# JP JOURNAL OF PARAPSYCHOLOGY

Volume 75 / Number 1 Spring 2011

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We would like to thank the following persons for their work in translating abstracts for this issue of the Journal: Etzel Cardeña (Spanish), Renaud Evrard (French), and Eberhard Bauer (German).

# **GUEST EDITORIAL**

# On Wolverines and Epistemological Totalitarianism<sup>1,2</sup>

By Etzel Cardeña

Whoever undertakes to set himself up as a judge of Truth and Knowledge is shipwrecked by the laughter of the gods.

Albert Einstein

And fashionable madmen raise Their pedantic boring cry From *Lullaby* by W. H. Auden

While strolling with my beloved in the local zoo, we came across a shortish, furry brown fellow who engaged our sight and seemed to want to play with us, albeit at a distance. He was friendlier even than the acknowledged local clowns (i.e., the bears) and surprise followed surprise as we read that this guy belonged to the ferocious wolverine species. Could this same jolly creature be one who would promptly dispatch us, much larger animals, if he were not fed for a while? Thinking about these seemingly contradictory views of one and the same being and of how reality is always more complicated than our models of it, I had the insight that what mostly afflicts "skepticism" is the inability to tolerate complexity and even seemingly contradictory but valid views about a phenomenon. I write "skepticism" in quotation marks to differentiate the epistemological absolutism that pervades both the strident anti- and pro-psi proponents from what I consider a healthy abeyance from fully committing to a final position in science or other aspects of life. I contend that although the person in a "new age fair" trading in everything from magical rocks to mysterious odors may seem to be the counterpoint of, say, the arch-skeptic academic who a priori declares psi impossible, they are both afflicted with the same inability to assimilate contradictory information and tolerate ambiguity; it is only their axioms that differ. And even those may not be that different, as evidenced by superficial materialism and superficial spiritualism (Cardeña, 2010). Consider Humphrey's comments (1995, p. 54) that "materialism is to all intents and purposes the fact of life" no matter how contentious that concept of "matter" is in physics and philosophy (e.g., Wigner, 1969), and

<sup>&</sup>lt;sup>1</sup> This editorial would not have come to light without the loving presence and astute editorial assistance of Sophie Reijman. I am also grateful to William Braud for his valuable suggestions.

<sup>&</sup>lt;sup>2</sup> This editorial is dedicated to the memory of the maestro José Sobrino, a very good piano teacher and composer, and an even better human being, who left us recently.

that of a Brazilian medium who reported that after death there is food, the same as here, just better-tasting (cf. Playfair, 2010). For both, nothing else seems to exist but "material things," the only difference being that for the second, they continue after death.

The main thesis of this editorial is that although the rhetoric of the aggressive psi critic, the all-believing psi proponent, or the New-Ager would seem to be, pun intended, universes apart, they both reveal an epistemological totalitarianism that assumes an all-knowing apprehension about the nature of reality, intolerance for complexity and ambiguity, and an indictment of anyone not sharing that view.

Now let me discuss the differences between the respectable skeptic and the "skeptic." The former is a person who is inclined to question accepted opinions, including those offered by "authorities," scientific or otherwise, and those stemming from one's own preconceptions. This attitude undergirds the scientific attitude toward epistemology, which divorced itself from pronouncements coming from way back (as in Aristotle's statements about the number of teeth found in a horse) or way up high (as in texts inspired by the religious or academic higher echelons). Here are two examples of this very healthy stance. The editors for the issue of the Journal for Personality and Social Psychology that published the recent series of studies on precognition by Daryl Bem wrote that they found the results "extremely puzzling [but] our obligation as journal editors is not to endorse particular hypotheses, but to advance and stimulate science through a rigorous review process" (Judd & Gawronski, 2011, p. 406). Also, Carl Sagan's principled refusal to sign a letter against astrology not because he felt "that astrology has any validity whatever, but because I felt and still feel that the tone of the statement is authoritarian ... That we can think of no mechanism for astrology is relevant but unconvincing. No mechanism was known, for example, for continental drift." He also questioned whether the signatories had any expertise on the matter and concluded that "we can question whether they have the right to state that 'there is no scientific foundation for (astrological) tenets' without having done the necessary homework" (in Gauquelin, 1983, p. 5).

In contrast, the "**skeptic**" is **s**implistic and **k**nowledge-adverse, **e**nsures that other perspectives cannot be considered, is **p**ejorative toward his/her antagonists, aims to terrify others, holds **i**nconsistent standards, and uses **c**ircular reasoning. In what follows, although I will refer to specific authors to make my points, my criticism is against a way of thinking found in both pro- and anti-psi stances rather than against particular individuals or conclusions about psi. Thus, I expect that this piece will make a number of readers uncomfortable, but hopefully will encourage reflection on the danger of endorsing any simple solution to our topic.

# 1) Simplistic

"Skeptics," notwithstanding their surface differences, are convinced that they have found a single explanation for everything, be it materialist

metaphysics, evolutionary theory, the action of psi in every event, or the world of the spirits and angels, and refuse to consider complexity and uncertainty. Isaac Asimov (1987) was insightful in his analysis of "pseudoscience" as providing "a security blanket, a thumb to suck" instead of the uncertainty and insecurity of science, but failed to extend it to those who use science for these same purposes. In a scolding rebuke to the latter, Marilynn Robinson (2010) discusses how the issue is not that broad theories such as evolution are wrong, but that they do not explain everything and are often used to underpin metaphysical commitments rather than scientific explanations, what the eminent evolutionary biologist Richard C. Lewontin calls "evolutionism" (2005). He also (1994) pointed out how biology, dependent on so many complex phenomena plus a sprinkling of randomness, might be considered more an interpretative discipline than an "exact" science, a perspective missing in so many psychologists and philosophers like Dawkins, Dennett, and Pinker, cloaking themselves with the mantle of an all-explaining evolutionary theory.

An equally all-encompassing (and as unfalsifiable as some functionalist evolutionary accounts) stance, although parting from a different metaphysical point, involves such ideas as the New Age *The Secret* (Byrne, 2006), which propose that positive thinking will transform reality. While there is some truth to the idea that attitudes and beliefs can have some effect on the self and others' experience and physiology (Cardeña & Cousins, 2010), to pass it as an all-powerful force makes a mockery of, among others, the victims of massacres and other forms of violence throughout history who, we should assume, were not thinking positively enough about themselves and their children.

"Skeptic" treatises are rife with other forms of oversimplification. For instance, Humphrey (1995) describes a monolithic science and states that "Most people most of the time actually behave as if they were thoroughgoing materialists" (p. 55), apparently not realizing that individuals may hold as valid *simultaneously* the reality of a world of objects and of seemingly nonmaterial forces, as the cross-cultural phenomena of shamanism, mysticism, and others exemplify (Cardeña, Lynn, & Krippner, 2000). Grossman (in Carter, 2010, p. x) also describes a monolithic science that "has in fact already established that consciousness can exist independent of the brain and that materialism is therefore empirically false." Predictably his and Humphrey's "sciences" arrive at opposite conclusions. A similar certainty about science is found in a theory of survival which states that "The reality of living spirits will no longer fall outside of science, it will be required by science (my emphasis)" (Schwartz & Russek, 1990). However, even the "mainstream" psychology I work with is not at all how these authors portray it. For every theory I know (including some in the "harder" sciences like biology and physics) there are knowledgeable people who vehemently disagree about the evidential value of different pieces of research, how to interpret them, and so on. Of course, the latter

is not a foreign idea at all to the philosophy and sociology of science (e.g., Lakatos & Musgrave, 1970).

2) Knowledge-averse

"Skeptics" do not need to read anything that runs counter to their beliefs because they already know. Thus, not even minimal rules of academic scholarship count. Humphrey (1985) provides an example of this attitude in a book written, ironically, while he held an endowment created to research psi phenomena. In it he shows that he is well-read in literature and philosophy, yet when it comes to the major theme in his book, psi phenomena, he only included slightly more than 10 references to psi research, most of them having to do with beliefs and attitudes, rather than with testing the validity of psi phenomena. An undergraduate thesis with about 10 references on its central topic would be unlikely to get a passing grade in my university. The same practice is followed by some psi proponents (e.g., Playfair, 2010) that fail to cover the relevant literature and give due credit to reasonable, alternative explanations, not to mention the many popular books that do not include even a single reference. In contrast, in a recent book evaluating the worth (or not) of most skeptical criticism of psi, McLuhan (2010) analyzed hundreds of publications for and against psi, discussing the merits of both sides. Besides the failure to conduct the typical first stage of a research project, namely doing a good literature review, Krippner (2010) provides a number of examples in which critics blatantly misrepresented his research (e.g., Zusne & Jones) and even failed to correct their mistakes after they had been pointed out to them (e.g., Hansel).

3) Ensures That an Alternative Perspective Will Not Be Listened To

Contrary to the free discourse of ideas propounded by John Stuart Mill and others, the "skeptic" wants to eliminate the existence of alternate positions. For instance, in his op-ed, the cognitive scientist Douglas Hofstadter (2011) blasted the editors of the prestigious *Journal of Personality and Social Psychology* for allowing an article on research in precognition, which had undergone appropriate peer-review, to be published, and concluded that it should have been ignored and denied publication. A similar type of censorship was attempted by physicists Antony Valentini and Mike Towler, who initially disinvited Nobel prize-winner Brian Josephson and physicist David Peat to a conference discussing the work of David Bohm because of their interest in, respectively, psi and synchronicity (Reisz, 2010). Ironically, Bohm himself endorsed the reality of psi and got an award from the American Society for Psychical Research.

Although I am not aware of similar egregious forms of censorship carried out by parapsychologists, a recent anthology on the possibility of survival (Storm & Thalbourne, 2006) did not include a single chapter that would provide an informed alternative to the position of the survival of consciousness. Along similar lines, in a closed list on survival research some of us get periodically chastised for expressing doubts about its reality, never mind that such knowledgeable authors as Gauld (1982) have a very difficult time reaching closure or clarity on what the relevant research means, even while accepting that there is a good case to be made for anomalous cognition in this area. And popular New Age books often fail completely to discuss alternative or supplementary explanations to their tenets.

#### 4) Pejorative

Although the attacks by "skeptics" against parapsychologists have not reached the extreme of comparing them to Hitler, as Frederick Crews did to Freud (in Begley, 1994), questions about personal integrity, intelligence, and even personal insults have been the order of the day. Richard Dawkins (1998), while showing no evidence that he had actually read parapsychology research, called psi "bunk" and those who "[t]ry to sell it to us fakes and charlatans, and some of them have grown rich and fat." Although in this and in other areas there have been and continue to be people who engage in fraud for personal gain, last time I checked with parapsychology researchers, I could not find anyone who would be considered wealthy, and their waists did not evidence a greater voluminosity than typically found in academic circles.

Hofstadter (2011), with unrestrained nastiness, called anyone endorsing or doing research on psi "crazy" and "crackpot." Thus, he must consider "crackpots" at least nine previous Nobel prizewinners in physics, medicine, and other disciplines (Marie Curie, Lord Rayleigh, Joseph John Thomson, Santiago Ramón y Cajal, Maurice Maeterlinck, Charles Richet, W. B. Yeats, Henri Bergson, Nicholas Murray Butler, and Brian Josephson), towering figures in psychology including William James and H. J. Eysenck, along with at least two past American Psychological Association presidents (James and Gardner Murphy) and current faculty members at such bastions of "craziness" as Cambridge University, the University of London, Edinburgh University, Princeton University, Cornell University, the University of California, and Lund University. And of course he claims to know more physics than Einstein (and Nobel prizewinner in physics Brian Josephson, who supports the validity of psi phenomena), who wrote that "we have no right to rule out a priori the possibility of telepathy. For that the foundations of our science are too uncertain and incomplete" (1946, in Ehrenwald, 1978, p. 138).

Going one pejorative step farther, Ganoe and Kirwan (1984) described research on psi as pseudoscience and "horse manure" (p. 376), and Eric-Jan Wagenmakers evidenced this scatological inclination by commenting about Bem's research that "It shouldn't be difficult to do one proper experiment and not nine crappy experiments" (in Kols, 2011).

On the "other side," we have the contempt of Grossman (in Carter, 2010) stating that whoever holds a materialist perspective is not "a

responsible investigator" and is dogmatic and "irrational." He also stated that those who succeed academically do so not on the grounds of "talent, but mostly on competition, self-promotion, and so forth." He also implies that anyone disagreeing with his conclusion has not accepted the primacy of love. I have encountered in other venues the similar idea that holding a materialist perspective necessarily implies that such an individual cannot be ethical, find meaning in life, or be a "nice person." As an antidote to that assumption, here are the beautiful words of Bruce Frederick Cummings (nom de plume Barbellion), who had no trouble expressing the sacredness of life without requiring an afterlife in his *Journal of a Disappointed Man* (1920, p. 72).

> To me the honour is sufficient of belonging to the universe—such a great universe, and so grand a scheme of things. Not even Death can rob me of that honour. When I am dead, you can boil me, burn me, drown me, scatter me—but you cannot destroy me: my little atoms would merely deride such heavy vengeance. Death can do no more than kill you.

# 5) Terrifies Others

One of the central principles of contemporary politics is that it pays to fear-monger so your audience will become terrified and flock in panic to you so you can rescue them from such threats. Just such a rhetorical strategy is used by Hofstadter (2011), who writes, without giving a scintilla of evidence supporting his contention, that publishing Bem's studies on precognition goes "against the laws of physics as we know them [and] ... our entire scientific worldview would be toppled ... and we would have to rethink everything about the nature of the universe." Really? This must be news to some physicists, including David Bohm, Brian Josephson, and emeritus dean of the Princeton School of Engineering Robert Jahn, who have written about the reality of psi phenomena without fleeing to a cave to wait for the imminent collapse of science as we know it. It is also worthy of remark that pronouncements about psi phenomena breaking the laws of physics a la Hofstadter typically fail to mention just what laws are being broken and in what way. For instead, consider that backward causation is both a recognized theory in physics (Sheehan, 2006) and compatible with the precognition data reported by Bem and others.

I could not think of similar fear-mongering by pro-psi authors, but in the New Age literature we are of course living just one year before 2012, the year that according to the interpretation by some of the Mayan calendar the whole world will end, although perhaps not for those who become spiritual enough to escape that fate. By the way, being Mexican, I have friends with Mayan roots, all of whom seem to be, amazingly enough, unconcerned about this imminent debacle.

#### 6) Inconsistent

The scientific process has a number of features that guard it against blatant authoritarianism and prejudice, among them the assumption that evidence trumps authority and that one's hypotheses should be put to the test not only by ourselves but by others who do not share our perspective. These safeguards are to be applied consistently by all players, but the "skeptic" frequently disregards the rules. As Robinson (2010, pp. 2, 33) writes, parascience (her term for scientism) "claims the authority of science [without practicing] the self-discipline or self-criticism for which science is distinguished ... [and presumes that it] has given us knowledge sufficient to allow us to answer certain essential questions about the nature of reality, if only by dismissing them." Consider a recent review of a book on neurobiological aspects of people claiming psi abilities. In it, Hughes (2010) chastises the authors for "casting aspersions" on "useful science" yet has no problem in stating that psi phenomena "do not exist in a way that can be seen, heard, felt, witnessed, or recorded by a disinterested observer [my emphasis]," failing to follow his own advice about aspersions. He also writes that the authors need to "acquire higher standards of epistemology," yet has no compunction in citing a meta-analysis of psi research (Milton & Wiseman, 1999) while failing to mention both the criticisms against various aspects of that study (Bem, Palmer, & Broughton, 2001) and a more comprehensive and recent meta-analysis (Storm, Tressoldi, & Di Risio, 2010).

Zingrone (2004) has documented many instances in which critics of parapsychology have failed to follow the standards they demand, whether rightly or wrongly, from psi research. She presents examples in which a number of "skeptics," including James Alcock, present alternative explanations to psi that either are irrelevant or that they themselves do not test (the published research records of a number of critics of psi methodology, including those of Alcock, Hansel, and Hyman, are noticeably thin, as evidenced by the PyscInfo database), and they are uncritical of the sources of their "data," including "anecdotes" whose use they criticize in the pro-psi literature. They also show lack of self-evaluation and criticism of their own arguments, while being thoroughly critical of those offered by parapsychologists. A more recent example documenting unscientific standards by "skeptics" is an analysis of Martin Gardner's attack of the research on the famous medium Mrs. Piper, which describes his blatant misrepresentation of the actual research (Taylor, 2010).

One point on which I agree with Hughes, though, is that some authors writing on parapsychology, spirituality, or similar topics are inconsistent in decrying mainstream science and the scientific method while at the same time using, admiring, and quoting scientific research data that may be interpreted as supporting their ideology. Grossman's (in Carter, 2010) claim that science has proved his conclusion while simultaneously blasting academia is an example of this tendency.

# 7) Circular and Other Forms of Specious Reasoning

Implicit in many of the examples discussed above is circular reasoning, which helps the "skeptic" retain its certainty. Thus, Grossman (in Carter, 2010) states that whoever holds a materialist perspective is not "a responsible investigator." How does he know? Well, because whoever is a responsible investigator does not hold a materialist perspective. Similarly, for Hofstadter (2011) anyone supporting psi is a crackpot. How does he know? Because only crackpots would support psi ... And there are other types of vicious circles. When aiming to appear reasonable, a critic may write that "it might be worthwhile to allocate some resources toward seeing whether these findings [on anomalous cognition] can be independently replicated" (Hyman, 1995) and some years later state that it is "craziness ... an embarrassment for the entire field" when a collection of studies replicating each other and previous studies is published (Hyman, in Carey, 2011).

A different kind of circular reasoning is the "abuse" that Wagenmakers and collaborators (2011) make of Bayesian statistics in which the probability of psi is given as 10<sup>-20</sup>. In context, this means that at the same time that evidence is demanded for the validity of psi, that evidence is invalidated a priori (for a rebuttal to Wagenmakers et al., see Bem, Utts, & Johnson, in press). Even Humphrey (1995, p. 75) does not buy the goods offered by Wagenmakers and coauthors: "It is important, however, that we play this fairly and do not load the dice against the paranormal ... we must be careful not to prejudge the issue of 'fishiness' [or experimental or statistical competence, I may add] by presuming that the very fact that a paranormal phenomenon would contravene normal laws is proof that it cannot have occurred." One final example is by Samuel Moulton (2011), who criticized parapsychology for not publishing negative results, yet when he was asked why he had not published his failures to replicate, a standard practice in parapsychology, he replied that his studies were not that interesting and that anyway he would not publish in a parapsychology journal.

With regard to proponents of psi, although I do believe that there are such things as decline and experimenter effects (Irwin & Watt, 2007), and not only in research on psi (cf. Schooler, 2011), I am sympathetic to the argument of some critics that such research is sometimes interpreted as supportive for it no matter what the actual results, and that all fishing expeditions for anomalies in data should be launched, rather than considering that some studies may just not show evidence of psi phenomena (Alcock, 2003). Failures to replicate in parapsychology, especially considering the very low statistical power of most projects, are not egregiously damning considering that accepted phenomena in mainstream psychology and other disciplines also show a far from perfect replication record (see Bem, 2011, for a discussion and references on this issue).

From "The Secret" type of New Age theories, one encounters a different form of circular reasoning: If people want something hard

enough, they will get it. If they do not, well, it is because they consciously or unconsciously did not want it enough.

I will now leave the "skeptic" to its certainty and give some words to the far humbler and more open perspective of William James. He wrote that (1956/1897, p. ix), "There is no possible point of view from which the world can appear an absolutely single fact." The courage to assume that one's perspective is not likely to explain all observations also underlies Henry Sidgwick's idea of the *tertium quid*, or the residue of unexplained phenomena in different areas of enquiry (Gauld, 1968). Yes, many reputed psi phenomena can be explained by failures in reasoning or fraud, yet there have always been observations and experimental results that could not be clarified by these either/or theories, and for which at this point we have the right to hold psi as a valid explanation. Furthermore, the cognitive and emotional ability to tolerate ambiguity, remain open to other possibilities, and attend to the "unclassified residuum" (James, 1956) can stimulate new forms of expression, ideas, and discoveries in both the arts and science (cf. Koestler, 1964).

To come back to the wolverine at the beginning of this article, he is not only a ferocious, deadly creature or a playful guy, but both and much more. To reduce him to either a "red of fang and claw" or a cute Disney creature fails to approach him in all his complexity. As some spiritual, phenomenological (Braud, 2011), and scientific (cf. Keller, 1983) traditions maintain, the cognitive and emotional openness to encounter phenomena as they are may reveal more of reality than the imposition of a priori models. To understand wolverines, and the world in general, we should reject self-indulgent epistemological totalitarianism and let ourselves be seduced by the melancholy whisper of uncertainty.

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# INFORMATION IN LIFE, CONSCIOUSNESS, QUANTUM PHYSICS, AND PARANORMAL PHENOMENA

#### By J. E. Kennedy

ABSTRACT: Information consists of symbols, media for storing and transmitting the symbols, and an interpretational infrastructure that establishes the meaning of the symbols, can generate and decode the symbols, and can take actions based on the symbols. Information processing in livings systems includes genetics, perception, behavior, memory, learning, communication, imagination, creativity, and culture. For certain hypotheses in quantum physics and most hypotheses in parapsychology, the media and interpretational infrastructures for information processing are beyond current scientific understanding. After extensive research, the hypothesis that an observer can sometimes paranormally influence the outcome of quantum events does not have convincing empirical support. The current experimental results in parapsychology do not have the properties of a signal in noise and cannot be convincingly distinguished from methodological bias. Prospective registration of experimental protocols could greatly reduce the confounding problem of methodological bias; however, the experimental results will likely continue to be inconsistent with the positions of both proponents and skeptics of experimental parapsychology. The findings of parapsychology may be most consistent with a model that paranormal phenomena are the result of supernatural information processing agencies with relatively independent motivations that manifest as spirituality and influence the meaning and direction of an individual's life.

*Keywords:* information, paranormal, spiritual, quantum-to-classical transition, consciousness, origin of life

Concepts involving information play an increasing role in some of the most challenging problems in science. Two of the most profound mysteries in science are how life began and how quantum physics should be conceptualized. There are strong arguments that concepts of information will have a fundamental role in understanding these mysteries (Greenstein & Zajonc, 2006; Schlosshauer, 2007; Yockey, 2005).

However, the relevant literature reveals differing concepts, terminology, and assumptions in discussing information in different scientific contexts. These differences result in ambiguities and inconsistencies that hinder scientific understanding. For example, the different uses and implications of the term *information* in biology and physics are not widely appreciated.

The purpose of this article is to summarize and clarify the concepts pertaining to information as these concepts are emerging in scientific research. This discussion may provide a basis for interdisciplinary insights about life, consciousness, creativity, quantum physics, and phenomena that would be considered paranormal with current scientific understanding. The article focuses on the current state of concepts about information processing and is not intended to be a thorough review of each topic. The references are primarily books and review articles. The scientists who had prominent roles in the development of the topics are generally not identified.

# **Information Concepts**

#### **Everyday Information**

Dictionary definitions of information focus on knowledge, facts, and data. These definitions include several assumptions and implications that need to be recognized if concepts of information are to be productively applied in science. Information has three components.

One component of information is symbolic representation. The knowledge, facts, and data of information are represented in some type of symbolic form. For humans, words are the most common symbols for conveying information. The evolution of human culture has resulted in increasing layers of symbolic representation. For example, a video recording of a scientific lecture is a symbolic representation of the original lecture, which in turn provided symbolic representations of scientific findings that were published in journals and were based on measurements that were symbolic representations of the outcomes of certain experimental conditions.

A second component is media for storing and transmitting the symbols. Different media can be used, such as printed pages, electronic signals, living brains, and sound waves. The same information can be stored and transmitted in different media and a given medium can be used with different information. Media involve matter and energy, whereas the symbolic representation has meaning that is distinct from the media.

The third component of information is an interpretational infrastructure that establishes meaning, value, and usefulness for the symbols, and can generate and decode the symbols. Without consistent meaning of the symbols, there can be no stable knowledge, facts, or data. The meanings assigned to different symbols are typically arbitrary in the sense that different symbols could be used equally well for different meanings, as occurs with different languages. Language requires the interpretational infrastructure of the human mind in context of culture. The interpretational infrastructure also includes the ability to generate and to decode the symbols in the media, and to take actions based on the symbols. Thus, the interpretational infrastructure also contains other information processing steps. As will become apparent, information processing implies the existence and interaction of multiple information processing systems.

Unfortunately, the interpretational infrastructure is often overlooked in discussions of information. However, the symbols would have no meaning or usefulness without the interpretational infrastructure. Because the symbols and the interpretational infrastructure are both essential, they must develop or evolve together.

One of the primary properties of information is that a relatively small amount of mass and energy in the media and symbols can be used to guide much larger amounts of mass and energy through the interpretational infrastructure. At the time of conception, the amount of mass and energy in the DNA of an elephant embryo is small; however, that genetic information will ultimately guide the development of a large animal. Similarly, the amount of mass and energy in a stop sign is much smaller than for the vehicles that the sign controls. In general, information is an innately emergent property that can have strikingly disproportionate influences on the distribution and flow of mass and energy.

From an everyday perspective, the concept of information appears to have meaning only in the context of living creatures. In particular, the interpretational infrastructure appears to be a function of living creatures.

#### **Quantitative Information Theory**

Quantitative information theory was developed to evaluate and design electronic communication systems. The theory focuses on quantifying and optimizing the information transmission rate in a communication channel and the reliability of transmission through a noisy channel (Cover & Thomas, 2006). The methods of information theory can be used to quantify information in many areas of investigation, including biology and psychology.

Virtually any probabilistic or statistical model can be expressed mathematically in terms of quantitative information. For example, statistical hypothesis testing and information theory are closely related (Cover & Thomas, 2006). The statistical results of a scientific experiment or an individual scientific measurement indicate information obtained about nature.

Quantitative information theory ignores interpretational infrastructure and focuses on probability rather than on information. The theory does not consider whether the probabilities are for symbols with meaning, purpose, usefulness to living creatures, or implications for the distribution and flow of mass and energy (Brillouin, 1962, pp. 9–10; Roederer, 2005, pp. 13, 32–33).

# Information and Life

#### **DNA and the Genetic Code**

DNA and the genetic code are very consistent with the everyday view of information. The medium for storing information is DNA, which consists of long sequences of chemical compounds called nucleotides that can be of four types: A, C, G, and U (Yockey, 2005). Each sequential group of three nucleotides is a symbol for an amino acid. This is essentially digital information similar to the sequence of binary electronic states used to store data in computers. Three nucleotides with four possible types for each can code 64 different items. However, there are only 20 amino acids to be coded and some are coded redundantly. For example, CGG, CGC, CGU, and CGA all code arginine, and only UGG codes for tryptophan (Yockey, 2005). Proteins constructed from amino acids in the sequences specified by DNA are the basis for life as we know it.

The interpretational infrastructure for the symbols in DNA consists of a complicated, integrated network of biochemical processes for storing and duplicating DNA, reading the sequences, constructing the proteins, and making error corrections. Each new generation must have the same interpretation of the symbols in the DNA. As Harold noted "... sequences are just strings of symbols without intrinsic significance. At the end of the day, the object of the genetic exercise is to specify the shape of a protein that performs a biological function" (Harold, 2001, p. 50). Error handling is particularly important. "The use of multiple, unrelated, and redundant regulatory devices is quite typical.... Control circuits ... are more elaborate than the processes which are regulated" (Harold, 2001, p. 53). As expected, this interpretational infrastructure involves other layers of information processing, particularly with the regulatory processes.

