original dataset of forced-choice publications dating from January 1987 to December 2010 (see the Appendix in Storm et al., 2012, p. 271). That dataset contains 91 studies, which were reported in 65 papers conducted by 96 investigators.

Inclusion Criteria

To be included in the present update, studies had to:

1. Be published between January 2011 and December 2022;
2. Have adopted a forced-choice procedure for the ESP identification of targets (therefore excluding studies that expressly tested free-response and psychokinesis);¹
3. Have used human participants only (not animals);
4. Have been carried out with groups of participants and not single cases;
5. Have incorporated randomization procedures for selection of targets which could not be manipulated by the experimenter or participant;
6. Have been peer-reviewed;²
7. Have sufficient information (e.g., number of trials and outcomes) for the authors to calculate the direct hit-rates and apply appropriate statistical tests, and calculate effect size (ES) as z/\sqrt{n} (where n = number of trials). Studies with only reaction times were also included separately as these did not have hits data but did have t scores by which ES values could be calculated.

Procedure

We present a PRISMA flowchart in Appendix A (Page et al., 2021). This figure details the counts of papers across four stages: identification, screening, eligibility, and inclusion. For each study, we checked the following factors: (a) the criteria adopted for selecting participants; (b) authors' names; (c) year of publication; (d) whether participants were selected or unselected; (e) type of ESP task (telepathy, clairvoyance, or precognition); (f) number of participants; (g) number of trials; (h) number of alternatives k per trial in the tasks; and (i) total number of hits (we preferred the direct hits measure as it provides a more "conservative" result—see Honorton, 1985, p. 54).

With these data, we derived the proportion of hits and compared these to the proportions expected by chance

(i.e., mean chance expectation; or MCE). When available, we collected the corresponding standard normal deviate z value and effect size ES (where $ES = z/\sqrt{n}$). These values were double-checked, and in some cases (e.g., Hitchman, Sherwood, & Roe, 2015), we found discrepancies between published z scores and our calculations using the Vassarstats Exact Binomial calculator (<http://www.vassarstats.net/binomialX.html>), which requires only hits, trial counts, and MCE.

Variables Considered

Each study included in the database was classified with the following variables: Authors, Year of Publication, Selected or Unselected Participants, Task Type (Telepathy, Clairvoyance, or Precognition); Target Type (pictures, letters, symbols, objects, etc.); Sample Size; Trials; Hits; Hits Percentage; Number of Choices (k); Type of Feedback (none = 0; trial-by-trial = 1; end of trials = 2), Peer Reviewed ('Yes' or 'No').

Meta-Analysis Design

We applied a random-effects model by using the metafor package v. 3.8 (Viechtbauer, 2010), adopting the restricted maximum likelihood (REML) to estimate the heterogeneity variance (Langan et al., 2019) and the Hartung method to control effect-size non-normality (Rubio-Aparicio et al., 2018) and corresponding confidence intervals estimation. We identified effect size outliers by using SPSS Stem-and-Leaf and Box-and-Whiskers Plots.

The whole database and the code used for all the statistical analyses are available for open access on: (https://figshare.com/articles/dataset/Forced-Choice_1987_-_2022_meta-analysis/22574218/5), for independent reproducibility, controls, and analyses.

RESULTS

After all inclusion and exclusion criteria had been met, 27 articles *with hits data* were included for analysis. There were 52 individual experiments/treatments/conditions ('studies' as distinct from 'articles') that had sufficient data for the calculation of specific z scores and corresponding effect sizes (ES). (For a list of these 52, see Appendix B.)

There were 17 articles *with no hit data* (these studies measured Reaction Time; 'RT'). In these articles were 25 individual experiments with t scores allowing for the calculation of corresponding ES s. (For a list of these 25, see Appendix C.) The References section lists all articles meta-analyzed (marked by asterisks). The total number of articles is 43 (not to count Bem, 2011, twice), that included a total of 77 experiments/treatments/conditions ('studies') with sufficient information to calculate ES s.

Two articles in our original database (Storm et al., 2012) were expanded to include various conditions/treatments (Luke, Roe, & Davison, 2008; Pitman & Owen, 2004); Thalbourne and Storm (2002-2005) remains in the 2012 meta-analysis even though it was later published as Thalbourne and Storm (2014) and is therefore not counted in the update.

In the original database (Storm et al., 2012) were two articles now excluded due to their datasets being incomplete (Vernon, Sandford, & Moyo, 2019; Zilberman, 1995). A further two articles by Tressoldi et al. (2009, 2010) were removed because it was decided that they did not use typical behavioral forced-choice procedures (i.e., they used sound targets).

Also, regarding the original database (Storm et al., 2012), six articles previously overlooked from the initial period were added in. We will correct the original statistics and re-do relevant analyses—these articles are: Batthyány, Kranz, and Erber (2009); Ertel (2010); Hadlaczký (2005); Savva, Child, and Smith (2004); Savva, Roe, and Smith (2005); Watt and Nagtegaal (2000).

Descriptive Statistics

We compiled two databases: New Studies #1, the set of articles *with hits data*; and (2) New Studies #2, the set of articles *with no hits data* ('RT' studies). In New Studies #1, there are a total of 162,989 trials and 71,678 hits. In New Studies #2, there are a total of 207,019 trials (no hits).

H1: Z statistics and effect sizes (ES). It was hypothesized that the new databases would yield statistical evidence of a communications anomaly known as ESP.

New Studies #1. For a heterogeneous dataset of 52 studies, mean $ES = -0.004$ ($SD = 0.20$), and mean $z = -0.84$ ($SD = 8.03$). These negative values are largely attributable to extreme scoring in two studies: Escolà-Gascón (2022), and Escolà-Gascón et al. (2022). It is noted that the skew of the ES distribution was not normal. Outliers were identified from SPSS Stem-and-Leaf and Box-and-Whiskers Plots as significantly deviant ("extreme") cases. Seven of nine extremely low-scoring values were found in the two Escolà-Gascón studies just mentioned (see Appendix B: #45, #47, #48, #49, #50, #51, & #52), and a further seven outliers removed (see Appendix B: #9, #12, #13, #14, #16, #24, & #32). Normality (homogeneity) was achieved after the removal of these 14 studies. A dataset of 38 studies is now homogeneous with mean $z = 0.90$ ($SD = 1.74$); mean $ES = 0.02$ ($SD = 0.04$). Ninety-five percent confidence intervals (CIs) are as follows: z scores, [0.33, 1.47]; ES values, [0.006, 0.03]. Note that neither of these 95% CIs includes values of MCE (i.e., zero). Stouffer $Z =$

5.55, $p = 1.43 \times 10^{-8}$ (one-tailed). A single-sample t -test revealed that ES values significantly deviated from mean chance expectation (MCE), where the test statistic is zero (i.e., $MCE = 0.00$), $t(37) = 2.94$, $p = .006$ (two-tailed). Eleven studies (29% of 38 studies) were independently significant at $\alpha < .05$ level.

We considered it necessary to assess homogeneity in a different context. Higgins' I^2 (Higgins, Thompson, Deeks, & Altman, 2003) indicates the proportion of effect-size variance explained by heterogeneity across effect sizes. I^2 lies between 0% and 100%. A value of 0% indicates no observed heterogeneity, and larger values show increasing heterogeneity. We found significant heterogeneity in the dataset, $Q(df = 37) = 436.3$, $p < .001$, and $I^2 = 93.04\%$ (very high heterogeneity). It is important to regard heterogeneity not as a measure of the quality of the studies, but as a measure of between-studies differences. We point out that experimental designs of forced-choice studies vary to a far greater extent than, say, free-response (especially Ganzfeld designs) in terms of type of task, targets used, number of trials, and so on.

New Studies #2 ('RT' Studies). For a heterogeneous dataset of 25 studies, mean $ES = 0.006$ ($SD = 0.020$), and mean $t = 0.54$ ($SD = 1.21$). The skew of the ES distribution was normal. However, two outliers were identified: Rabeyon (2014), and Wittmann et al. (2021, expt. 2). (See Appendix C: #13 & #23.) The homogeneous dataset of 23 studies has a mean $t = 0.74$ ($SD = 1.01$); mean $ES = 0.01$ ($SD = 0.01$). Ninety-five percent CIs are as follows: t scores, [0.31, 1.18]; ES values, [0.004, 0.02]. Note that neither of these 95% CIs includes values of MCE (i.e., zero). For comparative purposes, we calculated a Stouffer Z statistic since z approximates t when samples have 30+ trials, which is the case in this homogeneous dataset. For the 23 studies, Stouffer $Z = 5.50$, $p = 1.90 \times 10^{-8}$ (one-tailed). A single-sample t -test revealed that ES values significantly deviated from chance, $t(22) = 3.34$, $p = .003$ (two-tailed). Four studies (17% of 23 studies) were independently significant at $\alpha < .05$ level. Again, there was significant heterogeneity, $Q(22) = 104.07$; $p < .001$; $I^2 = 81.02\%$.

New Studies #1 and New Studies #2 ('RT' Studies) combined. The two databases (New Studies #1 & New Studies #2), totaling 61 studies, were not significantly different on ES values, $t(50.43) = 1.28$, $p = .207$ (two-tailed). The skew was normal, but two outliers were removed: Luke et al. (2012), and Shel Drake (2015). (See Appendix B: #10, & #33.) The homogeneous dataset of 59 studies has a mean $ES = 0.016$ ($SD = 0.03$), and mean $z = 0.84$ ($SD = 1.47$). Stouffer $Z = 6.42$, $p = 6.81 \times 10^{-11}$ (one-tailed). Table 1 lists statistics for the combined database of new studies only ($N = 59$), as well as subgroups of experimental conditions after outliers and other data exclusions. Subsequent analyses in this

Table 1. Combined Database of New Studies (2011 to 2022): Effect Sizes, and 95% Confidence Intervals, *p*-value and *I*²

Datasets and Subsets	<i>n</i>	<i>ES (SD)</i>	95% CI	<i>p</i>	<i>I</i> ²
Combined New Studies (N)	59	0.02 (0.03)	0.01, 0.02	3.5 × 10 ⁻⁶	92.6
Telepathy	4	0.025 (0.03)	-0.03, 0.08	2.3 × 10 ⁻¹	97.5
Clairvoyance	14	0.007 (0.04)	-0.01, 0.03	4.7 × 10 ⁻¹	88.2
Precognition	41	0.017 (0.03)	0.01, 0.03	2.3 × 10 ⁻⁶	90.9
Selected participants	9	0.02 (0.04)	-0.01, 0.05	2.0 × 10 ⁻¹	83.3
Unselected participants	50	0.02 (0.03)	0.01, 0.02	4.5 × 10 ⁻⁶	92.3
With feedback	47	0.02 (0.03)	0.01, 0.03	1.1 × 10 ⁻⁸	91.1
No feedback	12	0.002 (0.04)	-0.02, 0.03	8.6 × 10 ⁻¹	87.2

paper are conducted on this larger database of 59 studies. Telepathy seems an outstanding performer as a modality, but with only six studies in the subset, it is difficult to gauge its pertinence (see H2 below).

H2: Effect size differences for telepathy, clairvoyance, and precognition. It was hypothesized that the mean *ES* values for telepathy, clairvoyance, and precognition are different. Table 1 lists the *ES* values for the three modalities. Four studies (7% of 59 studies) tested telepathy; 14 studies (24%) tested clairvoyance; 41 studies (69%) tested precognition. Telepathy produced the strongest effect. A Univariate ANOVA test was conducted, entering the variable Psi Modality, as well as the variable Target Type (see H3 below). There was a just significant *ES* difference between the three modalities, $F(2, 51) = 3.16, p = .051$ (two-tailed). The greatest difference was between telepathy and clairvoyance (0.018), but a Tukey’s HSD test showed no significant difference.

H3: Target types. Target types may affect participants’ performances. As was done by Storm et al. (2012), data was divided into five types of targets: (1) Pictures/drawings/faces, (2) Symbols/fractals/*I Ching* hexagrams, (3) Numbers, (4) Letters/words/messages, and (5) Objects (i.e., targets that occupy 3-D physical space). The new set of telepathy studies used only ‘Pictures’; clairvoyance studies used all types except numbers; and precognition studies did not use numbers or objects. The same ANOVA from above (see H2) showed no significant *ES* difference between target types, $F(3, 51) = 0.61, p = .612$ (two-tailed). Nevertheless, the preferred targets were ‘Symbols’ and ‘Letters’ with *ES* about equal (*ES* = 0.04).

H4. ES differences between experimenters/laboratories. In order to ascertain whether our database was the result of extremely positive *ES* values for a limited pool of laboratories/experimenters, we conducted a Kruskal-Wallis ANOVA on the pooled data after dividing them into laboratory/experimenter groups. We formed

11 mutually exclusive experimenter groups with at least two studies in each. Some of these groupings were used in Storm et al. (2012): ‘Argibay’, ‘Bem’, ‘Bierman’, ‘Luke’, ‘Roe’, ‘Schlitz’, ‘Schönwetter’, ‘Simmonds-Moore’, ‘Sheldrake’, ‘Storm’, and ‘Watt’. Table 2 lists the mean *ES* values for each group. The same combined dataset was used as was tested in H2 & H3 (for the full-database tests, see *Post Hoc Analyses*). Fourteen single studies (24%) did not qualify, so these were excluded, but it would be misleading to categorize these as ‘Other’ since the variability of laboratory/author is too great. Mean *ES* values varied from -0.021 (‘Schönwetter’) to 0.049 (‘Luke’). Using a Kruskal-Wallis ANOVA, a marginally significant difference was found between experimenter groups, $\chi^2(10) = 18.13, p = .053$ (two-sided). However, no two groups were significantly extreme

Table 2. Experimenter/Laboratories: Effect Sizes, *SD*, and 95% Confidence Intervals

Grp.	Expt./Lab.	<i>n</i>	<i>ES (SD)</i>	95% CI
#1	‘Bem’	8	0.040 (0.02)	0.02, 0.06
#2	‘Schlitz’	3	0.004 (0.01)	-0.02, 0.02
#6	‘Argibay’	4	0.042 (0.04)	-0.02, 0.10
#9	‘Simmonds-Moore’	2	-0.018 (0.02)	-0.17, 0.14
#10	‘Schönwetter’	2	-0.021 (0.03)	-0.33, 0.29
#12	‘Bierman’	5	0.018 (0.02)	-0.005, 0.04
#14	‘Luke’	3	0.049 (0.03)	-0.04, 0.14
#16	‘Roe’	10	0.014 (0.03)	-0.004, 0.03
#17	‘Sheldrake’	3	0.040 (0.02)	-0.0006, 0.08
#19	‘Storm’	2	0.010 (0.02)	-0.20, 0.22
#21	‘Watt’	2	0.007 (0.02)	-0.14, 0.16

n = number of studies



in scoring to reach significance. The effects cannot be said to be due to a few outstanding investigators.

H5. The advantage in using a high k-choices design. We proposed that the number of choices k per trial is positively related to z (or t). In the combined dataset ($N = 59$), there are only three values for k choices: $k = 2$ ($n = 47$; mean $z = 0.95$); $k = 4$ ($n = 9$; mean $z = 0.23$); and $k = 5$ ($n = 3$; mean $z = 0.87$). Visual inspection shows no clear trend. A Pearson's r test on these values (grouped) was not significant, $r(1) = -0.29$, $p = .409$ (one-tailed). Correlating z scores for individual studies with their k values, was also not significant, $r(57) = -0.13$, $p = .158$ (one-tailed). Given these analyses, z (or t) scores tend not to increase with k .

H6. Change in ES values over the period of analysis (2011–2022). We propose that ES values have increased over this period based on a similar finding by Storm et al. (2012). However, we find the correlation between year of study and ES is negative and significant for the combined database ($N = 59$), $r_s(57) = -0.34$, $p = .004$ (one-tailed). Our hypothesis failed as this statistic indicates a decline in ES values over the 12-year period.

H7. The original database (1987 to 2010), and the new database (2011 to 2022), are not different and can be combined to form a larger dataset. The old database in Storm et al. (2012) identified 19 outlier studies. The database was reduced from 91 studies to 72 studies. Storm et al. reported the following: mean z score = 0.57 ($SD = 1.58$); $ES = 0.01$ ($SD = 0.03$); Stouffer $Z = 4.86$, $p = 5.90 \times 10^{-7}$ ($p = .253$). As explained above, we deleted some old studies that did not fit our criteria, but found new ones, warranting a re-assessment of the forced-choice database of studies dating 1987 to 2010.

There were 68 articles for this period, with 102 experiments/treatments/conditions (i.e., studies) with associated ES values. The heterogeneous database has a mean z score = 1.34 ($SD = 3.33$); 95%CI [0.69, 1.99]; $ES = 0.04$ ($SD = 0.09$); 95%CI [0.03, 0.06].

Once again, 19 outliers were removed to render the database homogeneous ($N = 83$).³ The database has mean z score = 0.68 ($SD = 1.70$); 95%CI [0.31, 1.05]; $ES = 0.02$ ($SD = 0.04$); 95%CI [0.01, 0.02]; Stouffer $Z = 6.18$ ($p = 3.21 \times 10^{-10}$). Note that these 95% CIs do not include values of MCE (i.e., zero). A single-sample t -test revealed that ES values significantly deviated from chance, $t(82) = 4.26$, $p < .001$ (two-tailed). Of 83 studies, 16 (19%) are independently significant ($\alpha = .05$).

The revised original database (1987 to 2010; $N = 83$) and the database of new studies (2011 to 2022; $N = 59$) were not significantly different on ES values, $t(140) = 0.08$, $p = .940$ (two-tailed). The two databases were combined. One outlier was removed.³ Table 3 lists statistics for the combined homogeneous database of studies from 1987 to 2022 ($N = 141$), as well as subgroups of experimental conditions. Statistics not given in Table 3, include mean z score = 0.72 ($SD = 1.58$); 95%CI [0.45, 1.00]; Note that most of the 95% CIs do not include values of MCE (i.e., zero). Stouffer $Z = 8.52$ ($p < 10^{-16}$). A single-sample t -test revealed that ES values deviated significantly from chance, $t(140) = 5.78$, $p < .001$ (two-tailed). Of 141 studies, 29 (21%) are independently significant ($\alpha = .05$).

Post Hoc Analyses

We re-assessed hypotheses H2 (modality) and H3 (target type), this time applying our tests to the largest database of forced-choice studies assembled to date ($N = 141$). As telepathy was not represented in two types of targets (Symbols and Numbers), and clairvoyance was not represented in one type of target (Numbers), relevant data were removed for this analysis only, reducing the database to $N = 103$. Again, we conducted a Univariate ANOVA. The following results were obtained:

- (i) Psi modality, $F(2, 94) = 0.30$, $p = .739$ (two-tailed)

Table 3. Combined Database of Studies (1987 to 2022): Effect Sizes, and 95% Confidence Intervals, p -value and I^2

Datasets and Subsets	n	ES (SD)	95% CI	p	I^2
Combined Studies (N)	141	0.02 (0.03)	0.009, 0.02	5.9×10^{-9}	97.1
Telepathy	12	0.03 (0.04)	0.004, 0.05	2.0×10^{-1}	95.6
Clairvoyance	58	0.01 (0.03)	0.001, 0.02	1.0×10^{-1}	96.4
Precognition	71	0.02 (0.03)	0.01, 0.02	1.1×10^{-6}	96.7
Selected participants	15	0.03 (0.04)	0.005, 0.05	2.0×10^{-2}	91.3
Unselected participants	126	0.01 (0.03)	0.007, 0.02	2.2×10^{-7}	97.0
With feedback	88	0.02 (0.03)	0.01, 0.02	1.0×10^{-9}	97.3
No feedback	53	0.01 (0.03)	-0.001, 0.02	1.8×10^{-2}	94.4

(ii) Target type, $F(2, 94) = 3.79, p = .026$ (two-tailed)

However, there were no significant differences between any two specific target types. There was a significant modality/target-type interaction effect, $F(4, 94) = 3.18, p = .017$ (two-tailed). Figure 2 illustrates the interactions between modality and target type. Letters were the most successful of the three target types, but only for telepathy.

Experimenter/laboratory differences ($H4$) were assessed separately since so much data was lost in this analysis due to the large number of single studies; 41 (29%) were excluded for this analysis. Also, we now had 19 mutually exclusive experimenter groups as a number of them from the old period (1987-2010) did not conduct studies in the new period (2011 to 2022). All 19 groups are: 'Argibay', 'Bem', 'Bierman', 'Dalkvist', 'Don', 'Ertel', 'Haraldsson', 'Luke', 'Palmer', 'Rao', 'Roe', 'Schlitz', 'Schönwetter', 'Simmonds-Moore', 'Sheldrake', 'Storm', 'Vaughan', 'Watt', and 'Wiseman'. There was a significant difference between groups of experimenters, $\chi^2(18) = 34.58, p = .011$ (two-sided). However, when mean ES values by group were checked against each other, there were no significant differences.

Finally, $H5$ concerning the relationship between z scores and k -choices was re-tested on the large database ($N = 141$). Previously, Storm et al. (2012) reported a significant trend ($r = 0.79$). On this occasion, the effect was moderate in strength but not significant, $r(5) = 0.48, p = .139$ (one-tailed). Correlating z scores for individual studies with their k values produced a significant outcome, $r(139) = 0.20, p = .008$ (one-tailed). The strongest z scores tended

to correlate with higher k values.