All known living cells, from bacteria to the cells in humans, use the same genetic code for mapping DNA to amino acids. At the same time, this mapping appears to be arbitrary like the meanings assigned to symbols in other types of information (e.g., CGG could have been used equally well for tryptophan as for arginine). These findings are generally taken as evidence that all life on earth evolved from one ancestor. If life spontaneously originated at different times, different genetic codes for constructing proteins would be expected, much like the different spoken (and computer) languages that have emerged.

The origin of life remains a profound mystery because the DNA medium, the genetic code symbols, and the complex interpretational infrastructure all must have originated together. It is difficult to imagine how the complex interdependent information processing systems that are the foundation of life could have spontaneously appeared. The principles of evolution cannot account for the origin of life because genetics and evolution as currently understood cannot occur without all the information processing components functioning in an integrated manner. Evolution cannot explain the origin of evolution.

# Perception

Perception of and response to environmental factors are basic information processing capabilities of living organisms. Single-cell bacteria

have the ability "to register cues from the outside world and to respond in a goal-oriented manner" (Harold, 2001, p. 87). The media for perception are receptors that respond to certain environmental factors. The output signals of the receptors are symbols for the environmental conditions. The interpretational infrastructure consists of biochemical processes that respond to the signals.

With evolution, the receptors have become more sophisticated and the processing of signals from receptors has become much more complex. In human vision, over a million individual receptors in the eye respond to specific details of edges, lines, angles, shapes, color, movement, and depth. The signals from these receptors are sent to several regions of the brain that perform specific integration functions, such as facial recognition or tracking movement of objects.

> As you look at someone, the visual information is sent to your brain as millions of neural impulses, then constructed into its component features, and finally, in some as yet mysterious way, composed into a meaningful perceived image, which is then compared with previously stored images and recognized. (Meyers, 2005, p. 152)

Extensive parallel processing and hierarchical integration are utilized in achieving this result. Again we find many layers of information processing with different media and symbols.

The senses of hearing, smell, taste, touch, and body position are similarly based on receptors that generate signals that are processed and integrated in the brain (Meyers, 2005).

# Learning

Developing the capability to learn was a very important step in evolution. The behavior of a simple living organism is determined by genetic programming of automatic responses to environmental conditions. For these organisms, adaptation to environmental changes occurs at the species level through genetic mutations and diversity in the species. When environmental changes occur, many or most individuals may die whereas a few with favorable genetic mutations survive and reproduce. Of course if the environmental changes are outside the range of species diversity, the species will become extinct, as has happened for over 99 percent of the species that have existed on earth (Guttman, 2002). The ability to learn allows individual organisms to adapt to environmental changes during their lifetimes and thus to delay death.

An implied requirement for learning is that an organism can generate variability in responses or behavior. Behavior is not limited to genetically programmed automatic responses to certain environmental stimuli. Neural mechanisms that provide variations in behavior have become increasingly sophisticated with evolution.

Another implied requirement for learning is that an organism can identify and remember correlations with and among the signals from receptors. Identifying these correlations creates information and requires an interpretational infrastructure that is dynamic as well as having memory. Similar to the processing of perceptions, learning can utilize groups or patterns of symbols to form higher level integrated symbols, such as recognizing an animal and anticipating its movements. Self-awareness results from receptor signals from internal processes rather than from environmental conditions.

The evolution of language in humans is a pinnacle of both information processing and learning (Deacon, 1997; Donald, 2001). Language allows people to share knowledge with others and across generations, as well as to negotiate and work cooperatively. In a communicating group, the effective memory and learning capacity can be much greater than for any individual. Language abilities required the evolution of special information processing capabilities in the brain, enhanced perceptual capabilities, and structures in the throat for speaking (Deacon, 1997).

For spoken words, the information medium is sound waves and the symbols are the words. The interpretational infrastructure for spoken words consists of many other layers of information processing, including the receptors for the sense of hearing as well as the subsequent processing and integration in the brain. Memory of the meaning of the words learned from culture is another important component of the interpretational infrastructure.

# **Imagination and Creativity**

The evolutionary trend toward increased information processing has culminated in consciousness with imagination. The media, symbols, and interpretational infrastructure for imagination initially reside within a brain. The symbols are to a great extent self-generated.

Imagination of potential or possible futures goes beyond learning empirical associations and introduces the ability to create new conditions in the world. The ability to do planning based on hypothetical futures is one of the key abilities resulting from the evolution of the human mind (Donald, 2001). Imagination allows manipulation of symbols in a way that can result in creativity and greatly enhanced problem solving. The imagined potential futures can include individual or group activities or new technology ranging from primitive tools to the complex electronic systems of modern society.

Creativity such as developing new technology typically involves developing new symbols or new meaning for symbols. The new information must be learned and distributed, which are adaptations of the interpretational infrastructure and include culture.

#### **Discussion of Information and Living Systems**

Livings systems have layer upon layer of interacting information processing, including within and among genetics, perception, behavior, memory, learning, communication, imagination, creativity, and culture. The purposeful nature of living creatures is based on information processing. The interpretational infrastructure consists of other layers of information processing. The information processing is parallel as well as sequential, and often with hierarchical integration. Information processing is a defining property of life.

Conceptually distinguishing symbols, media, and interpretational infrastructure may clarify the dilemma that our self-aware consciousness feels like it is separate from matter, yet appears to emerge from and depend on the matter in the brain. This dilemma is the source of much debate and controversy in science and philosophy. The media for information is matter and energy, but the meaning of the symbols is independent of the media.

The physical brain serves as media for symbols, but the symbols have meaning beyond the media function of the physical brain. The basic nature and value of information is that it provides meaning beyond the physical properties of the media. A type of dualism between meaning and media is implied. This is true for information in general and for imagination in particular.

The ability to symbolically represent hypothetical possibilities as well as manifest reality is pivotal. Ultimately, most information of interest to living beings pertains to manifest reality, whether current or future conditions. However, the ability to think about abstract possibilities provides the power to cause or create the manifestation of a desired possibility. This ability emerges from many layers of information processing.

# Information and Quantum Physics

#### **Quantum Physics and Potential Outcomes**

In quantum physics, equations have been developed that describe the outcomes of experiments with great accuracy; however, the interpretation of the terms in the equations has thus far defied scientific understanding (Greene, 2004; Greenstein & Zajonc, 2006; Schlosshauer, 2007). The primary equation of quantum physics is in the form of waves that include terms for every potential or possible outcome of an experiment or observation. However, there is intrinsic variability and uncertainty on the quantum level, and the waves indicate only the probability that a given outcome will occur. The equations do not deterministically specify which outcome will actually be found. The actual outcome that manifests appears to be random. The waves are often described as *probability waves* and the equation is called the *wave function*. There is no known medium or substance for the waves. Taken at face value, the wave function indicates that the actual physical state of a particle or system prior to observation is a combination of all possible outcomes of the observation. Numerous experiments support this interpretation (Greenstein & Zajonc, 2006; Schlosshauer, 2007). The most well known is the double slit experiment which indicates that an unobserved individual particle sent toward two slits in a screen in some way responds to both slits as if it were a wave spread over space rather than a discrete particle. The experimental results display *interference patterns* that are exactly in accordance with the wave function. The simultaneous existence of different possible outcomes in a wave function is called a *superposition*.

One of the most perplexing features of quantum physics is that when particles interact with each other, they can become entangled in a way that is nonlocal (Greenstein & Zajonc, 2006; Schlosshauer, 2007). Two particles become entangled when the wave function has interaction terms that make the state of one particle dependent upon the state of the other particle. The two particles must be considered as a unitary system. A particle that is not entangled can be completely described with a wave function that does not include terms referring to another particle. The entanglement is nonlocal because the two particles (or precursors to particles) may become widely separated in space but somehow remain connected. When the state of one particle is subsequently measured, the state of the other is instantly defined. Nonlocal entanglement has been verified empirically. The specific outcome that is found with a measurement appears to be randomly selected from the potential outcomes, which means entanglement cannot be used to directly transmit useful information instantly between different locations. Entanglement can also occur between a particle and a larger system or the environment.

The terms in the quantum wave function symbolize potential outcomes similar to the human imagination of potential future events. Both involve symbols of potential conditions rather than symbols of existing reality. In both cases, the manifestation of one of the potential outcomes can be viewed as information creation.

#### **Quantum Physics and Measurement**

In quantum physics, a measurement not only obtains information about the state of a system, but also has an active role in forming the state that is found. The system can be in a superposition of possible outcomes prior to measurement. The act of measurement or observation transforms the state of the system from the superposition to a single outcome state consistent with classical physics.

The basic wave function of quantum physics offers no insight into how and when the superposition of probability waves gets transformed into the one outcome that becomes manifest (Greenstein & Zajonc, 2006). This is known as the *measurement problem* and is subsumed by the newer term *quantum-to-classical transition*. The wave function predicts that when a particle interacts with a measurement apparatus, the particle and apparatus may become an entangled superposition, but not transformed into one outcome. At present, scientists understand neither how to conceptualize the probability waves nor how observed physical reality emerges from them. Several ideas have been proposed for addressing this measurement problem but none have convincing support. One of the oldest ideas is that the observation of a measurement outcome by a conscious observer causes the wave function to *collapse* from a superposition to a discrete outcome (Schlosshauer, 2007, pp. 359–365). As discussed in a later section, this hypothesis is often favored within parapsychology.

# Which-Path Information and the Quantum-to-Classical Transition

Recent studies have investigated what constitutes a measurement that causes the quantum-to-classical transition. It has long been known that adding a detector to determine if the particle passed through one of the slits in a double slit experiment will eliminate the quantum superposition and result in classical individual particles. Experiments have investigated different methods for obtaining this *which-path information* or *which-way information*.

One of the most important findings is that the quantum-to-classical transition occurs when there is potential which-path information, whether or not someone observes the information and whether or not there is a specific detector for it (Greenstein & Zajonc, 2006; Mandel, 1999; Schlosshauer, 2007). A common expression is that the information is available "in principle." For example, if individual photons (light particles) are sent one at a time through a screen with two slits, an interference pattern will occur indicating a quantum superposition. If plates that alter light polarization are placed in front of the slits, the photons from the different slits will have different polarizations that could be detected by an appropriate device to indicate which slit a photon passed through. The presence of the polarizing plates eliminates the quantum interference pattern. This occurs even if there is no detector to measure the polarization to identify which slit a photon actually passed through, and thus no observation of the which-path information (Schneider & LaPuma, 2002; Walborn, Terra Cunha, Padua, & Monken, 2002, 2003).

Another important finding is that the quantum-to-classical transition can be partial and gradual rather than an instantaneous all or none collapse (Greenstein & Zajonc, 2006; Schlosshauer, 2007). When partial information is obtained about the path of a particle, the resulting interference patterns are weaker but still present. The interference patterns fade out and the results become classical as more information is obtained about the path of the particle.

In other experiments, the decision as to whether or not to use a which-path device is made after the particle has presumably passed through

the slits. The quantum-to-classical results of these *delayed choice* experiments are the same whether the decision is made before or after the particle should have passed through the slit(s) (Greene, 2004, pp. 186–199; Greenstein & Zajonc, 2006, pp. 39–44). Such results are incomprehensible in terms of classical physics and traditional scientific determinism.

If the state of a particle is entangled with another particle, each particle does not have a quantum superposition or interference pattern when observed individually. If photon A has two possible paths and photon B has possible states that are entangled with the path of photon Å, then the which-path information for photon A can be obtained by observing photon B. Once photon A becomes entangled with photon B in a way that depends on the path of photon A, photon A will not show superposition or interference patterns if it is examined alone. This is true even if photon B is not observed by a person. However, if the two photons are examined together with a coincidence detector, an interference pattern can be seen in the relationship between the particles that cannot be found with either particle individually. These results have been found in various experiments (e.g., Herzog, Kwiat, Weinfurter, & Zeilinger, 1995; Wang, Zou, & Mandel, 1991; Zou, Wang, & Mandel, 1991) and can be derived from the wave function. The fact that which-path entanglement causes quantum superpositions to disappear for the individual entangled systems has important implications and is the foundation of decoherence.

# **Quantum Physics and Decoherence**

Outside of highly controlled laboratory conditions, quantum systems are in constant interaction with the environment. These countless interactions include air molecules, thermal radiation, and cosmic radiation (Greenstein & Zajonc, 2006; Schlosshauer, 2007; Zurek, 2003a, 2003b). The initial theoretical development of quantum physics focused on isolated systems and did not consider the implications of the interactions with the environment in open systems.

These countless interactions are actually the environment becoming entangled with which-path (or more appropriately which-state) information for a quantum system. Although the amount of which-path information in each individual interaction is tiny, the cumulative effect of all the interactions is decisive. Substantial theoretical and experimental research confirms this conclusion (Schlosshauer, 2007; Zurek, 2003a, 2003b). As noted in the previous section, which-path entanglement results in the loss of quantum superpositions and causes the quantum-to-classical transition.

These environmental interactions cause the absence of quantum effects in our everyday world (Schlosshauer, 2007; Zurek, 2003a, 2003b). The elimination of quantum superpositions by environmental interactions is called *decoherence*. For example, estimates of decoherence times for a dust grain are so fast that superpositions would be extremely difficult to

observe (Schlosshauer, 2007, p. 135; Zurek, 2003a). The decoherence times for larger objects are many orders of magnitude faster.

Decoherence is a dominant factor in the quantum-to-classical transition, but whether it fully resolves the measurement problem remains an open question (Greene, 2004; Greenstein & Zajonc, 2006; Schlosshauer, 2007). As yet it is not possible to empirically distinguish among different hypotheses. Given that key aspects of quantum physics remain beyond current scientific understanding, it is appropriate to remain cautious in drawing conclusions on this topic.

# **Discussion of Information and Quantum Physics**

Because the human experience most analogous to quantum probability waves is the imagination of hypothetical futures, the attribution of mental properties to the quantum domain may be inevitable. Stapp (2009, p. 195) described the quantum domain as "idealike" rather than "matterlike." He pointed out that the basic properties of the quantum domain are represented by potentialities and probabilities, and the actual outcomes that are manifest appear to be selected in a way not controlled by any known mechanical law. The interconnectedness in the quantum domain that supports entanglement and delayed choice apparently has a means to incorporate all the relevant factors, conditions, and possibilities in a given situation, even though the factors and conditions may be spread over space and time, and the possibilities may be potential or hypothetical events. Because this interconnectedness does not involve any known energy, the closest analogy appears to be information. As might be expected, the term information is increasingly used in discussions of quantum physics (e.g., Bohm & Hiley, 1993; Greenstein & Zajonc, 2006; Schlosshauer, 2007; Zurek, 2003b).

However, as yet there has been virtually no consideration of media, symbols, or interpretational infrastructure for the quantum domain. Theoreticians such as Bohm (Bohm & Hiley, 1993) appear to be using the term *information* as a label for unknown and basically incomprehensible processes. Bohm's assumption that a particle has a "rich and complex inner structure which can respond to information" (Bohm & Hiley, 1993, p. 39) and that "a rudimentary mind-like quality is present even at the level of particle physics" (p. 386) is attributing to particles the information processing capabilities of life. The analogies he offers to help clarify his ideas about information on the quantum level all involve living systems (seeds, people, ships guided by people). However, the theory does not attempt to identify or describe the medium or interpretational infrastructure in the quantum domain that functions as if there was instantaneous transfer of nonlocal information.

Discussions of decoherence often include descriptions that imply that the environment serves as media for symbolic representation of the state of a quantum system. These descriptions include, "encoding information in the environment," "transfer of information to the environment," "environmental monitoring," and "environment as witness" (Schlosshauer, 2007; Zurek, 2003b). However, there has been no description of an interpretational infrastructure that decodes the symbolic representations and takes corresponding actions for the quantum-to-classical transition.

On the other hand, there appears to be an emerging understanding that entanglement is the key factor for the quantum-to-classical transition, not whether the which-path state is actually measured or is symbolically represented in media (e.g., Ferrari & Braunecker, in press). The expression which-path information "in principle" implies that symbolic representation in media is not necessary. For example, which-path information has been based on the time of arrival of a particle even though the actual time differences were "millions of times shorter than the resolution of the detectors and electronics" (Mandel, 1999, p. S280).

On a more general level, Bell argued that the term *information* should be excluded from fundamental theories in physics because the term requires the specification of "whose information" and "information about what" (Bell, 2004, p. 215). Bell's point recognizes that established information processing is associated with life and has an interpretational infrastructure. If the term *information* is used in physics, the assumptions about media for the symbolic representations should be described, as well as whether the actions resulting from the information require an interpretational infrastructure that has properties of a living system.

One important question is whether some interactions cause quantum superpositions to collapse as historically assumed for measurement, or whether a more appropriate model is that superpositions endlessly shift to higher order interactions, with the classical world emerging behind this moving front of increasingly complex entanglement. The latter is more consistent with the wave function. Analysis of multiple interactions may provide insights about higher order entanglement and the measurement problem.

The quantum domain may fluctuate among possible outcomes, with the outcome that becomes manifest determined by the state of the fluctuations when an outcome inducing interaction occurs.<sup>1</sup> Entanglement implies that the components fluctuate in a correlated or connected manner that is not constrained by the space and time of classical physics. Thus, the fluctuations would appear to be among the virtual outcomes as units,

<sup>&</sup>lt;sup>1</sup> This model for the selection of the quantum outcome that becomes manifest is analogous to the operation of certain electronic random number generators (RNGs) used in parapsychological experiments. These devices internally oscillate rapidly between possible outcome states. When an outcome decision is initiated, a random time delay is implemented using radioactive decay or a noise diode. The state of the oscillator at the end of the delay is the selected outcome. Similarly, the quantum level could rapidly fluctuate among potential outcomes and the manifest outcome be determined by the state when an outcome inducing interaction occurs.

including nonlocal correlations for an outcome. This model may be an alternative to information processing on the quantum level.

#### Information and Paranormal Phenomena

#### **Unique Creation Events**

Can a functioning information processing system with symbols, media, and interpretational infrastructure develop spontaneously from interactions of inanimate matter and energy? This is a fundamental question for the origin of life. Investigation of this question is dominated by basic principles of scientific methodology.

The most convincing scientific evidence for a hypothesis comes from repeatable controlled experiments, preferably randomized and double blind. Studies based on nonexperimental observations can only report descriptions and correlations, and are inevitably controversial if people have differing motivations about the results. Any conclusions from these nonexperimental studies are dominated by the traditional warning in science that correlation does not prove causation. Alternative explanations can virtually always be proposed by opponents.

Most allegedly "scientific" claims about the origin of life or the origin of the universe are actually speculations with no hope of even minimally convincing empirical evidence for the indefinite future. The origin of the universe and origin of life are extremely difficult to investigate meaningfully because directly relevant observations are not possible. Claims for empirical evidence must be based on speculations about residual artifacts from unique events in the remote past, long before there was any possibility of human observation. These are extreme cases of controversial nonexperimental research.

A creation event that may have occurred only once in the history of the universe cannot be empirically distinguished from a miracle and is outside the domain of convincing scientific explication. The most convincing evidence would be if other occurrences were somehow found. Even events created in laboratory experiments would be controversial because that would only demonstrate that intelligent beings can create the event, not that the event can occur spontaneously in nature.

At present, opinions about these unique creation events are matters of faith in a personal philosophy and/or cultural fads rather than scientific evidence. A person's basic personality can be a determining factor for beliefs about such matters (Kennedy, 2005). For example, some people have personalities that are by nature drawn to transcendence and mysticism, whereas others have personalities that are materialistic and distrusting of abstract ideas. The plausibility of different philosophies can be expected to differ among people with these different personality factors.

#### **Conscious Observers**

For those who propose that conscious observation has a significant role in the quantum-to-classical transition, it is a relatively small step to propose that the observer can influence the outcome of the transition. In fact, a priori, if a conscious observer causes the quantum-to-classical transition, it would be more surprising if the observer could not influence the specific outcome than if the observer could influence it. However, such an influence would currently be considered paranormal because all prominent interpretations of quantum physics assume that the actual outcomes are completely random. Of course, this hypothesis must ultimately be addressed empirically. Walker (1975, 2000) has done the most work to develop the theory that conscious observers can influence the outcome of quantum events.

Walker developed a quantitative model of quantum effects at synapses in the brain and described the "will" as the information rate in human consciousness that could influence the outcome of quantum events. According to his estimates, the information rate of the will is about .001 smaller than the total information rate in the conscious stream, which indicates a very poor signal-to-noise ratio (Walker, 2000, p. 264–265). This could explain the unreliable effects in parapsychological experiments. He also retrospectively calculated the expected variation in the results of efforts to paranormally influence dice made of different materials and reported good agreement with a set of experimental data (Walker, 1975). He proposed that this model could explain the psi effects reported in parapsychological experiments.

The hypothesis that a conscious observer causes the quantumto-classical transition is less plausible now given the evidence that the transition requires neither a detector nor observation. Also, the hypothesis of a conscious observer has long been recognized to be problematic when applied to cosmology because it would appear to require a conscious observer that is outside of the recognized universe (e.g., Bohm & Hiley, 1993, p. 24). However, as noted above, these matters of interpretation are not yet fully resolved.

More importantly, Walker's work has not found significant empirical support. His work has not produced more reliable experimental results in parapsychology.

The experimental results in parapsychology do not have the properties of a signal in noise as assumed by Walker's model and as assumed for statistical analysis of experiments. For a phenomenon with a poor signalto-noise ratio, redundancy can be used to increase the reliability of results. This is the standard assumption for signal enhancement in quantitative information theory and for doing power analyses to determine the sample size for designing experiments. However, the results of efforts to apply signal enhancement methods in parapsychology have consistently deviated from the expected results (Kennedy, 1979, 1995). Similarly, meta-analyses and other summaries of parapsychological research have consistently found that a larger sample size in an experiment does not increase the likelihood of obtaining a significant result (Kennedy, 2004a, 2006).

These findings are contrary to the basic assumptions for statistical analysis and indicate that the standard procedures for statistical analyses, experimental design, power analysis, and meta-analysis are not applicable for parapsychological experiments. Such patterns are normally interpreted as symptoms of methodological problems in a meta-analysis (e.g., Egger, Smith, Schneider, & Minder, 1997).

The current experimental findings in parapsychology cannot be convincingly distinguished from a database dominated by methodological biases (Bosch, Steinkamp, & Boller, 2006a, 2006b; Kennedy, 2004a). After much research effort, there is not convincing empirical evidence for the hypotheses that an observer can sometimes influence quantum outcomes. The bottom line remains that if the primary challenge for parapsychological research was a poor signal-to-noise ratio, standard research methods should have produced reliable results long ago.

Parapsychology has not been able to successfully shift from an exploratory methodology to a convincing confirmatory methodology. Meta-analysis is a type of post hoc analysis that is useful for exploration, but as normally applied is methodologically incapable of providing convincing confirmatory evidence in controversial settings (Kennedy, 2004a, 2006). The strongest experimental evidence comes from developing a protocol that describes the planned experiment and planned analysis, and then carrying out the experiment in accordance with the protocol. The protocol should include a power analysis that specifies a sample size with at least 80% probability of obtaining significant results, and the results should be consistent with this expectation (Kennedy, 2004a). Unfortunately, the experience to date indicates that this research strategy does not work with parapsychological experiments.

The evidence that allegedly paranormal phenomena do not conform to the usual assumptions for experimental research does not mean that paranormal phenomena never occur. Different research paradigms, strategies, and methods may be needed (e.g., Kelly, Kelly, Crabtree, Gauld, Grosso, & Greyson, 2007; Kennedy, 2004b; White, 1997a, 1997b). This evidence does, however, rule out the simple experimental methods and models that have dominated parapsychology thus far. These methods were an appropriate starting point for research, and the experience with them is scientific progress.

Here too, a person's attitude will depend on personal philosophy, worldview, and personality. For example, those who are materialistic by temperament will probably interpret the current state of research as additional compelling evidence that paranormal phenomena do not exist. Alternatively, those who are more mystical by temperament will likely believe that it was naive to hope that these phenomena could be reliably controlled using relatively simple experimental methods. If that were true, the paranormal would be normal, which has been an implicit assumption of the research program. From this perspective, the current state of research is a natural evolution toward more appropriate models and methods. An obvious alternative research strategy is to investigate spontaneous cases to better understand the process and purposes of psi.

#### **Spontaneous Cases**

Surveys typically find that about half the general population report that they have had a paranormal experience (Stokes, 1997). These experiences have been a strong motivation for investigating paranormal phenomena. However, closer examination of the cases indicates that only about 10% to 15% of the population has had experiences that could be actual psi, which means that at least 70% to 80% of the people reporting psychic experiences appear to be misinterpreting the experiences (Kennedy, 2005). A previous article reviewed personality and motivations to believe, misbelieve, and disbelieve in paranormal phenomena (Kennedy, 2005).

The most commonly reported psychic experiences manifest in an uncontrolled manner through the imagination as dreams, hallucinations, or intuitions (Stokes, 1997). Belief in and reports of psychic experiences are associated with personality factors such as absorption that indicate higher degrees of imagination (Kennedy, 2005).

In terms of information processing, receptors would be expected that somehow respond to something like other dimensions of space or time. However, in the absence of predictable occurrences of the phenomena, there is little hope of identifying a receptor. In fact, it is unlikely that such receptors exist.

The absence of reliable, useful applications of psi virtually precludes the hypothesis that psi is a human ability, and precludes any associated information processing model for psi. Abilities of clairvoyance and/or precognition would obviously have great survival value and would be expected to be enhanced through evolution as has occurred with other useful perceptual abilities. However, the alleged psi abilities have not been reliably demonstrated to a degree that is convincing to most scientists and are not noticeably useful in the many situations when such abilities would be of great value. Psi apparently is not susceptible to evolutionary forces, and therefore is not consistent with a human ability.

The fact that psi is apparently not a human ability does not mean that paranormal phenomena do not exist. It does mean that the source is better conceptualized as external to living people. People describe these events as happening to them rather than as something that they initiated or could control. The association of psi experiences with imagination may reflect a tendency to misinterpret the experiences, or it could indicate that more imaginative people are susceptible to external paranormal influences.

#### Supernatural

The term *supernatural* generally implies a being or agency that is different from life as we know it and that has its own motivations and intentions. Even scientists who entertain the possibility of parapsychological phenomena often tend to balk at hypotheses involving the supernatural. Parapsychological models usually involve some type of perceptual or instrumental ability of living beings and assume that these abilities are directed by motivations, intentions, or needs of the living being. However, contrary to the assumptions of experimental parapsychology, the research findings suggest that paranormal phenomena may result from motivations or intentions that are not associated with identifiable living beings.

The seemingly capricious, evasive results of paranormal phenomena are often described in terms that indicate an active agency with motivations different from the people involved. These descriptions of psi include "actively evasive" (Beloff, 1994), "self-obscuring" (Braud, 1985), "trickster" (Hansen, 2001), "seems to avoid those positions in space and time when we are actively looking for it" (Batcheldor, 1994, p. 93), "can act capriciously, as if... to resist complete verification" (McClenon, 1994, p. 75), and "intended ... to remain *baffling*" (James, 1909/1960, p. 310). Hansen (2001) devoted an entire book to the applicability of the trickster concept to paranormal phenomena. The trickster has a long history in shamanism as a spirit whose role was "to show how egocentric, selfish behavior resulted in humiliation and bad outcomes, or how the spirit world could play unpredictable tricks on people and thus prevent them from becoming too self-confident or haughty" (Hayden, 2003, p. 119).

Ideas like the trickster appear consistent with the experimental findings that defy the assumptions for standard statistical methods. Researchers tend to propose these concepts only after decades of futile efforts to obtain reasonably consistent empirical results. Jahn and Dunne (2001) well summarized the situation as: "At the end of the day, we are confronted with an archive of irregular, irrational, yet indismissable data that testifies, almost impishly, to our enduring lack of comprehension of the basic nature of these phenomena" (p. 300). The failure to develop practical applications of psi after numerous efforts is strong evidence that these phenomena defy human intention and motivation (Kennedy, 2003).

Spontaneous cases of psychic phenomena are often most consistent with some type of supernatural explanation. These cases are typically unexpected, do not have any material benefit to the person, and are frequently transformative and interpreted as evidence that the person's life is guided or watched over by a higher power (Kennedy, 2000; 2004b; Kennedy & Kanthamani, 1995; White, 1997a, 1997b). Similarly, paranormal events were claimed in the history of most religious and/or spiritual traditions and are interpreted as evidence for the existence and intervention of a supernatural transcendent power or being (Kennedy, 2004b; McClenon, 1994; Woodward, 2000).

One possible explanation for this pattern of findings is that the primary function of paranormal experiences is to draw attention to spiritual matters. "The instances of striking psi draw attention away from the material world, and the capricious, actively evasive characteristics of psi thwart efforts to use psi for material self-interests" (Kennedy, 2004b, p. 1). White (1997a, 1997b) collected extensive documentation of the transformative after effects of psychic and other exceptional human experiences. These experiences can be subjectively very compelling for a person and have major effects on the person's worldview and values.

If paranormal effects could be reliably controlled, they would likely be used predominantly for material gain and dominance in business and war, as are other human abilities. Consistent with this view, the most extensive, well-funded investigation of psi has been the 24-year Star Gate project for military applications (May, 1996). The capricious, evasive properties of psi have consistently prevented successful development of such applications, even with extensive effort (Kennedy, 2003). The inability to develop practical applications for self-serving purposes is a key factor for paranormal phenomena being associated with spirituality and personal transformation.

If paranormal effects actually occur, the overall pattern of evidence is most consistent with the hypothesis that the effects are produced by beings or an agency separate from the people involved. Based on well over a century of efforts to investigate and control paranormal phenomena, the properties of the phenomena make other explanations very unlikely.

#### **Discussion of Information and Paranormal Phenomena**

Psi is usually described as a form of information transfer that does not involve any known physical media. The unexplained nonlocal aspects of quantum physics and the increasing scientific recognition that additional dimensions of space and/or time may be needed to explain the properties of the universe (e.g., Greene, 2004) enhance the possibility of interactions outside the space and time of classical physics. Such interactions could be considered paranormal or supernatural given our current level of understanding. However, such speculations must ultimately be supported by empirical evidence. As yet, parapsychology has not produced empirical findings convincing to most scientists.

Some people have had experiences that they believe are paranormal and that influence the direction of their lives (White, 1997a, 1997b). I am one of those people (Kennedy, 2000). These spontaneous cases do not provide convincing scientific evidence for cautious scientists; however, the subjective impact is compelling and is undaunted by the arguments of skeptics.

Just as quantum entanglement apparently cannot be used to instantaneously transmit useful information, perhaps paranormal phenomena cannot be reliably used for personal material gain or for military or business applications. These may be constraints built into nature. Parapsychological researchers have tended to rely on post hoc psychological speculations to explain the capricious, evasive results (e.g., Eisenbud, 1992; Radin, 2006; Tart, 1984). However, the persistent pattern of results appears more consistent with a fundamental property of nature (Kennedy, 2004b).

Given the research findings to date, the range of possible explanations for paranormal phenomena has narrowed considerably. A tentative model consistent with available data would be that there are other dimensions of space and/or time that humans are not aware of, and agencies in those dimensions can affect the physical world that we experience. However, those agencies intervene in the physical world only rarely and for very limited purposes related to meaning in life and spiritual growth for an individual person. The occurrence of such interventions varies greatly among people and can vary over the course of a person's life. With this model, paranormal phenomena are not human abilities and cannot be developed for reliable applications.

The spiritual aspects of paranormal phenomena may be a starting point for research. Kelly et al. (2007) proposed that a dualistic "psyche" associated with a person is the best explanation for paranormal and mystical experiences. This proposal came from an update and extension of the writings of William James and Frederick Myers. Kelly et al. described the associated psyche as an aspect of consciousness that is a fundamental, causal property of nature and probably is related to the interconnectedness of the quantum domain. With this model, a person's brain and associated psyche interact, with the brain generally serving as a filter or barrier for awareness of the associated psyche. The associated psyche apparently processes information in one or more dimensions that humans do not perceive directly. Kelly et al. note that the associated psyche may have autonomous aspects that are related to concepts of life after death. However, they do not specifically address the possibility that the associated psyche may have motivations, intentions, and values that are different than the biologically based motivations, intentions, and values of the physical body and brain.

The hypothesis that the associated psyche may introduce spiritual values is a minor clarification that has important implications and is consistent with the overall empirical data relating to paranormal phenomena and mystical experiences. If the primary purpose of paranormal experiences is to influence a person's sense of meaning in life and spirituality, then paranormal phenomena may tend to be conspicuous rather than unobtrusive. This is consistent with my experiences (Kennedy, 2000) and can be investigated by evaluating the effects of the experiences and alternative ways the effects could have been produced.

Unfortunately, parapsychologists have tended to avoid the religious or spiritual aspects of psi because they feared it would detract from their scientific standing. This was particularly true in the 1970s when I worked at J. B. Rhine's Institute for Parapsychology. Similarly, those recently investigating scientific perspectives on *divine action* do not mention parapsychology (Russell, Murphy, & Stoeger, 2008). These interdisciplinary discussions among scientists, theologians, and philosophers have focused on "noninterventionist" approaches that conceptualize divine actions as operating unobtrusively through points of indeterminism in natural processes rather than as miraculous interventions in natural processes. This strategy was specifically chosen to try to minimize discord with the worldview of the natural sciences. However, the spiritual aspects of paranormal experiences have central relevance for both parapsychology and the investigation of divine action.

# Conclusions

Life consists of many layers of information processing, including genetics, perceptions, behavior, memory, learning, communication, imagination, creativity, and culture. Once the basic information processing to support evolution was in place, the evolution of enhanced information processing abilities could be expected, and creativity and culture may have been inevitable. However, the origin of the information processing needed to support life and evolution remains a profound mystery.

Recognizing the components of information as symbols, media, and interpretational infrastructure clarifies the relationship between information and matter. These three components must function as an integrated unit for information to occur. The symbols and interpretational infrastructure of information provide meaning, value, and effects that are far beyond the physical properties of the media. For example, spoken words often have results that are vastly greater than the direct physical force of the vibration of air molecules. This leap from matter to information via symbols and interpretational infrastructures creates a basic dualism.

The meaning of symbols has a different nature and properties than the physical media that hold the symbols. The subjective impression that our thoughts are more than the matter in the brain is correct. At the same time, if the media are damaged, information processing is also damaged. The controversies about human consciousness (see e.g., Donald, 2001) may result from differing emphasis on physical media versus symbolic functioning. Those drawn to deterministic materialism may focus more on the properties of the brain functioning as media, whereas others may focus more on the virtually unlimited degrees of freedom and creativity of the symbols and interacting layers of interpretational infrastructures. All currently known information processing systems are a function of life. I find it impossible at present to conceive of symbolic information processing that is not ultimately a function of living systems. Therefore, hypotheses in quantum physics or parapsychology about information that is not a function of life as we know it imply dimensions of life that are beyond current scientific understanding. For example, the physical universe and/ or life as we know it could serve as media for information from a higher level of interpretational infrastructure.

Quantitative information theory as utilized in physics and engineering uses the term *information* narrowly for certain mathematical probability models that generally do not consider the interpretational infrastructure or the meaning of symbols. This terminology tends to be ambiguous and to promote the dubious implication that any situation where uncertainty or probability is involved has information processing capabilities similar to living systems.

The concepts of information used in both quantum physics and parapsychology assume information transfer without known physical media. A dimension of reality that is currently not recognized would presumably function as media for the symbolic information. Such hypotheses require empirical evidence.

The current experimental evidence for parapsychological phenomena cannot be convincingly distinguished from methodological bias. This is due to the post hoc nature of meta-analysis and the fact that experimental results in parapsychology do not become more reliable with larger samples sizes as assumed for statistical research. This pattern could be a property of paranormal phenomena or a result of methodological bias. This ambiguity could be greatly reduced by registering protocols for experiments prior to conducting them. The protocol would specify the planned hypotheses and analyses. A meta-analysis of the registered studies conducted in accordance with the protocols should be free of most methodological problems that currently confound meta-analyses.

However, I expect that the results of the registered studies will be similar to current findings and therefore will be inconsistent with the positions of both skeptics and proponents of experimental parapsychology. Of course, this expectation needs to be verified empirically. The current parapsychological findings do not have the properties assumed for statistical research and therefore will not provide convincing evidence in the absence of an explanation for this anomaly. If these anomalous properties are not due to methodological problems, then new research strategies and models are needed for parapsychological research. Three properties of the research findings make scientific research in parapsychology particularly difficult.

First, for well over a century the most conspicuous property of parapsychological research has been the capricious and seemingly actively evasive outcomes. This property prevents the reliable demonstration and useful application of psi effects. I see no hope for progress in parapsychology until this dominant characteristic is confronted. This property, combined with the evidence that paranormal phenomena often inspire meaning in life and spiritual transformations, suggests that investigation of the spiritual implications of paranormal phenomena may be productive. The overall properties of paranormal effects are more consistent with a model of a supernatural source rather than with a model of a human ability. The motivations and values of the supernatural source appear to be more consistent with spiritual values than with the materialistic self-interests that are assumed to underlie biological evolution (Kennedy, 2004b).

Second, as noted by Eisenbud (1992), parapsychological experiments are carried out with the curious assumption that everyone has psi ability except the experimenters. If psi is a human ability directed by motivation as assumed in experimental parapsychology, then the experimenters can paranormally influence the outcomes of their experiments to obtain whatever results they want. An experimental outcome is a random event and therefore would be susceptible to paranormal influence. Within the larger context of evasive results, consistent differences among experimenters have long been a prominent characteristic of parapsychological research. More successful experimenters have tended to be more successful subjects in psi experiments (Kennedy & Taddonio, 1976; Palmer, 1997; White, 1976a; 1976b). These findings imply that the experimental outcomes are usually related more to the experimenter than to the subjects. This property also undermines the interpretation and value of experiments.

A third property that undermines psi experiments is that psi appears to be goal-oriented (Kennedy, 1995; Schmidt, 1974; Stanford, 1977). This means that a psi effect is independent of the complexity of a random process. For example, with goal-oriented psi, an experiment can be viewed as the outcome of one complex random event with a probability of success of .05 (the alpha level of the experimental analysis). Alternatively, the experiment can be viewed as a series of subevents (i.e., each subject or each response) with a uniform effect applying to each subevent. The latter is the assumption for statistical analysis and results in higher statistical significance with larger sample sizes (more subevents) and effect sizes that are unrelated to sample size. However, if the experimental outcome is influenced as one random event, then the significance level will be unrelated to sample size and the effect size will be inversely related to sample size, which are exactly the characteristics typically found in meta-analyses of psi experiments (Kennedy, 2004a, 2006). Unfortunately, methodological bias such as selective publication also can produce this same pattern. However, this pattern has been found in at least one metaanalysis where publication bias was unlikely (Bem & Honorton, 1994). The proposed registration of psi experiments, combined with appropriate adaptations to the methodology and expectations for meta-analysis, should minimize this issue. In the absence of prospective registration of
experiments, methodological bias will continue to be the most common scientific interpretation for the findings.

If the results of psi experiments are not entirely due to methodological bias, the model that appears most consistent with the research findings is that psi effects are goal-oriented and operate on the overall experimental outcome as a unit within context of an active evasiveness that prevents reliable demonstrations or useful applications of psi. Also, the occurrence of paranormal experiences varies greatly among people, including experimenters. Research progress in this situation has been and will be very challenging. This model will strike many people as absurd. Of course that does not mean that it is incorrect, only that it is outside their current worldview.

There are sufficient anomalous effects to maintain the interest and sometimes inspire those who are attracted to mysticism or exceptional powers of the mind, and that appears to be a basic property (or intent) of the phenomena. However, the effects are too unreliable to convince cautious scientists and are not remotely convincing to skeptics. For the foreseeable future, neither skeptics nor proponents can provide convincing scientific evidence for their positions. Under these conditions, a person's attitude toward the paranormal will be subjective, with temperament and personality likely being significant factors (Kennedy, 2005).

The overall status of paranormal research has changed little over the past 100 years. In 1909, William James (1960) summarized the state of paranormal research by describing the phenomena as "... incoherent ... fitful ... with no law apparent but to interrupt, and no purpose but to baffle" (p. 319). He also concluded that "one cannot get demonstrated proof here. One has to follow one's personal sense ... of the dramatic probabilities of nature. Our critics here obey their sense of dramatic probability as much as we do" (p. 320).

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#### Abstracts in Other Languages

Spanish

# INFORMACIÓN EN LA VIDA, CONSCIENCIA, FÍSICA CUÁNTICA, Y FENÓMENOS PARANORMALES

RESUMEN: La información consiste de símbolos, medios para almacenar y transmitir los símbolos, y una infraestructura de interpretación que establece el significado de los símbolos, puede generar y decodificar los símbolos, y puede actuar en función de los símbolos. El procesamiento de información en sistemas vivientes incluye la genética, la percepción, el comportamiento, la memoria, el aprendizaje, la comunicación, la imaginación, la creatividad, y la cultura. Para ciertas hipótesis en la física cuántica y la mayoría de hipótesis de la parapsicología, los medios de comunicación y las infraestructuras de interpretación para el procesamiento de información van más allá de la comprensión científica actual. Después de una extensa investigación, la hipótesis de que un observador puede a veces influir paranormalmente el resultado de los eventos cuánticos no tiene sustento empírico convincente. Los resultados experimentales actuales en parapsicología no tienen las propiedades de una señal en medio de ruido y no se pueden distinguir en forma convincente de un sesgo metodológico. El registro prospectivo de los protocolos experimentales podría reducir considerablemente el problema del sesgo metodológico; sin embargo, los resultados experimentales probablemente seguirá siendo inconsistentes con las posiciones de los defensores y escépticos de la parapsicología experimental. Tal vez los hallazgos de la parapsicología sean más consistentes con un modelo en que los fenómenos paranormales son el resultado de agentes sobrenaturales de procesamiento de información con motivaciones relativamente independientes que se manifiestan como la espiritualidad e influyen el sentido y la dirección de la vida de un individuo.

## French

# L'INFORMATION DANS LA VIE, LA CONSCIENCE, LA PHYSIQUE QUANTIQUE ET LES PHENOMENES PARANORMAUX

RESUME : L'information est composée de symboles, des médias pour stocker et transmettre les symboles, et une infrastructure interprétative qui établit la signification des symboles, peut générer et décoder les symboles, et peut agir en se basant sur les symboles. Le traitement de l'information dans les systèmes vivants inclut la génétique, la perception, le comportement, la mémoire, l'apprentissage, la communication, l'imagination, la créativité et la culture. Pour certaines hypothèses dans la physique quantique et dans la plupart des hypothèses en parapsychologie, les médias et les infrastructures interprétatives pour le traitement de l'information dépassent notre compréhension scientifique contemporaine. Après une recherche étendue, l'hypothèse qu'un observateur peut parfois influencer paranormalement le résultat d'événements quantiques n'a pas de support empirique convaincant. Les résultats expérimentaux actuels en parapsychologie n'ont pas les propriétés d'un signal dans du bruit et ne peuvent pas être distingués de façon convaincante des biais méthodologiques. L'enregistrement prospectif des protocoles expérimentaux peuvent grandement réduire le problème confondant des biais méthodologiques ; toutefois, les résultats expérimentaux vont probablement continuer à être en contradiction avec les positions des tenants mais aussi avec celles des sceptiques de la parapsychologie expérimentale. Les résultats de la parapsychologie pourraient être plus conformes à un modèle dans lequel les phénomènes paranormaux sont le résultat d'un traitement supranormal de l'information avec des motivations relativement indépendantes qui se manifestent en tant que spiritualité et influence la signification et la direction de la vie d'un individu.

## German

# INFORMATION IM LEBEN, BEWUSSTSEIN, IN DER QUANTENPHYSIK UND BEI PARANORMALEN PHÄNOMENEN

ZUSAMMENFASSUNG: Information besteht aus Symbolen, aus Medien für die Speicherung und Weitergabe der Symbole und einer interpretativen Infrastruktur, die die Bedeutung der Symbole festlegt, diese erzeugen und entschlüsseln und aufgrund dieser Symbole Handlungen initiieren kann. Informationsverarbeitung in lebenden Systemen umfasst Genetik, Wahrnehmung, Verhalten, Gedächtnis, Lernen, Kommunikation, Imagination, Kreativität und Kultur. Für bestimmte

Hypothesen in der Quantenphysik und die meisten Hypothesen in der Parapsychologie gilt, dass die Medien und interpretativen Infrastrukturen, sofern sie die Informationsverarbeitung betreffen, das gegenwärtige wissenschaftliche Verständnis überschreiten. Nach eingehender Untersuchung konnte die Hypothese, dass ein Beobachter manchmal das Ergebnis von Quantenereignissen beeinflussen kann, nicht in überzeugender Weise empirisch bestätigt werden. Die gegenwärtigen Ergebnisse der experimentellen Parapsychologie weisen nicht die Eigenschaften eines vom Rauschen unterscheidbaren Signals auf und lassen sich nicht in überzeugender Weise von einem methodologischen Bias unterscheiden. Die prospektive Erfassung experimenteller Protokolle könnte das mitlaufende Problem des methodologischen Bias erheblich reduzieren; allerdings würde sich der Ausgang der Experimente wahrscheinlich nicht, wie bisher auch, mit den jeweiligen Positionen der Verfechter und Skeptiker der experimentellen Parapsychologie vereinbaren lassen. Die Ergebnisse der Parapsychologie könnten sich am ehesten mit einem Modell vereinbaren lassen, demzufolge paranormale übernatürlicher. informationsverarbeitender Phänomene das Ergebnis Wesenheiten mit relativ unabhängigen Motivationen sind, die sich auf spirituelle Weise manifestieren und die Bedeutung und Richtung des individuellen Lebens beeinflussen

# MOTOR AUTOMATISMS AS A VEHICLE OF ESP EXPRESSION<sup>1</sup>

#### By John Palmer

ABSTRACT: To explore the expression of ESP through motor automatisms (hand movements), 40 adult volunteers were tested. The target pool consisted of 100 homographs divided into 20 sets of 5 each. Detectors were seated in front of an alphabet board modeled after the Ouija board. For up to 30 min, they randomly moved the pointer around the board in an effort to find letters that appeared in the target word, recording each letter. An RRC staff member, located in a nonadjacent room, served as sender while listening to a pink-noise tape or a pink-noise tape with superimposed "binaural beats" in the theta and delta frequency ranges. Detectors then blind-rated a set of 5 possible targets for correspondence to the letters they got from the board and from other impressions. Detectors who said they felt an outside force moving their hand over the board (OF) from 1-40% of the time scored significantly above chance and significantly higher than other detectors. A trait measure of dissociation consisting of the Complex Partial Epileptic Signs scale with the Tellegen Absorption Scale partialled out correlated positively and significantly with the OF item. The findings suggest that moderate levels of dissociation are more psi-conducive than extreme levels.

*Keywords:* motor automatism, dissociation, extrasensory perception, Ouija board, temporal lobe epilepsy, absorption

This study was aimed at exploring ESP in dissociative states. Dissociation was defined as the tendency for actions or thought processes to occur involuntarily and separately from the normal stream of consciousness. The underlying hypothesis was that ordinary conscious mental activity interferes with psi, and if the psi process could be split off from this mental activity it would be more likely to manifest. Trance mediums have often produced relatively strong psi effects, and modern altered-state induction procedures such as hypnosis and the ganzfeld seem to create states that are at least mildly dissociative while arguably enhancing psi performance (Honorton, 1977; Stanford & Stein, 1994).

I previously conducted a series of ESP-dissociation experiments in which participants made ESP responses through a form of motor automatism, random eye fixations on the elements in a matrix of symbols. Before either each run or each trial, a motivational visual stimulus was flashed to participants subliminally. Overall significant results with this procedure, when they occurred, tended to be either psi-missing or tight variance, suggesting a negative reaction to the test (e.g., Palmer & Johnson, 1991). Desiring a measure of autonomous ESP that participants could relate to more easily, I decided to employ a psi task based on the popular Ouija board, for which the automatisms are hand movements.

<sup>&</sup>lt;sup>1</sup> This paper was independently peer reviewed under the auspices of Richard Broughton.

Sargent (1977) conducted two experimental series in which groups of volunteers played with a Ouija board in an informal atmosphere, mostly unaware that an ESP test was involved. In both experiments, belowchance scoring was obtained when the sequences of characters that participants selected from the board were structured (e.g., meaningful words) and above chance when they were unstructured. For the present experiment, I chose to employ a free-response procedure rather than the forced-choice procedure used by Sargent. To increase the number of potential associations to the target, I chose as targets simple, one-syllable homographs (words with more than one meaning). Subliminal perception research using words as stimuli suggests that associates to target words often are more pre-potent than the target words themselves (Bornstein & Pittman, 1992), and subliminal perception may involve discrimination mechanisms similar to psi (Schmeidler, 1986).

Both a "state" and a "trait" approach were utilized to assess whether participants with the greatest tendencies toward dissociation would get the highest scores on the alphabet board task. For the state approach, participants were asked whether they had the impression during the session that the pointer was being guided by an outside force. For the trait approach, participants completed the Complex Partial Epileptic Signs (CPES) scale (Persinger & Makarec, 1993), which measures tendencies toward temporal lobe epilepsy (TLE), which is characterized by dissociative behavior, often including motor automatisms such as involuntary chewing motions. The CPES scale correlates very highly with Bernstein and Putnam's (1986) Dissociative Experiences Scale, which is used to measure tendencies toward multiple personality (Persinger & Makarec, 1993). However, I have found that the CPES also correlates highly with the Tellegen Absorption Scale (TAS; Tellegen, 1978), which measures the tendency to become absorbed in one's phenomenological experience. Thus, the TAS was added as a suppressor variable re the CPES. In a previous survey of Ouija board users, the suppressed CPES scores correlated with reports of negative experiences using the board (Palmer, 1999).

Because it is possible that psi information might come through other vehicles than motor automatism, such as visual imagery, participants were asked to make separate ratings for impressions that came directly from the board and other impressions. As such impressions are not sought, they would be more dissociative, and arguably more likely to be psi-mediated, than many of those obtained in standard free-response experiments in which participants try to produce imagery. With respect to such spontaneous imagery, the Ouija board can be seen as a distracter.

Finally, a sender attempted to transmit the target word to the receiver. To induce a psi-conducive altered state of consciousness, the sender listened to an audio tape that contained either pink noise (a component of the ganzfeld procedure for inducing an ASC) or pink noise on which were superimposed binaural beats. These sounds are used by the Monroe

Institute to help induce out-of-body experiences and related altered states of consciousness in people who participate in their professional workshops by "influenc[ing] ongoing brainwave states by providing information to the brain's reticular activating system" (Atwater, personal communication).<sup>2</sup> It was speculated that having the sender as well as the receiver in a dissociated state would enhance the psi effect.

#### Method

#### Participants

The sample size was set in advance at 40. Participants consisted primarily of persons who had previously been tested in other experiments at the Institute for Parapsychology, especially a remote viewing screening experiment. Participants were referred to as "detectors."

#### **Targets**

A fairly elaborate procedure was used to create the target pool. The initial list of target words consisted of 390 homographs reported by Ferraro and Kellas (1990). These authors presented this list of words to 150 college undergraduates and asked them to indicate whether the word had no, one, or two meanings. The percentage of participants choosing two was the first selection criterion. The second criterion was based on an experiment by Nelson, McEvoy, Walling, and Wheeler (1980), who gave a list of 300 homographs to 46 college undergraduates, asking them to list as many meanings of each word as they could think of in a 50-min period. The responses to each word from all the participants were then compressed by the authors into categories which contained words of similar meaning. The second selection criterion was created by dividing the number of responses in the first or primary category by the total number of responses. For example, 46 different responses were given to the word bark, of which 37 made reference to a dog. Thus, the percentage score for bark was 37/46, or 80%. Note that for the first criterion a high percentage means high diversity, whereas for the second criterion a low percentage indicates high diversity.

The original Ferraro and Kellas list was reduced from 390 to 187 by eliminating words that were not included on Nelson et al.'s list. Five eliminated words that had a score higher than 75 on Ferraro and Kellas's list were added back and given a score of 72 on Nelson et al.'s list, which is the mean score of the words on their list. The resulting 192 words were ranked separately on the two sets of scores, with the highest diversity scores given the lowest ranks in each case. The ranks for each word were then

<sup>&</sup>lt;sup>2</sup> I wish to thank Skip Atwater of the Monroe Institute for preparing and sending me the tapes.

summed and the words reranked according to the rank sums. The first 100 words were chosen for the target pool.

The selected words were then ranked for frequency in the English language, using primarily the Kucera and Francis (1967) norms. This ranking was then used to divide the 100 words into 20 sets of five words each, such that the words in each set had maximally similar frequencies. Some reassignments were made to avoid words in the same set having highly similar meanings or too many common letters.

The list of 100 words was stored in a computer, and a pseudorandom algorithm from Quick Basic was used to select a sequence of 100 target words, with replacement. This was more than enough to cover the projected 40 trials and various pilot sessions. The sequence was not exposed, so that the target for each trial was not known to anyone until displayed to the sender during the trial in question.

## **Alphabet Board**

The alphabet board was similar to a Ouija board but purposely had a somewhat different appearance, as I did not want the context of the experiment to bear too strong a resemblance to those in which Ouija boards are customarily used. It consisted of a 16-inch square piece of white paper, with black lettering, that was taped to a heavy glass frame with rubber feet, and covered with laminating to produce a smooth surface. The pointer was the one supplied with the Parker Brothers Ouija board, but it was covered with black felt to blend with the appearance of the board.

The letters of the alphabet are displayed in a square format near the edges of the board. The letters on each of the four sides of the board were arranged such that the numbers of times they appeared, as a group, in the target pool were close to identical. Also, the most common letters appeared near the middle of each row, with the least frequent letters appearing at the ends, or near the corners. Numbers were not included, but the words "yes" and "no" and "maybe" were, in case the detector wanted to ask the board questions. Finally, the word "bye" was available to give detectors a basis for stopping the session at a hopefully optimum time.

#### Layout

The detector was located in a small  $(6' \times 8')$  room in the basement of the Institute. In the middle of the room was a table with a chair on each side. On top of the table was the alphabet board, a portable tape recorder, and a note pad and pen. The room was illuminated by a 20-watt red light bulb inside a standing lamp with white shade. The outside window was covered with opaque cardboard and dark drapes.