For the final database ($N = 141$), Table 3 shows differences between (i) the three modalities; (ii) selected and unselected participants; and (iii) feedback/no-feedback conditions. A Univariate ANOVA was conducted to test these differences. There were significant ES differences between participant type and feedback condition:

- (i) Psi modality, $F(2, 131) = 0.18, p = .834$ (two-tailed)
- (ii) Selected vs. unselected participants, $F(1, 131) = 4.39, p = .038$ (two-tailed)
- (iii) Feedback vs. no-feedback condition, $F(1, 131) = 5.43, p = .021$ (two-tailed)

Selected participants (mean ES = .03) were superior in ESP performance compared to unselected participants (mean ES = .01). Studies that gave feedback to participants (mean ES = .02) produced superior ESP performances than studies that did not give feedback (mean ES = .01). There were no significant interaction effects.

These findings prompted a comparison of selected participants who received feedback with selected participants who did not receive feedback. The former were very few in number ($n = 5$) compared to the latter ($n = 136$), but we can assume equal variance ($p = .205$), and the difference was significant, $t(139) = 1.87, p = .032$ (one-tailed). 'Selected with feedback' (mean ES = 0.04; SD = 0.04) outperformed 'selected with no feedback' (mean ES = 0.02; SD = 0.03).

Decline vs. incline effect. In this research field, some authors suggest *episodic* (within study) declines in effects

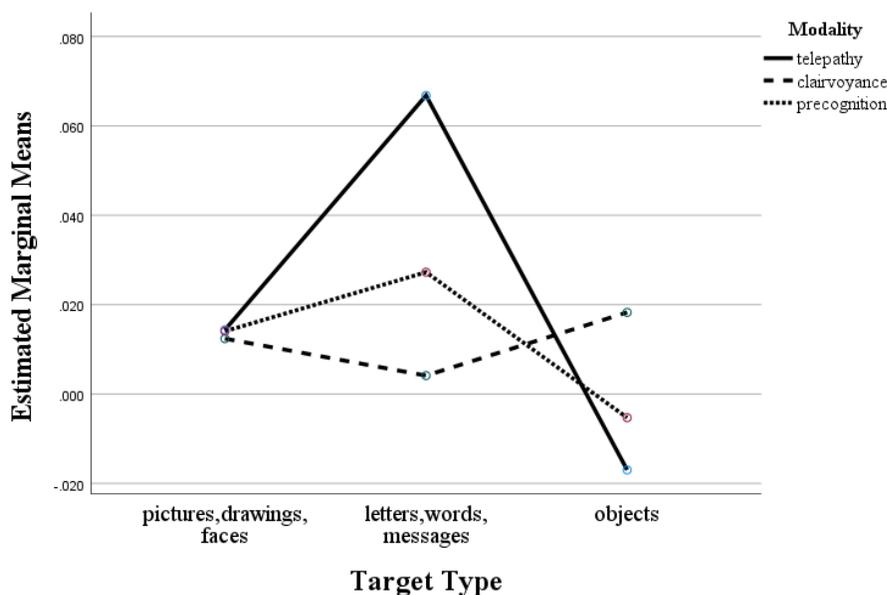


Figure 2. The target-type advantage: ESP differences on psi modality are not the same across levels of target type.

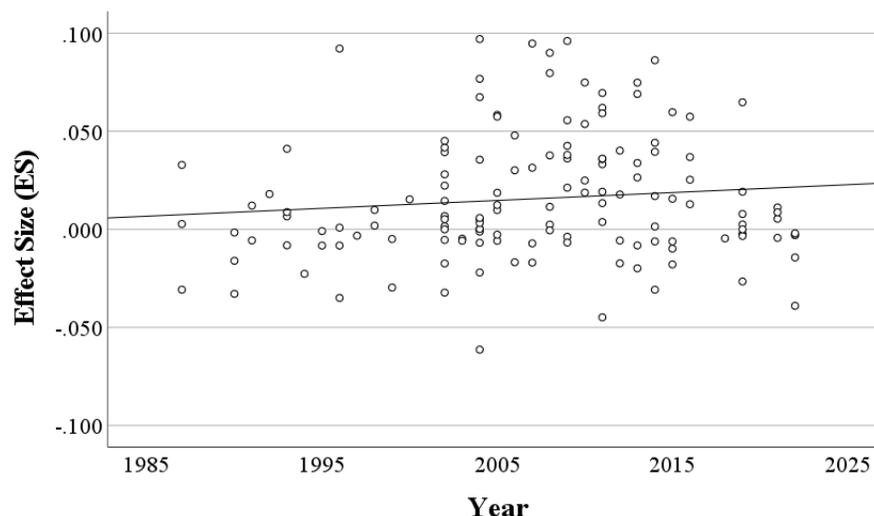


Figure 3. Scatter-plot of effect sizes (ES) for forced-choice studies showing a slight incline over a 36-year period.

are inevitable and appear as slow but constant decreases in the strength of effects due to repetition of similar tasks (Bierman, 2001, Kennedy, 2003). However, as Storm (in press) has pointed out, there is little evidence for *chronological* (between-study) declines. We tested the assumption of a chronological decline in two ways, where the hypothesis is that effect size (ES) covaries with year of publication and with a non-parametrical correlation between year of study and ES. The meta-regression coefficient is zero, with a p -value = .09. The Spearman's ρ correlation was positive and approached significance, $r(139) = 0.11$, $p = .098$ (one-tailed), suggesting an incline. The linear trend line formula is $ES = [0.0004 \times \text{YEAR}] - 0.79$; linear $R^2 = .011$ (see Figure 3). Our hypothesis (H_6) of an incline was partially supported.

Publication bias. As a means of avoiding publication bias, it has been the policy of the *Journal of Parapsychology* since 1975 to publish all papers passing peer review whether the reported results are significant or not. Other parapsychology journals have adopted the same policy. Grimes, Bauch, and Ioannidis (2017) note the “top-tier journals possess a limited number of publication slots and are thus overwhelmingly weighted towards publishing only novel or significant results” (p. 2). Parapsychological journals are free of that pressure due to the limited number of researchers in the field. We note that the majority of studies in this meta-analysis (91%) were either published in journals specializing in parapsychology or journals known to be favorable to parapsychological research. Clearly, the other 9% of journals expressed no bias at that time.

One empirical method to test if authors disseminated only experiments with positive statistical results is to count how many of them reached the statistical threshold of $p \leq .05$. In our database, we counted the number of

experiments obtaining a z or t value equal or higher than 1.65, corresponding to a one-tailed p -value of .05. For the heterogeneous database (i.e., before we removed outliers), we counted 52 (29%) out of 179 effect sizes that are independently significant. As reported above, even 29 (21%) of 141 studies in the homogeneous database is a small fraction of the total. This result supports the hypothesis that our database is not likely to have been contaminated by publication bias, as we should expect a much larger percentage of successful (significant) studies as a result of authors withholding (not publishing) unsuccessful studies.

Participant comparisons across experimental designs.

We compared selected and unselected participants across a range of experimental designs. Table 3 and our *Post Hoc* tests show that selected participants outperform unselected participants. Figures 4 and 5 show comparisons with forced-choice and various other meta-analyses—namely, free-response remote viewing (Tressoldi & Katz, 2023), free-response in a Ganzfeld environment (Tressoldi & Storm, 2023), and presentiment design (Duggan & Tressoldi, 2018). Figure 4 compares unselected participants; Figure 5 compares selected participants. Comparing Figure 4 with Figure 5, we see marked selection differences in other designs.

In reference to the two figures, we note that selected participants in ‘Forced-Choice’ are nearing *unselected* participants’ in ‘Free-Response Ganzfeld’ in terms of mean ES. However, forced-choice continues to deliver smaller effects compared to the other three designs.

DISCUSSION

The above two-stage forced-choice meta-analysis on (a) two newly-formed databases, 2011 to 2022, and (b)

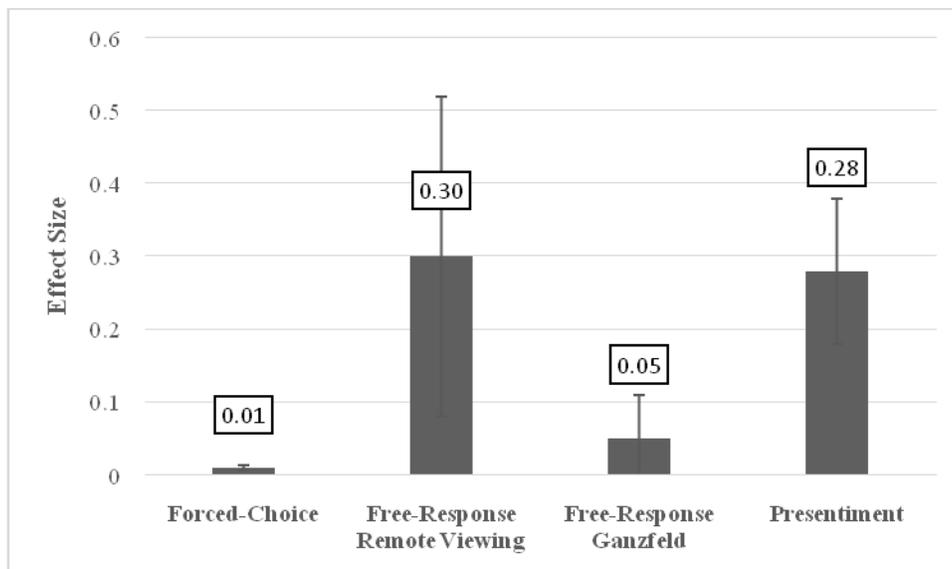


Figure 4. Unselected participants: Effect size with corresponding 95%CI, observed in the meta-analyses related to forced-choice, free-response remote viewing, free-response in a Ganzfeld environment, and presentiment designs.

the enlarged complete database 1987 to 2022 ($N = 141$), indicate that the forced-choice domain generally produces significant psi effects above MCE. Up until the present study, we had considered forced-choice effects to be very weak, and our position has not changed. The new findings are nevertheless encouraging, even across modalities, target types, and participant types (i.e., selected vs. unselected). We formed two databases—a dataset of New Studies #1 (studies reporting hit rates), and a dataset of New Studies #2 ('RT' Studies; i.e., measures not recording hits)—and although mean ES values were different (0.02 vs. 0.01, respectively), the difference was not statistically significant, so we combined the two. Also, New Studies #1

was more successful than New Studies #2 ('RT' Studies), with 29% of studies independently significant in the former compared to 17% in the latter. Generally, however, our results are very similar to those observed by Honorton and Ferrari (1989), Steinkamp et al. (1998), and Storm et al. (2012). The following is a break-down of our findings across a series of hypotheses.

We proposed six hypotheses and tested $H2$ to $H6$ using the combined dataset ($H1$ was tested separately for both smaller datasets #1 and #2). Interestingly, Storm et al. (2012) reported that effects by modality were "very weak for precognition, clairvoyance, and even telepathy, which was the strongest effect of the three" (p. 259)—this finding

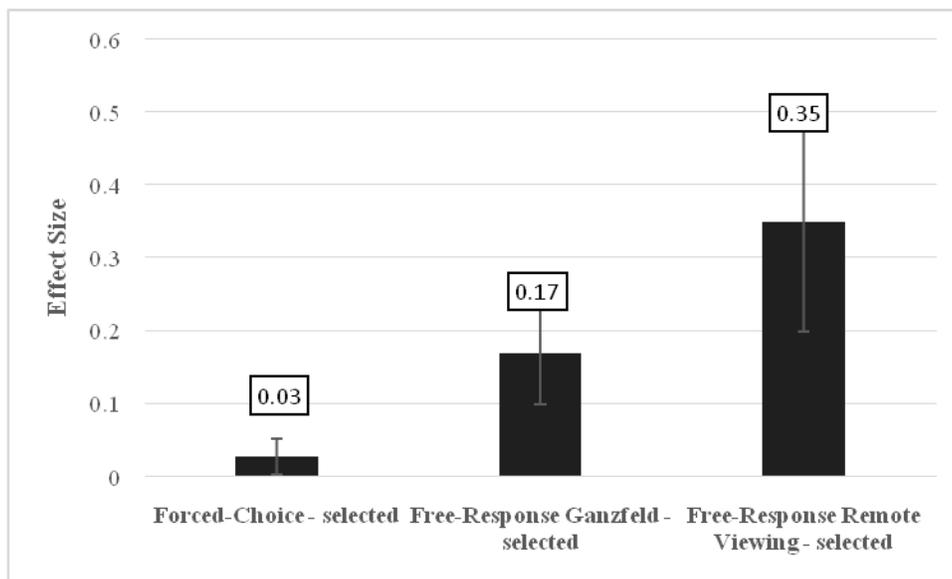


Figure 5. Selected participants: Effect size with corresponding 95%CI, observed in the meta-analyses related to forced-choice, free-response in a Ganzfeld environment, and free-response remote viewing designs (no data for presentiment).

was repeated with telepathy still the strongest effect, though not significantly (*H2*).

We found target type made no difference to effects in our test on the new studies ($N = 59$), but the test on the large database ($N = 141$) was significant (*H3*). However, there were no apparent differences between specific target types in the post hoc analysis. As we had already pointed out (see Storm et al., 2012, p. 260), possible reasons for these failures are to do mainly with participants' attitudes and reactions to targets—specifically, targets may be uninteresting and/or meaningless (i.e., Zener cards, numbers, letters, etc.) whereas experimenters should aim to offer emotionally stimulating and/or meaningful targets (i.e., divinatory readings, real pictures, video clips, etc.). Storm et al. also argued that cognitive noise may be higher in forced-choice studies compared to Ganzfeld and other designs where relaxation is offered. It is also thought that ecologically valid tasks are preferred by participants, such as e-mail or phone call predictions, and these are always telepathy tests (see Sheldrake et al., 2015). Preferred targets included various symbols (such as fractals) and text (i.e., words, letters, and messages).

Following Storm et al. (2012), we divided our database of new studies into mutually exclusive investigator/experimenter groups. Again, we found groups tended not to outperform each other (*H4*). No significant differences were found in the larger database.

Timm (2000) claimed that number of choices per trial (k) may be positively related to z score. However, when we tested the new set of studies, no proposed advantage based on k was found (see *H5*). A re-test on the larger database was not significant when z scores were grouped by k to form mean scores for each k -group, but correlating z scores for individual studies with k also produced a significant effect. The strongest z scores tended to correlate with higher k values.

In testing *H6*, we found a significant time-dependent decline in ES values in the new studies ($N = 59$), which covers a 12-year period, but for the longer period of analysis (1987 to 2022), there was a marginally significant incline (see Figure 3). We noted earlier that the correlation between year of study and ES indicated an incline, “meaning that ES values increased over the 24-year period” (Storm et al., 2012, p. 257). That effect was significant, and after 36 years, there is now good evidence the incline has been maintained.

Further tests on the largest ever database of forced-choice studies produced some additional findings that warrant mentioning:

First, we did not find a performance difference between modalities, but an interaction effect showed that telepathy was a ‘show-case’ modality, provided targets were letters,

words, or messages (see Figure 2).

Second, testing selected participants, compared to unselected participants, showed a significant mean ES difference in ESP performance. This finding shores up the general understanding that some gifted participants tend to obtain high scores in ESP tasks in forced-choice designs (for examples, see Honorton, 1987; Kanthamani & Kelly, 1974; Steinkamp, 2005).

Third, in testing studies with a feedback condition, we found that giving participants feedback (either after trials or after runs) also gives an advantage. Given this finding, and the previous one concerning selection, it followed that we should test the ‘selected with feedback’ condition against the ‘selected with no feedback’ condition. We found a significant difference between the two, with selected participants who received feedback producing a stronger mean ES than selected participants who did not receive feedback.

Fourth, we found no evidence of publication bias; otherwise, we would expect a much higher rate of independently significant studies than a mere 21% (29 out of 141 studies).

Our fifth and final point is that the forced-choice domain, with $ES = 0.02$, has confirmed previously reported low ES values (see Honorton & Ferrari, 1989; Steinkamp et al., 1998; Storm et al., 2012). The effect is enduring and consistent across time and other variables, albeit weak (which is to say ‘small’), and it might be argued that there is room for improvement. We note that the effect is weak because it is estimated by considering the number of trials and not the number of participants, and number of trials in forced-choice protocols are much larger than those used in typical free-response protocols. For all studies from 1987 to 2022 ($N = 179$) before outliers were removed, we estimate the typical participant performs 14 trials on average, whereas most participants in Ganzfeld experiments seldom do more than one trial each. Nevertheless, the number of forced-choice studies that are independently significant (21%) is better than that for the free-response domain, such as non-ganzfeld noise-reduction and standard free-response (19% and 15%, respectively; see Storm & Tressoldi, 2020, pp. 205-206), and not so far from Ganzfeld (26%). Also, for experimenters to get some kind of additional advantage in forced-choice studies, they are advised to test selected participants and certainly to offer feedback. They may then find that their participants (selected with feedback; mean $ES = .04$) perform possibly even better on average than participants in Bem-type precognition studies (mean $ES = .03$)—see Cardeña (2018, p. 667).

Given these findings, skeptics, critics, and even psi advocates may need to reconsider their current positions

on the efficacy of forced-choice designs insofar as their views may be negative. Yet, we too, suggested that the forced-choice “weak effect might prove difficult to deploy efficaciously” (Storm et al., 2012, p. 261). We have seen that there are steps that can be taken to improve that outlook.

ENDNOTES

1. For a review of the meta-analyses of these and other experimental domains, see Cardeña (2018).
2. Although Delorme et al. (2016) was initially peer-reviewed, it was later retracted by the hosting journal and is, therefore, officially unpublished. Hence, we excluded it from this meta-analysis on the grounds that it must again go through peer review prior to publication.
3. Higgins' $I^2 = 100\% \times (Q - df)/Q$, where Q is Cochran's heterogeneity statistic, and df is degrees of freedom. Heterogeneity benchmark values for I^2 are 25% (low), 50% (moderate), and 75% (high). For details about Cochran's Q statistic, see Lipsey and Wilson (2001).

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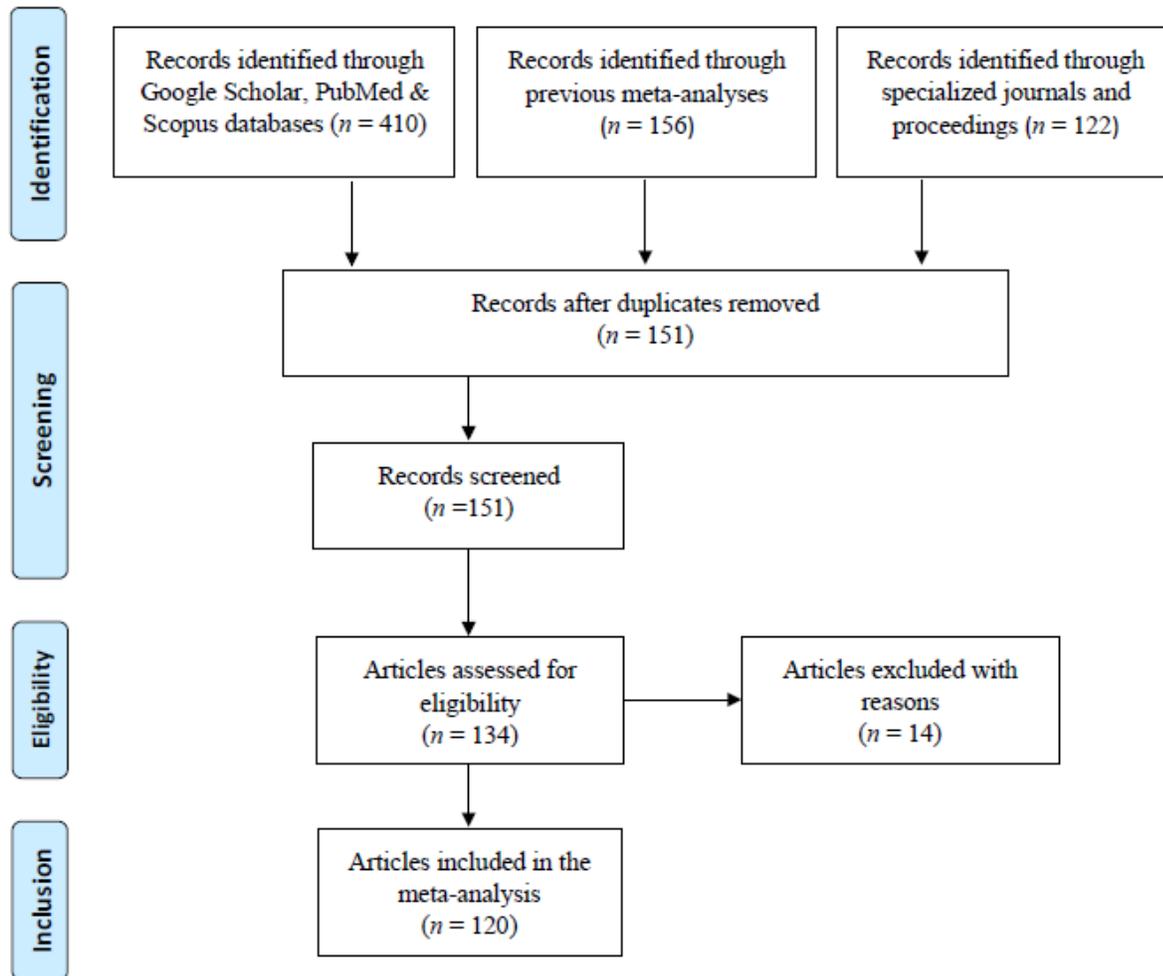
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APPENDIX A: Prisma Flowchart