The sender was located in a 6' x  $8\frac{1}{2}$ ' room on the second floor of the Institute, not directly above the detector's room. She was seated in

a reclining chair facing a TV monitor not used for the project and not connected to a computer. The sender's room was equipped with a pair of headphones connected to a cassette tape recorder located in an adjacent room. The outside window was covered with opaque cardboard, so the room was dark during the sending periods. Adjacent to this room on two different sides was an outer room, which contained an IBM-type microcomputer used to randomize and display target material, and a monitoring room which housed a cassette tape deck used to funnel sound stimuli to the sender during the session.

Description of the procedure and completion of rating scales took place in the Institute's library/conference room located on the first floor.

#### **Materials and Questionnaires**

**Triangle Psychological Inventory (TPI).** The TPI consists of 50 true-false items. Thirty-four of the items constitute the Tellegen Absorption Scale (TAS; Tellegen, 1978) and the remaining 16 items constitute the Complex Partial Epileptic Signs (CPES) scale (Persinger & Makarec, 1993). The items from the two scales are ordered randomly on the TPI. Both the TAS and CPES are components of larger scales that include checks for lying and acquiescent response bias, which allowed their authors to key all the items in the positive (true) direction. This creates the potential for acquiescent response bias when the scales are administered in isolation. To alleviate this problem, I created an alternative version of the TPI in which half the items on each component scale were reworded negatively, and this revised version was used in the present study.

**Detector Questionnaire.** This questionnaire asked the detectors about their experience during the session. It began with two questions using visual analog scales asking how likely they felt it was that the sender projected her consciousness into the detector's room and successfully communicated the target. The next two questions asked how much of the time detectors tried to move the pointer around the board, in contrast to waiting for it to move on its own, and what percentage of the time, if any, they felt the pointer was being guided by an outside force. The last two questions, which were open-ended, asked the detectors to describe any mental imagery or impressions they had during the session and any anomalous physical effects (e.g., movements, noises) they might have noticed.

**ESP Rating Scales.** These two scales asked detectors to rate from 0 to 20 each of the five words in the target set according to how well it corresponded to their impressions. The first scale asked for two independent sets of ratings, the first for what came through directly on the board, and the second for any other impressions obtained at any time during the experiment, including those mentioned on the Detection Questionnaire. The second scale asked them to make a single, composite set of ratings. It was stressed to detectors orally that they could weight the two previous sets

of ratings any way they wished to arrive at the composite rating. Detectors who gave the highest rating to more than one target alternative on any of the scales were forced to make a first choice by circling the corresponding rating on the sheet.

**Post-Feedback Questionnaire.** This questionnaire asked participants to mark any of the following five potential sources of information that caused them to give the target as high a rating as they did, and then to rank the ones marked in order of importance. The sources were movements on the board, other impressions before the session, other impressions during the session, other impressions after the session but before judging, and other impressions during the judging. The questionnaire was not given to eight participants who gave the target a composite rating of 0, because the questions were not meaningful in that situation.

**Noise Questionnaire.** We had become sensitized to the fact that our testing rooms were susceptible to various outside (nonanomalous) noises that detectors might find distracting. To assess this problem, the last 13 detectors were asked to complete a short questionnaire asking them to describe any such noises they heard during the session and to rate their distractedness on a 5-point scale.

**Projection Questionnaire.** This questionnaire asked the sender to estimate on visual analog scales the maximum alteration of consciousness she obtained during the session, her success in projecting her consciousness to the detector's room, and her success in communicating the target word to the detector. Finally, it asked her to guess which of the two sound tapes she had listened to.

Audio Tapes. The experimental (binaural beat) tape presented four carrier waves of 100, 200, 250, and 400 Hz that produced binaural beats of 1.5 Hz for the 100 Hz carrier and 4 Hz binaural beats for the other carriers. These correspond to brain waves in the delta and low theta ranges. The beats were superimposed on a background of pink noise. The control tape consisted of the pink noise only. The taped sounds were transmitted to the detector in stereo through headphones.

A sequence of 20 experimental and 20 control tape designations was randomly permutated using the same pseudorandom algorithm used to create the target sequence. The tape sequence was stored in the computer and not revealed until each designation was accessed at the beginning of a test session.

## Procedure

Most detectors completed the TPI at home prior to their session. The others completed it at the beginning of the experiment.

I, as experimenter, began by reading to the detector a description of the procedure. For reasons of informed consent, a paragraph was included at the end which noted that some people have had negative experiences using Ouija boards (to which our alphabet board bears some resemblance) but that the context of this experiment was different from those that ordinarily create problems (e.g., conjuring spirits), that none of our previous participants had a bad experience in the experiment, but that they should feel free to immediately stop the session if they encountered anything negative. All detectors agreed to continue and signed our consent form. None reported a negative experience during the session. The task was presented to the detectors as primarily a test of the sender's ability, so as to reduce their feeling of responsibility for the outcome (cf. Batcheldor, 1984).

I then escorted the detector upstairs to greet the sender in her office. The sender was Institute research associate Cheryl Alexander, who has experience getting herself into an altered state of consciousness. After a brief chat, we went to the sender's room. The sender sat down in the reclining chair and explained to the detector how she would do the sending: her strategy was to project her consciousness to the detector's room and guide the detector's hand to the letters on the board; she also would attempt to transmit the word itself and her associations to it. I then asked the detector to sit briefly on a couch in the hallway, after which the sender shut the door to her room. After the door was shut, I obtained from the computer, located in the outer room adjacent to the sender's room, a letter indicating whether the sender would hear the sound tape with the binaural beats or the control tape. I then cleared the computer screen and left the room, closing the door behind me. I went immediately to the monitoring room, located on the other side of the wall from the sender's room, and placed the appropriate tape inside the cassette tape deck, adjusted the volume, and pressed play. I closed the door behind me as I left the monitoring room. After I vacated the outer room, the sender entered the room and pressed a key on the computer keyboard that caused the target word to appear on the screen. (The word remained on the screen throughout the session.) She then reentered the sender's room, closed the door, turned off the light, put on the headphones, and began to enter an altered state of consciousness.

After I left the outer room, I met the detectors in the hallway and escorted them downstairs to the detector's room. I reviewed the key instructions, including the following points. I demonstrated how to move the pointer around the board. Detectors were told that, if the pointer did not move on its own, to try to move it around randomly and see if they could detect a force guiding it in a particular direction or toward a particular letter or word. They were also told that they should say out loud for the small cassette tape recorder located on the table every letter the pointer identified during the session, as well as any question asked of the board, and the board's reply. It was noted that no one would be listening in. They were told that after I left the room they could take a couple moments to get relaxed and centered and then to press the record button on the tape recorder, which I demonstrated. They were told they could write notes on the notepad to remind them of the board's responses when they were doing the judging, but they were not to interrupt periods when the board was active to take notes. They were told that the session would last a maximum of 30 min, which would be indicated by the tape running out (at which point a click could be heard from the recorder). They were told they could stop the session before that time, if they wished, by pressing the stop button on the recorder, which I demonstrated. When the session was over, detectors were instructed to call me on the intercom phone resting on the table. Instructions for doing so were listed on the phone. Finally, they were told to wait in the room until I came down to get them.

During the session, I was on the second floor engaged in other activities. When I received the phone call from the detector, I went to the monitoring room, turned off the tape recorder giving sound to the sender, and knocked twice on the wall to confirm that the session had been completed. I then went downstairs to retrieve the detector.

The sender in the meantime removed the headphones, turned on the light in the sender's room, and completed the Projection Questionnaire. She then entered the outer room and pressed a key on the keyboard that caused the number of the target *set* (1–20) to appear on the screen, replacing the target word. She then left the outer room, leaving the door open (as a signal that the target word was no longer on the screen), went to her office, and closed the door.

In the meantime, I escorted the detector up to the library. Detectors first completed the Detection Questionnaire, which I checked to be sure it had been filled out properly. I then went upstairs to the outer room to observe the number of the target set. I then went to my office and retrieved from a desk drawer one of 20 index cards which listed the five target alternatives for the session. I took the card with me back to the library and showed the card to the detector, who then completed the two ESP rating scales. When this was completed, the detector filled out the Noise Questionnaire.

I then went upstairs to retrieve the sender from her office and confirmed the identity of the target word. We went together to the library to reveal the target to the detector. After some discussion about the results, the sender left. If the target had been given a composite rating greater than zero, the detector completed the Post-Experiment Questionnaire. Lastly, detectors were invited to ask any questions they might have about the experiment, which were answered, and thanked for their participation.

#### Results

All *p* values reported in this section are two-tailed.

#### **Overall ESP Scores**

One detector could get no information in the experiment at all and that session was not counted. This detector was replaced by another one at

the end of the experiment. This new detector was given a new target word but the tape condition was the same as for the one replaced. This meant that the tape designation was, strictly speaking, not blind for this session, but the sender did not recall the designation for the aborted subject and in fact estimated on the Projection Questionnaire that the tapes for the two sessions were different.

There were three ESP measures: scores based on information that came through the board, scores based on information that came through other vehicles, and combined or total scores. The latter were defined as the primary scores for all analyses in the experiment. Combined ratings were not obtained for the first two subjects. Estimates were created for them by taking the averages of their ratings for the "board" and "other" scales for each of the five target alternatives.

For total scores, when detectors gave the same highest rating to more than one word, they were "forced" to circle one of them as their first choice. This was not required for the "board" and "other" ratings, and for these scales, ties were resolved by awarding a partial hit, defined as 1 divided by the number of tied high ratings.

The mean number of hits for the total score (N = 40) was 10, with MCE = 8. This is associated with a corrected z = 0.59, which is in the positive direction but nonsignificant (p = .55). The associated effect size ( $z / N^{1/2}$ ) is .09. There were four instances where every word in the set was given a rating of 0 (three on the "board" scale and one on the "other" scale), indicating that no information came through this vehicle. These scores were treated as missing. The mean number of hits for the "board" scale (N = 37) was 6.50 (MCE = 7.4), and the mean number of hits for the "other" scale (N = 39) was 8.75 (MCE = 7.8). Both values are nonsignificant.

As a secondary measure of overall ESP, *z* scores were created for each scale by subtracting from the rating given to the target word the mean rating for all 5 words and dividing by the standard deviation of all 5 words. The mean *z* score for the total scale was 0.16, t (39) = 1.09, p = .120 (nonsignificant). The mean *z* score for the "board" scale was 0.12 and for the "other" scale 0.06, both nonsignificant.

I had originally intended to have a second set of ESP measures based on independent judging of the oral records detectors made of their board responses during the sessions. However, when the tapes were transcribed it was discovered that in a great many cases the utterances were so faint that they could not be detected. Instead of analyzing clearly unreliable data, I decided to forego the independent *z* scores.

## Dissociation

The "state" measure of dissociation was the item on the Detector Questionnaire asking whether the detector felt at any time during the session that an outside force was guiding his or her hand. I wanted to break responses on this item into groups of at least 10. Inspection of the distribution of scores revealed that this could best be accomplished by creating the following three groups: felt outside force 0% of the time (n = 15), 1%–40% (n = 11), 41%–100% (n = 15). The aborted participant was included in analyses not involving ESP scores, raising N to 41.

As expected, the outside force question (OF) was significantly related to the "trait" measure of dissociation, the CPES scale, using the nonparametric Kruskal-Wallis test, K-W = 8.99, p = .011. As illustrated in Figure 1, the relationship is essentially linear, although the linearity is contributed primarily by the difference between the 1–40% group and the 41%-100% group. Expressed as a correlation, the relationship between these two variables is also significant,  $r_s$  (39) = .43, p = .006. It is noteworthy that the correlation between OF and the suppressor variable, TAS, was much lower,  $r_s$  (39) = .15, p = .34, despite the fact that, as expected, the CPES scale and TAS were highly correlated with each other,  $r_s$  (39) = .77. When the CPES scale and the TAS were entered into a multiple regression performed on a Spearman correlation matrix and with OF as the dependent variable, the (partial) correlation between CPES and OF was elevated to .76, t (38) = .344, p = 001. In fact, the suppressor effect of the TAS is almost significant, t (38) = -1.96, p = .058.



*Figure 1.* CPES in relation to percentage of time hand seen as being moved by an outside force

The relationship between the total ESP scores and OF is significant, *K-W*= 6.84, p = .033. However, as illustrated in Figure 2, the relationship is curvilinear, with the hitting concentrated in the 1–40% group. The mean *z* score of the 11 detectors in this group is .818, which is highly significant, *z* = 4.22,  $p = 2.4 \times 10^{-5}$ . This high significance is not due to one or two ultra-high *z* scores. Because of the way they are calculated, the highest *z* score in the experiment was only 1.79. The results for the "both" and "other" *z* scores were quite similar to those for the total *z* scores.

The total *z* scores did not correlate significantly with either the CPES scale,  $r_s(38) = -.03$ , or the TAS,  $r_s(38) = -.12$ . Correlations between these two predictors and the "board" and "other" *z* scores were comparable and nonsignificant.



*Figure 2.* ESP *z* scores in relation to percent time hand seen as being moved by outside force

## **Binaural Beat Tapes**

The beats are difficult to detect and there was some hope that the sender would not be able to tell the two tapes apart. If this were the case, it could be claimed that she was blind to the manipulation, and expectancy could thus be ruled out as an alternative explanation of any differences the tapes made in the results. The sender was able to correctly identify the tape she was listening to on 26 of the 40 trials (65%), which approaches

significance,  $\chi^2$  (1, N = 40) = 3.60, p = .058. However, this only means that she could tell the two tapes apart with some degree of success. She claimed that she was not able to identify which of the two tapes included the binaural beats, and she claimed that she made no effort to do so. Thus, I would say that the blinds were equivocally successful.

The two tapes did not differ in their effect on the sender's perceived entrance into an altered state of consciousness. On the 10-point continuous scale, the mean was 7.49 with the binaural beat tape and 7.62 with the control tape, Mann-Whitney U = 186, p = .705. There also was no effect of the tapes on how successfully she felt she had projected her consciousness into the detector's room ( $M_{\rm b} = 5.13$ ,  $M_c = 5.35$ ), U = 185, p = .69, or how successfully she felt she had communicated the target word to the detector ( $M_{\rm b} = 6.71$ ,  $M_c = 6.56$ ), U = 214, p = .71.

There were only two noteworthy relationships between detector variables and the tapes. There was a suggestive tendency for the "board" ESP *z* scores to be higher when the sender was listening to the binaural beat tape (N = 20,  $M_{\rm b} = .324$ , z = 1.87, p = .06) than when she was listening to the control tape (N = 17,  $M_c = -.118$ ), U = 227, p = .08. However, when the sender was listening to the binaural beat tape, the detectors felt it was *less* likely that she had "projected herself into the test room during the session" ( $M_{\rm b} = 4.48$ ) than when she was listening to the control tape ( $M_c = 6.94$ ), U = 288.5, p = .04.

## **Other Variables**

There were no significant relationships between the ESP z scores and sex of the subject or any of the items on the Detector, Noise, Post-Feedback, or Projection Questionnaires not addressed above.

#### Discussion

The matrix of correlations between the CPES scale, the TAS, and the OF question on the Detector Questionnaire could hardly have fit my expectations more closely. These results support the theoretical rationale that the variance the CPES scale does *not* share with the TAS is a good measure of dissociative tendencies and, more to the point, a good predictor of dissociative responses on a task like the alphabet board. These results provide support for the construct validity of both the trait and state measures. They also argue against a response bias interpretation, because someone who wanted to "appear mystical or psychic" would most likely try to get a high score on the TAS as well as the CPES scale. Moreover, the items on the two scales are difficult to distinguish from each other just by looking at them.

In light of the psi-missing and tight variance effects I customarily found with the eye fixation test, it was refreshing to see that the hit rate of .25 with the alphabet board was at least above chance (.20). However, the value was not significant, and thus the alphabet board was not as psiconducive as originally hoped. Although the effect size of .093 is comparable to the .096 found for the standard, post-PRL ganzfeld experiments (Bem, Palmer, & Broughton, 2001), an N of 40 is not large enough to produce a reliable measure of *ES*. In my opinion, only effect sizes from significant results should be interpreted in isolation.

The number of significant relationships between ESP and predictor variables was small but concentrated on the predictors of greatest theoretical interest. Foremost among these was the question about proportion of time the detector felt his or her hand was being moved by an outside force (OF). This variable indeed related significantly to the ESP z scores, but not in the manner expected. Instead of a positive linear relationship between these variables, a curvilinear relationship was found, with the highest scoring among those who experienced OF for 1 to 40% of the session. My first inclination was to suspect that the experience of these detectors might have been more veridical than those who experienced the OF more consistently, because one might expect true ASCs of this type to be very intermittent. This interpretation, in addition to being ad hoc and speculative, is inconsistent with the fact that the validity measure for the OF question, the CPES scale, predicted OF most strongly for high-frequency (>40%) experiencers (see Figure 2). The <40% group differed hardly at all on the CPES scale from those who never experienced the OF during the session. The mean z score for the <40% group is quite high (.818), but like any isolated finding it needs to be replicated. If the relationship is real, it would appear that too much dissociation might be counterproductive to ESP.

Having the sender listen to the binaural beat tape did seem to facilitate psi-hitting on the part of the detector, but only to a suggestively significantly degree (p=.08) and only on ESP scores based exclusively on the results of spontaneous hand movements. In other words, the effect is quite weak and its validity questionable. Nonetheless, it is enough to encourage continued exploration of the influence of binaural beat stimuli on a variety of psi tasks. Insofar as this influence was real in the present experiment, it supports an active role for the sender in the communication process, bringing it in line with what is often assumed to be the process in DMILS research. There are a variety of types of binaural beats that could be used, and the one selected for this study may not be the most effective. Because the background sound is similar to that used in the ganzfeld, binaural beat tapes would fit particularly well in ganzfeld protocols.

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#### **Abstracts in Other Languages**

#### Spanish

# AUTOMATISMOS MOTRICES COMO VEHÍCULO DE EXPRESIÓN DE LA PES

RESUMEN: Para explorar la expresión de la PES a través de automatismos motrices (movimientos de la mano), evalué a 40 voluntarios adultos. Los estímulos consistieron en 100 homógrafos divididos en 20 series de 5 cada uno. Los detectores estaban sentados delante de un tablero alfabético siguiendo el modelo de una tabla ouija. Durante un máximo de 30 minutos movieron el puntero al azar por el tablero con el propósito de encontrar las letras de una palabra determinada, haciendo un registro de cada letra. Un miembro del personal del RRC, ubicado en un cuarto no adyacente, fungió como agente mientras escuchaba una cinta con sonido rosa o una cinta con sonido rosa y "ritmos binaurales" superpuestos en los rangos de frecuencias theta y delta. Los detectores bajo condiciones de máscara evaluaron un grupo de cinco objetivos posibles en cuanto a la correspondencia con las letras que recibieron de la tabla y con otras impresiones. Los detectores que mencionaron sentir que una fuerza movía sus manos sobre el tablero (FE) puntuaron de 1-40% significativamente por encima del azar y significativamente más alto que otros detectores. Una medida rasgo de disociación consistente en la escala Complex Partial Epileptic Signs (Signos de Epilepsia Parcial Compleja) con la Escala de Absorción de Tellegen controlada correlacionó positiva y significativamente con el FE. Los resultados sugieren que los niveles moderados de disociación son más favorables a psi que los niveles extremos.

#### French

## LES AUTOMATISMES MOTEURS EN TANT QUE VEHICULE DE L'EXPRESSION DE L'ESP

RESUME : Pour explorer l'expression de l'ESP à travers les automatismes moteurs (mouvements de la main), 40 participants adultes furent testés. La base de cibles contenait 100 homographes divisés en 20 lots de 5 chacun. Des participants « détecteurs » étaient disposés en face d'un tableau alphabétique modelé d'après la planche du Oui-ja. Dans des périodes allant jusqu'à 30 minutes, ils devaient déplacer aléatoirement le pointeur sur la planche afin de trouver les lettres qui allaient apparaître dans le mot cible, chaque lettre étant enregistrée. Un membre de l'équipe du RRC, situé dans une pièce non-adjacente, servait d'émetteur alors qu'il écoutait une cassette avec du bruit rose ou une cassette avec du bruit rose sur laquelle étaient surimposés des « battements binauraux » dans des gammes

de fréquences thêta ou delta. Les détecteurs devaient ensuite coter en aveugle un lot de cinq cibles possibles pour leurs correspondances avec les lettres obtenues grâce à la planche et sur la base d'autres impressions. Les détecteurs affirmant avoir senti une force extérieure guidant leur main sur planche (OF pour Outside Force) dans 1 à 40 % du temps avaient des scores significativement supérieurs à la chance et significativement supérieurs à ceux des autres détecteurs. Une mesure du trait de la dissociation réalisée avec l'échelle Complex Partial Epileptic Signs de l'échelle d'absorption de Tellegen se corrélat partiellement de façon positive et significative avec l'item OF. Les résultats suggèrent que des niveaux modérés de dissociation sont plus propices au psi que des niveaux extrêmes.

#### German

## MOTORISCHE AUTOMATISMEN ALS VERMITTLER VON ASW-INHALTEN

ZUSAMMENFASSUNG: Zur Untersuchung der Frage, inwiefern sich ASW-Inhalte durch motorische Automatismen (Handbewegungen) vermitteln lassen, wurden 40 erwachsene Freiwillige getestet. Der Pool an Zielobjekten bestand aus 100 Homographen, die in 20 Gruppen zu je 5 aufgeteilt waren. Die Detektoren sassen vor einem alphabetischen Brett, das einem Ouijabrett nachgebildet war. 30 Minuten lang bewegten sie den Zeiger zufällig auf dem Brett in der Absicht, diejenigen Buchstaben ausfindig zu machen, aus denen das Zielwort bestand, wobei jeder Buchstabe protokolliert wurde. Ein Mitglied des RRC, das sich in einem entfernten Raum befand, fungierte als Sender, während es einem Band mit rosa Rauschen oder einem Band mit rosa Rauschen mit überlagerten "binauralen Rhythmen" in den Theta- und Delta-Frequenzbereichen zuhörte. Die Detektoren mussten dann eine Gruppe von 5 möglichen Zielobjekten in ihrer Übereinstimmung mit den Buchstaben, die sie vom Brett und aufgrund anderer Eindrücke erhielten, blind zuordnen. Die Detektoren, die angegeben hatten, sie würden eine äußere Kraft spüren, die ihre Hand über das Brett (ÜB) im Bereich von 1-40% der Zeit bewegte, schnitten überzufällig und signifikant besser ab als andere Detektoren. Eine Traitmessung der Dissoziation, die aus der Complex Partial Epileptic Signs-Skala mit ausparzellierter Tellegen Absorption-Skala bestand, korrelierte positiv und signifikant mit dem ÜB-Item. Die Ergebnisse legen nahe, dass eine moderate Dissoziationsneigung psi-förderlicher ist als extreme Ausprägungen.

# THE EVOLUTION OF BELIEFS IN GOD, SPIRIT, AND THE PARANORMAL. III: DIRECT BENEFITS OF PARANORMAL ABILITIES

#### BY MICHAEL P. KELLEY

ABSTRACT: Positive schizotypy (reality distortion), and other components of transliminality, may constitute a genetic balanced polymorphism in which the disadvantageous effects of conditions associated with extreme ends of the trait dimension are balanced by advantages associated with more moderate levels of trait expression. Positive schizotypy and creativity are associated with mating success. The relatives of psychotic individuals have elevated schizotypy levels, and one recent study reported that the relatives of psychotics have greater fecundity. The evolution of beliefs in God, spirit, and paranormal phenomena may be mediated not by reduced death anxiety, but rather by a set of interrelated adaptive traits including creativity, positive schizotypy, and hypnotizability, which are components of the superordinate trait dimension of transliminality. Paranormal beliefs are related to paranormal experiences as well as paranormal abilities, which, if veridical, would have direct adaptive advantage. Correlates of paranormal abilities overlap with component characteristics of transliminality. Beliefs in spiritual and paranormal phenomena may have evolved simply because such beliefs are in some manner true, and the associated traits and abilities are highly adaptive.

Keywords: paranormal belief, evolution, transliminality, direct benefits

In the first article of this series, the terror management theory of religion was reviewed. Although there is extensive evidence linking religiosity to reduced death anxiety, the evidence is somewhat inconsistent and limited to certain aspects of death anxiety, certain aspects of religiosity, and a restricted range of belief conviction. There is no evidence linking death anxiety to fecundity. Ritual healing theory (McClenon, 1997) is an alternative evolutionary account of beliefs in the paranormal, spirit, and God, which proposes that anomalous experiences are the experiential source of such beliefs, and that such experiences originally occurred in the context of shamanic healing rituals. Individuals who were high in hypnotizability were more susceptible to the healing benefits of such rituals, resulting in selection for this heritable trait, facilitating the evolutionary development of beliefs in paranormal and spiritual phenomena. In the second paper, evidence was reviewed suggesting that hypnotizability and paranormal belief and experience are components of a superordinate trait dimension, transliminality (Thalbourne & Delin, 1994), which is also composed of schizotypy, fantasy-proneness, and creativity. In this article, schizotypy, and by extension transliminality, is considered in light of the balanced polymorphism model of the genetics of psychosis. Disadvantageous effects

of psychosis on fecundity may be balanced by advantageous effects conferred by schizotypy, hypnotizability, and particularly creativity, all components of transliminality. Paranormal beliefs and experiences, as well as other aspects of transliminality, are also associated with paranormal abilities. A further evolutionary account is described, in which genes contributing to transliminality were selected because associated paranormal abilities have direct benefits in terms of enhanced survival.

#### **Balanced Polymorphism**

Far from being just a pathological condition, vulnerability to schizophrenia spectrum disorder or other "psychosis-continuum" psychopathological conditions (i.e., schizotypy) may at times confer certain advantages or superior abilities, such as creativity, giftedness, and high intelligence (Brodsky & Brodsky, 1981; Huxley, Mayr, E., Osmond, H., & Hoffer, 1964). The occurrence of normal as well as disadvantageous phenotypes suggests that the genetic determinants of schizophrenia spectrum disorders may be what is known as a "balanced polymorphism." Schizophrenics and their unaffected siblings have a lower fertility rate than the general population (Avila, Thaker & Adami, 2001; Bassett et al., 1996; Buck, Hobbs, Simpson, & Wanklin., 1975; Erlenmeyer-Kimling, 1978; Gottesman & Erlenmeyer-Kimling, 1971; Lewis, 1958; MacSorley, 1964; Odegaard, 1980; Slater, Hare, & Price, 1971; Stevens, 1969), as do patients with affective illness (Baron, Risch, & Mendelwicz, 1982; Odegaard, 1980; Slater, Hare, & Price, 1971). The genes underlying schizophrenia should be decreasing in frequency with each generation. However, the incidence rate for schizophrenia has remained stable world-wide for the past 100 years (Gottesman, 1991; Jablensky et al., 1992; Sartorius & Jablensky, 1976), and the prevalence rate is regarded as being similar across different cultures and different times (Book, Wetterberg, & Modrzewska, 1978; Hafner, 1987; Rosenthal, 1970). The lowered reproductive capacity of the schizophrenic and closely related phenotypes may be offset by a high mutation rate, or by other phenotypes that are either very widespread or have an increased survival value compared to the general population. The decreased survival value of the schizophrenic phenotype may be compensated by phenotypes, probably manifest in healthy (non-first-degree) relatives, with advantages in terms of increased survival value in order to maintain a stable incidence of the schizophrenic genotype in the population (Huxley et al., 1964; Jarvik & Deckard, 1977; Nettle, 2001; Shaner, Miller, & Mintz, 2004).