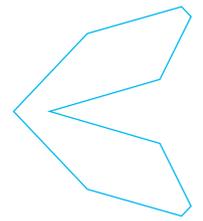


APPENDIX B: List of New Studies with Hits Data in the Meta-Analysis and Their Results

	Author(s)	Year	Trials	Hits	Z	ES (z/\sqrt{n})	Task
1	Bem (expt. 1)	2011	3600	1912	3.72	0.062	PR
2	Bem (expt. 2)	2011	5400	2790	2.44	0.033	PR
3	Bem (expt. 3)	2011	1800	963	2.95	0.070	PR
4	Bem (expt. 5)	2011	2400	1274	2.90	0.059	PR
5	Bem (expt. 6)	2011	3600	1865	2.15	0.036	PR
6	Schönwetter et al.	2011a	657	151	-1.15	-0.045	CL
7	Schönwetter et al.	2011b	350	71	0.07	0.004	CL
8	Hitchman et al. (nonintentional)	2012	750	201	1.10	0.040	PR
9	Houran & Lange	2012	60	27	3.43	0.443	PR
10	Luke et al.	2012	200	43	-1.06	-0.075	PR
11	Dalkvist	2013	19560	9585	-2.78	-0.020	TE
12	Ertel	2013	7740	2293	21.16	0.241	CL
13	Lange & Houran	2013	60	34	5.52	0.713	PR
14	Parra & Argibay (believers; mental)	2013a	896	520	4.78	0.160	CL
15	Parra & Argibay (believers; motor)	2013a	896	482	2.24	0.075	CL
16	Parra & Argibay (live/nolive)	2013b	856	511	5.64	0.193	CL
17	Parra & Argibay (suicide/nosuicide)	2013b	856	458	2.02	0.069	CL
18	Parra & Argibay (motor live/nolive)	2013b	856	424	-0.24	-0.008	CL
19	Parra & Argibay (motor suicide/nosuicide)	2013b	856	443	0.99	0.034	CL
20	Storm et al.	2013	12016	2531	2.90	0.026	CL
21	Houran & Lange	2014	744	187	0.04	0.001	CL
22	Luke & Morin (contingent)	2014	210	57	0.64	0.044	PR
23	Luke & Morin (no-contingent)	2014	200	58	1.22	0.086	PR
24	Luke & Zychowicz (intentional; intuition)	2014	200	40	-1.55	-0.110	PR
25	Luke & Zychowicz (nonintentional; preference)	2014	200	52	0.24	0.017	PR
26	Simmonds-Moore	2014	95	22	-0.30	-0.031	CL
27	Simmonds-Moore	2014	95	24	-0.06	-0.006	CL
28	Billows & Storm	2015	3725	736	-0.35	-0.006	CL
29	Hitchman et al. (intentional)	2015	500	245	-0.40	-0.018	PR
30	Hitchman et al. (nonintentional)	2015	500	247	-0.22	-0.010	PR
31	Hitchman et al. (nonintentional)	2015	735	390	1.62	0.060	PR
32	Sheldrake et al. (three callers)	2015	1728	718	7.22	0.174	TE
33	Sheldrake et al. (two callers)	2015	660	370	3.08	0.120	TE
34	Hitchman et al. (nonintentional)	2016	624	160	0.32	0.013	PR
35	Sheldrake & Beeharee (study 1)	2016	11160	5901	6.07	0.057	TE
36	Sheldrake & Beeharee (study 2)	2016	2720	1395	1.32	0.025	TE
37	Sheldrake & Beeharee (study 3)	2016	8860	4594	3.47	0.037	TE
38	Kekecs et al.	2019	37836	18876	-0.43	-0.002	PR
39	Varvoglīs et al. (all no feed)	2019	1172	570	-0.91	-0.027	PR
40	Varvoglīs et al. (all with feed)	2019	1828	932	0.82	0.019	PR
41	Varvoglīs et al. (selected no feed)	2019	358	179	0.00	0.000	PR
42	Varvoglīs et al. (selected with feed)	2019	602	321	1.59	0.065	PR
43	Arora et al.	2022	5148	2566	-0.21	-0.003	PR
44	Escolà-Gascón (mediums; positive)	2022	900	432	-1.17	-0.039	CL
45	Escolà-Gascón (mediums; neutral)	2022	900	287	-10.83	-0.361	CL
46	Escolà-Gascón (mediums; haunted)	2022	900	443	-0.43	-0.014	CL
47	Escolà-Gascón (non-believers; positive)	2022	900	238	-14.10	-0.470	CL
48	Escolà-Gascón (non-believers; neutral)	2022	900	252	-13.17	-0.439	CL
49	Escolà-Gascón (non-believers; haunted)	2022	900	248	-13.43	-0.448	CL
50	Escolà-Gascón et al. (study 1)	2022	7110	2133	-33.72	-0.400	PR
51	Escolà-Gascón et al. (study 2; healthy)	2022	3630	1117	-23.15	-0.384	PR
52	Escolà-Gascón et al. (study 2; psychiatric)	2022	3540	1310	-15.45	-0.260	PR

APPENDIX C: List of New Studies with No Hits Data (RT Studies) in the Meta-Analysis and Their Results

	Author(s)	Year	Trials	t	ES (z/ \sqrt{n})	Task
1	Savva & French (expt. 1)	2002	1371	0.83	0.022	PR
2	Savva & French (expt. 2)	2002	1800	1.19	0.028	PR
3	Savva & French (expt. 3)	2002	4320	0.00	0.000	PR
4	Boer & Bierman	2006	9792	2.98	0.030	PR
5	Rabeyron & Watt	2010	4960	1.32	0.019	PR
6	Bem (expt. 4)	2011	3168	2.03	0.036	PR
7	Bem (expt. 7)	2011	9600	1.31	0.013	PR
8	Bierman	2011	5408	1.41	0.019	PR
9	Roe et al. (study 1)	2012	1504	0.69	0.018	PR
10	Roe et al. (study 2)	2012	1344	-0.64	-0.017	PR
11	Wagenmakers et al.	2012	1500	-0.22	-0.006	PR
12	Bierman & Bijl	2014	4288	2.59	0.040	PR
13	Rabeyron	2014	896	-1.35	-0.045	PR
14	Vernon	2015	9792	1.55	0.016	PR
15	Rabeyron et al.	2018	2944	-0.25	-0.005	PR
16	Jolij & Bierman (expt. 1)	2019	7104	0.21	0.002	PR
17	Jolij & Bierman (expt. 2)	2019	1984	-0.15	-0.003	PR
18	Wehrman	2019	4080	0.50	0.008	CL
19	Schlitz & Delorme	2021	4449	-0.29	-0.004	PR
20	Schlitz et al. (expt. 1)	2021	19720	0.76	0.005	PR
21	Schlitz et al. (expt. 2)	2021	22560	1.68	0.011	PR
22	Wittmann et al. (expt. 1)	2021	3640	0.53	0.009	PR
23	Wittmann et al. (expt. 2)	2021	3720	-2.34	-0.038	PR
24	Muhmenthaler et al. (expt. 1)	2022	26171	-0.45	-0.003	PR
25	Muhmenthaler et al. (expt. 2)	2022	50904	-0.46	-0.002	PR



**SPECIAL
SUBSECTION**

Special Subsection Afterword: ESP Research and Cognitive Neuroscience: Possibly Incompatible - But Methodologically Complementary

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HIGHLIGHTS

Despite their different assumptions, mainstream neuroscience and experimental parapsychology can definitely help each other to refine research methods and explanatory models about subjective experiences and cognitions.

ABSTRACT

This commentary considers the fields of extrasensory perception (ESP) research and cognitive neuroscience, discussing points of conflict and domains where they may be complementary. ESP research challenges the assumption in cognitive neuroscience that the mind is the product of known physical processes in the brain. Cognitive neuroscience methods and tools applied to ESP research could benefit and bridge the gap between the two fields. Firstly, concurrently studying subjective experiences and neural activity during ESP tasks would allow us to better characterize subjective states typically associated with ESP. Secondly, similarities between mind-wandering and free-response ESP experimental designs allow us to speculate on the potential implication of the default-mode network during the percipient's experience. Finally, tools developed in computational neurolinguistics and natural language processing may become valuable to automatize judging procedures in free-response ESP paradigms such as remote viewing. Despite potentially incompatible assumptions about the mind and the brain, ESP research can gain new insights from cognitive neuroscience methods and approaches and can contribute in its own way to the study of human subjective experiences and cognition.

KEYWORDS

Neuroimaging, psi, experimental parapsychology, mind-body problem, altered states of consciousness, neurophenomenology, natural language processing.

INTRODUCTION

I was kindly invited to write a commentary from the perspective of a cognitive neuroscientist for this special subsection on 'non-local perception' (Piao & Katz, 2023; Storm & Tressoldi, 2023; Tressoldi & Katz, 2023) – which I will label 'ESP' from now on for 'Extrasensory Perception'. I accepted this challenging but interesting exercise.

Two papers (Storm & Tressoldi, 2023; Tressoldi & Katz, 2023) are meta-analyses of forced-choice and Remote Viewing (RV) experiments, showing significant effects for both types of designs but with much weaker effect sizes for the forced-choice ones. By updating previous meta-analysis reports, they demonstrate consistency and robustness in the effects reported in the literature. The third paper (Piao & Katz, 2023) is an empirical paper



using a single-blind RV protocol and introducing a new method to assess the closeness of the percipient's description from the target.

I was invited for this commentary to touch upon how these papers, and ESP in general, challenge or may contradict current neuroscientific theories. The short answer is that non-local perception contradicts the most fundamental assumptions of how neuroscientists view the mind. In the first section, I briefly invite the reader for a peek into the rabbit hole of the Mind-Body problem, admittedly in a very simplified manner.

In the second section, I describe, in a formalized way, different ways in which neuroimaging techniques could advance our understanding of reported ESP effects and how, by adding a focus on subjective experiences, ESP research can contribute to more mainstream topics in neuroscience.

The third section is a continuity of the latter, noting the similarities between free-response ESP tasks and the study of mind-wandering, and speculates about the potential significance of the default-mode network in ESP-prone states.

Finally, in the continuity of the RV methodological paper by (Piao & Katz, 2023), the third section describes how recent advances in neurolinguistics and natural language processing could be used for judging free-response reports in ESP tasks, and in particular, RV.

ESP Goes Against the Intuitive Worldview of (Most) Cognitive Neuroscientists

Cognitive neuroscientists are interested in understanding *the brain*, this enormously complex part of the body where our thoughts, personality, memories, perception, and consciousness appear to lie. The brain is a physical organ that most neuroscientists would compare to a computer that implements various routines, from which ultimately emerge our perceptions, thoughts, feelings, and behavior. Most cognitive neuroscientists more or less implicitly adopt a mechanistic-functionalist view of the mind, whereby brain states produce (or are equivalent to) mental states. These brain states are the product of the state of the individual neurons, elementary computational units that are governed by the laws of physics and follow the principles of causality (see Pulvermüller et al., 2014 as a very good illustration of this view). According to this view, all percepts emerge from – or simply are – physical processes: an object is perceived visually thanks to rays of light stimulating receptors in the retina, which send chemical-electrical information to the visual cortex, then producing a downstream pattern of activity that would finally generate the visual percept (Fig. 1a).

And although most computational models describe neural activity stochastically, I think most cognitive neuroscientists tend to implicitly hold a deterministic view of the brain – and therefore of the mind –, in part because of the strong influence of cybernetics in the field. The recent successes in the field of machine learning have further reinforced this algorithmic view of the mind. 'Deep neural network' computing systems, composed of large arrays of simple computational units ('neurons'), are now able to generate highly complex human-like content or behavior, as exemplified by conversational agents such as *ChatGPT* (*OpenAI, Inc.*, CA, USA).

The idea of ESP is that information about an object or event can be gained outside of the known physical means. According to the worldview I described above, there is naturally little room for this phenomenon. A purely physicalist account for ESP would imply the existence of unknown fields, forces, and interactions, an unknown way to reach and receive that information across space – and time if one wants to account for precognition (Fig. 1b). There is the argument that ESP would not be *in principle* incompatible with what we know about the physical world – for instance from quantum mechanics (e.g., Radin, 2006), but a cognitive neuroscientist may respond that, at the present time, there is no need nor demand to recruit concepts such as non-causality, quantum entanglement or other yet-to-be-discovered mechanisms to account for cognition. However, while neuroscientists have underlying assumptions or beliefs about the mind-body problem, cognitive neuroscience as a field does not have definite answers to provide yet, and neuroscientists more versed in the niche topics of free will or mental causation may have more nuanced views (see, e.g., Delnatte et al., 2023; Roskies, 2006). The concept of ESP and other psi phenomena are difficult to reconcile with a purely physical, mechanistic, and deterministic account of the mind (Kelly et al., 2010), and ESP could be to physicalist cognitive neuroscience what the precession of Mercury was to Newtonian physics: an observed anomaly that cannot be explained without a radical change of paradigm. Indeed, ESP and psi phenomena may be easier to conceptualize if one accepts the idea of mental causation, where the mind operates somehow independently of the body, allowing for weaker and rarer interactions for access to information throughout space and time (Fig. 1c) (See Kelly et al., 2015 for the description of various alternative worldviews that could account for ESP.) In any case, ESP challenges the overarching model under which cognitive neuroscience operates, which is why it is such a subversive idea.

However, the tools, methods and models developed by cognitive neuroscience have shown undeniable

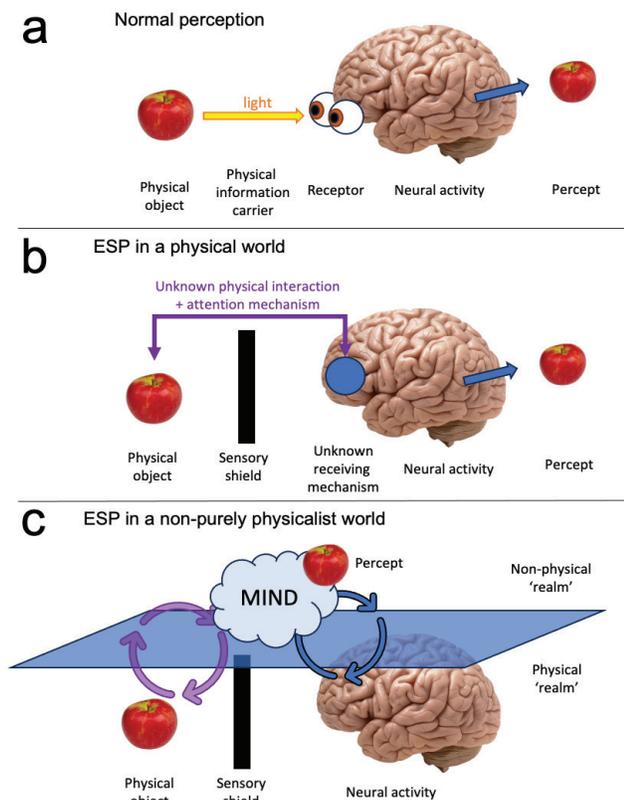


Figure 1. Normal Perception and extrasensory perception (ESP) and the brain. a) Accepted general physicalist model accounting for perception. A stimulus excites a receptor, which generates a wave of neural activity, generating or equating to a percept. b) ESP in a purely physicalist worldview. Unknown physical and attentional processes must take place for an ESP percept to arise. c) ESP in a non-purely physicalist world. In this view, the mind and the body are separate but interact. ESP could be seen as an interaction between the mind and the object of the same nature as between the mind and the body. [Brain image from Flickr.com by _DJ_, CC BY-SA 2.0 license]

success and progress. They may prove very useful for the study of measured ESP effects despite this conceptual incompatibility. This is what I will develop in the subsequent sections.

Neuroimaging and ESP: Approaches and Framework

Purely behavioral (i.e., response-based) paradigms are the most common in parapsychology. By looking at variables such as participants' individual differences and manipulating the target and other parameters in the protocol can probe some of the characteristics of and mechanisms underlying ESP – very much like mainstream experimental cognitive psychology operates. Because of the absence of a mechanistic model for ESP, ESP in the lab-

oratory is defined as an anomalous statistical deviation, i.e., a deviation that cannot be explained by any known physical means. Without a model, positive results are more difficult to interpret but also to communicate to the rest of the research community. Adding into the picture physiological features that could systematically be associated with observed ESP effects could potentially help on both these fronts. Except for the presentiment paradigm (Duggan & Tressoldi, 2018; Mossbridge et al., 2012) and a few notable studies (see Krippner & Friedman, 2010), to my knowledge, very little experimental research has been devoted to studying the physiology of participants undergoing psi tasks.

There are three general approaches that can be taken: Firstly, in an extension of individual differences research trying to identify traits for high-scoring individuals, one approach is to look for biological markers – or for a neuroscientist, *neuromarkers*: biological features lying in the brain of individuals. These neuromarkers can be of structural or functional nature. Structural markers can be, for instance, cortical thickness in certain areas, the size of brain structures, and structural connectivity between areas, all of which can be measured using a scanner. Functional markers are signatures in neural activity as measured, for instance, by functional magnetic resonance imaging (fMRI) or electro-encephalography (EEG), at rest or during specific standardized tasks. The question addressed in this approach is: If higher ESP scoring is an individual trait, are there associated traits lying in the brain reflecting this high ESP scoring test?

Secondly, if anomalous perception events can be generated and identified in time with sufficient precision and in a repeated manner, an associated trace can, in principle, be measured using event-related designs. This approach would intend to identify the neural correlates of ESP per se in the same way as we can observe stereotypical EEG traces following visual or auditory stimulation. This was the approach adopted e.g., by McDonough et al. (1992) and Moulton & Kosslyn (2008) – see also Acunzo et al. (2013) for a critical review – and corresponding to Figure 2, side c. For this approach to be truly informative, individual 'hit' trials must be observed and identifiable as veridical ESP hits. With very small effect sizes such as the ones reported for forced-choice designs (~0.02; Storm & Tressoldi, 2023), most hits will be imputable to chance, according to the expected 'hit' probability under the null hypothesis. In that case, the signal-to-noise ratio for the difference in brain activity between 'hit' and 'miss' trials will be extremely low, and any existing ESP signal will be extremely difficult to observe.

Finally, a third approach is to characterize and identify prolonged neural states that are associated with hits

in ESP tasks (psi-prone states, Fig. 2, whole triangle d.). As in the second approach, this necessitates concurrent recording of brain activity while the participant is undergoing an ESP task. In an experimental or applications setting, these identified states could, in principle, help to predict when higher probabilities of hits will occur. If the characteristics of such states are known, the ways to induce or provoke them can be made easier, for instance, by using methods inspired by neurofeedback. In particular, various altered-states of consciousness (ASCs) have been associated with ESP in the literature – often some type of dissociative state, sleep, trance induced by rituals, psychedelic substances, and/or meditation (Cardeña et al., 2014; Kelly & Locke, 2009), while some of the most successful ESP experiments involved induced ASCs such as in the Ganzfeld or sleep (Sherwood & Roe, 2003). Characterizing these psi-associated states may, therefore, be a key element to the understanding of ESP (Fig. 2, side a) and is an approach highly compatible with free-response designs, which appear to be the way forward for this field, given the higher effect sizes (Storm & Tressoldi, 2023; Tressoldi & Katz, 2023). Various tools and approaches have been developed to probe the subjective experience of individuals undergoing these ASCs,

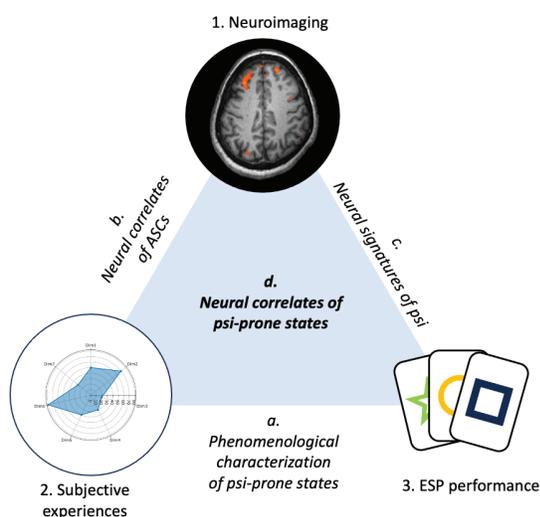


Figure 2. General framework for the neuroscientific study of altered states of consciousness (ASCs) and extrasensory perception (ESP) in the laboratory. Using concurrent neuroimaging (1.), experience reports (2.), and ESP performance (3.) measures can help the neural characterization of psi-prone states. Using only two of these measures also provide valuable insights. For a description and thorough discussion of a more complete framework, see (Kelly & Locke, 2009). [Brain image for illustration, from Kim et al. (2010). PLoS One. 11;5(8):e12068, CC BY 2.5 license]

but come with methodological challenges: concurrent experience sampling may interfere with the experience itself, while retrospective interviews can suffer from various biases, distortions, and poor recollection and temporal precision (see Cardeña & Pekala, 2014 for a thorough discussion). This is where neuroimaging methods can be helpful and complementary in the study of ASCs. They can provide signatures allowing us to compare the similarity and differences between different types of ASCs, identify the dynamics and transitions necessary to go from one state to another, provide clearer interpretation of subjective reports, and may inform us on certain disorders (e.g. dissociative disorders, schizophrenia). By obtaining a measure of the different experiential components of the ASCs (e.g., sense of agency, sense of self...), concurrent neuroimaging recording opens the way to identifying the neural correlates of each component. This is the ‘neurophenomenological’ approach (Varela, 1996), which has gained momentum in recent years, in part thanks to the rise of psychedelics research, and has been advocated for the study of ASCs in a recent opinion paper (Timmermann et al., 2023). This same approach can be applied during psi tasks, including in free response designs. It also offers the advantage for the researcher to provide additional hypotheses to test: since ESP behavioral results are so elusive in the laboratory, valuable insights can be gained from the neuroscience of ASCs per se, regardless of ESP results (Fig. 2, side b).

Free-Response ESP Designs and the Default Mode Network

The Default Mode Network, or Default Network (DN; Raichle et al., 2001), is a set of brain areas that are more active when the participant is at rest and less active when the participant is engaged in a task (for a recent review on the DN, see Menon, 2023). The discovery of this network contributed to the emergence of task-free imaging studies. Rapidly, it became apparent that the DN does not simply reflect the absence of engagement in a task but rather engagement to self-generated, internal tasks. Most particularly, the act of “mind wandering” (i.e., when individuals disengage their attention from their perceptual environment and engage in introspective thoughts) was identified as contributing to the activation of the DN (Christoff et al., 2009). One can easily see the similarity between mind-wandering on the one hand and a Ganzfeld, Remote Viewing, or mediumistic reading session on the other hand. While the tasks are different and the subjective experience will greatly differ, they are both families of internally generated experiences with attentional disengagement from sensory input. They are,

therefore, close enough so that methods of study (and observations) can overlap.

These similarities would allow us to use mind-wandering and resting states as control conditions for free-response ESP tasks. Because a free-response ESP task also involves internally generated thoughts and sensations, it is likely to somehow recruit aspects of the DN. It may, therefore, be a fruitful avenue to try and identify what may be specific regarding the DN when apparent anomalous cognition occurs, in terms of patterns of activation, but also connectivity between nodes, co-activations, and switching with other networks. One can speculate that when participants engage in a free-response ESP task, nodes of the DN would display a diminished activity, as is the case in various states of consciousness that have been reportedly associated with psi perception in the literature, in particular, meditation (see e.g., Brewer et al., 2011), REM sleep (Hong et al., 2021) and psychedelics (Carhart-Harris et al., 2012; Dos Santos et al., 2016).

Because parapsychology is not a heavily-funded field of inquiry (Zingrone et al., 2015), and neuroimaging methods such as magneto-encephalography (MEG), fMRI, or positron emission tomography (PET) are very costly, they will likely not be the preferred modality in the field. However, other non-invasive techniques, such as EEG and functional near-infrared spectroscopy (fNIRS), allow us to measure neural activity non-invasively at a much lower cost. Some compromises have to be made when using these methods, such as head coverage and spatial resolution, but they also offer some benefits, including ecological validity, movement tolerance, and safety. The characterization of the measured signals in these neuroimaging modalities in terms of how they relate to large-scale networks such as the DN is still a topic under development, but even studying contrasts between conditions (ASC vs. control, or 'hit' vs. 'miss' trials) and correlations with subjective reports (Fig. 2a, d) while remaining agnostic to the specific areas involved will still provide valuable insights.

Using Advances in Computational Neurolinguistics for ESP Research

The third paper of the series (Piao & Katz, 2023) tackles the difficult question of rating the correspondence between a percipient's description of the target to the target itself in an RV paradigm. They propose an extension of the fuzzy set approach developed by May et al., (1990), inspired by telecommunication engineering. I will now discuss an idea of how neuroscience tools can also contribute to this topic. Many free-response designs use one or several blind judges to rate the correspondence between the percipient's account on the one hand and

the target and decoys on the other hand. This is a difficult and time-consuming exercise for which there is often no definite correct answer, which is why methods to formalize this process are being developed.

The fields of computational neurolinguistics and neural language processing (NLP, a subfield of machine learning and computer science) are currently developing tools and models that could greatly help the encoding and analysis of free-response reports. In particular, there are now freely-available pre-trained NLP models, such as BERT (Devlin et al., 2018), that can transform (encode) words, sentences, and paragraphs into embeddings, i.e., an array of numbers. These encoding models are trained on massive text databases and are an essential component of automated translation tools such as *Google Translate* (Google LLC, CA, USA) or generative models such as *ChatGPT*. They allow interesting semantic calculations, such as the typical examples: *Rome - Italy + France = Paris*, or *king - man + woman = queen*. Importantly, these embeddings allow us to calculate semantic similarities between pairs of words, sentences, or paragraphs using operations such as cosine similarity. Such similarity measures allow, for instance, to calculate that the word *cat* is more semantically related to *dog* than it is to the word *apple*. These methods are successfully being used in cognitive neuroscience and are now part of the tools that neuro-linguists apply in the study of how humans understand and produce language and how the meaning of concepts is reflected in the brain (see, e.g. (Acunzo et al., 2022; Pereira et al., 2018).

Getting back to RV and free-response paradigms, it would therefore be possible, in principle, to encode into embeddings (1) textual descriptions of the target and decoys, which would be prepared by hand in advance by an experimenter and (2) the report given by the percipient about the target. Similarity measures can subsequently be applied to compare the closeness of the percipient's report on the one hand and the target and decoys descriptions on the other hand, allowing to conveniently automatize the rating procedure (Fig. 3). Naturally, such a method would have to be evaluated, possibly on past data, before being deployed, but I believe it may be a fruitful direction to take in terms of methodological development for the field. If proved reliable, it could greatly improve efficiency and reduce the human cost of experimental designs that traditionally necessitate one or several judges.

One important limitation in using these embeddings is that they are not easily interpretable by humans. They are generated automatically by the algorithms, and the numbers are meaningless to us. However, Chersoni et al. (2021) and Turton et al. (2020) developed methods

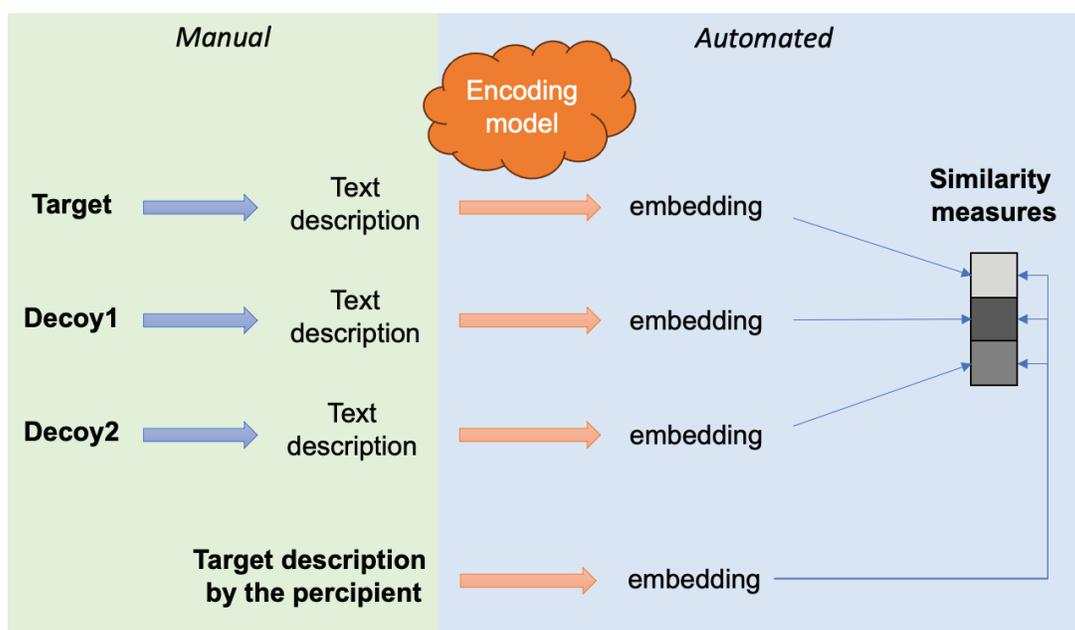


Figure 3. Proposed general method for an automated judging procedure using natural language processing (NLP) techniques. Experimenters prepare a text description of all targets and decoys. The textual description by the percipient, as well as all the text descriptions, are encoded into embeddings. A similarity measure can be applied, quantifying the correspondence between the percipient's description and the target and decoys, removing the need for blind judges.

to project these embeddings onto an interpretable set of dimensions developed by a team of neuro-psycholinguists (Binder et al., 2016). These embeddings consist of ratings on sensory, motor, spatial, temporal, affective, social, and cognitive dimensions. Using such interpretable embeddings opens the possibility to more easily study the various dimensions and assess, for instance, whether some of them appear to be more consistently captured (or missed) by the percipient. More generally, NLP offers a new array of techniques allowing us to study verbal reports of ASCs and spontaneous anomalous experiences that could prove very valuable to the field.

Concluding Words

In conclusion, even though ESP results appear to contradict underlying cognitive neuroscience assumptions about the brain and mind, neuroscientific techniques have a lot to offer to the study of ESP. Including some neuroscientific methods and approaches in ESP designs will provide new insights and ways to use and interpret the data. Conversely, studying ESP in the laboratory jointly with subjective reports and with neuroimaging techniques will help to bridge together the currently rather segregated fields that are cognitive (neuro)science and parapsychology.

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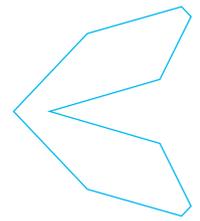
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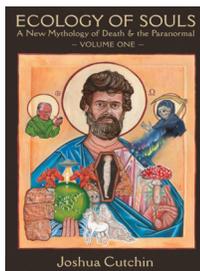
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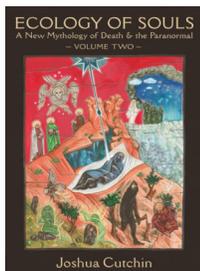
**BOOK
REVIEW**

Ecology of Souls: A New Mythology of Death & The Paranormal (Volumes 1 and 2)

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To begin at the ending, these volumes are recommended for members of the SSE. That is despite the many difficulties that I found in reviewing these books. It appears to me that the author is an astute observer and reporter on various phenomena, as opposed to being a practitioner, experimenter, or independent researcher of the topics about which he writes. Nonetheless, the sheer volume of anecdotes collected from around the world is worth the trip.

From a personal perspective, the subtitle raises questions. That subtitle is called *A New Mythology of Death & the Paranormal*. Frankly, I and many members of the SSE have been addressing the integration of these topics for decades. Ken Ring wrote about the parallels between NDEs and UFO abductions over three decades ago. That was published in *The Omega Project: Near-Death Experiences, UFO Encounters, and Mind at Large* in 1992. That same year, I gave a presentation on that topic at the conference on alien abductions at MIT. That famous conference was hosted by celebrated psychiatrist and Pulitzer Prize-winner, John Mack, M.D. of Harvard, and world-renowned optical physicist David Pritchard of MIT in 1992. My presentation, also based on Ring's work, was titled, "Comparative Phenomenology" and can be found in the *Proceedings of the Abduction Study Conference at the Massachusetts Institute of Technology*. Cutchin is aware of Ring's book as it is addressed on pages 31-32 of Volume One.

While we might agree with much of the discussion, the idea of coincidence of these disparate topics would hardly be considered new. The newness of the concept of cross-pollination and interrelationships between seemingly disparate phenomena may be true for the casual reader but not likely for most SSE members. For at least decades, many of the SSE members have been aware of theoretical entanglements of interdisciplinary studies of phenomena.

It is notable that several experts in related fields have provided laudatory comments in support of these works. It also is observed that the volumes are highly referenced. So much so, that it encompasses an entire third volume devoted solely to those references. That volume with over 4,200 citations is available for free at Cutchin's website: https://www.joshuacutchin.com/_files/ugd/e44a4e_0c39cd7964e145fd8e6c71bf5343a4d7.pdf.

Of concern is that all numeric references are listed for nearly every paragraph, but there is considerable disparity in the qualifications of those persons. For example, on page 75, Lobsang Rampa is quoted and footnoted as 421. There is no doubt that T. Lobsang Rampa is a highly published author of numerous popular books, including his best-known, *The Third Eye*. Upon investigation, it was discovered that T. Lobsang Rampa was a pseudonym for one who was posing as a venerable Tibetan Lama when, in reality, he was later exposed as a Canadian plumber. Those books are very detailed and interesting, it is just that the authenticity of the author is dubious (although Rampa later claimed

that he was a soul transplant into the plumber's body after being caught in the atomic bomb attack on Hiroshima, Japan). There are several other examples in which popular writers are listed as references. The issue is not sourcing but credibility.

Conversely, there are listed more highly credible references, many of whom are personal friends, and some are even members of the SSE. The problem for the reader is that unless they have extensive background in the topics, they might not differentiate between highly qualified references and those who may not be as credible.

These volumes contain a vast overview of the material Cutchin has reviewed, and it is prodigious. A worthy attempt. However, there were substantial omissions of well-known works related to the fields. Carlos Castaneda comes to mind as a specific example. When discussing near-death experiences (NDE) studies, a few were covered, including Raymond Moody and Ken Ring. However, other key scientists, ones who have shaped the field, are not. These might include Bruce Greyson and Michael Sabom, who, like Ring and Moody, were the founding members of the International Association for Near-Death Studies (IANDS). Among those not mentioned was Eben Alexander, the neuroscientist who has produced some of the most profound works based on both his professional background and personal NDE. In fact, the International Association for Near-Death Studies (IANDS) is not listed as a reference. That is surprising, as IANDS is the premiere organization in the world on the main topic of these books.

Considering the substantial discussion concerning spirits, I would have expected to find extensive literature by Allan Kardek, who generally is regarded as the founder of Spiritism religions such as Candomblé, Umbanda, or Santo Daime. Those religions are prevalent in South America and are derived from practices in old Dahomey in West Africa and imported to Brazil with the Portuguese slave trade. To be clear, physical possession by discarnate entities and interactions with psychopomps are mainstream fare in the Spiritist ceremonies and would add to, not detract from, the basic thesis of Cutchin's volumes.

One of the highly credible experts Cutchin relies on is Terrence McKenna, an ethnobotanist who explored naturally occurring psychedelic plants. In fact, on page 217 of Volume One, he credits McKenna with the title phrase, "ecology of souls." Terrence and his brother Dennis are well known for their studies on ayahuasca and the psychoactive ingredient dimethyltryptamine known as (DMT).

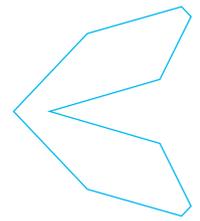
The volumes lead to broad interpretations and leaps in logic. Page 218 of Volume One begins, "If psychedelics take us to the afterlife, then they are guided tours in the 'afterlife vehicle.'" A lot is covered by the caveat "if" but leads to further leaps. Two paragraphs later, in the discussion of various psychedelic drugs, Cutchin states, "altered states of consciousness themselves are psychopomps, providing foreknowledge of the afterlife realm." That would certainly be open to debate by those who study psychopharmacological substances. While an interesting hypothesis, what realms are being explored is far from a certainty.

There are extensive discussions about souls and their attributes. There are extensive reports of the interactions of psychopomps, agents such as spirits, angels, or deities in many religions whose duty is to escort newly deceased souls from Earth to the afterlife. These emerge as discussions of the interactions between the physical and non-physical. Can outside technology interact with the non-physical or spirit world?

Some of Cutchin's comments come across as somewhat flippant. As an example, on page 164 of Volume Two, he addresses psychic explorations by Andrija Puharich. Here he states, "Puharich investigated claims of self-proclaimed psychics like Uri Geller," Having known Andrija, and still friends with Uri Geller (who did write the foreword for my most recent book), the notion of "self-proclaimed" seems an unnecessary denigration. In fact, several members of the SSE were involved in extensive testing and validating of his extraordinary capabilities and have spoken out supporting him. Since Uri's capabilities were topics I discussed with Andrija on several occasions, I am confident he would not concur with the "self-proclaimed" description either.

When viewed as an extensive collection of tales of fantastical events that are evidenced in physical reality, the works have considerable merit. There is also a benefit in the philosophical issues raised.

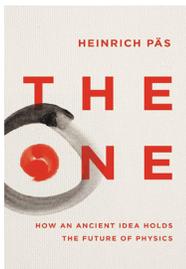
In the end, while *Ecology of Souls* is a substantial exploration of psychic topics, it is more a compendium of what Cutchin has read than a complete text of all the issues. The latter is probably impossible, even with the more than 260,000 words he has used admirably in these two volumes. An astute observer of what he has read, Cutchin is still bound by his established beliefs based on his Christian upbringing. That is an effect of which he is well aware, and notably quotes John Keel, "Belief is enemy."



**BOOK
REVIEW**

The One: How an Ancient Idea Holds the Future of Physics

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Heinrich Päs, a German physicist, has put forward perhaps a somewhat conflicting point of view of today's physics. Surprisingly, this "One" view, pointing towards the possible future of physics, rests on an ancient concept called *monism*—the idea that oneness or singleness is the basis for all that is.

The One is a well-researched and very well-written treatise containing nine chapters, 357 pages, 741 footnotes, and numerous references and recommendations for further reading. Päs, although a native German speaker, writes very well in English and is an engaging story-teller about the early discoverers and discoveries of quantum physics—which proves to be the important cornerstone to his monistic thesis. But just how and why this singular viewpoint arises takes the reader along many different and sometimes entangled paths. Nevertheless, this is an interesting and valuable book for anyone interested in the history of ideas and especially how our modern views of physics, and especially quantum physics, play a very special role. Let me explain a few of the points he raises—there are several I won't cover in this review dealing with the religious views brought forward by Päs.

In "The Hidden One" he offers several perhaps surprising anecdotes about the "fathers" of quantum physics, circa 1920s, struggling with what this "new physics" had to mean. Included in the list are, of course, Albert Einstein and his many discussions with Niels Bohr, Werner Heisenberg, and many other luminaries of this *new physics*. Up to then, it was widely believed that observed phenomena—brought forward by experiments—simply existed "out there" regardless of what idea or theory we had about them. Einstein upset this point of view when he declared, "it is the theory that determines what we can observe." In other words, without any idea or concept of what is out there, we cannot really know what we are observing. But what to do when the theory gives two contradicting points of view? This dichotomy—that may be well-known to some of you readers as the "wave-particle" duality—makes complementary observations that provide information either about the wave (so-called wavelength measurements indicating the momentum of the particle) or the particle (so-called location measurements indicating the position of the particle), but never both accurately at the same time.

This dichotomy led to the idea that whatever was accurately revealed in a measurement, there was always a hidden reality. (Observe the momentum of a particle, and its position cannot be seen with any accuracy and vice versa.) The analogy of Plato's cave comes to mind—the slaves in the cave are chained, so they can only see shadows of things passing across the sunlit opening in the cave, while outside the cave, real things exist casting those shadows. Due to their chains, the slaves' reality is only what they observe—for them, nothing else exists. In a similar light, the viewing of the momentum of the particle means the position of the particle doesn't quite exist—or else it consti-

tutes a hidden reality.

In “How All is One,” Päs takes us farther into his vision of *the One* by explaining how quantum physics tells us that this is so in spite of how ridiculous it appears. Quantum physics is indeed a strange business for all of us, including not only lay readers, perhaps such as you, but also we physicists who have studied it for many years now. In its early conceptualization, its founders began to recognize that quantum physics did not describe reality as we commonly see it. For example, the universe we experience in our ordinary lives consists of separate objects that may or may not interact with each other but nevertheless remain separately distinct as far as each of them possessing certain complementary attributes. The common complementary attributes of any object “out there” are its momentum, describing its movement, and its position. In the pre-quantum worldview, these attributes were supposedly simultaneously knowable and, therefore, simultaneously real. But quantum physics introduced a new idea labeled *entanglement* that made that simpler view untrue.

WHAT IS ENTANGLEMENT?

With entanglement, quantum physics changed all that, but what that change resulted in has been and continues to be debated today. The key idea that *entanglement* introduced was a new concept—it meant that if two or more firstly deemed separate objects, as commonly understood, were to interact with each other, no matter how briefly, and then separate, they became entangled—each object could no longer behave as if the other, long ago left behind object(s), was no longer acting as an influence on it. Even though each object was not involved any further with the other object or objects with which it had previously interacted, each object seemingly depended on the other(s) observed possible behavior.

Such entangled behavior resulted in 1935 with the appearance of a paper published in the *Physical Review* written by Albert Einstein, Boris Podolsky, and Nathan Rosen (abbreviated as EPR), entitled “Can Quantum-Mechanical Description of Physical Reality Be Considered Complete?” In it, EPR, all then with the Institute of Advanced Study at Princeton University, argued that quantum physics indicates that if the two objects mentioned above were so far apart that no signal could pass between them quickly enough, nevertheless any measurement performed on one object of either its momentum or its position, the other object would instantly possess the same attribute. Not only would that occur, but the act of measurement would bring either attribute instantly into reality. Since in quantum physical theory, such attributes are described

by a mathematical entity called the *quantum wave function*, the action of measurement was called “the collapse of the wave function.”

Even though quantum physics says neither object after interaction with the other could possess both momentum and position simultaneously, a measurement of either position or momentum performed on one object would seemingly instantaneously cause the other object to have the same attribute. Since Einstein, nearly 30 years earlier, had shown that no form of communication could travel at speeds greater than lightspeed, this entanglement between the objects violated “the special theory of relativity.”