#### Schizophrenia Spectrum Disorders and Creativity

The schizophrenia genotype(s) may be associated with certain advantageous characteristics, such as creativity and intellectual giftedness, and this association may apply at both the individual and familial levels.

Whereas a subgroup of preschizophrenic individuals have academic difficulties and cognitive impairments, another subgroup may be gifted. A higher proportion of preschizophrenic boys (11%) had excellent school grades compared to only 3% in comparison groups (Isohanni et al., 1999). Another study found that preschizophrenic children attained higher school grades in drawing and writing but lower marks in physical education compared to controls matched for school, grade, and sex (Hultman et al., 1999). There is extensive evidence that positive schizotypy is associated with creativity (e.g., review by Brod, 1997), which may be the advantageous phenotype which is selected for (O'Reilly, Dunbar & Bentall, 2001). If the schizophrenic spectrum includes creative tendencies in addition to neurotic traits, antisocial behavior, mental deficiency and psychoses, there may well be reproductive advantages as well as disadvantages of the genotype (Brodsky & Brodsky, 1981; Huxley, Mayr, Osmond, & Hoffer, 1964). While there is no compensating increase in the fertility of parents (Hare & Price, 1970) or siblings of schizophrenics (Bleuler, 1978; Buck, Hobbs, Simpson, & Wanklin, 1975), it may be that such advantages are expressed only in more distant relatives.

There is evidence that creativity is associated with mental illness, including both schizophrenia spectrum disorders and manic-depressive illness, on both familial and individual levels (e.g., Andreasen, 1987; Eysenck, 1983; Hare, 1987; Jamison, 1989, 1990, 1993). Family studies consistently reveal a range or spectrum of psychopathology associated with the schizophrenic genetic diathesis: about 15% will be psychotic and 40% will be antisocial, that is, sociopathic or alcoholic (Rosenthal, 1970). Of the remainder, some will be normal and perhaps 5% will be "superphrenic" (Brodsky & Brodsky, 1981). These are described as individuals who are artistically or musically creative, intelligent and rational, and are functioning at an above average level in their lives. Pedigree analyses of families with schizophrenic members in Iceland revealed that the relatives of psychotics have a significantly greater probability of being eminent and successful scholars, creative authors, political leaders, financially successful community officials, and clergymen, compared to the general population or to control subjects without psychotic relatives (Karlsson, 1968, 1970, 1974, 1978, 1981, 1983, 1984). Conversely, when scholarly achievement or creative success was used to define index cases, the relatives of accomplished Icelanders showed a higher rate of psychotic disorders (Karlsson, 1981). Other earlier genealogic studies have found increased rates of mental illness in the families of creative persons (Babcock, 1895; Galton, 1871, 1892; Juda, 1949; Kretschmer, 1931; Lombroso, 1891; Maudsley, 1895; Myerson & Boyle, 1941; Nisbet, 1900). More recent investigations have also supported the hypothesis of familial and individual associations between mental illness, particularly affective disorder, and creativity (Andreasen, 1987; Andreasen & Canter, 1974; Andreasen & Glick, 1988; McNeil, 1971; Richards, Kinney, Lundes, Benet, & Merzel, 1988).

Heston (1966) and Heston and Denny (1968) reported that the adopted-away children of schizophrenics showed an increased incidence of schizophrenia, mental deficiency (IQ < 70), sociopathic personality, and/ or neurotic personality disorder. Heston and Denny (1968) also reported:

The 21 experimental subjects who exhibited no significant psychosocial impairment were not only successful adults but in comparison to the control group were more spontaneous when interviewed and had more colorful life histories. They held more creative jobs: musician, teacher, home designer; and followed the more imaginative hobbies: oil painting, music and antique aircraft. (Heston & Denny, 1968)

Heston (1966) and Heston and Denny (1968) suggested that their results may be explained in terms of a polygenetic disorder, in which a subcritical dose of the pathological genes produces or predisposes to disabilities other than schizophrenia "and perhaps in other combinations to especially adaptive personality traits" (Heston & Denny, 1968).

These considerations suggest that schizophrenia is a "balanced polymorphism." This is defined as "a polymorphism that is stable (tends to remain unchanged over time) and is probably maintained by an advantage of the heterozygote over both homozygotes" (Bodmer & Cavalli-Sforza, 1976, p. 756). For example, while sickle cell anemia, a genetically determined disorder, results in decreased fertility, the gene frequency for the sickling trait does not decrease over time because of an advantage conferred to heterozygotes involving resistance to malarial diseases. Schizophrenia, and perhaps its genetic determinants, may also be associated with certain biological advantages, such as a resistance to rheumatoid arthritis (Baldwin, 1979; Eaton, 1985; Jablensky, 1986; Tsuang, Perkins, & Simpson, 1983), and possibly to neoplastic disease. Perhaps these resistances to certain physical diseases apply also to relatives without spectrum disorders. The selection of advantageous phenotypes may occur at the level of selected traits, such as creativity (O'Reilly, Dunbar & Bentall, 2001). Whether protection against certain physical diseases or greater functional adaptability due to high levels of creativity and talent, the schizophrenic genotype may confer some reproductive advantages to nonaffected carriers, thus compensating for the lowered fertility of schizophrenics and their siblings and maintaining the gene frequency over time.

#### Heritability and Reproductive Advantage

**Schizotypy.** Twin and family studies have demonstrated a genetic contribution to schizotypy, and both positive and negative schizotypy have been found to have moderate to high heritability (Battaglia et al., 1999;

Kendler & Hewitt, 1992; Kendler et al., 1991; Lin et al., 2007; Linney et al., 2003). Negative schizotypy seems to be more closely linked to schizophrenia (Bunke, Pogue-Geille, Garrett, & Hall, 1991; Huxley et al., 1993; Kendler, McGuire, Gruenberg, & Walsh, 1995; Squires-Wheeler et al., 1997; Torgersen, 1985), whereas positive symptoms of schizotypy are more likely to be associated with "healthy schizotypy." That is, the occurrence of positive traits alone is neutral with respect to mental health outcomes, whereas the combination of positive schizotypy with negative and/or disorganized schizotypy is associated with an increased likelihood of the later development of psychosis (Chapman, Chapman, Kwapil, Eckblad, & Zinser, 1994; Kwapil, Miller, Zinser, Chapman, & Chapman, 1997). Cluster analytic studies have suggested that when positive schizotypal traits occur alone (in the absence of high scores on other aspects of schizotypy) they are associated with good health, but when positive schizotypy occurs in conjunction with negative and/ or disorganized schizotypal traits, poorer mental health results (Goulding, 2004, 2005; Goulding, McClure-Tone & Compton, 2009). Schizotypal symptoms have been found to be as elevated in the first-degree relatives of patients with affective disorder as in the relatives of schizophrenics (Gilvarry, Russell, Hemsley, & Murray, 2001; Squires-Wheeler, Skodol, Friedman, & Erlenmeyer-Kimling, 1988; Squires-Wheeler, Skodol, Bassett, & Erlenmeyer-Kimling, 1989). Conversely, the incidence of mood disorder is elevated in the first-degree relatives of patients with schizotypal personality disorder (Bornstein, Klein, Mallon, & Slater, 1988; Schulz et al., 1986). These findings are consistent with the hypothesis of a schizophrenia-affective disorders continuum and the association of schizotypy with the later development of both schizophrenic and affective psychoses.

Nettle and Clegg (2006) studied the relationship between mating success, defined as the number of different sexual partners, and schizotypy in a large sample of poets, visual artists, and control subjects. A sample of 425 British adults was categorized as not producing poetry or art, being a hobby producer, a serious producer, or a professional producer. Across the entire sample, there were significant positive associations between the number of different sexual partners and scores on the O-LIFE Unusual Experiences and Impulsive Nonconformity scales, and a significant negative association with scores on the Introvertive Anhedonia scale. Similar relationships were found in the subsample of those who were not producers of poetry or art. Serious and professional art producers had larger numbers of sexual partners than nonproducers and hobby producers. Path analysis showed that Unusual Experiences had a significant positive effect on creative activity (poetry and art), which in turn had a significant positive effect on number of partners. In other words, the relationship between positive schizotypy and mating success was mediated by creativity. Impulsive nonconformity had a direct positive effect on number of partners that was not mediated by creative activity. Introvertive anhedonia had both an inhibiting effect on creative activity, and also a direct inhibiting effect on number of sexual

partners. Thus, both unusual experiences and impulsive nonconformity were related to enhanced mating success, and the relationship between unusual experiences and mating success was mediated by creative activity. The relatives of psychotic patients have higher schizotypy levels (Clementz, Grove, Katsanis, & Iacono, 1991; Franke, Maier, Hardt, & Hain, 1993; Gilvarry, Russell, Hemsley, & Murray, 2001; Grove et al., 1991; Katsanis, Iacono, & Beiser, 1990; Kendler, Thacker, & Walsh, 1996; Schürhoff, Laguerre, Szöke, Méary, & Leboyer, 2005), and one study has reported a higher fertility rate in the relatives of schizophrenic probands than in control subjects without psychotic relatives (e.g., Weiser et al., 2009), although there are several reports of contradictory findings for relatives of schizophrenics, cited earlier. Another study reported a trend toward greater fertility in the offspring of psychotic probands (McCabe, Koupil, & Leon, 2009). Of course, enhanced fertility, sexual frequency, and number of sexual partners are at best weak proxy measures of enhanced evolutionary fitness, as such associations may not be universal and may not apply to premodern eras or populations.

Other components of transliminality. Transliminality is a hypothesized tendency for psychological material to cross thresholds into or out of consciousness. The concept of transliminality was suggested by the research of Thalbourne and Delin (1994), who found that belief in the paranormal, creativity, mystical experiences, magical ideation, a history of manic-like experience, and a history of depressive experience were all highly intercorrelated and loaded highly on a single factor. Subsequent studies expanded the concept of tranliminality to include schizotypy, psychoticism, extraversion, neuroticism, fantasy proneness, absoption, hyperaesthesia, general religiosity, frequency of dream interpretation, and a positive attitude toward dream interpretation (Thalbourne, 1998; Thalbourne & Delin, 1999; Thalbourne, Keogh, & Crawley, 1999; Thalbourne, Bartemucci, Delin, Fox, & Nofi, 1997). Many of the components of transliminality have been found to be influenced by genetic factors. The results of twin studies indicate that hypnotizability is influenced by genetic factors (Duke, 1969; Morgan, 1973; Morgan, Hilgard, & Davert, 1970). The relationship between hypnotizability and the therapeutic benefits of hypnotherapy for both psychological and somatic disorders has been well documented (e.g., see McClenon, 1997). The beneficial effects of hypnotizability on mental and physical health may enhance the likelihood of survival and enhance fecundity. Similar benefits may derive from a more general propensity to enter altered states of consciousness, that is, transliminality, via its association with absorption and dissociation. Twin studies have also yielded evidence that creativity is influenced by genetic factors (e.g., Barron, 1970; Barron & Parisi, 1976; Grigorenko, LaBuda, & Carter, 1992). Creative artists have greater mating success (a larger number of sexual partners) than nonartists, and creative productivity mediated the relationship between schizotypy and mating success (Nettle & Clegg, 2006). Studies done in Asia many years ago demonstrated that gifted persons have in the past had an increased likelihood of bringing larger families to adulthood (Osborn, 1968). Twin and family studies have revealed a genetic contribution to other components of transliminality, including openness to experience (Bergeman et al., 1993; Wainwright, Wright, Luciano, Geffen, & Martin, 2008) and religiosity (Bouchard, Lykken, McGue, Segal, & Tellegen, 1990; Button et al., 2011; Martin et al., 1986; Vance, Maes, & Kendler, 2010; Waller, Kojetin, Bouchard, Lykken, & Tellegen, 1990; Winter, Kaprio, Viken, Karvonen, & Rose, 1999). There is considerable evidence that religion and religiosity are associated with a wide range of physical and mental health benefits (e.g., Koenig, 1998).

## The Search for Candidate Genes

As yet, no studies have examined the heritability or genetics of transliminality. However, there is extant research concerning heritability and genetic influences on constituent characteristics such as schizotypy (and its extreme manifestation, schizophrenia), creativity, hypnotizability, openness to experience, and religiosity. There is also evidence to suggest that transliminality and its constituent characteristics may be associated with enhanced interhemispheric transfer and increased size of the corpus callosum. Therefore, genes involved in the development of the corpus callosum and schizophrenia spectrum traits may be potentially viable candidate genes for transliminality.

The search for a single genetic locus underlying psi abilities or transliminality and its constituent characteristics is likely doomed to failure, given the considerable evidence supporting a multifactorial polygenic model of genetic influences on schizophrenia spectrum vulnerability, and interaction of polygenetic with epigentic factors influencing neurodevelopment (e.g., reviews by Abdolmaleky, Thiagalingam, & Wilcox, 2005; Gejman, Sanders & Duan, 2010; Jablensky, 2000; Owen, 2005; Portin & Alanen, 1997; Tsuang, Gilbertson & Faraone, 1991). Gottesman and Shields (1982) argued that a multifactorial-polygenic system underlies the diathesis, with vulnerability increasing as the number of different genetic factors increases. Although random mutation theories have been proposed (e.g., Keller & Miller, 2006), the polygenic model seems to have wider support. For example, Pearlson and Folley (2008) stated:

> Although it is possible that the disorder may represent an agglomeration of diseases caused by multiple, rare, individual mutations, schizophrenia is more likely a complex, multigene trait, with common risk alleles in the general population that may have relatively weak individual effects, be pliotropic, and interact with each other multiplicatively. No single such allele is either necessary or sufficient for the development of the full disorder. (Pearlson & Folley, 2008, p. 722)

The genetics and evolutionary models of schizophrenia are beyond the scope of this review (see reviews by Keller & Miller, 2006; Pearlson & Folley, 2008; Polimeni & Reiss, 2003). While the polygenic balanced polymorphism model could certainly benefit from additional empirical support, it remains a viable candidate theory. Transliminality is similarly a complex behavioral phenotype, likely to be influenced by a large number of genetic factors. Family studies to identify genetic markers, and reverse phenotyping using genetic markers to refine the phenotype, will provide valuable information concerning the neurobiology of transliminality (Schulze & McMahon, 2004). The val allele of the gene for catechol-O-methyltansferase (COMT) was associated with negative schizotypy (Docherty & Sponheim, 2008; Schürhoffetal., 2007), positive schizotypy (Schürhoffetal., 2007), perceptual aberration (Avramopoulos et al., 2002), and disorganized schizotypy (Smyrnis et al., 2007; Stefanis et al., 2004), although others have reported an association of met/met homozygosity with disorganized schizotypy (Ma et al., 2007; Sheldrick et al., 2008). One study failed to find any significant association between paranormal beliefs and COMT polymorphisms (Raz, Hines, Fossella, & Castro, 2008). Rather than searching for a single gene, investigation of various combinations and interactions of genes, epigentic factors, and environmental influences is likely to prove more illuminating for understanding the etiology of transliminality. Interestingly, Ott, Reuter, Hennig and Vaitl (2005) found that although absorption (a component of transliminality) was not significantly related to the COMT val(158)met polymorphism alone, there was a significant association between absorption and the interaction between the T102C and COMT polymorphisms. Bachner-Melman et al. (2005) found that creative dance performance and absorption were associated with the interaction between genes coding for the serotonin transporter and the arginine vasopressin receptor.

#### **Testable Hypotheses**

McClenon (1997) proposed that hypnotizability is the mediating factor linking shamanic healing ritual to beneficial effects, and the evolution of paranormal and religious belief. The evidence reviewed here suggests that hypnotizability is but one component of a superordinate trait dimension, transliminality, which also includes positive schizotypy, paranormal beliefs and experiences, creativity, and sleep-related experiences. McClenon's (1997) theory would be further strengthened by replacing hypnotizability with transliminality as the mediating psychological endophenotype. Cooper and Thalbourne (2004) found that hypnotizability was positively and significantly correlated with anomalous experience, and anomalous experience was positively and significantly correlated with shamanic belief/experience, suggesting that the various variables postulated by McClenon in the chain of causation are related to each other in the way that he posits. Transliminality correlated with all the variables in the model except childhood trauma, suggesting that transliminality may mediate the relationship between hypnotizability and anomalous experience. This extension of McClenon's (1997) theory suggests the following hypotheses, the first five of which are parallel to those suggested by McClenon.

1. Transliminality, and its constituent characteristics, should be associated with higher survival and fecundity, and perhaps with better physical and mental health.

2. Transliminality should mediate or account for the beneficial effects of hypnosis, meditation, prayer, trance states, and spiritual healing.

3. Transliminality, and its constituent characteristics, should have a genetic component, manifested in a high degree of heritability in twin and family studies.

4. Altered states of consciousness induced by shamanic and religious ritual practices have been practiced for a sufficient time to have a meaningful impact on the frequency of transliminality genotypes (see McClenon, 1997).

5. Transliminality should affect the frequency and characteristics of anomalous, paranormal, and religious experiences.

6. Transliminality, and its constituent characteristics, should be associated with increased interhemispheric coherence and the size of the corpus callosum.

7. Transliminality, and its constituent characteristics, should be associated with overlapping polygenic sets of genetic loci and gene polymorphisms implicated in corpus callosum neurodevelopment and schizophrenia spectrum vulnerability, possibly including COMT, DISC1, GRIN1, and BDNF genes.

# Adaptive Advantages of Paranormal Ability

Several studies have reported strong correlations between paranormal beliefs and paranormal experiences (Blackmore, 1997; Glicksohn, 1990; Musch & Ehrenberg, 2002; Persinger & Makarec, 1986; Rattet & Bursick, 2001). Paranormal belief is also associated with paranormal ability (e.g., Haraldsson, 2003; Haraldsson & Houtkooper, 1992; Palmer, 1977; Parker, Grams, & Pettersson, 1998; Schmeidler, 1952; Schmeidler & McConnell, 1958). Indirect benefit theories posit that ESP and other paranormal abilities and experiences contribute to human survival through associations with adaptive emotional and memory functions (e.g., Broughton, 1988, 2006; Stanford, 1974a, 1974b, 1977, 1990; Simmonds-Moore, 2010; Taylor, 2003; Winkelman, 1982). An alternative evolutionary account posits that God beliefs and beliefs in the paranormal or a spiritual dimension to existence evolved because these beliefs were associated with a greater likelihood of paranormal or spiritual experiences (including veridical paranormal experiences) and paranormal abilities, which would be highly adaptive. The selection of psi abilities would be more likely in healthy schizotypes and transliminals, who may be more prevalent in cultural contexts more conducive to anomalous experiences (i.e., shamanic societies). The fact that psi abilities do not appear to be increasing from generation to generation in modern times may be due to the decreased overall incidence of psi beliefs and experiences due to the pervasive influence of the prevailing scientific-materialist zeitgeist.

There is considerable experimental evidence that paranormal phenomena such as telepathy, clairvoyance, precognition, and psychokinesis actually exist (e.g., meta-analytic reviews by Bosch, Steinkamp, & Boller, 2006; Milton, 1997; Radin, 1997; Radin, Nelson, Dobyns, & Houtkooper, 2006; Storm, Tressoldi, & Risio, 2010). This conclusion is compellingly supported by meta-analyses of hundreds of studies, which have become increasingly methodologically sophisticated over the past several decades. There is also evidence from well-controlled studies of communication with the dead that mediums are able to access information about deceased individuals (e.g., Kelly & Arcangel, 2011; Schwartz, 2002). If, as the empirical evidence suggests, these paranormal and "spiritual" phenomena actually exist, then it may be reasonable to speculate that other paranormal phenomena, that is, various shamanic powers or Siddhi powers, may possibly be real, albeit extremely infrequent, and may be the object of legitimate scientific inquiry. This is not to say that such phenomena are real, only that there is no valid logical a priori reason to assert that they are impossible.

Such paranormal abilities would likely be highly adaptive. Precognition has obvious survival value, as knowing about impending threats facilitates avoidance of danger. Clairvoyance, obtaining knowledge of distant events, would allow knowing where distant game or food resources are located. Similarly, telepathy has survival value, as longdistance communication would facilitate group survival in a variety of ways. Psychokinesis also has obvious survival value, especially advanced forms such as levitation or deflection of projectiles, which would enhance survivability by enabling an individual to escape more quickly from predators or to defend oneself during intertribal conflicts. Access to information from spiritual (transdimensional) realms of existence would also have survival value by providing a wide range of potentially useful knowledge. If spiritual dimensions of existence interact with and influence events and processes within the four-dimensional physical realm, then communicating with spiritual entities may actually be able to influence physical processes, including biological functioning. There is evidence that prayer is efficacious as a healing process, that is, prayer is associated with improved health outcomes (e.g., Astin, Harkness, & Ernst, 2000; Dossey, 1998; Harding, 2001; Jantos & Kiat, 2007), although there are many contradictory findings and controversies concerning the healing power of prayer (e.g., Abbot, 2000; Halperin, 2001; Paul, 2008; Roberts, Ahmed, Hall, & Davison, 2009).

A material reductionist accounting for the cross-cultural universality or ubiquity of mythic archetypes of the shaman figure (e.g., wizard, witch, magician, saint, holy person) assumes that these stories are fictional (based on false or delusional beliefs), arising from wish-fulfillment fantasies, cognitive distortions, and fraud or trickery. The adaptive value of such beliefs is indirect, presumably mediated by reduced death anxiety (or other psychological factors). If the evidence provided by parapsychological research is valid, it may be reasonable to entertain an alternative and simpler evolutionary account which posits that such stories of paranormal abilities and associated beliefs in the paranormal/spiritual are true. For some individuals, anomalous experiences may lead to belief in the paranormal, whereas for others belief in the paranormal may predispose the person to an openness to anomalous experiences. Beliefs in the paranormal/spiritual and associated experiences and abilities may be selected for because associated experiences and abilities are directly related to enhanced adaptation and group survival. This evolutionary theory can be tested. Experimentally demonstrated psi performance should be associated with enhanced fecundity (number of offspring, number of mating partners, frequency of sexual contact) and enhanced survival (enhanced physical and mental health outcomes), particularly in cultural contexts in which belief in psi abilities is more widespread (i.e., shamanic tribal cultures). Of course, it is likely that there is also a high frequency of fraudulent attempts to claim such abilities, or an embellishment through showmanship by those shamans and aspirants whose abilities may be transient, not well developed, and not easily controlled. Even experienced shamans may employ showmanship to enhance the expectancy effects of ritual participants, enhancing their responsiveness to hypnotic suggestions concerning health and somatic functioning. Enhanced expectancy effects may also extend to enhanced susceptibility to altered states of consciousness and receptivity to psi phenomena.

#### **Correlates of Psi Performance**

Belief in the paranormal is a core characteristic of transliminality, and one of the most widely replicated predictors of psi performance. Belief in paranormal phenomena such as ESP is associated with paranormal abilities. Subjects who accepted the possibility of paranormal success under experimental conditions, classified as "sheep," scored significantly higher than nonbelievers, classified as "goats," on card-guessing ESP tasks (e.g., Haraldsson, 2003; Haraldsson & Houtkooper, 1992; Palmer, 1977; Parker, Grams, & Pettersson, 1998; Schmeidler, 1952; Schmeidler & McConnell, 1958), indicating that those who are open to the possibility of ESP experiences will be more apt to have these experiences. The sheepgoat effect is one of the most widely replicated findings in ESP research (Palmer, 1977). Subjects who believe in paranormal or psychic phenomena (i.e., "sheep") performed better on ESP tests than nonbelievers or "goats" (e.g., Haraldsson, 2003; Haraldsson & Houtkooper, 1992). There is also an experimenter effect in parapsychological research, such that investigators who believe in the possibility of paranormal phenomena are more likely to find evidence of such (review by Irwin, 1999). Paranormal belief is strongly associated with positive schizotypy, and subjects who performed successfully on a psi task scored significantly higher on the Magical Ideation Scale, a measure of positive schizotypy, compared with nonsuccessful subjects (Parker et al., 1998). Distant healers scored higher on schizotypy measures as well as measures of conscientiousness and openness to experience compared to control subjects (Hergovich & Arendasy, 2007).

ESP performance is significantly correlated with religiosity (Haraldsson, 2003; Haraldsson & Houtkooper, 1992). Several studies have reported that paranormal belief has low but significant positive correlations with measures of religiosity, particularly intrinsic religiosity (Goode, 2000; Haraldsson, 1981; Hergovich, Schott, & Arendasy, 2005; Irwin, 1985; Thalbourne, 2003; Thalbourne & Hensley, 2001; Thalbourne & Houtkooper, 2002). General religiosity is strongly correlated with transliminality (Thalbourne, 1998; Thalbourne & Delin, 1999).

ESP performance in the ganzfeld is associated with a history of spontaneous psi experiences (paranormal experiences), a history of practicing meditation or other mental discipline, and a feeling-perceptive Jungian personality type (Honorton, 1997; Honorton & Schechter, 1987; Kanthamani & Broughton, 1994). Receivers who practiced mental discipline such as yoga, transcendental meditation, and so forth, produced a better hit rate in an autoganzfeld task than those who did not (Alexander & Broughton, 2001), and there is extensive evidence that meditation increases interhemispheric coherence.

Extraversion is significantly correlated with success in tests of extrasensory perception (e.g., Honorton, Ferrari, & Bem, 1998; Schmeidler, 1982; review by Palmer, 1978). A meta-analysis of 60 studies reported a small but highly significant correlation between ESP performance and extraversion (Honorton, Ferrari, & Bem, 1998). Several investigations have reported significant associations between paranormal beliefs and extraversion (Eysenck, 1967; Thalbourne, 1981; Thalbourne & Haraldsson, 1980), and between precognitive experiences and extraversion (Rattet & Bursik, 2001). Hypnotizability is significantly correlated with extraversion (Green, 2004). Extraversion is significantly related to transliminality (Thalbourne, Bartemucci, Delin, Fox, & Nofi, 1997).

Historically, altered states of consciousness (e.g., dreams, hypnosis, drug-induced states) have been considered to be conducive to ESP (review by Alvarado, 1998). Various altered states of consciousness, induced by hypnosis, sensory deprivation or the ganzfeld procedure, meditation, progressive relaxation, hypnagogic states, and dreaming have been found to be conducive to ESP ability (e.g., review by Honorton, 1977). Hypnosis has been found to facilitate ESP performance better than a normal waking

state or self-relaxation (reviews by Stanford, 1987, 1992; meta-analysis by Stanford & Stein, 1994). Enhanced psi abilities with hypnosis are associated with hypnotizability, the hypnotic context, or an interaction between the two (Cardena, 2006; Cardena, Lehmann, Jonsson, Terhune, & Fabre, 2007). Spontaneous extrasensory experiences are associated with a higher frequency of dream recall (Haraldsson, Gudmundsdotir, Ragnarsson, Loftsson, & Jonsson, 1977; Palmer, 1979), and dream recall was significantly correlated with ESP ability in laboratory studies (Honorton, 1972, Palmer, 1978, 1982). REM sleep-related experiences (e.g., dream recall, vivid dreams, etc.) and a general susceptibility to altered states of consciousness are related to transliminality, and hypnotizability is associated with transliminality (Cooper & Thalbourne, 2004).

Many of the reported correlates of psi performance are closely related to transliminality, and several studies have reported significant associations between transliminality and performance on ESP tasks. Transliminality-relevant measures significantly predicted scores on a precognition task (Thalbourne, 1996, 2000b). Transliminality, absorption, and hynotizability were strongly correlated with hits in a clairvoyance-like task, but only if participants were in a hypnotic state induced with OBE instructions (Del Prete & Tressoldi, 2005). A combination of hypnosis and special induction instructions tailored for the ESP task (emphasizing the capacity to visualize a remote picture or emphasizing out-of-body experience) facilitated ESP performance in participants with medium to high absorption or transliminality scores (Tressoldi & Del Prete, 2007). Self-rated success in a psi task was significantly correlated with thinness of boundaries (Richards, 1996). The construct of thinness of boundaries (Hartmann, 1991) is strongly associated with transliminality (Thalbourne & Maltby, 2008). Together, all of these findings suggest that transliminality is a key trait dimension underlying psi abilities.

## Do Paranormal Phenomena Violate the "Laws of Physics"?

An impartial approach to scientific inquiry suggests that the possibility be considered that at least some paranormal experiences may be veridical, that is, experiences of genuine paranormal phenomena. Skeptics contest the empirical evidence from parapsychological investigations that such phenomena actually exist (e.g., Bressan, 2002; Krippner & Friedman, 2010; Stanovich, 2004), or suggest that paranormal phenomena are incompatible with "current" theories of physics (e.g., Musch & Ehrenberg, 2002). However, others regard the empirical evidence for psi (telepathy, clairvoyance, precognition, and psychokinesis) as methodologically sophisticated, well replicated, and confirmed meta-analytically (e.g., Bosch, Steinkamp, & Boller, 2006; Irwin, 1999; Milton 1997; Radin, 1997; Radin, Nelson, Dobyns, & Houtkooper, 2006; Storm, Tressoldi, & Risio, 2010; Tart, 1977/2001). An impartial and open-minded scientist must follow where
the data lead. If a theoretical paradigm dictates that certain phenomena cannot possibly exist, and those phenomena clearly and demonstrably do exist, then the old ("classical") paradigm must be integrated into a more complete and encompassing paradigm. While it is true that paranormal phenomena are incompatible with the "laws" of classical Newtonian-Cartesian physics, governing "physical" reality (four-dimensional spacetime containing matter and energy), more current theories of quantum and relativistic physics, superstring theory, M-theory, and cosmology are not limited to considerations of phenomena within our four-dimensional universe, but also consider multidimensional, nonlocal, and holographic models of reality that fundamentally challenge core ontological assumptions of classical (material-reductionist) science and the "core knowledge" of ordinary waking consciousness (e.g., Greene, 1999; Kaku, 1994; Talbot, 1991; Wolf, 1988, 1989, 1994, 1996). In David Bohm's theory (Bohm, 1980), the explicate (visible, tangible) order of existence, our fourdimensional physical reality, arises from and is directed by implicate orders of existence, that is, "hidden variables," the nonlocal realm of the quantum potential. Superimplicate orders of existence are realms of information rather than physical existence, which in higher derivatives may constitute "consciousness." The philosophical implications of the New Physics may be more compatible with Idealism than Materialism (Goswami, 1995), that is, consciousness rather than physical matter/energy is ontologically primary. If consciousness is transdimensional in nature (not restricted to the four-dimensional level of material reality) then the material-reductionist assumption that consciousness depends on and is an epiphenomenon of brain function must be false. Certainly, the processes of consciousness are closely correlated with brain function, but this does not necessitate the assumption of reductionism. The dynamic highly complex holographically patterned information processing network constituting consciousness may be maintained in media other than the brain, perhaps in quantum potential interference patterns in superimplicate orders or transdimensional levels of existence (higher orders of dimensionality than the four-dimensional physical realm). Processes of consciousness operating in the nonlocal superimplicate levels of existence or higher dimensional levels interact with the four-dimensional explicate level of reality, usually within the brain, but occasionally with material systems outside the brain, giving rise to transient, infrequent, low probability phenomena which appear to violate "local" laws governing four-dimensional existence, in much the same way that the inhabitants of Flatland would find the actions of a three-dimensional being to violate the physical laws of their two-dimensional world (Kaku, 1994). These anomalous events are typically interpreted in terms of spiritual or paranormal processes. These phenomena are "supernatural" only if one restricts the definition of "natural" to the four-dimensional physical existence apprehended by ordinary waking human consciousness. Other levels of existence (higher dimensional realms, superimplicate

orders) are not only possible, but strongly suggested by the mathematics of recent unified field theories, that is, superstring and M-theory. More current theories of physics overturn many of the core assumptions of the classical scientific paradigm, making room for paranormal (and "spiritual") phenomena within the scope of legitimate scientific inquiry. The worldview suggested by new physical theories may share much with the worldviews of shamanism (Wolf, 1991), Buddhism (Ricard & Thuan, 2001), Taoism (Capra, 1985), and spiritualism (Friedman, 1990), which all share positive beliefs about the reality of a wide range of paranormal phenomena and the reality of spiritual levels of existence.

## The Evolution of Psi Ability

The reductionist evolutionary account requires that we accept the notion that the vast majority of humans who ever lived have been delusional, and that their reality distortion was adaptive because it alleviated death anxiety, or produced some other beneficial and adaptive consequence, despite the falsehood of these beliefs. The development and maintenance of such delusions involves the largely unconscious operation of various cognitive biases and tendencies to avoid or discount disconfirmatory evidence or arguments (e.g., Persinger, 2009). The supposition that religious belief is associated with lower death anxiety has received extensive though perhaps somewhat limited and inconsistent empirical support, and there is no direct evidence that death anxiety compromises reproductive success or fecundity. There is indirect evidence that belief in the paranormal and paranormal experience is associated with increased fecundity, possibly mediated by a group of interrelated traits including positive schizotypy, hypnotizability, fantasy-proneness, and creativity, together comprising the superordinate trait dimension of transliminality. Several of the component characteristics of transliminality show moderate to high heritability, and there is some evidence that they are associated with adaptive benefits. Several of the constituent characteristics of transliminality are associated with increased interhemispheric communication and enlarged corpus callosa. Genes involved in callosal neurodevelopment and schizophrenia spectrum disorders may be worth investigating as candidate transliminality genes. Belief in the paranormal is strongly associated with paranormal experiences and abilities, which would have obvious adaptive advantages if such abilities were real. Extensive parapsychological research provides compelling evidence that telepathy, clairvoyance, precognition, psychokinesis, and communication with the dead are real phenomena. Psi abilities, like paranormal beliefs, are associated with transliminality and its constituent characteristics. The emerging quantum relativistic multidimensional holographic paradigm is capable of encompassing these findings, which challenge the core ontological assumptions of the classical Newtonian-Cartesian material-reductionist paradigm.

Thus, we have several competing theories of the evolution of beliefs in God, spirit, and the paranormal. The material-reductionist theories posit that the vast majority of people are delusional; their delusions (false beliefs) are formed and maintained by largely unconscious (unobservable) biases and cognitive distortions; and those reality distortions are adaptive due to an association with reduced death anxiety, enhanced social cohesion, enhanced hypnotic suggestibility, or some other mediating factor. The alternative "direct benefit" theory posits that such beliefs evolved simply because they are true and their associated abilities have very obvious adaptive value. Occam's Razor suggests that the simpler explanation tends to be the right one. With respect to accounting for the universality and ubiquity of spiritual and paranormal beliefs in an evolutionary framework, it may be that, compared to the goats, the sheep may have a simpler and more direct model that is consistent with a broader range of empirical evidence (i.e., parapsychology), is not incompatible with the extant research supporting the terror-management function of religious belief or other evolutionary accounts, requires fewer tenuous assumptions (e.g., regarding mass delusion, or an inverse relation between death anxiety and fecundity), and does not require the irrational discounting of an entire field of scientific inquiry (parapsychology) as fraudulent, on the basis of doctrinal ontological assumptions grounded in an outdated nineteenthcentury paradigm.

The direct benefits evolutionary theory can be empirically tested by examining the fecundity or reproductive success of individuals with experimentally demonstrated high levels of psi abilities. The number of offspring surviving to reproductive age would be the critical variable to examine, although other variables such as number of sexual partners (for males), frequency of sexual contact, and a range of measures of health and well-being would also be relevant. Such evidence may be more readily obtained in cultural contexts favorable to paranormal belief and experience. The direct benefits theory has been rejected by others because there is no evidence that psi abilities are increasing from generation to generation. However, it is possible that the selective processes favoring psi abilities are not operative in modern secular societies, although they may have been responsible for the evolution of beliefs in God, spirit, and the paranormal throughout millennia of shamanistic hunter-gatherer social organization. It is also possible that the genetic factors contributing to psi abilities are in equilibrium, sufficient to maintain the prevalence of psi abilities, without increase or decrease across generations. These genetic factors may constitute a balanced polymorphism, with a balance between advantageous and deleterious phenotypes, resulting in steady prevalence rates of both. The search for genetic factors related to psi abilities could begin with those polymorphisms and genetic loci already linked to schizophrenia spectrum disorders and the neurodevelopment of the corpus callosum. Evidence that psi abilities and associated beliefs in the paranormal and spiritual have

direct adaptive value does not imply that characteristics associated with the absence of these abilities and beliefs has none. It is likely that believers and nonbelievers have different cognitive styles (associated with right and left hemisphericity, respectively), each of which may have different but equally adaptive advantages.

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#### Abstracts in Other Languages

#### Spanish

# LA EVOLUCIÓN DE LAS CREENCIAS EN DIOS, EL ESPÍRITU Y LO PARANORMAL, III: BENEFICIOS DIRECTOS DE LAS CAPACIDADES PARANORMALES

RESUMEN: La esquizotipia positiva (distorsión de la realidad) y otros componentes de la transliminalidad pueden constituir un polimorfismo genético equilibrado en el que los efectos desfavorables de las condiciones asociadas a los extremos de la dimensión de rasgo se compensan por las ventajas asociadas a niveles más moderados de la expresión del rasgo. La esquizotipia positiva y la creatividad están asociadas con el éxito en el apareamiento. Los familiares de los individuos psicóticos tienen niveles elevados de esquizotipia y un estudio reciente encontró que los familiares de los psicópatas tienen una mayor fecundidad. La evolución de las creencias en Dios, el espíritu, y los fenómenos paranormales pueden estar mediados no por la reducción de ansiedad ante la muerte, sino por un conjunto de rasgos adaptativos relacionados entre sí, en particular la creatividad, la esquizotipia positiva y la hipnotizabilidad, que son componentes de la dimensión subyacente de rasgo de la transliminalidad. Las creencias en lo paranormal están relacionadas con experiencias paranormales así como con habilidades paranormales, que, si son verídicas, tendrían una ventaja adaptativa directa. Los correlatos de las capacidades paranormales se solapan con los componentes característicos de la transliminalidad. Las creencias en los fenómenos espirituales y paranormales pueden haber evolucionado, simplemente porque esas creencias son de alguna manera ciertas y los rasgos y habilidades asociados son muy adaptativos.

#### French

# L'EVOLUTION DES CROYANCES EN DIEU, AUX ESPRITS ET AU PARANORMAL, III : BENEFICES DIRECTS DES CAPACITES PARANORMALES

RESUME : La schizotypie positive (distorsion de la réalité) et d'autres composants de la transliminalité peut constituer un polymorphisme génétique équilibré dans lequel les effets désavantageux des conditions associées avec les extrémités du trait dimensionnel sont contrebalancés par les avantages associés avec des niveaux modérés de l'expression du trait. La schizotypie positive et la créativité sont associés avec des succès d'accouplement. Les proches d'individus psychotiques ont des niveaux élevés de schizotypie, et une étude récente montre que les proches de psychotiques ont une meilleure fécondité. L'évolution des croyances en Dieu, aux esprits et aux phénomènes paranormaux pourrait être médiatisée non pas par la réduction de l'anxiété pour la mort, mais plutôt par un ensemble de traits adaptatifs inter-reliés dont la créativité, la schizotypie positive, l'hypnotisabilité, qui sont des composants d'un trait dimensionnel premier de transliminalité. Les croyances paranormales sont reliées aux expériences paranormales tout comme les capacités paranormales qui, lorsqu'elles sont véridiques, devraient avoir un avantage adaptatif. Les corrélations des capacités paranormales se superposent avec les composants caractéristiques de la transliminalité. Les croyances dans la spiritualité et les phénomènes paranormaux ont pu évoluer simplement parce que de telles croyances sont vraies d'une certaine façon, et que les traits et les capacités associés sont hautement adaptatifs.

## German

# DIE EVOLUTION DES GLAUBENS AN GOTT, GEIST UND DAS PARANORMALE, III: DIREKTER NUTZEN PARANORMALER FÄHIGKEITEN

ZUSAMMENFASSUNG: Positive Schizotypie (Realitätsverzerrung) könnte zusammen mit anderen Komponenten von Transliminalität einen genetisch ausbalancierten Polymorphismus darstellen, bei dem sich die nachteiligen Effekte der Bedingungen, die mit extremen Ausprägungen der Traitdimension einhergehen, durch die Vorteile, die eher mäßige Traitausprägungen bieten, die Waage halten. Positive Schizotypie und Kreativität gehen mit Fortpflanzungserfolg einher. Die Verwandtschaft von Psychotikern weist erhöhte Schizotypiewerte auf, und eine neuere Studie belegt, dass Verwandte von Psychotikern eine erhöhte Fruchtbarkeit aufweisen. Die Evolution des Glaubens an Gott, Geist und paranormale Phänomene könnte nicht durch eine reduzierte Angst vor dem Tod gefördert werden, sondern eher durch das Zusammenspiel adaptiver Traits, die Kreativität, positive Schizotypie und Hypnotisierbarkeit umfassen, die Komponenten der übergeordneten Traitdimension Transliminalität darstellen. Paranormale Glaubenshaltungen haben sowohl mit paranormalen Erfahrungen wie auch paranormalen Fähigkeiten zu tun, die, wenn sie echt sind, einen unmittelbaren Anpassungsvorteil hätten. Korrelate paranormaler Fähigkeiten überschneiden sich mit charakteristischen Komponenten von Transliminalität. Der Glaube an spirituelle und paranormale Phänomene könnte sich einfach deshalb entwickelt haben, weil ein solcher Glaube in bestimmter Hinsicht echt ist und die damit verknüpften Traits und Fähigkeiten einen hohen Anpassungswert aufweisen.

# DOES A MODIFIED GUILTY KNOWLEDGE TEST REVEAL ANOMALOUS INTERACTIONS WITHIN PAIRS OF PARTICIPANTS?

#### BY TIM SCHÖNWETTER, WOLFGANG AMBACH, AND DIETER VAITL

ABSTRACT: This study aimed to investigate anomalously modulated physiological responses as an indicator of anomalous interactions between emotionally related partners. For this purpose, we used a modified version of the Guilty Knowledge Test. In this experiment, partners were spatially separated. One partner (Participant 1) was confronted with probe objects such that these objects gained particular significance for Participant 1. The other partner (Participant 2) was investigated for differences in their physiological responses to pictures of probe objects and pictures of objects that Participant 1 had not been confronted with (irrelevant objects). In the case of an anomalous interaction between participants, the particular significance of probe objects was expected to modulate the physiological responses of Participant 2. Physiological variables consisted of electrodermal activity, heart rate, respiratory activity, and pulse activity. Behavioral variables consisted of reaction times and hit rate in a guessing task. Paranormal beliefs and connectedness of participants were assessed, via questionnaires, as possible moderators for the performance of Participant 2. Correlations between questionnaire scores and physiological as well as behavioral variables were analyzed. Overall, the analyses revealed no anomalously modulated physiological responses or other indicators for anomalous interaction between participants. Methodological remarks and implications for future studies are discussed.

*Keywords:* anomalous interaction, psychophysiology, Guilty Knowledge Test, participant pairs, connectedness of participants, paranormal belief

#### Psychophysiology in Parapsychological Research

The investigation of correlations between bodily functions and mental processes is the research approach of psychophysiology. Physiological variables (e.g., electrodermal activity and heart rate) are measurable as spontaneous activity (nonspecific responses during resting phases), as tonic activity (long-term level), or as phasic responses to presented stimuli (Stern, Ray, & Quigley, 2001). Analyses refer to changes in participants' physiological activity depending on task or presented stimulus.

Psychophysiology was introduced into parapsychological research in the second decade of the 20th century (for reviews see Beloff, 1974; Palmer, 1978; Schouten, 1976). Thereby, anomalously modulated physiological activity, i.e., physiological activity related to spatially and/or temporally separate events (e.g., stimulus presentation), was measured as an indicator for extrasensory perception (ESP).

Justification for the implementation of the physiological approach in parapsychology is based on analyses of spontaneous ESP cases, according to which, ESP is basically unconscious but able to produce bodily reactions and emotions (e.g., Broughton, 2006; Rhine, 1962; Tyrell, 1946). In particular, crisis situations causing emotional arousal seem to provoke spontaneous ESP experiences (e.g., Rhine, 1978; Stevenson, 1971). Hence, the use of emotive stimuli and the investigation of autonomic responses seem to be more appropriate for detecting anomalous phenomena than investigating behavior (Beloff, 1974; Broughton, 2002) or reactions of the central nervous system, which are linked to cognitive processes (Barry, 1996).

Aside from emotional arousal, possible moderator variables that are thought to influence the performance of participants in parapsychological experiments are the degree of participants' paranormal belief (Schmeidler, 1945; for a meta-analysis see Lawrence, 1993) and the connectedness of partners in participant pairs (e.g., Alexander & Broughton, 1999; Delanoy, Morris, Brady, & Roe, 1999; Schmidt, Tippenhauer, & Walach, 2001).

A vast amount of parapsychological research using physiological measurement has investigated anomalous phenomena such as ESP within pairs of participants. Most of these studies principally used the same procedure: One partner (Participant 1) participates in a periodic event. This event consists of either a stimulation of Participant 1 or the attempt of Participant 1 to influence a partner (Participant 2) by means of mental activity. Simultaneously, Participant 2 rests, spatially separated from Participant 1 and isolated from any stimulus. Participant 2 is tested for physiological differences in tonic activity or nonspecific physiological responses between periods with and without the stimulus event. Significant differences in Participant 2 between these two kinds of periods are interpreted as indicators of an anomalous effect.

Several parapsychological working models have been tested via this procedure. Significant effects were interpreted as ESP (e.g., Ramakers, 2008), *direct mental interaction with living systems* (DMILS; e.g., Delanoy, 2001), or unexplained correlations in brain activity between participants (e.g., Wackermann, Seiter, Keibel, & Walach, 2003). Overall, results are heterogeneous (reviews of early ESP studies with physiological measurement: Beloff, 1974; Palmer, 1978, 1982; Schouten, 1976; meta-analysis of DMILS studies: Schmidt, Schneider, Utts, & Walach, 2004; review of brain correlation studies: Charman, 2006).

An unusual approach consists of stimulating Participant 2 instead of measuring tonic activity or nonspecific responses of a resting and not stimulated participant. Phasic physiological responses of Participant 2 to presented stimuli are measured and analyzed for response differences related to different stimulation conditions in the spatially separated Participant 1. If there are statistically significant response differences, the physiological responses of Participant 2 are regarded as anomalously modulated.

In this vein, Herbert, Boehm, and Plihal (2002) used the startle eyeblink modification paradigm to examine startle responses of Participant 2 depending on the different stimulation conditions of the spatially separated Participant 1. These conditions consisted of presenting pictures with varying emotional content (positive, negative, and neutral). Normally, startle-reflex components are stronger during confrontation with positive than with negative pictures. In the study mentioned above, the researchers measured startle reflex by electromyographic (EMG) startle eye-blink amplitudes and startle-related electroencephalographic (EEG) components. No evidence for an influence of Participant 1 on the startle reflex of Participant 2 was found in an analysis of EMG amplitudes. EEG analyses revealed significant differences in startle-related EEG amplitudes at single electrodes sites of Participant 2 when Participant 1 was confronted with positive pictures.

In the same vein, Moulton and Kosslyn (2008) used functional magnetic resonance imaging (fMRI) for measuring the brain activity of Participant 2 during the presentation of pictures. In each trial of a guessing task, Participant 2 was successively confronted with two pictures, taken from the International Affective Picture System (IAPS: Lang, Bradley, & Cuthbert, 2008). The spatially separated Participant 1 was simultaneously confronted with one of the two pictures (psi stimulus) and tried to mentally send it to Participant 2. After the presentation, Participant 2 was asked to guess the psi stimulus. Based on intensive research in cognitive neuroscience, suppressed brain activity was expected when Participant 2 knew about the psi stimulus. Further, enhanced brain activity was expected in the case of increased attention to the psi stimuli. If there was no anomalous effect, no difference in brain activity between presentation of psi pictures and nonpsi pictures was expected. Analyses of hit rate and brain activity revealed no evidence for an anomalous effect. The authors interpreted their negative results as "the strongest evidence yet obtained against the existence of paranormal mental phenomena" (Moulton & Kosslyn, 2008). This conclusion was criticized by Palmer (2009). Other fMRI studies, which investigated the influence of a participant's mental activity on the brain functions of a spatially separated and nonstimulated partner, yielded positive results (Achterberg, Cooke, Richards, Standish, Kozak, & Lake, 2005; Richards, Kozak, Johnson, & Standish, 2005).

The attempt to investigate anomalously modulated physiological responses to presented stimuli may provide advantages compared to the usual method. It involves the possibility of using well-investigated psychophysiological paradigms and developing clear hypotheses about physiological response differences of Participant 2, which are expected in the presence of anomalous interaction between participants.

#### The Guilty Knowledge Test

The Guilty Knowledge Test (GKT, also known as the Concealed Information Test) is a well-established experimental paradigm in psychophysiological research. It was developed by Lykken (1959) for detecting guilty knowledge by means of measuring physiological response differences between stimuli with and without particular significance for the participant.

In a variant of the GKT, participants become familiar with different objects by handling them during a mock crime. Thereby, these objects gain particular significance for the participant. Each object belongs to a particular category. Afterwards, pictures of the objects are presented in succession and by category on a computer screen, in combination with four other objects in that category. Thus, each presented category consists of one known object (probe object) and four previously unseen objects (irrelevant objects). Participants are asked whether each object was part of the mock crime or not. The significance of the probe object is enhanced by the instruction to conceal the knowledge of this object during the presentation but to answer all other questions truthfully. Response differences to probe and irrelevant objects are detectable by means of physiological measurement (for a review see Ben-Shakhar & Elaad, 2003; MacLaren, 2001). A memory test is often conducted after the GKT to test participants' memories of the probe objects (e.g., Ambach, Stark, Peper, & Vaitl, 2008).

The orienting response (OR) is a basic component of physiological responses in the GKT (e.g., Ben-Shakhar & Elaad, 2002; Gati & Ben-Shakhar, 1990; Lykken, 1974; Verschuere, Crombez, Clercq, & Koster, 2004). The OR is the response of an organism to all perceivable changes in the environment, and was first characterized by Pavlov in 1927 (Sokolov, 1963a). According to Sokolov (1963b), the OR is a unitary reaction consisting of motor and autonomic components (e.g., cardiovascular and skin conductance responses), as well as respiratory changes, and it ensures optimal perception of new stimuli. The OR is modulated by the novelty, significance, and intensity of the stimulus (Lynn, 1966). In the GKT, the particular significance of probe objects is regarded as mainly responsible for the differences in the OR between probe and irrelevant objects (e.g., Barry, 2004; Ben-Shakhar, 1994; Furedy, 2009). The instruction to answer deceptively (i.e., to deny the knowledge about the probe objects) induces a response conflict and a response inhibition for probe objects, and also modulates the physiological responses and the reaction times. Thereby, deceptive answering improves the accuracy of the GKT for detecting concealed information (e.g., Ambach et al., 2008; Ben-Shakhar & Elaad, 2002; Ben-Shakhar & Elaad, 2003; Bradley, MacLaren, & Carle, 1996; Elaad & Ben-Shakhar, 1991; Furedy & Ben-Shakhar, 1991; Vendemia, Buzan, & Simon-Dack, 2005; Verschuere, Crombez, Koster, Van Bockstaele, & De Clerg, 2007).

Typical physiological and behavioral response differences in the GKT between probe and irrelevant objects consist of higher electrodermal response amplitudes, suppressed respiration, decelerated heart rate, reduced pulse amplitudes, and longer reaction times to probe objects (e.g., Gamer, Rill, Vossel, & Gödert, 2006).

## Aims of the Study

In this study, we aimed to investigate anomalously modulated physiological responses as an indicator of anomalous interactions between participants. For this purpose, we modified the GKT to investigate participant pairs. At the beginning of the experiment, the partners in each pair were spatially separated. Because the question of the timing of anomalous interactions is still open, the usual timing protocol of GKT studies was retained. First, Participant 1 was confronted with objects (probe objects) in a Mock Task (MT); the MT was expected to create a crisis situation for Participant 1 and therefore induce negative emotional arousal. After Participant 1 completed the MT, Participant 2 was tested for physiological response differences between pictures of the probe and irrelevant objects in a modified GKT (MGKT). This procedure is contrary to most parapsychological studies, which use synchronistic timing.

For every object presentation in the MGKT, Participants 2 were asked whether they were certain that the object was part of the MT. These participants were instructed not to guess, but to answer "yes" only in case of absolute certainty. We expected a low number of "yes" responses, because Participants 2 would not normally be expected to be sure about the probe objects. Hence, in the case of anomalous interactions between participants, we expected response conflict and response inhibition to be apparent subsequent to the presentation of the probe objects.

The standard concluding memory test was designed as a Guessing Task (GT) in order to test participants' conjectures about the probe objects.

## Hypotheses

Assuming anomalous interactions between participants, we expected the following results:

**Physiological analyses**. We hypothesized that the objects in the MT (probe objects) would have particular significance for Participant 2, and the physiological responses to the probe objects would be modulated by this significance. In this case, we expected a typical pattern of response differences: higher electrodermal response amplitudes, suppressed respiration, lower heart rate, and lower pulse activity for probes than for irrelevant objects.

**Behavioral Analyses**. Because of the expected response conflict and inhibition processes, we expected longer reaction times for probe than

for irrelevant objects in the MGKT. On the GT, the hit rate should be above chance.

**Correlation Analyses**. We assumed that participants with a stronger belief in paranormal phenomena, and participant pairs with stronger connectedness, would show stronger physiological response differences in the MGKT, and higher hit rates in the GT, than other participants.

## Method

## **Participants**

We recruited 52 participant pairs (20 pairs of friends, 29 couples, 3 pairs of siblings; 35 male, 65 female; M = 26.45 years, SD = 7.05) via an announcement in the local student job agency (25 pairs) and in a local newspaper (27 pairs). Participants were of reportedly good health, unmedicated, and participated voluntarily in the study for a payment of 24 Euros per pair. Informed consent was obtained from all participants. The data from two pairs had to be discarded because of noncompletion of the experiment.

## Procedure

The experiment consisted of four phases:

Welcome Phase. One of two experimenters welcomed the participant pairs to the laboratory. The experimenter informed the participants about the procedure and randomly assigned them to the two experimental tasks. Participant 1 was sent to an office, where a second experimenter, responsible for the MT, was waiting. Participant 2 remained with the first experimenter in the laboratory for the MGKT. Any contact between participants and between the experimenters was prevented until the end of the experiment.