Entanglement, although a new and unexpected result in physics, actually had its roots in ancient ideas of monism—an all-encompassing unity in common with many indigenous religions in separate regions of the globe—indicating a sacred or spiritual concept of the natural world. Nearly all (and perhaps all) ancient spiritual belief systems indicated that underneath the mundane appearance of the natural world lies a hidden realm, out of which springs the world of appearances. But what do we make of this hidden world? And how many of them are there?

WHAT ARE MANY WORLDS?

In “How One is All” the author continues with his thesis, showing how quantum physics continuously points us to his monistic view. Here, he takes up a revolutionary paper of Hugh Everett, a Ph.D. thesis under the tutelage of John Wheeler, a visionary Princeton physicist who called himself a “radical conservative.” Everett’s radical thesis says we should take quantum physics seriously and not deal with the inconsistent “act of measurement” that somehow occurs when one of the attributes, position, or momentum, of either object is observed.

Before Everett came on the scene in 1957, Niels Bohr, the well-known co-discoverer of quantum physics, told us that observation of an object’s attribute instantly brings that attribute into existence—the so-called “collapse of the wave function.” Instead of a collapse, Everett envisioned the quantum wave function as containing the whole enchilada—every possibility, each in its own world, that could occur together with its observer. Thus, when an observer measures momentum in one world, that same observer would split and observe position in another. Both the object and the observer would be duplicated into as many worlds as there were possibilities.

Such a viewpoint was called the many-worlds interpretation or parallel universes interpretation. Taken together, entanglement merges the possibly infinite num-

ber of worlds into a single “all-encompassing one.” The question is, “how does this parallel universes view turn into the commonly observed world of objects that we see every day? To answer that, Päs next considers the work of physicist Heinz Dieter Zeh, who, among others, postulated a process called *decoherence* that seemingly converts the scramble of entangled worlds into a single world—*The One* and seemingly only.

WHAT IS DECOHERENCE?

To understand how decoherence does this, let me use a metaphor of my own (not found in *The One*). Here, we will consider only two worlds, although the same argument could apply to as many worlds as there are possibilities. Suppose we had an ordinary two-sided coin that, if flipped, could land heads (H) or tails (T) with equal probabilities of 50%. After flipping, in the world we see around us each day, we would observe either possibility and think nothing weird had occurred even though we could count these possibilities as possible worlds. In either of these possibilities or worlds, we would have the experience of knowing what we had seen—either H or T, never both entangled with each other. It is that experience of knowing that beclouds the issue.

In the quantum physical universe, after flipping, it would land both H in world one (call this H1) and T in world two (call this T2). But since the coin has not been observed, no one knows which world has arisen. Now, suppose you come along and observe the coin. Here is where the many worlds view of Everett enters. In the world in which you see a result, say H, the other world with T becomes hidden from you and *vice versa*. But why does this happen?

To see why may take a little patience for the reader. Accordingly, you too would split into two observers: observer one is seeing H (I write O1H shorthand for observer seeing H in his or her world 1), and observer two is seeing T (similarly observer two seeing O2T). Because these worlds entangle, the result would come out to be a sum O1H plus O2T, yet only one of these worlds would appear to be real to you.

But which world is real? According to the rules of quantum physics, we must determine the various probabilities of these events, and that comes about by multiplying the sum of O1H plus O2T times itself (for those with some knowledge of quantum physics, actually multiplying the sum with its complex-conjugate).

There would be as a result four terms (O1H)*(O1H) plus (O2T)*(O2T) plus (O1H)*(O2T) plus (O2T)*(O1H). The first two terms are what you would expect based on commonsense (O1H)*(O1H) equals 50%, and so does

(O2T)*(O2T).

If these were the only terms arising from such quantum physical consideration, we would say, of course, there are two possibilities or worlds, if you wish, arising from observing a flipped coin. This would be no more mysterious than our commonsense viewing of a flipped coin—as such, we would label this as the view from a classical physics viewpoint. The effect of having an observer present in these terms O1H*O1H just leaving H and the same for O2T*O2T just leaving T with equal probabilities of 50%.

But the cross terms O1H*O2T and O2T*O1H do not cancel out—they remain as messy mathematical entities dependent on time. This is where the idea of decoherence enters. These cross terms depend on the mathematical representation of an observer who must also be in entanglement with his or her environment containing the coin. Given that the entanglement of human brains with environments are quite complicated, the values obtained from (O1H)*(O2T) and (O2T)*(O1H) will be largely random and would differ in value when repeating the flips several times.

Consequently, these cross terms, on average, over several times would only yield random errors slightly muddying the H or T result. Hence, the so-called classical worlds of H or T but not both would emerge, as commonly observed, even though they remain in this entangled way. Out of the many interacting objects, composing the universe consisting of the coin and its many observer-environmental possibilities would emerge the world we commonly observe simply because the cross-interfering terms decohere or cancel out over time. Of course, the two possible worlds containing H and T would still be there, just as they would appear to you if quantum physics didn't exist—called the classical physics viewpoint.

Let me summarize: What is “really out there” is the complete sum of all of those terms, including all cross terms. But what is observed is an illusion of either the H world or the T world disentangled from all the rest. In this way, we see a classical world even though that viewpoint is still a part of the whole many worlds ensemble. In actuality, all observations are entangled with everything—it is the limited perspective of any observer that brings out a particular observation and, in so doing, seemingly hides the observer's connection with the other possibilities. In the example I just gave, the O1 and O2 worlds are disconnected from each other such that in world 1 H is seen while in world 2 T is seen as if the other possibility is not present. But understanding entanglement and decoherence in quantum physics allows us to recognize that all possibilities are yet present, composing a monistic view—a grand oneness or unity.

WHY IS THIS VIEWPOINT IGNORED?

In “The Struggle for One,” the author poses the question: How is it possible that such a revolutionary viewpoint was ignored for so long? The answer seems to be that the accepted view of quantum physics, as put forward by Bohr, Heisenberg, and others, labeled the Copenhagen dogma, basically told physicists, who tended to think about the monistic view to simply “shut up and calculate.” Any physicist who brought themselves to think about the monistic-parallel universes-entanglement-decoherence concept of quantum physics—the implied meaning of quantum physics—were most often criticized and may have indeed found it difficult to find jobs after getting their Ph.D.’s. Like racial discrimination, this was considered being found guilty of “thought-crimes” as George Orwell put it.

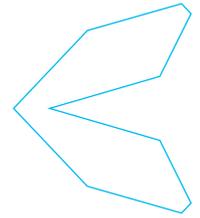
But hundreds of years earlier, any such monistic “thought-criminals” faced more serious punishment, such as being burned alive, tortured, or killed like Giordano Bruno. It wasn’t that monism was then a new idea that

sprung into these “thought-criminals” minds. The idea of monism had been around for perhaps thousands of years earlier.

In the remaining very detailed chapters, we are led further down the path of monistic enlightenment through quantum physical entanglement and decoherence. The subject of human consciousness is also considered, but this proves to be beyond the scope of quantum physical monism or any physics theory to date.

The author concludes with the thought that monism, even though arising from ancient spiritual belief systems, is perhaps the only correct view as it is based on scientific reasoning. However, he adds the sobering thought that if quantum monism is indeed based on scientific reasoning, it must have an experimental foundation. As such, any single experiment or logical extension of quantum monism that disproves this theory would toss the theory into the junk bin—as any theory based on science must be able to be proven wrong.

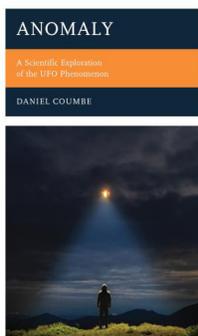
So, this leaves us with the opening question: If *nothing* is *something*, then what is it?



**BOOK AND
MULTIMEDIA
REVIEW**

ANOMALY - A Scientific Exploration of the UFO Phenomenon

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I confess to reading many books dealing with ufology, and – apart from a few exceptions – most of the time, I was substantially bored, not stimulated intellectually, and unmotivated to finish. Unless it deals with the in-depth psychological study of the witness, which is of great importance, uncritically presenting a collection of several testimonies of UFO incidents is like showing a video where several static and unrelated snapshots are linked together. On the contrary, reading this book by Dr. Coumbe, I felt a logical continuum page by page, and I was pleasantly surprised that reading a book about the UFO phenomenon was able to enthrall me from the beginning to the end.

The book presents its issues in a very orderly and methodical way. The first general chapter shows what are the parameters which are able to validate a UFO case; such as eyewitness testimony, sensor data, and physical evidence. After a critical discussion, these parameters are weighed one by one, and a final score is given. Subsequently, four important UFO cases are analyzed according to this criterion.

Every analysis is accompanied with quantitative evaluations, which when concrete data are available from trusted sources, show how a police-like investigation such as the one typically carried out by UFO investigators can be drastically replaced, or at least integrated, by a full physics-like study. At this point, the term “ufology” becomes something that could be baptized with the name of “anomalistic physics.”

The description of each case is never heavy; mathematical calculations are expressed in simple forms and very well formulated and explained so that the book can also be accessible to non-specialists and academic scholars. It is impressive how, through the availability of the necessary data, it is possible to derive with acceptable precision important physical parameters, such as speed and acceleration of anomalous aerial objects or even the weight of allegedly landed objects, for instance.

Every discussed case is full of graphs where a given parameter is plotted with its error bar against an arbitrarily chosen independent variable. Each of the four cases are presented in a targeted way in order to show situations where different physical information are available, dealing with sightings of anomalous objects, sensor measurements, and direct physical evidence. The discussion of previous data interpretations is critically presented, where more or less probable conclusions are weighed and compared together, exactly in the same way in which physical science normally proceeds.

The book is extremely well documented, and after an accurate analysis case by case, the witnessed phenomenon is analyzed as a whole in a redundant way by showing the importance of statistical and correlation analysis both in space and in time. From the charts that are presented and discussed regarding UFO cases, it appears there is no solid certainty as of yet. The admission of our global ignorance that is emerging directly from quantitative analysis, except for some aspects of individual cases, is very instruc-

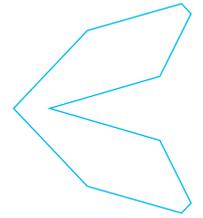
tive, and it should stimulate science to get much more in-depth in the systematic study of this problem, as it is clearly shown, can be treated in many cases, when sufficient numerical data are available as a target of general physics. However, even if the author himself admits that *correlation doesn't mean causation*, some of the very few correlations that are effectively emerging are unexpectedly surprising.

Independently from the critical way in which the UFO problem is treated both logically and mathematically and from all the doubts that come out from the derived numbers, Dr. Coumbe – by simply following numbers – is not afraid to show some of the absurdities manifested by the phenomenon itself, such as impossible speed and acceleration or the capability to move ultrafast even underwater. This is exactly how scientific minds are stimulated, which do not necessarily investigate only the physics that is known and accepted. In fact, scientific exploration is the only way to bring true discovery by accepting – after having weighed it very carefully – the anomaly in its integrity without filters of academic convenience. Scientists must study the phenomenon in order to learn something new about the nature of reality and not to profess what sci-

entific knowledge is officially accepted while rejecting all that does not fit in it.

In general, my impression is that Dr. Coumbe's efforts are excellent by working on this book exactly in the same way as when working on a technical article. Yet, the treatment is simplified in order to make understanding accessible. The presentation is very clear, orderly, organized, and guided in such a way that a non-specialist can understand without too much effort. In fact, this work might be well considered as a textbook for all those "ufologists" who want to face the problem in a serious, meticulous, and scientific way. I recommend this book to whoever wants to face the UFO problem with balanced objectivity, in particular to scholars having BS or MS degrees in the STEM disciplines and to scholars of different disciplines who want to be informed correctly and without any sensationalism about the phenomenon and the way in which it must be studied.

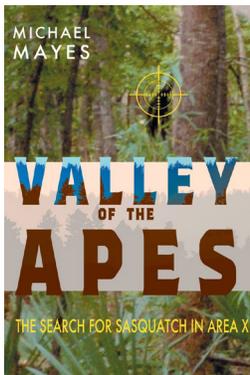
In conclusion, the study of UFO cases demands an interdisciplinary and in-depth effort, which involves both physical sciences and psychosocial matters. Without a doubt, Dr. Coumbe was successful in the first sector.



**BOOK AND
MULTIMEDIA
REVIEW**

Valley of the Apes: The Search for Sasquatch in Area X

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Mike Mayes is a long-time member and Investigator with the North American Wood Ape Conservancy (NAWAC -- <https://www.woodape.org/>) and currently serves as Chairman of its Board of Directors. *Valley of the Apes* chronicles a pioneering long-duration research program conducted by the members of NAWAC, whose mission statement reads: To investigate and conduct research regarding the existence of the unlisted primate species we refer to as the wood ape, also known as the sasquatch or Bigfoot; to facilitate scientific, official and governmental recognition, conservation, and protection of the species and its habitat; and to help further factual education and understanding to the public regarding the species, with a focus on the continent of North America.

This ambitious undertaking, dubbed the Ouachita Project, comes at a premium of personal time and resources, perhaps the largest obstacle to “amateur” investigation. Mayes notes the human foibles inherent in any group of sometimes fractious volunteers, especially understandable under the frequent logistical challenges and privations of field conditions. He concedes the lack of generational knowledge of how to hunt these animals and pragmatically rates their chances of success as slim at best. Yet he recognizes and highlights a commitment by members of the NAWAC to the application of the scientific method in their dedication to solving this mystery.

The group’s adoption of a strategy for the lethal collection of a specimen is naturally a lightning rod for strongly felt opinions on its merits and ethics. Mayes takes this bull by the horns right out of the gates in the preface. He immediately lays out this highly polarizing issue that is unavoidably integral to this book – *kill or not kill*. Is the lethal collection of a definitive specimen justifiable? The topic is grappled with repeatedly. The NAWAC team cites the January 2020 “Collection of Voucher Specimens” guidelines of The Animal Research Review Panel (ARRP) and Animal Ethics Committees (AECs) to rationalize their position. Mayes points out that this principle was not applied indiscriminately. In over ten years of the Project, firearms were discharged only five times.

Some would argue the point as moot since they will not acknowledge the existence of an unrecognized species of ape in North America as a legitimate possibility. Others assume Bigfoot or Sasquatch is a phenomenon of the Pacific Northwest, not the South. Accordingly, the first chapter establishes the case for Bigfoot in the four-state region of Texas, Oklahoma, Arkansas, and Louisiana. Extensive tracts of forested lands blanket the hill country of this region. “if the region can support black bears, which it does in great numbers, there is no reason to think a small population of wood apes could not survive there as well.” (p. 25). Indeed, the location reportedly has a history of encounters dating back to the 19th century. Wood apes are said to be part of the landscape.

The tactics for the Ouachita Project evolved into a series of overlapping shifts

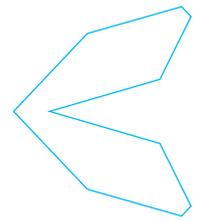
in order to sustain the presence of investigators at the research site. These initially were employing what was considered the standard methodologies: boots on the ground, cutting sign, deploying camera traps, night vigils with thermal cameras, etc. But, innovative approaches were also developed. For example, the novel use of tiny nanotracker deployed to entangle in the hair of a tall animal passing by.

The Project spans over ten years. The bulk of the book comprises a chapter for each phase, or operation, of the Project, dubbed with titles such as Endurance, Persistence, Tenacity, and Relentless. The chronological narrative spanning more than a decade becomes somewhat tedious, which is actually a fair representation of the nature of this sort of enterprise. A dedicated field researcher must be disciplined to the daily and nightly routines, which are only rarely, if at all, punctuated by evidence or "activity" -- some quite mundane, often subjective, some more intriguing, or even quite sensational. Past director of NAWAC, Alton Higgins, reflected that "events that in themselves, often serve as compelling evidence for participants, but which for many readers or skeptics merely comprise fodder for the fantastic."

The repetitive narrative would have benefited greatly from a table listing project titles, locations, times, and distinguishing events. More photos, especially an insert of glossy or color photos, would have enhanced the conveyance of the observed evidence. A generic map, without divulging specific locations in Area X, but providing

some orientation to events would have been helpful. A useful supplement, which was only first mentioned and referenced in the endnotes to cChapter 10, is the *Ouachita Project Monograph*. It provides the reader with some of these missing elements, but glaring absences of corroboration of reported encounters and discovery of trace and physical evidence remain. Mayes indicates in one of the closing chapters that a pause and pivot was eventually undertaken by NAWAC. He frankly suggests that the single-minded pursuit of a holotype resulted in the neglect of evidence collection and proper documentation. This is apparent in, for example, the lack of photos of "pristine" tracks with "toes clearly visible," or the lack of mention of any follow-up analysis of the possible blood sample. Therefore, the leadership mandated that collecting photographic evidence is now the top priority of the Project, although it appears that specimen collection is still an objective.

Overall, in *Valley of the Apes*, Mayes provides an engaging narrative introducing the NAWAC and drawing the reader into their experiences of a sustained field operation to hunt the elusive wood apes. He succinctly raises a number of issues, from the pragmatics of the ultimate mission objective to the evaluation of evidence sustaining the motivation for the Project. He provides a forthright, if brief, summary of outcomes in the penultimate chapter, "What we have learned," with the pledge that the NAWAC has not ended its quest. "Stay tuned."



**BOOK AND
MULTIMEDIA
REVIEW**

Forbidden Science 5: Pacific Heights, The Journals of Jacques Vallee 2000 - 2009

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This is an astonishing book, and on a number of levels. I learned much about the author, some of which I knew, some of which I had forgotten (like the fact that we had corresponded as early as October of 2007). Allow me to explain why this book moved me so, why I think it is so important to what is going on today in the American public media and the U.S. political, military, and intelligence communities, and why you should, yes, really read these pages . . . like right now.

First, the personal part. I wrote and published a chapter essay on the life and work of the author in a book entitled *Authors of the Impossible: The Paranormal and the Sacred* (Chicago: University of Chicago Press, 2010). That book features four English and French authors over the last 150 years whom I consider to be especially important to the ongoing conversation about the reality of the paranormal and its double or paradoxical translation into physical events and human experience. Jacques Vallee was one of them. The book under the present review convinced me, again, that my earlier assessment was more than correct. Jacques Vallee is that good, and that important of an author.

I should add in this same context that it was Vallee himself who initiated our Archives of the Impossible project at Rice University in 2014, an initiation that was actually a multi-year series of events that I am certain will be discussed more in *Forbidden Science 6*, presumably on the decade from 2010-2019. The Archives of the Impossible today are some actual physical archives consisting of about 15 separate collections (and well over one million documents) on different aspects of anomalous phenomena, from the UFO encounter and the abduction experience through declassified documents on the remote viewing program, to physical mediumship, paranormal pop-culture, and New Age evolutionary spirituality. In the last two years, I have personally hosted two international conferences on the same archives to an enthusiasm that simply broke all of our academic assumptions and models. To give you some sense of what happened: a normal academic event might get 500-1000 views in its entire life; our first conference in March of 2022 garnered 150,000 views *in two weeks*.

Much of this overwhelming interest was due to the presence and vision of Jacques Vallee, who convinced me to envision and then enact the archival project with our Director of Woodson Research Center (our special collections unit). For personal and professional reasons, Jacques's own archival donations are on moratorium for ten years. That is, they are not available for research or public inspection. Confidentiality and secrecy are thus woven into the original gift and are clearly on display again in the present journals.

"Display" is chosen deliberately. Vallee's argument about the phenomenon works in paradoxical ways (much like the phenomenon itself). He consistently insists that the phenomenon communicates itself in both physical *and* paranormal ways, that is,



that it works in *both* dimensions, not in one or the other. Yes, there is a physics involved. Hence, all the careful attention to material detail--landing marks, the flight of apparent objects, burns, deaths, injuries, and wild physical coincidences in the immediate environment. But, the actual physics displayed by such objects do not follow our present models. There are too many behaviors to list here that are well-known; the phenomenon clearly violates our naive notions of linear time. Words like past, present, and future cease to seem as fixed or absolute. Space-time becomes hyperdimensional.

Yes, there is also a biology involved. Hence Vallee's keen interest in bodies and their various physiological and neurological responses to the phenomenon--a kind of "read-out" to invoke the immunologist Colm Kelleher, who appears throughout these journals. But what Vallee calls the "paranormal realities" go well beyond physics and biology, beyond the sciences entirely, into a set of imaginal displays, a kind of physical-spiritual theatre that we should watch with great interest (I reject, utterly, the common religious notion that we should ignore such things for the sake of some contemplative goal) but not, please note, take too literally. This is precisely what so many do, of course, including in Washington, D.C. today. Human beings believe what they see or, worse, what they are told. They interpret things as if their appearances and rumors were what is actually so.

They also follow the reigning ideology and mythology of their place and time, in our own case, some kind of secular physicalism or reductive materialism. And so we end up with something like the ETH or Extra-Terrestrial Hypothesis, an astrophysical or science-fiction framework that Vallee continuously rejects as naive and inadequate to the phenomenon itself (since the ETH can actually explain very little about the full phenomenon, which overflows into all kinds of *bizarrie*). As a historian of religions who is trained to be suspicious of any and all belief systems (including secular and scientific ones), I can only celebrate this radical doubt and long-learned skepticism. Why we should reject every other belief system in its literal form, *except this one*, is simply beyond me.

The older demonological framework, about which we know a good deal--historically, sexually, and theologically--is even worse (but is perhaps a good reminder here). The demonologies (comparatively speaking, there are hundreds, if not thousands, of them) carry some truth, as Vallee himself acknowledges in an appropriately dark and suspicious mood, but they themselves are deeply problematic and almost certainly are reflections or reflexes of our own primate fear before, well, we do not know.

There is a particular recurring image in these journals that seems especially significant: the religious art

of the stained-glass window. Vallee writes of how he and his late wife, Janine, helped out with the restoration of stained-glass windows in the Cathedral of Our Lady of Chartres. He also writes about creating his own stained-glassed windows in his San Francisco home, which I have seen and written about in the aforementioned chapter essay (I also thought these were especially significant then). Such windows display mythical and religious figures (Melchizedek, a rose, and a goddess, for example), but they also filter and shape a pure white light from outside the study entirely. That doubleness--the light as light, and the light as mythical theatre, apparition, or display--is important again. In one of the windows, there is a little mischievous demon that refracts and scatters the pure white light. Seems about right.

There is another aspect to this doubled view that comes into gradual but rather clear focus in the present journals. Vallee has a long history of interacting with government, military, and corporate institutions, often around the phenomenon itself. He argues, in coded ways, that there is likely a very secret "black project"; that it is probably in the corporate world and not the government or military worlds (and so beyond any and all FOIA regulations or even political need-to-know); and that--and this is key--that *the possessors of the secret do not themselves understand what they possess*. They, too, are basically clueless. In simple terms, there is indeed an actual secret, *but no contemporary human being or organization understands it*.

And probably cannot. This is the other thing one takes away from Vallee--that there is something eerily or cosmically non-human about the phenomenon; and that, accordingly, our evolved cognitive, sensory, and imaginative capacities are inadequate and always will be. The phenomenon thus tries to communicate in the only way it can speak to us, that is, through symbol and myth, but we are always messing up the message, mistaking the imaginal form for the actual content, as it were. We are fooled by the stained-glass windows, confusing them with the light outside. We are focusing on the light scattered by the tricky demon instead of on the light itself. Today, then, we are always turning everything into a "threat," or a promise of a new propulsion technology or free energy from the quantum vacuum, when, in fact, the phenomenon could care less about our political, military, or capitalistic interests. There is, in the end, then, a certain profound ethical impulse at work in Jacques Vallee, but it is not our own. And that which is truly ethical emerges from that which is truly non-human, cosmic, and ecological in the broadest and most radical sense.

We also miss the deeper esoteric message that is the "intersign," anomaly, or synchronicity of the phenom-

enon--the wild coincidence that is no coincidence, the paradoxical sign that points to the fact that everything is connected within an invisible but active information network. Only a combination of science and esotericism, a "forbidden science," can begin to plumb that hidden information network. That the history of science itself likely began within esoteric convictions and invisible colleges is highly relevant in this context. What one eventually sees is that Jacques Vallee is precisely such a secret scientist. He does not want to practice a science or an esotericism. He wants to practice *both*. And so he does. This is finally what a "forbidden science" involves: a double approach to a doubled appearance of a unified or connected reality.

There is so much more in these pages still. One is reminded, for example, that Vallee was trained in remote viewing by none other than Ingo Swann; and that Vallee himself helped create the coordinate system that became the classical remote viewing technique in Palo Alto in the 1970s. Such a technique was based, in turn, on the information theory of computer science (Vallee holds a Ph.D. in computer science and AI from Northwestern University) but was never fully theorized as such. One also learns in these journals that it was Jacques Vallee who helped create the data organization and software programs for what became BAASS (Bigelow Aerospace Advanced Space Studies), a secret government-sponsored UFO research program that was first revealed in in the *New York Times* in December of 2017 by Helene Cooper, Ralph Blumenthal, and Leslie Kean and then written about more extensively, from the inside now, by James T. Lacatski, Colm A. Kelleher, and George Knapp in *Skinwalkers at the Pentagon: An Insiders' Account of the Secret Government UFO Program* (2022). The latter three authors, like Vallee himself, insist on the doubled technological and paranormal aspects of the phenomenon. They report, in effect, on another forbidden science.

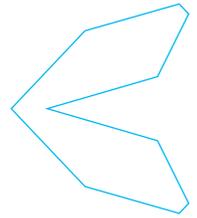
Do I have any reservations about this book? Some. I always quietly react to Jacques's rejection of some of the wilder aspects of the human religious imagination and its encounters, for example, around instectoids and psychedelic experience. Vallee wants to keep everything on his table except, oddly, these things. Perhaps this is a result of where he has lived for so many years--in the Bay Area of San Francisco, in "Pacific Heights," as the subtitle of these journals has it. He has seen a great deal, of course, and he has reason to be suspicious. But a thousand bad trips

and a hundred lost lives do not erase a single psychedelic revelation of reality or, for that matter, the removal of the fear of death such revelations sometimes bring. The scholarship on the psychedelic humanities, for example, is quite serious and international now and extremely sophisticated. It would resist such resistances. People have esoteric and paranormal encounters with reality on psilocybin. Philosophers change their minds dramatically, because of the plants (or toads). Humans "become" God on LSD. They also encounter instectoid presences or mechanical bugs in their bedrooms. *These things happen*. It does no good at all to write such moments off with deflecting words like "drugs" or associate them with paranoid conspiracy theories, which, of course, abound in this realm.

But are not these conspiracy theories also part of the data, part of the human response? And why not? The phenomenon is indeed mind-bending and likely *inherently* elusive, deceptive, and tricky. Reality really does dissolve, then. Is not this the ultimate conspiracy theory, even if the deconstruction also involves the deconstruction? But, really, these are the only moments where I flinched and wished for something more, where I wanted Jacques Vallee to be more Jacques Vallee, where I wanted suspicion of the suspicion.

There is actual talk of "non-human intelligences" and "intelligent or extraterrestrial technical supremacy" in the U.S. Congress and media as I write these lines in July of 2023. If Jacques Vallee is correct in these journals, that political conversation will grow (and almost certainly screw things up in the process). But we will not begin to understand what is happening until we can practice a forbidden science with Jacques Vallee, that is, take the esoteric as seriously as we take the scientific. That will mean, in practice, hiring anthropologists, philosophers, and historians of religions and esotericism alongside rocket scientists, astrophysicists, biologists, and propulsion experts. Obviously, we are not there. Not even close.

Finally, reading these volumes, I was so struck by their prescience. It is as if the events Vallee is writing about in the first decade of the twenty-first century are back again, but with a new clarity and a new public obviousness. What was predicted twenty years ago is now more so, only we are still messing up the story. Let's see what happens now . . .



RE: Thermotropy Exploratory Study

CORRESPONDENCE

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This thought-provoking article by James Weifu Lee (*Journal of Scientific Exploration*, 37: 5-16) brought to mind Thomas Gold's publications postulating a "deep hot biosphere" where life on Earth originated and which was the source of oil and gas deposits.

Gold suggested chemical sources of energy substituting for photosynthesis, but the possibility of thermotrophs lends further plausibility to this hypothesis. A search for thermotrophs in the deep biosphere seems called for.

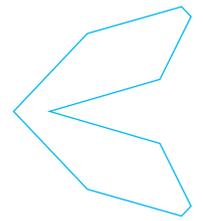
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CORRESPONDENCE

Age of Ancient White Sands, NM, Human Tracks Questioned

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In the previous issue of the *Journal of Scientific Exploration*, I published a note on recent evidence bearing upon the question of the antiquity of the presence of humans in the New World (Jett, 2023)—historically, one of the most contentious topics in archaeology. One aspect of that discussion was the alleged presence, at White Sands, NM, of a line of human footprints dated to between 23,000 and 21,000 years ago (Bennett et al. 2020, 2021). However, *JSE* readers should be informed that since the publication of these findings, some of their aspects have been questioned, as has been very recently summarized by Bradley T. Lepper (2023), a conservative thinker on this and other archaeological topics.

The principal issue is the tracks' age. The age range Bennett et al. gave was based on radiocarbon dating of associated ditch-grass (*Ruppia*) seeds. However, critics pointed out that such seeds, if the plants had grown in lake water, could have been subject to the old-carbon effect, in which the water might have contained in solution older inorganic carbon, which would have yielded a falsely old date for the seeds (Madsen et al., 2022; Haynes, 2022). The original authors replied by pointing out that their dated seeds had come from river, not lake deposits, at a very shallow water depth (Pigati et al., 2022a). Oviatt et al. (2023) and Rachel et al. (2022) then raised the possibility that these seeds had not originated at the site but had been redeposited there after having been blown in from elsewhere (as from a nearby lakeshore) and could, therefore, be of an age greater than that of the tracks.

Pigati et al. (2022b) countered with the observation that datings of seeds from multiple layers had all come in in correct stratigraphic order—not an absolute impossibility even if all seeds displayed an old-carbon effect, pointed out Oviatt et al. (2023). These points have caused many archaeologists to suspend judgment concerning the real age of the tracks.

The original papers reported what they saw as an association between the line of presumed human-made tracks and one of megafauna tracks, suggesting possible inter-specific interaction. However, Rachel et al. (2022) questioned the assertion that these tracks had been made more or less simultaneously. Further, Rachel et al. raised the question as to whether some (although not all) of the prints Bennett et al. classed as human were, in fact, such, proposing the possibility that those poorly preserved marks may, instead, be eroded sloth tracks.

Still, of these, several cited scientists who have questioned the quality of evidence concerning the White Sands tracks, only Haynes—an originator decades ago of the “Clovis-first” model of the peopling of the Americas—rejected the possibility of the human tracks being at least in part and to a degree, pre-Clovis in age.

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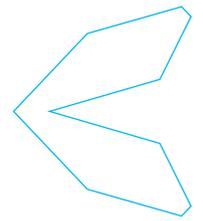


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CORRESPONDENCE

Why a Retroactive Analyzer Influence Should be Considered in Remote Viewing Research

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Müller and Wittmann (2021) used in their experiment a procedure called associative remote viewing (ARV), which refers to a specific tasking scheme within a free-response method known as remote viewing (R.V.). It allows a focus on a future event outcome when there are usually only two (or not much more) options possible. Such a protocol has been used many times to forecast, for example, whether a stock market price will rise or fall within a defined period or to predict who will win a particular sports game (an overview of relevant ARV studies is given by Müller, Müller & Wittmann, 2019). Instead of viewing the actual target event, digital photos, each associated with one possible event outcome, are used as referenced stimulus. The tasking describes a logical state: “If case 1 is the event outcome, the viewer will receive image A as feedback, and if case 2 is the event outcome, the viewer will receive image B as feedback.” The viewer should only be presented with the image that corresponds to the actual outcome of the event. According to the standard view,¹ which I strongly support, this is assumed to “close the feedback loop” using the correct associated image. When predicting that feedback image in advance, the associated event can be determined in advance as well. However, the alternative view, according to which feedback to the viewer is not relevant for the ARV process, is not disregarded.

In the experiment in question here, hit rates from two different associative tasking approaches were compared and statistically evaluated. One tasking approach related to the present condition (two statements about current world knowledge, of which only one was true), and the other tasking approach was used to predict future events (two possible outcomes of an event that had not yet occurred at the time of the remote viewing session). It was assumed that if there were no significant differences between the results of either the future predictive condition and the current condition, that would indicate a deterministic future, whereas significantly better results for the current condition would indicate a probabilistic future. Although I do not object to this logic, it can only be universally valid if the associative mechanism works reliably and cannot be influenced in the parapsychological sense by a mechanism which I will describe in this paper.

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DESCRIPTION OF THE PROBLEM

The evaluation procedure presupposes that the viewer’s description has a higher degree of correspondence to one or the other image. Simply put, the more convincing the description of a particular image, the higher the certainty for a correct prediction. However, it can happen that some descriptions in one session are highly relevant for the first image, and other descriptions of the same session are highly relevant for the second image, though the pairs of images are very different. In other words, both images were described in part. Following the hypothesis “feedback is not relevant,” one could



easily conclude that “the future has not yet been decided.” But when following the hypothesis that the viewer predicts his/her own feedback, my conclusion is that both target stimuli were accessed because an error source is responsible for two retroactive feedback signals at the same time. Accordingly, in those cases when the associative mechanism fails to work in the expected way, finding out the correct image might degenerate into a game of luck, no matter how carefully the analysis of results is done.

The first error source may occur if the viewer, at some point in the future, also receives feedback on the image that turned out to be wrong with respect to the actual outcome. When this happens, the viewer may be influenced at the time of the viewing by the experience of seeing the wrong image at the time of the future feedback, even if the viewer sees the correct image as well. But, this is a solvable problem since wrong feedback can be easily excluded by eliminating the wrong image after the judge has performed the analysis. As mentioned previously, this means that one important condition for ARV may be that the viewer should be shown only the correct associated image, and the incorrect image should be “sealed off” against the viewer’s access.

The second error source may be a retroactive telepathic connection (backward in time) between the viewer and anyone participating in the experiment and analyzing the correspondence between both images (either before or after the feedback time). More specifically, I term this a *retroactive analyzer influence* since the subsequent analysis process (after the session) may be a potential source of affecting the viewer’s result. What does that mean? An important assumption many people make in ARV is that if the viewer is never given access to the incorrect image, then that effectively “seals off” that image from the viewer’s access. However, if there is a retroactive effect, that effectively makes both images available to the viewer at the time of the session.

The implication is that the associative mechanism can have its own failure sources independent of the act of remote viewing and that the analysis process can influence what the viewer perceives, independent of the assumed predictability of the target event (whether present- or future-time condition).

Loopholes in the Müller/Wittmann Experiment

As described in the Müller/Wittmann experimental procedure, the principal investigator (P.I.) prepared the image pairs for both time conditions. While this investigator received the results trial-by-trial, the viewer and

the judge received feedback for the present-time condition only after 50 sessions when all five viewers had finished the first block. Besides creating the target pools, the principal investigator performed the administrative work for the experiment but otherwise played no further role. However, he may still have unintentionally contributed to a retrocausal telepathic feedback loop. This would contribute to a better result for the present-time viewing condition. The reason is because the P.I. would always have the correct image in mind since he would have already known the correct outcome as he was preparing the target sets. This would especially be the case if the P.I. was motivated by curiosity to see whether or not the session results reflected the target image.

So unconsciously, the principal investigator could possibly have “sent” information about the correct image (since the correct image would be dominant in his thoughts) via the retroactive analyzer influence backward in time to the viewer—similar to the way a viewer may be able to “send” information backward in time along his or her own unconscious path to the time of the viewing event.

Because the viewers received no trial-by-trial feedback for the present-time condition, this could have increased the likelihood that the principal investigator took over the role as “reflector” on the timeline—and so both worked together as an information gathering team. Possibly, the same applies also for the judge in the latter period of the experiment.

Under the future-time condition, the analyst—no matter whether the principal investigator or the judge (or other relevant individuals) is meant—has no preference for either of the two images at the beginning of the analysis. In contrast to the present-time condition, the analyst is more deeply involved in a comparison mode. If we assume the possibility of an unconscious path via the retroactive analyzer influence, then it would be possible that there are two different signals, each originating from one of the two images as the analyst mentally perceives them during the analysis process. These signals could overlay, dominate, or replace the correct precognitive signal to the viewer from the actual feedback. This could cause the viewer to partially perceive both images (or even the wrong one exclusively) and easily lead to a worse outcome for the future-time condition.

In Müller and Wittmann (2021), the authors discussed the possibility that motivation and concentration may have biased the data in the block design. But, they did not consider the possibility of a “placebo effect” (the viewers knowing that the first target block 1-10 was present-time related could be psychologically relevant for some) since it is not an uncommon belief that the present is easier or

more reliable to view.

What I have explained above offers an alternative explanation of why the viewers obtained better results in the present-time condition compared to the future-time condition. This explanation would be independent of the assumed relation between hypothesis H2 ($\text{effect}_{\text{present}} > \text{effect}_{\text{future}}$) and a probabilistic future as proposed by Müller and Wittmann (2021). Accordingly, it seems questionable whether comparing hit rates under present- and future-time conditions to decide if the future is probabilistic or deterministic is conclusive.

BACKGROUND AND RATIONALE

It is often argued that the term retrocausation can be interpreted as another way of referring to either precognition (that is, information-related) or to retroactive-PK (that is, action-related). Retrocausation, used in the sense of a connection from one mind to another mind backward in time, receives comparatively little or no attention. Therefore, it seems appropriate to consider a retroactive analyzer influence as a subset of precognitive telepathy,² from different contexts.

1. Historical Background:

The concept of future-related telepathy goes back to Whately Carington, who realized that telepathy need not be a “now or never affair” when he postulated the displacement effect from his experimental results (Carington, 1945, pp.31-32). Subsequently, the same effect was noted in the work of Soal & Goldney (1943), and revisited by J.B. Rhine as precognitive telepathy (Rhine, 1953, p. 92). In the post-Rhine era, research focused on the replication of psi-data, while at the same time, there was a tendency to consider psi categories (like telepathy, precognition, direct target access, etc.) as less relevant. Some even believed that such categories are misleading and prevent deeper understanding (e.g., Shoup, 2002).

2. Consideration in Known Experiments:

To prove the existence of direct target access (also called clairvoyance) in forced-choice experiments in their automated procedure, Targ & Tart (1985) eliminated “feedback to the percipient and/or telepathically mediated feedback wherein the percipient ‘reads the mind’ of an experimenter or observer who later observes the target set.” [emphasis added] Since the procedure and results were not directly transferrable to remote viewing, Targ, Targ, and Lichtarge (1985) conducted a subsequent free-response experiment. Again, the possibility of any type of retrocausation was eliminated: “A system of data handling was

arranged such that no single person (neither viewer, nor experimenter, nor judge) ever knows which non-feedback slide was projected during any given trial, or whether the viewer’s response to any given slide was correct.” Under the non-feedback condition, a p-value of 0.05 was achieved. In addition, not only did the feedback sessions not score better, they even failed to reach significance at the 5% level. I cite this experiment not because of the outcome but to demonstrate once again that the concept of retroactive telepathy (and more specifically, the retroactive analyzer influence) is not inconsequential and has been considered in serious experimental research.

3. General Theoretical Background:

Walker’s quantum mechanical theory (1974/2015) applies to consciousness and psi phenomena. He described a time-independent coupling between a recipient and an experimenter. In experimental mind-matter research, Schmidt (1993) reproduced a retroactive-PK effect under highly controlled conditions where influencing periods start after a random distribution has already been recorded. Costa de Beauregard (1987) has described retroactive-PK as a natural effect in his quantum-relativistic theory. He emphasized that retrocausation never means “reshaping the past but it does mean shaping the past.” This raises the question: is there a relationship or equivalence between retroactive-PK and precognitive telepathy, and if so, what does that relationship amount to?

4. Other Authors in the Field of Remote Viewing:

Brown (2006, p. 44) proposed that analysis can influence the session backward in time and that a session is not “closed” before the analysis has been finished: “‘Closing’ a remote-viewing session is done by the first person who seriously examines the remote-viewing data obtained in a session. This person does not need to be the remote-viewer.” He thus describes what I have called the retroactive analyzer influence. But in contrast, I do not see the need to introduce “a first person.” My view is that a backward-in-time causation can be connected to the viewer via feedback (thus precognition), to the analyst (thus the retroactive analyzer influence), or to both at the same time (superimposed).

5. The Experimenter Effect in Parapsychology Research:

From a broader perspective, in standard parapsychological experiments, there is often a well-known experimenter effect present, as re-examined by Parker and Mil-lar (2014). This indicates that the experimenters’ biased

opinion as to what the result should be could influence the result through some as-yet undetermined psi-mechanism. But, in this research, it is usually not explored from where on the timeline the experimenter's own psi might influence the result. Some may believe that this question is irrelevant. However, it seems plausible to assume that this effect is likely to be most powerful when analysis is performed, i.e., after the viewer has finished the session. It is at this point that the thoughts of the analyst are absorbed in the experiment and its results. So, a retroactive analyzer influence might be interpreted as a time-independent experimenter effect.

THE RELEVANCE OF FEEDBACK

In their paper, Müller and Wittmann (2021) took up the controversy of what the source of information is: Does it come from the target itself, from later feedback, or from one of a number of possible futures? (They hypothesized the latter possibility, seemingly to more easily support their conclusion that the future is probabilistic rather than fixed or determined.) The authors stated: "In the present study, we gave feedback for both time conditions, but the hit rates still significantly differed. Therefore, feedback cannot be used as an axiomatic explanation for observed Psi effects." This suggests that a statistical comparison for both time conditions requires equal test conditions. But this raises the question: How can the authors assume that feedback (at the end) for the present-condition, and trial-by-trial feedback for the future-condition, are the same? In general, I would expect feedback that is given at the end of the total experiment, rather than at the end of each individual trial, to be less effective, if it isn't altogether useless (because it raises a significant risk of displacement conflating the results).

At first glance, this assumption seems to contradict my objections since the condition of no trial-by-trial feedback led to the better result. I would suggest, however, that according to the reasoning above, it is not a contradiction when considering the much more complex interrelationships that would apply in a retroactive analyzer influence scenario. The authors' overly simple assumption about feedback adds unnecessary complication to the analysis of the experiment and gets in the way of a sound conclusion.

However, the same conclusion about feedback arrived at in an earlier experiment by Müller, Müller, and Wittmann (2019), to which the authors also referred, may offer a clearer explanation. In that study, ARV was tested to predict the German stock index DAX. In 38 out of 48 predictions conducted by 15 viewers, a highly significant hit rate of 79.16% ($p = 2.3 \times 10^{-5}$; $z = 3.897$; $E.S. = 0.56$) was

reported. To simultaneously investigate whether or not feedback is a necessary prerequisite for the ARV process, half of these sessions were designed with trial-by-trial feedback to the viewers and the other half without any feedback at any time. The authors concluded that "feedback seems not to be a necessary requirement for the process," based on the fact that a statistical comparison between feedback and no-feedback conditions showed no significant difference in the hit rate.