**MT Phase**. After giving informed consent, Participant 1 was instructed about the MT. A training run preceded the main run. Afterwards, the experimenter left the room and Participant 1 started the main run with a key press. After Participant 1 had completed the task, the experimenter signaled the end of the MT to the other experimenter by slipping a blank sheet of paper under the door of the laboratory. Both directly before and after the MT, the emotional state of Participant 1 was assessed by a questionnaire. Additionally, Participant 1 filled in two personality questionnaires. Then, Participant 1 was kept busy with a brain teaser until Participant 2 completed the MGKT. Not until then did Participant 1 complete a questionnaire concerning the connectedness of the pair.

**MGKT Phase**. After giving informed consent, Participant 2 filled in two personality questionnaires and was led into the experimental room. There, the experimenter connected Participant 2 to the recording devices

and handed out written instructions. When the other experimenter signaled the end of the MT, the MGKT was initiated. A training run preceded the two main runs. After completing both main runs, Participant 2 performed the GT. At the end, a questionnaire concerning the connectedness of the pair was administered to Participant 2.

**Information and Closure Phase**. Both experimenters and both participants got together in the laboratory. The experimenters informed the participants of the cover story (see Mock Task) and answered questions about the theoretical background of the study. Finally, the participants received their payment.

Each of the two experimenters was responsible equally often for the MT and for the MGKT.

#### Mock Task

In an office room, Participant 1 handled seven objects, each belonging to a different object category (e.g., household articles). Participant 1 handled the objects in sequence according to instructions displayed on a computer screen. After the participant had initiated the task by a key press, the sequence started with the instruction to collect a particular object that was located somewhere in the room (e.g., "Please collect the household article from the desk"). Then, the participant was instructed to estimate the weight of the object. The estimate had to be keyed in and feedback of its correctness was given ("correct" or "false"). This sequence was repeated for each object. Only the experimenter responsible for the MT, and Participant 1, knew the identity of the objects.

Each category consisted of five different objects; in each experimental session only one object from each category was presented. The selection of the objects to be presented was pseudo-randomized, so that each object in the category was selected equally often across participants.

The instruction sequence was computer controlled. The time allowed for collection of an object was 20 s. Participants then had 30 s to estimate the weight and a further 5 s to type in their estimate. Each sequence lasted 1.5 min; the duration of the whole task was nearly 10 min.

A cover story was implemented to induce negative emotional arousal and motivation for attentive inspection of the objects. Every "false" feedback was combined with a pretended reduction of the pair's payment (loss of 1 Euro) and every "correct" feedback meant no such reduction. In fact, participants' actual estimates did not determine their feedback—every participant received feedback that five responses were "false" and two were "correct."

## Modified Guilty Knowledge Test

In the MGKT, Participant 2 was instructed to identify the objects that had been present in the partner's task (probe objects).

We adopted the stimulus material, the program, and the experimental design of the MGKT reported by Ambach et al. (2008). Five pictures, including the probe object and four irrelevant objects from the same category that were not presented in the MT, were shown on the screen in sequence. To eliminate sequential effects, the order of the objects within each category and the position of the probe object within each category were pseudo-randomized for each run and balanced across participants. Participant 2 was told that some of the presented objects were part of the partner's task, but not how many.

Each picture was presented together with a question, which was simultaneously displayed above the picture and related to the MT (e.g., "Are you sure that this household article was present?"). Participants were instructed not to guess, but to answer "yes" only if they were absolutely certain about the presentation of the object in the MT.

Preceding each category, two neutral objects were presented as distractors. The neutral questions referred to everyday objects that had to be identified (e.g., "Is this a yellow flower?"). Participants had to answer one of the two neutral questions correctly with "yes" and the other correctly with "no" (using a pseudo-randomized sequence of "yes" and "no" answers). The correctness of the responses to these neutral questions was evaluated as a clue for the compliance of the participants. The presentation of five category-related objects and two neutral objects for each of the seven object categories resulted in a total of 49 object presentations per run; the total experiment consisted of two runs.

Questions and object pictures were presented to Participant 2 foveally on a 19-in. monitor at a distance of 90 cm for 10 s, followed by a blank screen for equally distributed 5.0–7.5-s intervals. Picture size was  $6.0^{\circ} \times 8.0^{\circ}$  of the visual angle.

Two indication fields containing question marks appeared with a delay of 4 s after a question was asked; this prompted participants to answer. They had to answer as quickly as possible, both by pressing one of the two response keys and by responding vocally with "yes" or "no." Key assignment was balanced across participants. Following the answer, the given "yes" or "no" replaced the question marks and remained visible on the screen for as long as the object question was presented.

## **Guessing Task**

In the concluding GT, all five pictures in each category were presented simultaneously on the screen. Participant 2 was now informed that one object in each category had been part of the partner's task. He or she was asked to guess which object among the five this was. The objects were numbered from "1" to "5" and participants responded by pressing a number on a numeric keypad.

## **Physiological Measurement**

The physiological recordings took place in a dimly lit, electrically and acoustically shielded experimental chamber (Industrial Acoustics GmbH, Niederkrüchten, Germany). Participants sat in an upright position so that they could see the monitor and reach the keyboard comfortably.

Skin conductance, respiratory activity, electrocardiogram (ECG), and finger plethysmogram were registered. Physiological measures were A/D-converted and logged by the Physiological Data System I 410-BCS manufactured by J & J Engineering (Poulsbo, Washington). The A/D-converting resolution was 14 bit, allowing skin conductance to be measured with a resolution of 0.01  $\mu$ S. All data were sampled with 510 Hz. Triggers indicating stimulus onsets were registered with the same sampling frequency.

For skin conductance recordings, standard Ag/AgCl electrodes (Hellige; diameter 0.8 cm), an electrode paste of 0.5% saline in a neutral base (TD 246 Skin Resistance, Mansfield R&D, St. Albans, Vermont), and a constant voltage of 0.5 volts was used. The electrodes were affixed at the thenar and hypothenar sites of the nondominant hand.

For registration of thoracic and abdominal respiratory activity, two PS-2 biofeedback respiration sensor belts (KarmaMatters, Berkeley, California) with built-in length-dependent electrical resistance were used. They were fixated at the upper thorax and the abdomen.

ECG was measured with Hellige electrodes (diameter 1.3 cm) according to Einthoven II.

Finger pulse signal was transmitted by an infrared system in a cuff around the middle finger of the nondominant hand.

#### **Behavioral Measures**

During the MGKT, participants responded both with "yes" or "no" by key presses and with verbal expressions (the latter were not analyzed further). During the GT, participants responded with "1" to "5" by key press. The key presses were time-logged and stored on the stimulus-presenting computer for later evaluation of reaction times in the MGKT and hit rate in the GT.

#### Questionnaires

Participants' paranormal beliefs were recorded via the Paranormal Conviction Scale (PCS; Schriever, 1998/1999, 2000), which is in the German language and based on the Paranormal Belief Scale (Tobacyk, 1991; Tobacyk & Milford, 1983). Participants' exceptional experiences were recorded by means of an unpublished scale from our laboratory (results of the scale are not reported). Only the questionnaires completed by Participants 2 were analyzed. The connectedness of each pair was evaluated by the Questionnaire on the Evaluation of Relationships (QER; Schmidt et al., 2001). A connectedness index for each participant pair was assessed by averaging the QER scores of both partners.

For analyzing the influence of the MT on participants' emotional state and emotional arousal, the Self-Assessment Manikin (SAM; Bradley & Lang, 1994) was filled in both before and after the MT. The SAM consists of the scales Emotional Valence ("Valence"), Emotional Arousal ("Arousal"), and Feeling of Dominance ("Dominance").

## **Data Reduction**

All neutral objects and the first irrelevant object of each category were buffer items and therefore discarded from analyses. In addition, trials with a missing key press within the time-window provided for answering (2.5 s) were discarded. For 50 participant pairs, this resulted in 2,654 valid trials for physiological analyses and analysis of reaction times.

Data from two participants had to be discarded from the heart rate (HR) analysis, one because of technical artifacts and the other because of extrasystoles. HR data were notch-filtered at 50 Hz; R-wave peaks were automatically detected and visually controlled. The R-R intervals were transformed into HR, and real-time scaled (Velden & Wölk, 1987). Phasic heart rate (pHR) was calculated by subtracting a baseline (average of three s before stimulus onset) from each of 10 second-per-second post-stimulus values.

Respiratory data were low-pass filtered and the respiration line length (RLL) was computed automatically over a time interval of 10 s after trial onset for breast (RLL\_breast) and abdominal respiration (RLL\_abd). The RLL measure integrates information about frequency and depth of respiration. The method has been derived from Timm (1982) and modified by Kircher and Raskin (2003). Data from two participants had to be discarded because of technical artifacts.

The finger pulse waveform length (FPWL) within the first 10 s after trial onset was calculated from the finger pulse waveform and then subjected to further analyses (Elaad, & Ben-Shakhar, 2006). The FPWL comprises information about HR and pulse amplitude.

Data from four participants had to be discarded from the skin conductance analysis because of electrodermal hyporesponding ( $\geq 90\%$  nonresponses). Skin conductance reactions were assessed by a computerized method (LEDALAB, Version 3.2.3) based on decomposition of overlapping reactions by means of nonnegative deconvolution (Benedek & Kaernbach, 2010). The sums of the EDA amplitudes within the time window after stimulus onset (0.5–4.5 s) were additively combined to form a first response (EDA\_1). The sum of the EDA responses between 4.5 and 8.5 s after stimulus onset (i.e., 0.5–4.5 s after the participants were prompted to answer) was calculated as the second response (EDA\_2).

Lykken and Venables (1971) proposed a within-subject standardization of measured values. Here, according to Ben-Shakhar (1985), EDA, RLL, pHR, FPWL, and RT were z-transformed for each participant. The responses of all trials with probe and irrelevant items of a participant were used for the calculation of individual means and standard deviations (Ambach et al., 2008). The z-transformed values were used in the subsequent statistical analyses.

## Statistics

Statistical analyses were performed with SYSTAT, Version 13 (Systat Software Inc., Chicago, Illinois).

For each physiological measure as well as for reaction times, a *t* test for matched samples was conducted (one-tailed,  $\alpha = .05$ ). Cohen's *d* was calculated as an effect size estimate according to Cohen, 1988 (2nd edition, p. 48, formulas 2.3.5 and 2.3.6).

For analyzing the hit rate in the GT, a binomial test for proportions was performed (one-tailed,  $\alpha = .05$ ).

Pearson product-moment correlation analyses were conducted between scores on the questionnaires and z-score differences between probe and irrelevant objects (physiological measures and RTs) as well as the number of hits in the GT. Correlation coefficients were tested for statistical significance (two-tailed,  $\alpha = .05$ ).

Participants' scores on the SAM before and after the MT were analyzed by means of paired *t* tests (two-tailed,  $\alpha = .05$ ).

#### Results

## **Physiological Analysis**

In case of anomalous interaction between participants, probe objects should have obtained significance for Participant 2. If so, we expected particular physiological response differences between probe and irrelevant objects. These differences should have consisted of higher averages on EDA\_1 and EDA\_2, and lower averages on RLL, pHR, and FPWL for probe than for irrelevant objects. This hypothesized systematic pattern of physiological response differences was not found: For probe objects, the averages for EDA\_1, EDA\_2, and RLL\_breast tended to be lower than for irrelevant objects. The averages of RLL\_abd, pHR, and FPWL tended to be higher for probe than for irrelevant objects (Table 1).

For each physiological channel, a t test for paired measures (onetailed) was conducted (assessed via z values). None of the tests revealed a significant difference in physiological reactions to probe versus irrelevant objects (Table 2).

|                         | Probe objects |      | Irrelevant objects |      |
|-------------------------|---------------|------|--------------------|------|
|                         | М             | SEM  | М                  | SEM  |
| EDA_1 [nS]              | 157           | 19   | 173                | 23   |
| EDA_2 [nS]              | 256           | 33   | 264                | 31   |
| RLL_breast [arb. units] | 1668          | 119  | 1678               | 115  |
| RLL_abd [arb. units]    | 2618          | 250  | 2613               | 251  |
| pHR [1/min]             | 1.28          | 0.27 | 1.09               | 0.19 |
| FPWL [arb. units]       | 178           | 150  | 176                | 142  |

 
 Table 1

 Descriptive Statistics of Raw Scores for Each Physiological Data Channel for Probe and Irrelevant Objects

*Note.* M = Means; SEM = Standard error of means; EDA\_1 = First electrodermal response; EDA\_2 = Second electrodermal response; RLL\_breast = Breast respiration line length; RLL\_abd = Abdominal respiration line length; pHR = Phasic heart rate; FPWL = Finger pulse waveform length.

 
 Table 2

 Calculated t Values, p Values, and Effect Sizes for the Differential Responses to Probe versus Irrelevant Objects

|            | t(df)      | р    | Effect size ( <i>d</i> ) |
|------------|------------|------|--------------------------|
| EDA_1      | -0.36 (45) | .641 | -0.054                   |
| EDA_2      | -0.71 (45) | .759 | -0.105                   |
| RLL_breast | -0.67 (47) | .252 | -0.097                   |
| RLL_abd    | 0.55 (47)  | .706 | 0.079                    |
| pHR        | 0.90 (47)  | .813 | 0.130                    |
| FPWL       | 0.97 (49)  | .831 | 0.137                    |
|            |            |      |                          |

*Note.* df = Degrees of freedom; d = Cohen's d; EDA\_1 = First electrodermal response; EDA\_2 = Second electrodermal response; RLL\_breast = Breast respiration line length; RLL\_abd = Abdominal respiration line length; pHR = Phasic heart rate; FPWL = Finger pulse waveform length.

## **Behavioral Analysis**

We hypothesized that reaction times in the MGKT would be longer for probe than for irrelevant objects in the case of anomalous interactions between participants. Hit rates in the subsequent GT were expected to be above chance.

Analysis of reaction times revealed no differences between probe (M = 803.73, SEM = 238.9 ms), and irrelevant objects (M = 805.66, SEM = 198.47 ms), t(49) = -0.82, p = .415, d = -0.116.

The number of hits in the GT, averaged across participants, was M = 1.42, SD = 1.11. In 350 trials, 71 hits occurred. This proportion is at chance level (expected proportion = .20, sample proportion = .203, z = 0.13, p = .894).

## **Correlation Analyses**

We tested whether the degree of paranormal belief and the connectedness of the participants were correlated with physiological and behavioral response differences between probe and irrelevant objects. Table 3 shows the results of the correlation analyses. The response difference of pHR between probe and irrelevant objects correlated significantly with the scores on the PCS, r(46) = .32, p = .028. No other correlation occurred (Table 3).

| to I love versus interevant Objects as well as the futures in the Of |                 |      |          |      |  |
|--|-----------------|------|----------|------|--|
|  | PCS             |      | QER      |      |  |
|  | r ( <i>df</i> ) | р    | r (df)   | р    |  |
| dEDA_1   | .16 (44)        | .366 | .01 (44) | .945 |  |
| dEDA_2   | 27 (44)         | .075 | .15 (44) | .323 |  |
| dRLL_breast  | 05 (46)         | .746 | .05 (46) | .717 |  |
| dRLL_abd   | 04 (46)         | .794 | .06 (46) | .667 |  |
| dpHR   | .32 (46)        | .028 | 16 (46)  | .288 |  |
| dFPWL  | .07 (48)        | .628 | .05 (48) | .745 |  |
| dRT  | .17 (48)        | .235 | .09 (48) | .547 |  |
| GT   | .03 (48)        | .817 | .10 (48) | .503 |  |

 
 Table 3

 Correlations Between Scores on Questionnaires and Response Differences to Probe versus Irrelevant Objects as Well as Hit Rates in the GT

*Note*. PCS = Paranormal Conviction Scale; QER = Questionnaire on the Evaluation of Relationships; r = Pearson product-moment correlation; df = Degrees of freedom; EDA\_1 = First electrodermal response; EDA\_2 = Second electrodermal response; RLL\_breast = Breast respiration line length; RLL\_abd = Abdominal respiration line length; pHR = Phasic heart rate; FPWL = Finger pulse waveform length; GT = Guessing Task.

#### Analysis of the Influence of the MT

We expected the MT to influence the emotional state and the emotional arousal of Participants 1. Table 4 shows the averaged scores of the SAM before and after the MT. For each scale the mean score was lower after the MT. The difference was significant for the scales Valence, t(49) = 5.83, p < .001, and Dominance, t(49) = 2.76, p = .004, but not for Arousal, t(49) = 0.60, p = .299.

|           | Before MT |      | After MT |      |
|-----------|-----------|------|----------|------|
|           | <i>M</i>  | SD   | <i>M</i> | SD   |
| Valence   | 7.08      | 1.28 | 5.72     | 1.96 |
| Arousal   | 4.66      | 1.86 | 4.50     | 2.02 |
| Dominance | 5.54      | 1.30 | 5.04     | 1.55 |

|             |                    | Table 4           |                      |
|-------------|--------------------|-------------------|----------------------|
| Descriptive | Statistics for the | Valence, Arousal, | and Dominance Scales |
|             | of the SAM         | Before and After  | the MT               |

*Note*. MT = Mock task; *M* = Means; *SD* = Standard deviation.

#### **Exploratory Analyses of the MGKT**

Contrary to our expectations, a high number of "yes" answers occurred in the MGKT. This enabled an exploratory analysis of decision behavior. Of the 50 participants, 34 answered "yes" in at least one trial, M = 14.3, SD = 13.77, and 16 answered all trials with "no." Overall, a "yes" answer was given in 20.6% (715) of all answered trials (3,474). "Yes" answers were associated with 140 hits (19.6%). This hit rate is near the chance level of guessing for one object among five (20%).

Exploratory correlation analyses were conducted between the scores on the questionnaires (QER, PCS) and the numbers of "yes" answers. The number of "yes" answers was positively and significantly correlated with scores on the PCS, r(48) = .43, p = .002. No significant correlation was found between the numbers of "yes" answers and scores on the QER, r(48) = .25, p = .083.

#### Discussion

The present study was aimed at investigating anomalously modulated physiological responses as an indicator of anomalous interactions between participants. To that end, we conducted a modification of the GKT. In the experiment, one partner (Participant 1) was confronted with objects of different object categories in the MT. Therefore, these objects gained particular significance for the participant. Afterwards, the spatially separated partner (Participant 2) was confronted with pictures of these objects (probe) and of other objects of the same object categories (irrelevant). Physiological and behavioral response differences of Participant 2 between probe and irrelevant objects were analyzed.

## Anomalously Modulated Physiological Responses

We hypothesized that if there were anomalous interactions between participants, probe objects would have particular significance for Participant 2. Therefore, physiological responses to probe objects should be modulated by this significance, in contrast to responses to irrelevant objects. We expected the response differences to be qualitatively similar to the typical response differences in the GKT, consisting of higher electrodermal response amplitudes, suppressed respiration, decelerated heart rate, and lower pulse amplitudes to probe than to irrelevant items (Gamer et al., 2006). This hypothesized pattern of response differences was not found in the present study. In fact, no evidence for any systematic deviation of the physiological response differences among the physiological measures from a random pattern was found.

The typical GKT is a sensitive instrument for detecting particular physiological response differences between objects with and without particular significance, usually resulting in high effect sizes (Cohen's d)—around 2 for EDA or phasic HR (e.g., Ambach et al., 2008; Ben-Shakhar & Elaad, 2003). In contrast, in the present study, effect sizes were small (Cohen, 1988) and all response differences were nonsignificant. Accordingly, physiological analyses found no evidence for anomalously modulated physiological responses.

# **Behavioral Indicators for Anomalous Interaction**

Reaction times in the MGKT did not differ between probe and irrelevant objects. Apparently, probe objects did not evoke response conflict or inhibition, as we expected in case of enhanced significance of these objects for Participant 2.

In the GT, the number of correct choices was at chance level. Hence, we found no evidence for conscious knowledge of Participant 2 about the probe objects.

# Influence of Moderator Variables on Participants' Performance

For investigating the influence of participants' paranormal beliefs on their performance in the MGKT, we performed a correlation analysis between scores on the paranormal belief scale and physiological response differences between probe and irrelevant objects. Only the difference in pHR correlated significantly with the degree of paranormal belief. However, this result has to be interpreted cautiously because no alpha-correction for multiple testing was performed. No correlation occurred between the degree of paranormal belief and participants' hit rates in the GT.

The connectedness between participants was not correlated with physiological response differences or with hit rate in the GT.

Based on these results, we could not confirm our expectation of better performance in participants with stronger belief in paranormal phenomena or of participant pairs with closer emotional relationships.

## **Decision Behavior in the MGKT**

An unexpected finding concerned the high number of "yes" answers during the MGKT. Despite the instruction to answer with "yes" only in case of absolute sureness, two-thirds of the participants answered at least once with "yes"; the number ranged from 1 to 47 times. However, the hit rate for the "yes" answers was at chance level.

Earlier studies investigated cognitive biases as possible explanations for the behavior of participants with high scores on paranormal belief scales in parapsychological experiments. For example, Blackmore and Troscianko (1985) found that people with strong paranormal belief tend to underestimate the likelihood of coincidence, which is then interpreted as a paranormal event. Schienle, Vaitl, and Stark (1996) investigated the covariation bias in people with paranormal belief during a telepathy experiment. The covariation bias describes the tendency of people to estimate the co-occurrence of events in line with their belief about the covariation of these events. The authors found an overestimation of the number of successful telepathic transmissions for believers, whereas skeptics gave accurate estimates. In the present study, exploratory analyses revealed a positive and significant correlation between the number of "yes" answers and scores on the Paranormal Conviction Scale. Possibly, this result revealed the tendency of participants to confirm their conviction about the existence of paranormal phenomena. This confirmation bias may be due to cognitive dissonance produced by a contradiction between the instruction and participants' paranormal belief. Therefore, participants behaved in line with their subjective hypotheses rather than in line with the instructions.

#### Methodological Remarks

Four methodical aspects could have negatively influenced the results of the present study.

The first aspect refers to possible weak points in the instructions for Participant 2. These participants did not respond consistently with "no" as expected. Therefore, it is debatable whether the instruction to answer only with "yes" in case of absolute certitude was adequate to evoke response conflicts and processes of inhibition.

It is also imaginable that some participants were confused about this instruction because it suggests the possibility of being absolutely sure about probe objects. In particular, this could be the case for participants with rather weak beliefs in paranormal phenomena. Therefore, it is debatable whether all participants took the experiment seriously and were as motivated as possible, although we have no hints of a lack of compliance. Evidence for good compliance during the MGKT can be taken from the percentage of correct answers for the neutral questions. In the MGKT, two neutral questions preceded each category, whereof one had to be answered correctly with "no" and the other correctly with "yes" (see Modified Guilty Knowledge Test). The percentage of correctly answered neutral questions was 98%. The percentage of answered questions among all trials (neutral, irrelevant, and probe trials), which was 99%, provides further evidence for good compliance.

A further weak point refers to the exploratory analyses of the physiological data, which revealed significantly higher electrodermal activity for "yes" than for "no" answers. Therefore, physiological response differences between "yes" and "no" answers and between probe and irrelevant objects were confounded. However, "yes" and "no" answers were equally distributed for probe and irrelevant items in the present study (20% to 80%). Hence, it can be concluded that this issue did not affect the physiological analyses. Future studies should overcome these weak points in the instructions. One possible solution could be to attempt to conduct the MGKT without a question during the object presentation. In GKT studies without behavioral measures of the participants, differences in physiological responses between probe and irrelevant items were nonetheless statistically significant (Ben-Shakhar & Elaad, 2003).

The second methodical aspect refers to the timing of the experimental procedure. According to the usual GKT procedure and to the fact that the question of the timing of anomalous interactions is still open, a nonsynchronistic variant was used: One partner was confronted with objects and thereafter the other partner was investigated by means of physiological measures. This procedure is rather unusual in parapsychological research. Most studies investigating participant pairs focus on physiological responses of the nonstimulated participant that occurred at the same time as the stimulation of the partner. Thus, the timing characteristic of the present study could have been inadequate for measuring an anomalous effect. Therefore, we suggest synchronistic timing of the experimental procedure for future studies. The computer-controlled instructions of the MT could be synchronized category-wise with the presentation of the objects in the MGKT, so that Participant 1 handles one particular object at the same time as Participant 2 is presented all objects in the particular object category. For example, while
Participant 1 handles one particular household article, all household articles of the category are presented in succession to Participant 2.

The third methodical aspect refers to the influence of the event on the emotional state and emotional arousal of participants. The importance of events causing negative emotional arousal was confirmed in a few studies that analyzed reports of spontaneous cases (e.g., Rhine, 1978; Stevenson, 1971). Experimental parapsychology attempted to heighten the ecological validity of experiments by using emotional stimuli such as IAPS pictures (e.g., Moulton & Kosslyn, 2008; Ramakers, 2008). Because the aim of the GKT is to measure the modulation of orienting responses by their significance to the participant, all objects have to be neutral in emotionality and similar in initial significance. Probe objects should not have particular significance for Participant 1 until the MT. Therefore, we tried to evoke emotional arousal by implementing the MT with a difficult task and a pretended monetary loss for both participants. The influence of the MT on participants' emotional state and arousal was measured via the SAM. Results showed a significant reduction of participants' emotional valence in the direction of reduced happiness and a reduction of feeling of dominance during the MT. These results seem plausible; the reduction of participants' emotional valence could be explained by the pretended loss of payment. Participants' feelings of dominance were presumably reduced due to the predetermined feedback. However, reductions on both scales were small and the mean scores did not fall below the medians of the scales. Moreover, participants' arousal was not increased during the task and the mean scores fell slightly below the median of the scale before and after the MT. If a high level of emotional arousal is a necessary condition for the occurrence of anomalous interactions between participants, it is debatable whether the MT is an adequate method to achieve this condition. For future research, we suggest enhancing the emotional load of the task, for example, by implementing a real (not cover) story and by increasing the impact of the performance of Participant 1 on the monetary gain or loss of both participants. Further, the feedback during the MT could be dropped to evoke a greater feeling of uncertainty in Participant 1 during the entire task. So, if Participant 1 feels more responsible for the gain or loss of his or her partner, if this participant's performance is more important than in the present study, and if Participant 1 is more uncertain about his or her performance, all this could evoke enhanced emotional arousal in Participant 1 during the MT.

The fourth methodical aspect refers to the *experimenter effect*, that is, an experimenter influences a participant's behavior and score according to his or her expectancies through his or her own behavior (Rosenthal & Rubin, 1978). The present study was conducted double-blind to avoid this bias. The experimenter responsible for the MGKT did not know the particular probe objects, and the experimenter responsible for the MT did not have any contact with Participant 2 and with the other experimenter

until the end of each experimental session. Parapsychological research raised the question of a *parapsychological experimenter effect*, that is, the data of an experiment partially dependent on the influence of paranormal abilities of the experimenter. The unintentional use of these abilities depends on the experimenters' needs, wishes, expectancies, and moods (e.g., Kennedy & Taddonio, 1976). In the present study, nothing was known about the paranormal abilities of the experimenters and they were not tested for their paranormal belief, needs, and wishes to get a positive or negative result. Therefore, the influence of a possible parapsychological experimenter effect is unknown in this study.