But once the session "monitors" (the term used by the experimenters for those who not only monitored the viewers during the session but also performed the analysis and judging) became aware of the actual result of the trial, it is possible that they could have "shared" the correct feedback via precognitive telepathy/retroactive analyzer influence with the viewer, especially when re-analyzing the session with full awareness of the actual outcome. This could explain why there was no significant difference between the feedback and no-feedback conditions in their previous study. It can, therefore, be only tentatively concluded that a viewer needs no feedback.

I suggest this for the following reasons. First, according to my hypothesis, it is possible that under certain circumstances, the experimenter would be the one who closes the feedback loop (the retroactive analyzer effect). Second, the assumption that there is no need for feedback can be only correct as long as the viewer and experimenter have not previously become "entangled" (that is before someone in the experiment has become consciously aware of the actual result). Being "entangled" before the results are known increases the risk of the viewer receiving two different signals, each originating from one of the two images as the analyst mentally perceives them during the analysis process, as argued for the experiment by Müller and Wittmann (2021).

Moreover, what actually happens can depend on many factors: the viewer, the experimenter, tiny details of the experiment, or coincidence. Not taking this complex situation into account can lead to the dangerous conclusion that it does not matter whether the viewer sees both images in (for example) ARV,³ simply because of the premise that receiving no feedback leads to better results than receiving it. I would assume that it is better for the outcome if viewers receive no feedback than to see a wrong feedback by receiving both feedback images—but it is best for sustainable good results when viewers receive only the correct feedback stimulus in a trial-by-trial feedback.

Finally, Müller and Wittmann (2021) referred to (1) May et al., 2014; (2) Targ et al., 1985; and (3) Müller et al., 2019 to support their conclusion. But the following should be taken into account:

- (1) In the referenced study by May, Lantz, and Piantanida (2014, pp. 104-116), the feedback issue was simplified by focusing on visual feedback *intensity*. The researcher postulated that if precognition of the feedback is the underlying mechanism for ESP (“anomalous cognition”), then the result should show a linear relationship: “The more information in the feedback, the higher the quality of the A.C. (anomalous cognition). That is, the more information in the receiver’s future, the more A.C. in the session.” Under the condition that “even the strongest display intensity was insufficient to provide a ‘satisfying’ study of the target material,” the result was: “None of the data showed significant correlation of feedback intensity with A.C. quality.” My objection is that nothing can be concluded about the question as to whether it is the intensity that matters. Consider the possibility that it is actually the *content*—the mentally perceivable *meaning*— of the target that catches the mind’s attention (whether the mechanism for that is conscious or subliminal in nature) through recognition of what the image *contains*. As a consequence, if my objection is correct, the result would be that the relationship between the intensity of feedback and the quality of ESP is perhaps less relevant than the meaningful content of the target, and therefore, there is no contradiction with the concept of feedback-mediated precognition.
- (2) The relevant study for remote viewing (as I have referred to above) by Targ, Targ & Licharge (1985) indicates that there may be a direct target access without the need for feedback, but even though this study produced significant results, we cannot judge the validity of this conclusion without further replication under the same rigorous conditions (triple-blind to exclude precognitive telepathy). Over time, only a few forced-choice experiments have shown significant results under conditions without trial-by-trial feedback for research participants and experimenter (e.g., Targ & Tart, 1985). On the other hand, the meta-analysis by Honorton & Ferrari (1989)—a much larger database—found a strong relation between effect size and the degree of feedback in forced-choice precognition experiments. So, it appears the results for forced-choice type experiments are mixed.

In addition, there are also various experiments and experiences concluding that feedback seems a prerequisite for successful remote viewing (Puthoff, 1978; Puthoff, Targ, & May, 1978, p. 13; Targ & Harary, 1985, p. 27; Schnabel, 1995). But the crucial point should be that there are

two types of feedback: To the viewer and to a separate analyst who evaluates the session—both are possible reflectors in time which can close the feedback loop. Thus, applying the question of feedback relevance only to the viewer is likely too simplistic. Ignoring this possibility might be similar to trying to solve a mathematical equation with two unknowns, paying attention to only one unknown while ignoring the other.

IMPLICATIONS

Bem (2011) remarked: “My approach to the problem of experimenter effects has been to minimize the experimenter’s role as much as possible, reducing it to that of greeter and debriefer, and leaving the experimental instructions and other interactions with the participant to the computer program.” Such kinds of safeguards can be easily applied only to forced-choice tests and similar procedures (where the psi result is the answer to a yes/no question). In any free-response technique, the experimenter becomes potentially a psi-active participant in the procedure during the analysis phase—this is unavoidable so long humans perform the evaluation. “Post-session activities” can trigger a retroactive analyzer influence just as ordinary telepathy can be triggered when the experimenter participates in the experiment in realtime (in remote viewing, sometimes called telepathic overlay). In the case of forecasting sports events or stock price movements with ARV, this effect can be easily masked by other assumed mechanisms and factors, such as the belief that a probabilistic future can limit the success rate, yet rarely does anyone challenge these conclusions. But in the experimental situation where reliability of the associative mechanism is an absolute prerequisite to decide whether a hypothesis must be either rejected or accepted, we should question the use of ARV as an experimental research tool to answer unknowns of a fundamental nature.

This would be true whether or not the postulated retro-causative mechanism can be proven. The justified doubt alone makes this conclusion necessary. Even from a “classical point of view,” we can say that no information is safe from access by remote viewing (even the wrong target), so the reliable functioning of the associative mechanism cannot necessarily be assumed. Therefore, I do not believe that replication studies of the Müller/Wittmann experiment can shed new light on the question whether the future is probabilistic or deterministic. I believe it would be beneficial to perform experiments involving manipulated target probabilities—but with a more explicit R.V. structure rather than the problematic ARV setting, as the authors have already suggested. Targ & Targ (1986) have performed such an R.V. study, and the

result seems not to indicate a probabilistic future.

Against this background, it is natural to consider retroactive analyzer effects in remote viewing research and practice outside of ARV as well. Even if the viewer does not describe his/her own feedback, he/she may describe a feedback or a conviction the analyst “injected” time-backward into the session. This is of high relevance because it is not easily possible to confirm direct target access (e.g., to a distant location) only because realtime telepathy and precognition under the applied procedures have been excluded. Any further research into the subject “from where does the information arise,” as Müller and Wittmann have proposed, is an important future task, but should not ignore the role of precognitive telepathy/retroactive analyzer influences when designing experiments, interpreting results, or drawing conclusions from hypothesized mechanisms. As an additional future task, it might be possible to investigate the conditions under which the occurrence of a retroactive analyzer effect is more likely, and whether there are individual susceptibilities to this effect. This could also contribute to improving the reliability of ARV in its classical field of application.

ENDNOTES

- 1 According to Katz, Grgić, Tressoldi, and Fendley (2021), the importance of feedback in the ARV process is a widely accepted view.
- 2 In this article, I take telepathy and precognitive telepathy to be generic terms for a mind-to-mind connection, which could refer to two possible models. In the first model, the viewer’s unconscious mind, on its own initiative, picks up information from another mind (“reading the mind”)—where the active involvement of the other mind (the analyst) is not necessary. The second model is an “influencer model,” according to which one mind “offers” information to another mind via an unconscious channel. Independently of that, the term retroactive analyzer influence simply indicates that the analysis process after the session, performed by the analyst, is responsible for the information exchange without making further assumptions. “Precognitive telepathy” might then apply in situations where the analyst is not engaged in active analysis or similar activity, but rather, it is the residual knowledge resident in the mind of the analyst that seems to be the source the viewer is accessing.
- 3 Stephan Schwartz, the principal inventor of ARV, stated that the viewer should never be shown the second image to avoid creating more than one possible outcome. This seems to remain the most strongly held view in the R.V. research community (Schwartz, 2007, p. 160).

EDITORIAL NOTE

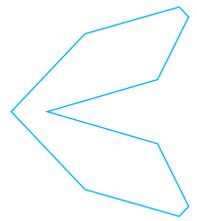
JSE invited a formal Reply from Müller and Wittmann, but the study’s authors decided it was not necessary. Specifically, they indicated in a personal communication to the Editor-in-Chief (09 August 2023) that, “Thorsten’s comment contributes to the discussion, even if it remains un-commented from our side. Remote viewing is a controversial field where different opinions should coexist due to a lack of theory that ties it all together. What Thorsten does is discuss other potential interpretations concerning the differences in effects for the present-future conditions. We agree with the given interpretations in that they are potentially relevant. That is, a future study could take up the recommendations to exclude or verify the factors that potentially could explain our findings in a way that differs from our interpretation. In that respect the author does a good job in sketching potential further studies.”

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CORRESPONDENCE

Commentary on Bengston and Nies (2023)

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Research papers should provide a complete description of the methods. Bengston and Nies' (2023) paper on the potential healing effects of "informed (therapeutic) water" neither explained how the water was prepared, nor did they cite any scientific source that contained such a description.

Specifically, reference was made to Bengston (2007) and Bengston (2010). Bengston (2007) does not describe any preparation of water. Bengston (2010) does not refer to a scientific article, but to a commercial CD, the purchase of which can hardly be expected by research colleagues wishing to reproduce a scientific research method. Furthermore, reference is made to an article in *Energy Magazine* (Bengston, 2020), but this is no scientific source either, and it also does not describe how the "informed water" is prepared.

The exact method should really be clear from the paper itself, a downloadable appendix, or cited scientific literature. Thus, a clarification of the method should be added to Bengston and Nies (2023).

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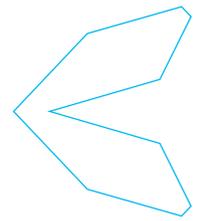
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Reply to Hiener Schwenke

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Indeed, we agree with Schwenke that in the perfect world there ought to be full disclosure of method in a scientific paper. But, in the real world all disclosure has boundaries when there are proprietary technologies in use. When there are proprietary technologies in use disclosure is achieved by some sort of balancing of competing interests, hopefully to the satisfaction of as many parties as possible.

We believe we have struck a fair balance in our paper, providing several ways that interested parties could produce the healing effect to create “informed water” that contains healing properties.

Schwenke objects to the lack of accessibility of the healing technique we used in this study.

The references actually do describe the preparation of the water. That description sometimes has been posted in peer reviewed journal articles, and sometimes published in a way to disseminate the information more widely. So, the 2007 and 2010 references, for example, were peer reviewed by scientific journals as providing sufficient information for replication. I also published a lengthy, multi-hour tutorial on how to replicate the production of water for a healing experiment. This has been widely used around the world at virtually no profit to me so that researchers could replicate, and non-researchers could experience. I submit that these two references alone present more than sufficient detail of what is necessary to replicate or experience the healing method. There is virtually nothing else that would be needed by an outside independent agent to continue the research. The fact that our 2010 reference is commercially available in no way detracts from its legitimacy as a stand-alone approach for reproducing the healing.

In many in vitro and in vivo healing studies the methods presented in my publications are sufficient for independent replication. Anyone at this point can easily learn, practice the technique, and produce treated water themselves for experimental or personal purposes.

The water preparation used in this experiment is adequately described. As mentioned in the paper:

“Approximately 6 oz of filtered tap water was treated by Bengston, using the techniques that he developed, for one-half hour. . . . That sample of water was serially diluted and succussed numerous times, and the end water product of that procedure became the basis for scaled production.”

The water is then scaled using a proprietary device. Schwenke is correct, that the device used for scaling is not fully described though the paper contains the following:



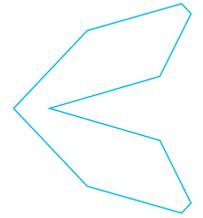
“This device was made of copper, had a hose fitting for water input and output, and a central cylinder into which the material to be duplicated was placed. The output water moves around the central cylinder.”

And while the copper scaling device may be propri-

etary and not sufficiently described to easily replicate, note footnote 4.

We will be glad to supply researchers with the informed water should they wish to replicate or collaborate.

Takers, anyone?



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Can Bayesian Statistics Be Used to Analyze Phenomena in Folk Zoology?

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In a recent issue of the *JSE*, Bauer (2022), using a Bayesian approach, argued for high odds of Loch Ness Monsters being real but unidentified animals. In this *Letter*, an alternative interpretation of the data is respectfully provided as balance for interested readers who may be less familiar with Bayesian statistics and the underlying assumptions.

The Bayesian approach to ‘updating’ odds in light of evidence (sometimes called the ‘diachronic interpretation’) is as follows.

1. The first step is to define a hypothesis **H**. In the case of the analysis by Bauer, **H** is the hypothesis that unknown Loch Ness animals are real. Conversely, ‘not **H**’ or the ‘complement’ of **H** is the hypothesis that is in some way opposite to **H** and is denoted **H^c**. In this case, **H^c** is the hypothesis that these animals are not real.
2. The probability of **H** is the ‘prior probability’, denoted **P(H)**. The odds of **H** are the ‘prior odds’ defined as $O(H) = P(H) / [1 - P(H)]$. Similarly, the probability of **H^c** is **P(H^c)**, and the odds of **H^c** are $O(H^c) = P(H^c) / [1 - P(H^c)]$.
3. Next, evidence relevant to **H** is collected. In the case of the analysis by Bauer, these are the five lines of evidence: (1) eyewitness reports, (2) surface photographs, (3) moving films, (4) sonar findings, and (5) underwater photographs. These are the ‘data’, each denoted **D**.
4. For each **D**, the probability of **D** under **H** is found. These are the ‘likelihoods’, denoted **P(D|H)**. Conversely, the probability of **D** under **H^c** is found and denoted **P(D|H^c)**. The ratio between these probabilities is the ‘Bayes factor’, $BF = P(D|H) / P(D|H^c)$.
5. The prior odds are successively multiplied by each Bayes factor to obtain ‘posterior’ odds given **D**, denoted **O(H|D)**. This is the process of ‘updating’ the prior odds. In the case of the analysis by Bauer, $O(H|D) = BF_1 \times BF_2 \times BF_3 \times BF_4 \times BF_5 \times O(H)$.

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In the original article, Bauer acknowledges that “[t]he nature of the evidence does not allow for definitively quantitative calculation of Bayes Factors” (step 4 above), and herein lies a very serious complication in applying Bayesian methods to Loch Ness, and by extension, similar cryptozoological phenomena.

As described above, the posterior odds are, by definition, the mathematical product of the prior odds and Bayes factors. If the Bayes factors are >1, then the posterior odds are necessarily greater than the prior odds, as is the case when the evidence supports **H**. Conversely and crucially, if the Bayes factors are <1, then the posterior odds are necessarily *less than* the prior odds, as is the case when the evidence does *not* support **H**, and indeed goes against **H**. Thus, while Bauer correctly argues that the “starting point [**P(H)**] matters not very much,” the likelihoods (and so the Bayes factors) matter tremendously.



Because we cannot definitively calculate the Bayes factors, Bauer assumes in the original article that each of the five lines of evidence provide Bayes factors > 1 , and so support **H**. This assumption necessarily leads to posterior odds greater than the prior odds, even when starting with a “pessimistic, disbelieving” prior probability. In other words, Bauer describes the scenario in which the evidence is “reflected in a somewhat positive Bayes Factor that would modify the low prior probability to a somewhat higher posterior probability.”

The testimonial and circumstantial evidence (i.e., non-autoptical evidence) characteristic of cryptozoology is certainly interesting and, in some cases, may well warrant serious scientific exploration, but many authors offer a different interpretation of the Loch Ness data to the one presented by Bauer. Those authors argue that the Loch Ness evidence, which includes hoaxes and cases of mistaken identity, does *not* support the hypothesis that unknown Loch Ness animals are real. In that case, the data would be reflected by Bayes factors < 1 that would modify the low prior probability to an even lower posterior probability, precisely the opposite result to that of Bauer.

Bayesian analysis represents strong statistical theory, but when applied in this way to Loch Ness, this approach fundamentally boils down to the same question as in all cryptozoological debates: Does cryptozoological evidence support the existence of ethnoknown animals not recognized in conventional zoology? Cryptozoologists may argue ‘yes’ and assume Bayes factors > 1 . Skeptics may argue ‘no’ and assume Bayes factors < 1 . By assuming Bayes factors > 1 , the analyst implicitly assumes that eyewitness reports, sonar findings, and photography *do* support the existence of Loch Ness Monsters. If, however, these lines of evidence are contested, then the opposite conclusion can be drawn. The Bayesian argument in this

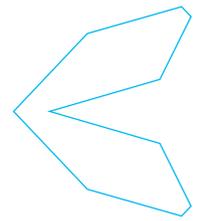
context is a circular one; if we assume *a priori* that the evidence supports the existence of Loch Ness Monsters (Bayes factors > 1), then the posterior odds will be high, and the Bayesian approach will support the existence of Loch Ness Monsters. If we instead assume *a priori* that the evidence does *not* support the existence of Loch Ness Monsters (Bayes factors < 1), then the posterior odds will be low, and the Bayesian approach will not support the existence of Loch Ness Monsters.

While the original article does admit that “many people have misinterpreted natural phenomena,” that “there are many ways to be fooled into thinking one has seen a Nessie when one actually hasn’t,” and that no known animal forms “fit comfortably with all the evidence,” the case of Bayes factors < 1 was not explored in that work. Bauer laments that ‘facts do not suffice to change long-ingrained beliefs’, and this is surely true, but what of long-ingrained belief in Loch Ness Monsters?

In the absence of evidence that allows for definitive estimation of Bayes factors, Bayesian analysis provides limited insight for cryptozoology phenomena, at least for the kind presented at Loch Ness. In other contexts, such as in medicine, astrophysics, and perhaps certain other cryptozoological phenomena, Bayesian methods can provide valuable insight and should continue to be explored in future scientific works.

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CORRESPONDENCE

Response to Foxon's (2023) "Can Bayesian Statistics Be Used To Analyze Phenomena in Folk Zoology?"

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Foxon (2023) gave an impeccable exposition of the formalities of the Bayesian procedure. Where the probabilities of the available evidence are readily quantifiable, those formal steps can be taken. But the various kinds of evidence about "Nessies" are not precisely quantifiable as to their likelihood, so subjective estimates, quantified approximately, have to be relied upon, just as they are in applications of the Bayesian approach to medical diagnosis or in considering likely candidates for authorship of the literature conventionally attributed to Shakespeare. In those circumstances, one estimates Bayes Factors directly.

For example, concerning the sonar evidence, the Bayes Factor is the ratio of (a) the probability of obtaining such evidence if Nessies are real and (b) the probability of obtaining that evidence if Nessies are not real. That cannot be quantified, but it is surely reasonable to presume that it is much more likely that frequent sonar echoes from apparently large single targets, usually deep and often moving quite rapidly, are much more likely to be obtained if large animals are present than if they are not. The Bayes Factor for sonar evidence is strongly positive ($\gg 1$) for the existence of Nessies.

As to the eyewitness reports, my original paper explained in detail why it seems unreasonable to dismiss *all* of the eyewitness reports but suggested only a quite weak positive (>1) Bayes Factor.

As to Scottish folklore featuring legends of strange aquatic animals, one would compare the probability of these reports not being mistaken sightings stimulated by expectation with the probability that the reports are all misinterpretations and misperceptions. Watson (2011) has pointed out that such reports are more frequent from Loch Ness than from other bodies of water in Scotland, which might warrant a rather weak but >1 Bayes Factor. In any case, if Nessies are real, they will certainly have been incorporated into folk tales.

Foxon seemed to criticize things that I did not say. I did not "us[e] a Bayesian approach" to "argue . . . for high odds of Loch Ness Monsters being real." I simply argued that the existence of Nessies is the simplest explanation, to be preferred under the philosophers' criterion of Occam's Razor, for the fact that five *independent* different kinds of evidence are all compatible with the existence of these animals, whereas if they do not exist, then separate and different explanations would be needed to explain the artifacts that all simulate living creatures even though obtained by entirely different techniques. I *then* pointed out that the same conclusion could be reached by successive application of the independent evidence, as in the Bayesian protocol.

Foxon further argued against the validity of a Bayesian approach *in cryptozoology in general*, but I did not propose that. Nevertheless, the Bayesian approach is just *the explicit consideration of evidence*, something that should always be done if one tries to gain

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a well-informed, evidence-based opinion about anything at all. It suits the case of Loch Ness because of the cumulation of evidence quite untypical of cryptozoology, where little, if any, evidence is typically in hand other than eyewitness reports and folklore. For Nessies, there are sonar echoes, at least one arguably unimpeachable film, a variety of surface photographs, and underwater photography with simultaneous sonar observation. As some have put it, people have been hanged on less definitive evidence.

Foxon offered a hypothetical example of “circular . . . if we assume *a priori* . . .” and refers to “authors [who] argue that the Loch Ness evidence, which includes hoaxes and cases of mistaken identity . . .”. Elsewhere (Bauer & Watson, 2023) we have discussed in detail the faulty argumentation of those who insist on certainty that Nessies do not exist.

Considerations that speak against the reality of Nessies can be treated in one of two ways: in the *a priori* estimate of a prior probability or estimating the probability of individual factors that make reality unlikely. The latter include: A type of animal not known to science but featured in folklore, misidentification by eyewitnesses, and the occurrence of hoaxes. Those three factors apply to any topic in cryptozoology, so I took them into account in assigning the prior probability. Alternatively, if one wanted to consider each of those three factors as evidence against the reality of Nessies, one would have to begin with agnosticism, 50/50 odds, and a prior probability of $p = 0.5$.

The first Bayes Factor would then concern how often have animals not known to science but reported by eyewitnesses and mentioned in folklore turned out to have some basis in real creatures not yet discovered? Cryptozoologists would happily cite quite a number of folk tales of strange creatures that turned out to be plausibly based on real animals: giraffe, gorilla, platypus; perhaps the Kraken (giant squid); and “dragon” tales, at least in China, might well have originated with fossils of dinosaurs. One might also reference the discovery of previously completely unknown *aquatic* creatures (megamouth shark) or ones thought long extinct (coelacanth). If Nessies are

real, they would surely be present in folk tales. So, a subjective estimate of Bayes Factor is “unlikely” but not “very unlikely.”

Hoaxes, too, would occur whether or not Nessies are real — hoaxers get their kicks from deceiving and will take any opportunity for that. Maybe a Bayes Factor <1 , but not by much.

As to mis-identifications, I considered that in assigning only a very low >1 Bayes Factor for the eyewitness evidence, explaining why it seems unreasonable to dismiss *all* the numerous multiple reports by independent groups of people, some of them quite conversant with pertinent environments.

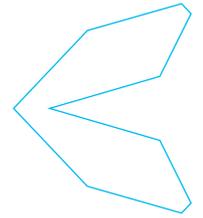
In my judgment, those three would cumulate to a composite Bayes Factor corresponding to something between “unlikely” and “very unlikely”, a probability of between 0.05 and 0.25, so a Bayes Factor of about 1/6, which seems reasonably conservative.

Using a prior probability of between 0.05 and 0.25, as I did, is the same as assuming nothing *a priori* and applying a Bayes Factor of about 1/6 in view of mis-identifications, hoaxes, presence in folklore, and as yet unknown to present-day science.

It seems that the point of contention is really whether Nessies are typical of cryptozoology: Foxon treated them as such, whereas I pointed to evidence of sonar, film, and photography that is almost wholly lacking on almost all other cryptid claims.

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Emergent Effects in Astrology

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McRitchie (2022) presents a review of research designs in astrology with examples of each design to identify those most likely to yield useful results. He suggests that the complexity of a birth chart brings “emergent properties” not possessed by the individual parts and concludes that science is now finding “more accurate astrological descriptions of potential and emergent worlds than is humanly possible” (p. 714).

But this conclusion is premature. Astrology is based on Greek mythology and ancient imaginings rather than empirical observations. It is seriously flawed both philosophically (Kelly & Saklofske, 2023) and scientifically (Dean *et al.*, 2022), well beyond the levels popularly recognized by critics and routinely dismissed by astrologers.

Against this, McRitchie claims, “recent astrological research and a meta-analysis ... is tackling problems and improving results.” But, his “meta-analysis” (p. 711) is not a valid meta-analysis (one that includes all relevant studies, positive or negative, together with a secondary statistical analysis to assess the outcome). Instead, it is just ten studies cherry-picked from the hundreds available (Dean *et al.*, 2022). The history of science tells us that reliable conclusions are not going to arise from this kind of thing, which now includes McRitchie’s claim that an emergent super-human revolution is happening.

His claim also conflicts with the actual practice of astrologers, where the idea of emergence never arises, just as it never arises in similar symbolic systems such as the Tarot. Why? Because there is always enough symbolism to meet any demand for a fit. In any case, the supposed emergent properties would require a compelling theoretical rationale quite different from those found in philosophy and science, where emergent properties arise only via physical processes, as when hydrogen and oxygen react to form water. Until this is provided, it is unclear whether McRitchie’s “emergent effects” can mean anything (Kelly & Saklofske, 2023, p. 66).

His claim faces two further problems. The first is that astrologers who unwittingly use wrong birth data (off by hours, weeks, years, it makes no difference) invariably find that the *birth chart still accurately fits the client* (Dean *et al.*, 2022, pp. 856-859). The same is true of charts where individual meanings have been reversed (pp. 304-309). It means that accurate birth charts are not needed for well-received readings. Nor can they be a reliable guide to reality. So, how is it possible for controlled tests to report positive effect sizes? Ironically, an answer is provided by the second problem, which involves controls.

Present methods of control work by shuffling birth data between subjects while keeping everything else unchanged. But, they do not discriminate between effects due to astrology and effects due to prior knowledge of astrology. If the owner of a birth chart containing X behaves in an X-related way, is it because her chart contains X (hooray for astrology) or because she *knows* her chart contains X (hooray for role-playing)? The pos-

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itive effect of role-playing in astrology was demonstrated nearly fifty years ago (Delaney & Woodyard, 1974) and since then has been amply confirmed (for a review, see Dean *et al.*, 2022, pp. 214-215, pp. 768-770). It is a problem because shuffling birth data randomizes the astrology indicated by birth charts but not the prior knowledge held by subjects, which independently creates astrology-like effects and the false impression that astrology is directly responsible. Shuffling is not an effective control.

Furthermore, astrology is sufficiently popular to make prior knowledge of astrology a potential confound in every human population used to test it (Kelly & Saklofske, 2023, p. 41). Especially as people don't need to be aware of their prior knowledge because it can still operate subconsciously to cue their behavior (Bargh, 2017). Indeed, since "astrology is supremely flexible and there is no brand of human thought or belief with which it is incompatible" (Campion, 1987, p. 9), and "there is no area of human existence to which astrology cannot be applied" (Parker and Parker, 1975, p. 81), we might expect prior knowledge of astrology to give positive effect sizes (rather than zero effect sizes) in all areas of human life.

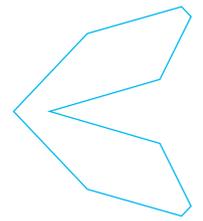
Similarly, given that astrology has no known physical explanation (gravity, magnetism, radiation, quantum effects), the observed small positive effect sizes are more plausibly explained by prior knowledge than by some mysterious unknown-to-science property of astrology (Dean *et al.*, 2022, pp. 712, 736).

In other words, until the examples quoted by McRitchie are independently replicated with research designs known to rigorously exclude prior knowledge, discussion of their relative merits and of supposed emergent effects will be premature. It doesn't help that critics tend to underestimate the strength of the case against

astrology, while astrologers focus on symbolism, looking for what fits, and ignoring the rest.

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Defense of Emergent Effects in Astrology Research: Rebuttal of Dean and Kelly (2023)

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For the benefit of the larger community, and especially for those who might want to do their own research, my essay (McRitchie, 2022) introduced a more formal approach to focused *single-factor* and *multifactor* experiments regarding their design criteria and limitations. Then, I describe a third test design, *whole-chart* experimentation, that has languished on the sidelines for more than a decade but has been revived and automated to become highly objective (Godbout, 2020).

Additionally, recent research has made improved use of effect size metrics and meta-analysis (Currey, 2022) that make better sense of the big picture¹. This leads to a discussion on the explanatory concepts of emergent effects. I wrote the article to deter critical negligence and scientific misconduct, i.e., to reduce the number of ill-conceived and improperly analyzed studies that reach publication.

While Dean and Kelly (2023) carefully ignored nearly all the substance I presented, they exercise a very old rhetoric of claims that dates back over a thousand years. Their apparent intent is to impugn the whole of astrology and avoid the current findings and topics as not worth discussing. I have argued against their claims before (McRitchie, 2016), but let us consider what they offer now.

Emergent Effects Claim

As astrology deals with complex but measurable processes, I argue that the best way to think about these processes is to consider *emergent effects* (strengths of emergent properties). In disagreement, Dean and Kelly argue that emergent properties do not apply to astrology as it would require a “compelling theoretical rationale” that is “different from those found in philosophy and science.”

Yet, the rationale is not different. Emergent effects models, such as the decision trees currently used in whole-chart modeling, are directly applicable to astrology as they simulate the mental combinatorial processing that astrologers use in their consultations. This is indeed perfectly consistent with “the actual practice of astrologers” that Dean and Kelly state they accept.

The best way to study any kind of effect is through experimentation that would either support or falsify a conjecture of outcome. Doing this, the research program is finding formidable, experimentally replicated results. Contrary to what many critics try to suggest, astrology research does not depend on traditionally understood *physical causes* and *mechanisms* for its effects. As I explain in the essay, it is the *effective information* that emerges according to the theory that is significant. When models of effective information are applied to the data, it is hard to argue with the facts.

The leading example is an inherently objective automated chart-matching study by researcher Vincent Godbout (2020) that uses a *semantic proximity model* to evaluate

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emergent effects. Dean and Kelly do not criticize or even mention it. The machine far outstrips its human counterparts in combination *semantics* (meanings), resulting in both high effect sizes ($r = .42$ to $.63$) and extremely low probabilities against chance ($p = 1.7 \times 10^{-4}$ to 3.9×10^{-8}). Godbout's study (and others that I list) challenge Dean and Kelly's claims with strong new evidence. Yet they remain silent on all positive results.

Origins Claim

Dean and Kelly argue that my conclusions are wrong or at least "premature" because astrology has its origins in the "ancient imaginings" of Greek mythology. Besides ignoring all the astrological observations and discourse recorded on clay tablets from Mesopotamia that predate Hellenistic Greece, attacking a claim's origins is a spurious argument. It is a *genetic fallacy* that the editors and reviewers of academic publications reject because it does not demonstrate whether the claim itself is false. It is well acknowledged by historians of science that modern theories emerged out of not-scientific imaginings.

As an extension of their origins claim, Dean and Kelly cite an unpublished paper by Kelly and Saklofsky (2023, pp. 1-2) to make a murky issue out of "symbolic systems" and suggest that the very old symbols of astrology can mean anything, which they do not. Symbolism is not a practice peculiar to astrological connections, relationships, and meanings, nor are they confined to the ancient past.

At their origins, many scientific disciplines have based claims on symbolism, metaphor, and imagination. Current disciplines have used these to generate hypotheses, which are then subject to testing. A famous example is August Kekulé's reverie or wakeful-dream of the alchemical ouroboros symbol, which he said led him to propose that the atoms of the benzene molecule form a ring.

Wrong Chart Claim

In another argument, Dean and Kelly claim that "accurate birth charts are not needed" because clients sometimes accept consultations based on accidental use of the wrong chart. But this is merely *anecdotal evidence*. Presently, I do not know of any well-designed studies of acceptance of wrong chart consultations or of a potential *placebo effect* (which doubtless exists in astrology as it does in medicine), but the *burden of proof* is on those who make the claim.

Self-Attribution Claim

Dean and Kelly claim that "shuffling is not an effective control" for test subjects who have "prior knowledge

of astrology" because the subjects would tend to comply (perhaps unconsciously) with what they know about their astrological (Sun-sign) attributes. Presumably, this false *self-attribution* condition operates in the same way that people might misdiagnose themselves with an imagined medical or psychiatric condition that they do not really have.

Pressing this argument, Dean and Kelly claim that astrology is "sufficiently popular" and that knowledge of it can confound astrological experiments for "every human population used to test it." So insidious is this self-attribution claim that its authors may fail to appreciate what they are saying. Assuming the claim were true, it would make not only astrology testing—but *all tests of personality*—unreliable.

Fortunately for the human population, a recent experiment by Currey (2023) that uses Dean's own data in an Eysenck Personality Inventory (EPI) test does not support the claim. Many people within Western influence know some traits of their Sun signs, but very few know anything more than that. Dean, in his original EPI experiment (1985, p. 9), states: "Because few people know the sign position of the other planets and the Ascendant, a self-attribution cannot apply to these factors." This observation is important.

As the Sun, Moon, and Ascendant are independent variables, and each plays a strong role in personality, Currey tested EPI results for these placements and found the Moon and Ascendant to be independently significant ($p = .005$, $r = .13$) in corroboration with traditional astrology (in addition to the Sun $p = .003$, $r = .18$). Thus, Dean's claim of self-attribution is wrong by his own criteria by using his own data.

No Physical Explanation Claim

Finally, the forever imperishable (it seems) arguments are trotted out that there is "no known physical explanation" for the "observed small positive effect sizes." Firstly, not only is it a mistake to disregard any experimentally replicated effect, but the effect sizes in the newer multifactor studies tend to be medium to large. Secondly, the "no known physical explanation" argument is specious *scientism*. Many scientific findings of effective information are usefully applied without knowing a physical cause.

From history, there is the example of Ignaz Semmelweis, who understood the significant results of hand washing on the rate of childbirth mortality before discoveries by Louis Pasteur and Joseph Lister developed germ theory as the cause of infections. Also, Alfred Wegener described the origins of continents and oceans, which he

called “continental drift,” because there was significant evidence of it even though plate tectonics had not been discovered as the cause.

The human mind craves the sense of freedom and security from knowing simple material causes to easily interpret and quickly deal with phenomena, and it dislikes the ontologies that emerge from contributory models, theories, and correlations. All complex models and theories, whether scientific, are suspect because when generalized into an imposing metaphysical worldview, they tend to take on too many wrong assumptions that do not fit contrary experiential and correlational evidence, which is consequently ignored and even scorned. As there are scientific models, religious models, philosophical models, medical models, economic models, political models, psychological models, language models, and astrological models, among many others, there are deep and valid issues of limitations and open-mindedness to be sorted through (Phillipson, 2000, pp. 171-181).

Replication and Pro-Replication

Apart from the problems with their arguments, I fully support Dean and Kelly’s endorsement of the need for independent replication of positive results. Doing so would have made for a different and better criticism from them. To this entreaty, I would add that there is an equal need for independent replication of published negative results where reliable source data is available (either published or on request). Negative replications entail a critical assessment of a study’s research design, protocols, and analysis with corrections where necessary. In observance of this rule, I included examples of reversed (*pro-replicated*) negative studies in my essay.

A good pro-replication example comes from the detailed reappraisals by Suitbert Ertel (2009) and Robert Currey (2023, pp. 76-80) of Shawn Carlson’s famous 1985 double-blind chart-matching study published in *Nature*. Ertel showed a significant probability that the positive evidence was not due to chance based on Kendall’s *tau* for ranked results ($p = .037$; $ES = .10$; $N = 100$). Currey’s multivariate regression analysis of the same data shows that there was a good agreement among the astrologer participants in rating correct matches above false matches with a high level of consistency ($r = .57$).

CONCLUSION

It is sad to see that the once great researcher Geoffrey Dean who, from his initial brilliant 1977 book *Recent Advances in Natal Astrology* with co-author Arthur Mather—that had inspired a generation of researchers including myself—has over the years fallen into routine

recitations of the old “astrology cannot be true” arguments dating back to Cicero and Augustine; as well as the pitfalls of scientism and its attendant fallacies. Yet, as the better-equipped and more recent research in astrology moves on and continues to discover consistent, effective information, the meaningful connections and truth values at the basis of astrology will have important consequences for science and philosophy.

ENDNOTES

- ¹ In response to Dean and Kelly’s criticism that there were no astrology tests with negative results included in Currey’s meta-analysis, the title of that study specifically states that it covers the years 2020-2021. During that period, there were ten studies published with positive results, and there were no studies published with negative results.

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The editorial team eagerly welcomes Cindy Little as our dedicated media specialist — a strategic liaison for public relations (PR) and education campaigns about *Journal* content and its implications for model-building or theory formation across the scientific community (contact: jsemedia@scientificexploration.org).

She obtained her Ph.D. in Educational Psychology from Baylor University and has taken parapsychology courses through the Rhine Research Center. Dr. Little is currently a researcher with the Institute for the Study of Religious and Anomalous Experience (I.S.R.A.E.) and teaches parapsychology courses online at Udemy and locally at McLennan Community College. She is also an instructor in Baylor University’s Department of Educational Psychology, where she teaches courses on research methods and human development. Her professional interests include field research on haunt phenomena, citizen science applications to anomalistics, and fostering a strong online presence to help bridge professional scientists and the global community of students and amateur researchers.



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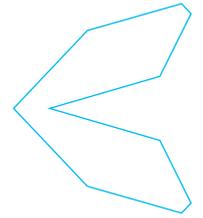
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A. REGULAR ARTICLES (11K WORDS MAX)

Primary research or interesting and important theoretical papers that foster the diversity and debate inherent to the scientific process. This entails novel or innovative ideas that have some 'fragmentary' experimental or empirical support but which can be evaluated with logic and open-mindedness to present academia with provocative hypotheses that would otherwise be rejected by most conventional journals. Additional requirements are as follows:

1. All empirical results that have not been replicated should be called 'preliminary' with the findings treated as such. Peer-review and publication priority will be given to studies that are (a) pre-registered or (b) replications. Note that 'replication' can involve repeating the research procedure in a (nearly) identical separate study to be reported within the same paper (e.g., 'Study 2: Replication'). Or, large datasets can be divided randomly into 'Training' and 'Test (or Validation)' sets, i.e., the research findings presented are those results that replicated in the Test set.
2. To promote stricter transparency and context for readers, all analyses where appropriate should provide effect size statistics in the form of direct percentages of either *association* (correlative analysis) or *mean percentage differences* (ANOVA, *t*-tests, etc.). In the case of correlative analysis, reported results shall report R^2 to provide a covariance percentage estimate. Mean tests shall provide a 'percentage change' indicating the actual percentage change between groups (e.g., $M = 3.44$ Group 1 versus $M = 4.02$, in Group 2, on a five-point scale is calculated by the following: $ABS [M_1 - M_{2/5} (\text{scale range})] = 11.6\%$ shift or change in means). Standard effect statistics also are allowed, so long as the above percentage techniques are likewise reported. These statistics should be reported in results as 'percentage effect' and follow immediately after standard statistical analysis notation. For correlation, ($r = .43, p < .01$, percentage effect = 18%), for means tests ($M_1 = 3.44$ versus $M_2 = 4.02, t = 3.443, p < .01$, percentage effect = 11.6%).

B. SYSTEMATIC, NARRATIVE, AND SCOPING REVIEWS (12 K WORDS MAX)

All meta-analyses and systematic reviews should include a PRISMA flow diagram to clarify for readers how the exclusion/inclusion criteria were applied to create the literature set under consideration: See <http://www.prisma-statement.org/>

C. BRIEF REPORTS AND RAPID PUBLICATIONS (2K WORDS MAX)

These are usually pilot studies, direct or conceptual replication attempts of previous work, case studies, brief evaluations, reviews, or 'citizen scientist' efforts that are unique, first-time reports, with no more than two tables and/or figures and 10 references. This rapid publication option is especially appropriate for graduate-level student studies, pilot or preliminary research, or descriptions of important new methods or instrumentation. These reports are subject

to blinded peer review in the same manner as research articles. Authors should follow all requirements for longer manuscripts when submitting Brief Reports, including that they have not been submitted or published elsewhere.

D. BOOK AND MULTIMEDIA REVIEWS (2K WORDS MAX)

Structured for readability and utility in which the content is suitably contextualized and includes links to general model-building or theory-formation in the respective domain(s). Please use the following headers, or otherwise incorporate these themes into the review: (a) Author Disclosures; (b) Content Overview; (c) Pros, Cons, and the Book's Contributions to the Literature; (d) Recommendation; and (e) References (if applicable). For an example, see: <https://www.spr.ac.uk/book-review/poltergeist-night-side-physics-keith-linder>

Multimedia reviews can cover films, documentaries, recorded presentations or symposia, video series and reports, websites that are comprehensive resources, software for scholars, and even peer-reviewed articles in other journals that are pertinent to frontier science. Submissions are now being accepted, and authors should note that these multimedia reviews should include four components: (a) Introduction; (b) Summary of the Media Content; (c) Description of the Value of the Media to the *Journal's* Readership; and (d) Critique of the Media. These components need not constitute major sections, but each issue should be clearly addressed in the submission. We strongly encourage prospective authors to discuss their topic for a multimedia review with the Subsection Editor P. D. Moncrief (pdmoncrief@yahoo.com) prior to submission.

E. ESSAYS (8K WORDS MAX)

Important conceptual or philosophical commentaries, observations, or arguments to spark constructive discussion or debate relative to theory, methodology, or practice.

F. LETTERS TO THE EDITOR (1K WORDS MAX)

Must address substantive issues relative to recently published content in the Journal.

SUBMISSIONS (A) TO (C) AND (E) AS APPROPRIATE, MUST ALSO INCLUDE THE FOLLOWING SECTIONS:

1. **Highlights (i.e., lay summary) (50 words max).** Placed at the beginning of the article before the scientific abstract, this is a short—1 to 3 sentences—bottom-line description of the paper. Avoid technical terms and prepare the comments akin to a published quote to a non-specialist or uninformed journalist or student about the researchers' interpretation of the main results.
2. **Implications and Applications (~150 words max).** Placed immediately after the Discussion section to succinctly summarize or suggest how the study's methods or findings can potentially inform the study of other issues, anomalies, or fields of study, including interdisciplinary and multidisciplinary approaches.
3. **Author Contributions (Contributor Roles Taxonomy).** Please include this information within or following the Acknowledgments section. Follow standard guidelines such as this one from Elsevier: <https://www.elsevier.com/authors/policies-and-guidelines/credit-author-statement>. Also, please include ORCID numbers for authors where possible (on the online submission page).
4. **Data-sharing requirements.** Primary (raw) data (redacted for confidential or personally identifying information) must either be (a) uploaded to a freely accessible repository for independent verification or analysis by qualified researchers and the URLs shared in the paper and in a section called Data Availability under the Acknowledgments section (the *Journal* can provide such space), or (b) otherwise provided to qualified researchers on formal request.