## Conclusions

The present study failed to find anomalously modulated physiological responses or other indicators of anomalous interactions between participants. Nevertheless, the present method seems promising for future research. Behavioral (e.g., reaction times and decision behavior) as well as physiological variables were analyzed and interpreted on the basis of clear hypotheses about the effects that should occur if there are anomalous interactions between participants. Some methodological adaptations are suggested for future studies. First, the weak points of the instruction for Participant 2 have to be overcome. In particular, the prevention of an unequal distribution of "yes" and "no" answers for probe and irrelevant objects would be desirable to overcome the confounding of physiological response differences between answers. Second, the timing of the experimental procedure could be changed to a synchronistic variant, which is more in line with parapsychological research on anomalous interactions between participants. Third, the influence of the experimental procedure on participants' emotional arousal should be increased. Fourth, the influence of the parapsychological experimenter effect on the data could be tested. Taking into account these suggestions, the attempt of investigating anomalously modulated physiological responses (to presented stimuli) as indicators of anomalous interactions between participants should be continued.

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## Acknowledgments

We thank the BIAL Foundation for supporting this project with their research fund. Further, we thank Sabrina Brüstle for help with data collection. Institute for Frontier Areas of Psychology and Mental Health (IGPP) Wilhelmstraße 3a, D - 79098, Freiburg, Germany schoenwetter@igpp.de

#### Abstracts in Other Languages

#### Spanish

## ¿REVELA UNA PRUEBA MODIFICADA DE CONOCIMIENTO CULPABLE INTERACCIONES ANÓMALA EN PARES DE PARTICIPANTES?

RESUMEN: Este estudio tuvo como objetivo investigar respuestas fisiológicas anormalmente modulada como un indicador de las interacciones anómalas entre parejas vinculadas emocionalmente. Con este fin, usé una versión modificada de la Prueba de Conocimiento Culpable. En este experimento, las parejas fueron separadas espacialmente. Le presenté a uno de los miembros de la pareja (Participante 1) objetos específicos para que adquirieran una importancia especial para el participante. Evalué las diferencias en las respuestas fisiológicas del otro miembro (Participante 2) a imágenes de objetos presentados al Participante 1 y a objetos no presentados (objetos irrelevantes). En el caso de una interacción anómala entre los participantes, esperaba que la importancia especial de los objetos presentados al Participante 1 modularía las respuestas fisiológicas del participante 2. Las variables fisiológicas consistieron en la actividad electrodérmica, taza cardíaca, actividad respiratoria, y pulso. Las variables de conducta consistieron en los tiempos de reacción y la tasa de aciertos al adivinar el objetivo. Evalué las creencias paranormales y la conexión entre los participantes a través de cuestionarios, como posibles moderadores para el desempeño de los participantes 2. Analicé las correlaciones entre las puntuaciones al cuestionario y fisiológicas, así como las variables de conducta. En general, los análisis no revelaron respuestas fisiológicas moduladas anormalmente u otros indicadores de interacción anómala entre los participantes. Discuto observaciones metodológicas e implicaciones para futuros estudios.

## French

## EST-CE QU'UN TEST MODIFIE DE CONNAISSANCE DE CULPABILITE PEUT REVELER DES INTERACTIONS ANOMALES ENTRE DES PAIRES DE PARTICIPANTS ?

RESUME : Cette étude tente d'étudier des réactions anomales modulées physiologiquement en tant qu'indicateur d'interactions anomales entre des partenaires émotionnellement liés. Pour ce faire, nous utilisons une version modifiée du Test de connaissance de culpabilité. Dans cette expérience, les

partenaires étaient séparés spatialement. L'un des partenaires (Participant 1) était confronté avec des objets-sondes tels que ces objets acquéraient une signification particulière pour le Participant 1. L'autre partenaire (Participant 2) était étudié pour ses différences dans ses réactions physiologiques à des images des objets-sondes et à des images d'objets auxquelles le Participant 1 n'avait pas été confronté (objets sans importance). Dans le cas d'une interaction anomale entre les participants, on s'attend à ce que la signification particulière des objets-sondes module les réactions physiologiques du Participant 2. Les variables physiologiques étaient l'activité électrodermale, la fréquence cardiaque, l'activité respiratoire et le pouls. Les variables comportementales étaient les temps de réaction et le taux de succès dans la tâche de divination. Les croyances paranormales et la connectivité des participants furent évaluées via des questionnaires, en tant que possibles modérateurs pour la performance du Participant 2. Les corrélations entre les scores au questionnaire et les variables physiologiques ainsi que comportementales furent analysées. Globalement, les analyses révélaient aucune réaction anomale modulée physiologiquement ou d'autres indicateurs d'interactions anomales entre les participants. Les remarques et implications méthodologiques pour d'autres études sont discutées

## German

## EIGNET SICH EIN MODIFIZIERTER TATWISSENTEST ZUR AUFDECKUNG ANOMALER INTERAKTIONEN ZWISCHEN PARTNERN VON PROBANDENPAAREN?

ZUSAMMENFASSUNG: Ziel dieser Studie war die Untersuchung anomal modulierter physiologischer Reaktionen als Indikator für anomale Interaktionen zwischen emotional verbundenen Partnern. Dazu verwendeten wir eine modifizierte Form des Tatwissentests. Einer von zwei räumlich getrennten Partnern (Proband 1) wurde mit Objekten (relevante Objekte) konfrontiert, so dass diese Objekte eine besondere Bedeutung für Proband 1 bekamen. Danach wurde der andere Partner (Proband 2) auf physiologische Reaktionsunterschiede zwischen Bildern von relevanten Objekten und Bildern von Objekten, mit denen Proband 1 nicht konfrontiert wurde (irrelevante Objekte), untersucht. Im Falle einer anomalen Interaktion zwischen den Partnern erwarteten wir, dass die besondere Bedeutung der relevanten Objekte für Proband 1 die physiologischen Reaktionen von Proband 2 verändert. Elektrodermale Aktivität, Herzrate, Atemaktivität und Pulsaktivität wurden untersucht. Als Verhaltensdaten dienten Reaktionszeiten sowie Trefferquoten in einer Rateaufgabe. Der Glaube an paranormale Phänomene und die Verbundenheit der Probanden wurden als mögliche Moderatorvariablen für das Abschneiden von Proband 2 mittels Fragebögen gemessen. Zusammenhänge von Fragebogenwerten mit physiologischen Daten sowie mit Verhaltensdaten wurden untersucht. Es zeigten sich keine anomal modulierten physiologischen Reaktionen oder andere

Indikatoren für anomale Interaktionen zwischen den Probanden. Methodische Anmerkungen und Implikationen für zukünftige Studien werden diskutiert.

## REG OUTCOME IN AN ALARM SITUATION IN ZEBRA FINCHES

#### By Fernando Alvarez

ABSTRACT: Micro-PK was explored in zebra finches (Taeniopygia guttata) to test the hypothesis of nondirectional REG randomness reduction during an alarm situation. A 15-s video clip of a crawling snake was presented to 80 participants and a REG's outcome during the presentation of the stimulus was analysed under three conditions: Bird Alone, Bird Plus Observer, and Observer Alone. One 200-bit trial was collected every quarter of a second during the presentation of the stimulus and the 5-min control period before the start of the disturbing stimulus, and the obtained cumulative chi-square deviation scores were analysed. The finding that the scores during the stimulus period for the three conditions belonged to the same population, their direction being the same when independently and globally analysed, together with the nonsignificant difference with respect to their controls do not support the proposed hypothesis. However, an as yet undifferentiated psi observer effect is suggested by the global scores of the stimulus periods departing from chance while the scores of the corresponding controls did not, by the former's values surpassing the latter, and by the scores of the stimulus periods deviating from chance when the observer was present.

Keywords: birds, micro-PK, REG, zebra finches

Devices known as random event generators (REGs) depend upon quantum effects, and although they are designed to produce a stream of purely random numbers, when people direct their attention to a single focus (not specifically intending to influence the REGs), a surprising reduction of randomness occurs.

This nondirectional effect was demonstrated when the attention of an audience (size from one person to 3 billion people) was concentrated on a single matter, be it a human disaster, a personal growth workshop, a comedy show, a poltergeist event, or a praying service (Bierman, 1996; Blasband, 2000; Mason & Patterson, 2007; Nelson, 2001, 2003; Radin, 1997; Radin, Rebman, & Cross, 1996; Williams, 2010).

When individual subjects were tested in an attempt to detect any effect of induced emotions on REG outcome, a reduction of randomness resulted during anger induction (Lumsden-Cook, 2005a), especially during anger and sadness dissipation (Lumsden-Cook, 2005b).

One question we may ask ourselves is whether attention or emotional states by nonhumans would also affect the random functioning of REGs. Although the prospect for enhanced experimental manipulation would be higher with nonhuman subjects, work with them is very scant. The only two studies of which I am aware dealing with the potential influence on up-to-date, reliable REG devices used soil nematodes and young chickens in the experiment. The first one explored the role of the presence of different genetic lines of a nematode species on REG output, yielding marginally significant results in relation to output variance (Franklin, Kendall, & Vassilieva, 2005). In the second one, a small self-propelled robot on which chicks had been previously imprinted, and driven by an internal REG to manoeuvre randomly, moved significantly more often than chance toward the chicks' location, denoting a reduction in randomness in the output of the REG and suggesting psychokinesis (PK) by the birds (Peoc'h, 1995).

My hypothesis, based on the results of these studies, is that a nondirectional reduction in randomness in REG production will occur specifically during the presentation of a disturbing stimulus to birds. At the same time, an observer manipulation will be introduced into the experiment, in order to explore the existence of a psi observer effect.

### Method

The animal species used was the zebra finch (*Taeniopygia guttata*). This bird is one of the most common subjects of research in many scientific disciplines, both in the wild and in the laboratory (Zann, 1996), serving as a model for investigation in neurology, behavior development, and environmental variables that impact human health, and it also appears to be gifted with the ability for short-term precognition (Alvarez, 2010a).

All subjects (80 adult male and female zebra finches) lived in two unisexual adult groups of conspecifics in  $3 \times 3 \times 2$  m aviaria near Seville, Spain, where water and food (seeds and vegetables) were supplied *ad libitum*.

The 70 x 35 x 35 cm testing cage was provided with four perches and a TFT screen at one end, where a still background image of red tiles was always on display during the experimental sessions. During the sessions, an Orion REG device was permanently in position on the centre of the cage floor and provided the data relative to output randomness. The laptop computer controlling the presentation of the stimulus on the TFT screen and storing the information from the REG was located in an adjacent compartment and was connected to the devices by two long cables. The same scene was shown at the same time on the TFT screen beside the testing cage and on the screen of the laptop computer in the observer compartment.

Three conditions were tested: (a) Bird Alone: the test was applied to 40 birds while the observer had gone away from the experimental area (5 to 25 m from the testing cage); (b) Bird Plus Observer: while the tests to 40 other birds were taking place, the observer (who knew in advance the time of stimulus presentation) was continuously receiving the same stimulation as the birds on a laptop screen and was intently waiting for the stimulus to appear; (c) Observer Alone: the same as in b (40 tests), but the testing cage was empty. The experiments were performed between June 23 and November 9, 2010. Starting between 6:50 and 11:30 UT, the subjects (one at a time) were taken from their group and put in the testing cage. Each bird was unfamiliar with the testing situation and had not seen TV images before, and received only one test. During the test, the subjects could see the area with vegetation outside the aviarium, since being visually enclosed apparently reduces the expression of spontaneous behavior of alarm in zebra finches (Lombardi & Curio, 1985). Each subject was put into the testing cage for 30 min, where from the beginning it would encounter the still image of red tiles. After a period of 15 min, an alarm stimulus consisting of a 15-s video clip of a whip horseshoe snake (*Coluber hippocrepis*) slowly crawling over the red tile background was presented on the screen. The presentation of video playback on TFT screens has been used with great success to obtain behavioural responses in zebra finches and other estrildines (Ikebuchi & Okanoya, 1999; Galloch & Bischof, 2006, 2007; Alvarez, 2010b).

The operation of the REG on the floor of the testing cage was synchronized with the presentation of the stimulus and produced a sequence of 9,600 bits per second during the stimulus period and during the 5-min control period before the start of stimulus presentation of each condition.

The REG by Orion Electronics consists of two analogue Zener diodes, each independently producing a stream of random bits (ones and zeros), combined (using an XOR<) and then transmitted to the port of the computer. The computer software was set to collect data at a rate of one 200-bit trial at the start of every quarter of a second (one trial), the rest of the REG production being discarded, and to provide the sum of the ones for each trial per subject during the observation period. Analyses of REG production were carried out for the 60 trials within the 15-s block during stimulation and for each condition.

#### Statistical analysis

Deviations from the expected mean of 100 for each trial and each subject were converted to normally distributed *z* scores. Therefore, for the total number of subjects there were 40 *z* scores for each quarter of a second. Because the hypothesis is nondirectional,  $z^2$  scores, which are independent of the direction of the potential effect, were used, and the sum of the  $z^2$  across trials ( $\sum z^2$ ), being  $\chi^2$  distributed when summed across subjects and across time as the cumulative deviation of chi-square, were used as an index of deviation from random (Bierman, 1996).

#### Results

The per-trial values of the cumulative deviation of chi-square during the stimulus period and control periods of the three experimental conditions are shown in Table 1.

| -                  | -     |      |       |
|--------------------|-------|------|-------|
|                    | М     | SD   | Ν     |
| Bird Alone         |       |      |       |
| Stimulus period    | 41.34 | 9.29 | 60    |
| Control period     | 39.87 | 9.76 | 1,200 |
| Bird Plus Observer |       |      |       |
| Stimulus period    | 42.31 | 8.60 | 60    |
| Control period     | 40.61 | 8.92 | 1,200 |
| Observer Alone     |       |      |       |
| Stimulus period    | 42.13 | 9.84 | 60    |
| Control period     | 39.90 | 8.73 | 1,200 |
|                    |       |      |       |

 Table 1

 Cumulative Deviation of Chi-square (Mean and Standard Deviation) per Trial

 During the Three Conditions for the Stimulus and Control Periods

The global values of the cumulative deviation scores of the stimulus periods, combined for the three conditions, were found to differ significantly from chance,  $\chi^2$  (7,200) = 7,546.6, p = .002, whereas the corresponding global values of the control periods, combined for the three conditions, did not,  $\chi^2(144,000) = 144,454.5$ , p = .20. The combined values of the pertrial chi-square cumulative deviations during the stimulus periods proved to be significantly higher than the corresponding values of the combined control periods (Experimental:  $M \pm \text{SD} = 41.9 \pm 9.2$ ; Control:  $40.1 \pm 9.2$ ), t(3,778) = 2.57, p = .01.

When the values of the cumulative deviation of chi-square were compared for the three conditions during the stimulus period, the three were found to belong to the same population by one-way ANOVA, F(2,177) = 0.19, p = .83, and the three paired comparisons proved to be nonsignificant by Scheffé test: Error MS (177) = 85.67, p = .85–.99.

The cumulative deviations of chi-square across subjects and across time during the stimulus periods were significantly different from chance in the Bird Plus Observer and Observer Alone conditions,  $\chi^2(2400) = 2,538.3$ , p = .03;  $\chi^2(2400) = 2,527.8$ , p = .03, and nonsignificant for the Bird Alone condition,  $\chi^2(2400) = 2,480.5$ , p = .12.

The total cumulative deviation of chi-square for the control period (the observation time before stimulus presentation) proved to be nonsignificantly different from chance in the three experimental conditions: Bird Alone,  $\chi^2(4,800) = 47,845.6$ , p = .69; Bird Plus Observer,  $\chi^2(4,800) = 48,730.3$ , p = .01; Observer Alone,  $\chi^2(4,800) = 47,878.6$ , p = .65.

The comparisons of the cumulative deviations of chi-square of the two conditions showing significant divergence from randomness (Bird Plus Observer and Observer Alone) with their controls yielded nonsignificant differences, t(1,258) = 1.43, p = .15 and t(1,258) = 1.13, p = .26.

#### Discussion

The main hypothesis of a nondirectional reduction in randomness during stimulation with birds as observers is not supported: when the birds were observers and the stimulus was presented, no significant difference was obtained with respect to their respective controls. When analysed both independently and globally, the scores during these two conditions did not differ from those obtained when no bird was present.

Although the exploration of a psi observer effect produced no definitive results, the existence of such influence is suggested by the following facts: (a) the global scores of the stimulus periods for the three combined conditions departed from chance, whereas the corresponding global scores during the control periods did not; (b) the global values of the stimulus periods surpassed those of the control periods; and (c) the scores of the stimulus and control periods for the Bird Plus Observer condition and of the stimulus period of the Observer Alone condition also deviated from chance.

Although not supported by the results, the potential of PK in a predatory context, such as the one mimicked in this study, appears to be worth considering. Since predation is a major selective force in the evolution of morphological, physiological, and behavioral characteristics of animals, if potential prey species could manipulate the predatory context to their own benefit by way of PK to reduce the risk of being captured, the selection for individuals and genes capable of such a feat appears inescapable. However, as noted by Levin (1996), PK and other psi abilities should have evolved to the point of being widespread today, while on the contrary, observation of animals in action does not appear to support this expectation.

Several hypotheses have been advanced (see Table 2) and reviewed by Levin (1996) to explain this inconsistency, including: (a) rejecting the implicit premise that psi is not observed in nature; (b) denying some aspects of neo-Darwinian evolutionary theory, although the neo-Darwinian approach gives some support to psi function (Broughton, 1988; Taylor, 2003); (c) difficulties resulting from signal-to-noise ratio due to the conflicting desires of many organisms; (d) the impossibility of reliable analyses of psi under present scientific paradigms; (e) the possible advantage to the animal of not advertising its own psi skills as an evolutionary strategy; (f) psi energy requirements being perhaps too high and unavailable; and (g) considering psi a function of nonmaterial consciousness, and therefore not entirely subject to encoding by genes, reducing the likelihood of its selection (Kennedy, 2004; Levin, 1996).

# Table 2Hypotheses Intended to Explain Why PsiDoes Not Appear to Be Widespread

| Psi present in biological phenomena still<br>unexplained                          | Morris, 1970<br>Sheldrake, 1995   |
|---|-----------------------------------|
| Denying aspects of neo-Darwinian evolution  | Koestler, 1972<br>Sheldrake, 1981 |
| Signal-to-noise ratio problems derived from conflicting desires of many organisms | Levin, 1996                       |
| Nature of psi disallowing reliable analysis under present scientific paradigms    | Levin, 1996<br>Swanson, 2003      |
| Profitable not advertising own psi skills under<br>evolutionarily stable strategy | Broughton, 1993                   |
| Energy required for psi perhaps too high and unavailable                          | Levin, 1996                       |
| Psi in some way nonmaterial and decoupled from evolution                          | Levin, 1996<br>Kennedy, 2004      |

Considering that some evidence is available for the existence of PK in humans and other animals, of all these views, I consider the first one the most reasonable, as a variety of biological phenomena are still in need of explanation (Morris, 1970; Sheldrake, 1995). We should not just assume that the corresponding abilities will be explained in the future in an orthodox but as yet unknown way; instead, we should try to understand the actual mechanism of action from different perspectives.

As already stated, though not entirely supported by the results of this study, the possible action of an observer psi effect should not be discarded. Such an effect has been demonstrated in experiments with humans (Roe, Davey, & Stevens, 2006; Smith, 2003; Watt & Ramakers, 2003; Wiseman & Schlitz, 1997), and it perhaps also took place in an animal study in which the experimenter was continuously watching the subjects (cockroaches) during the tests, where the results showed a departure from chance in the opposite direction than expected (Schmidt, 1970).

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## Acknowledgments

I thank M. Vázquez for help in finch maintenance, and E. Collado for preparing the software for stimulus presentation and collection of REG outcome.

#### Abstracts in Other Languages

#### Spanish

## PRODUCCIÓN DE UN DISPOSITIVO REG EN UNA SITUACIÓN DE ALARMA EN EL MANDARÍN LISTADO

Con objeto de probar la hipótesis de reducción de aleatoriedad no direccional en la producción de un dispositivo REG (generador de números aleatorios) durante una situación de alarma, se exploró la existencia de micro-psicoquinesis en el mandarín listado (Taeniopygia guttata). A 80 aves se les presentó individualmente un videoclip de 15 segundos de duración de una culebra reptando en una pantalla TFT, y se analizó la producción de un REG durante la presentación del estímulo bajo tres condiciones: ave sola, ave más observador y observador solo. En cada prueba de cada cuarto de segundo se recogió la producción de 200 bits durante la presentación del estímulo y durante el periodo control previo de 5 minutos, y se analizaron los valores de las desviaciones acumulativas de chi cuadrado obtenidas. Los resultados no apoyaron la hipótesis propuesta, ya que los valores durante el periodo del estímulo para las tres condiciones pertenecían a la misma población estadística, su dirección era la misma cuando se analizaron independiente y globalmente, y las diferencias entre los periodos experimental y control no fueron significativas. Sin embargo, la divergencia respecto al azar de los valores globales durante los periodos de estimulación y su correspondiente aleatoriedad durante los periodos control, el hecho de que los primeros sobrepasaran a los segundos, y el que los valores durante el periodo de estimulación con el observador presente se desviaran del azar, sugieren la existencia de un efecto indiferenciado psiobservador sobre la producción del dispositivo REG.

## French

## RESULTAT D'UN GEA DANS UNE SITUATION D'ALARME POUR DES DIAMANTS MANDARINS

RESUME : La micro-PK a été explorée avec les diamants mandarins (Taeniopygia guttata) pour tester l'hypothèse d'une réduction de l'aléatoirité d'un GEA non-directionnel dans une situation d'alarme. Un vidéo clip de 15 s d'un serpent rampant fut présenté à 80 participants et un résultat de GEA durant la présentation du stimulus fut analysé selon trois conditions : Oiseau Seul, Oiseau Plus Observateur, et Observateur Seul. Un essai à 200 bits fut collecté à chaque quart de seconde durant la présentation du stimulus et la période contrôle de 5 minutes avant le début du stimulus perturbateur, et les scores obtenus de déviation cumulative chi<sup>2</sup> furent analysés. Les résultats montrent que les scores durant les périodes de stimulus pour les trois conditions appartiennent à la même population, leurs directions étaient la même lorsqu'elles étaient analysées indépendamment et globalement, et la différence non significative

entre les périodes stimulus et contrôle ne soutiennent pas l'hypothèse proposée. Cependant, un effet d'un observateur psi encore indifférencié est suggéré dans les scores globaux des périodes stimulus, s'écartant du hasard alors que les scores des périodes contrôles correspondantes ne le font pas, dans les premières valeurs surpassant les dernières, et dans les scores aux périodes stimulus déviant du hasard lorsque l'observateur était présent.

## German

## DAS ERGEBNIS EINES ZUFALLSGENERATORS BEI ALARMIERTEN ZEBRAFINKEN

ZUSAMMENFASSUNG: Um Miko-PK bei zehn Zebrafinken (Taeniopygia guttata) zu untersuchen, wurde die Hypothese getestet, ob sich in einer Gefahrensituation die ungerichtete Zufälligkeit eines Zufallsgenerators (REG) reduziert. Ein 15sekündiger Videoclip einer kriechenden Schlange wurde 80 Teilnehmern präsentiert, wobei das Ergebnis des REGs während der Präsentation des Stimulus unter drei Bedingungen ausgewertet wurde: Vogel allein, Vogel mit Beobachter und Beobachter allein. Ein 200-Bit-Trial wurde jeweils für die Dauer einer Viertelsekunde während der Präsentation des Stimulus und für eine 5-minütige Kontrollperiode vor Beginn des beunruhigenden Reizes erfasst. Die kumulativen Werte der Chi-Quadrat-Abweichungen wurden ausgewertet. Die Ergebnisse, dass die Werte während der Stimulusperiode für die drei Bedingungen zur gleichen Population gehörten, wobei ihre Richtung bei unabhängiger wie globaler Auswertung gleich blieb, zusammen mit den nichtsignifikanten Unterschieden in Bezug auf ihre Kontrollperioden, konnten die vorgeschlagene Hypothese nicht bestätigen. Jedoch wird ein bisher nicht weiter differenzierter Psi-Beobachter-Effekt nahegelegt, da die globalen Werte der Stimulusperioden vom Zufall abweichen, im Unterschied zu den Werten der dazugehörigen Kontrollabschnitte, indem die Werte der ersteren über denjenigen der zweiten liegen und indem die Werte der Stimulusperioden dann vom Zufall abweichen, wenn der Beobachter anwesend war

# A PROPOSED PROCESS FOR EXPERIENCING VISUAL IMAGES OF TARGETS DURING AN ESP TASK

#### By YUNG-JONG SHIAH

ABSTRACT. Experiencing a visual image of a target occurs in ganzfeld and remote viewing experiments as well as in spontaneous cases. However, little is known about how participants generate these images. At the beginning of an ESP task, participants try to imagine and anticipate seeing a target. This leads to the priming of the representation of the target's ostensible properties in the brain. The primary visual cortex serves the function of binding perceptual information across different areas of the brain to construct an image of the target. Next, the frontal lobe processes the stored structure in memory's cortical areas and sends a signal to the inferior temporal lobes to activate a representation of the target, creating a visual image. This image is formed when visual memories are activated, which is a precursor of the visual experience. Activation of area V1 is followed by activation of the higher visual areas, which creates the visual ESP experience. Conclusions and suggestions for future research are provided.

*Keywords:* ESP, visual imagery, primary visual cortex, V1, higher visual cortex, memory

Extra-sensory perception (ESP) is sometimes assumed to be active all the time (e.g., Carpenter, 2005). It has been suggested that ESP is an ability through which one might perceive a stream of subtle and weak information units from a variety of sources, resulting in a meaningful representation (Carpenter, 2004; Roll & Persinger, 1998; Schmeidler, 1991; Stanford, 1990; Stevens, 2002). ESP is commonly manifested as visual images, and the available evidence indicates that the experience of targetrelated visual imagery plays a crucial role in ESP performance. For instance, participants are asked to image remote targets when exposed to ganzfeld stimulation (Bem & Honorton, 1994; Bem, Palmer, & Broughton, 2001; Palmer, 2003; Storm & Ertel, 2001; Utts, 1995), in remote viewing (Dunne & Jahn, 2005; Puthoff & Targ, 1976), and in dream research (Sherwood & Roe, 2003). Spontaneous cases also commonly involve visual impressions (Honorton, Tierney, & Torres, 1974; Roll & Persinger, 1998; Stanford, 1974, 1990; Stevenson, 1970).

Two main approaches, Irwin's (1978a, 1978b, 1979) information processing model and Carpenter's (2004, 2005) first sight model, illustrate what is involved in participants' visual experience of targets. There are two stages. In the first stage, ESP information enters the brain via unknown sensory mechanisms. In the second stage, this information interacts with target-relevant memories, resulting in the experience of targets-related visual images. This process is likely similar to the process of creating visual information in the brain in nonpsi contexts. However, a full theoretical account of the possible neural and biophysical mechanisms that underlie the experience of target-related visual images has never been proposed. Below, I propose a process to explain visual ESP experiences.

## A Proposed Process for Visual Experience in ESP

## **ESP and Memory**

One component of ESP is retrieved memories (Blackmore, 1980; Roll, 1966; Stanford, 1970), especially long-term memories (Irwin, 1979). Many studies confirm the positive relationship between memory and ESP (Rao, Kanthamani, & Palmer, 1990; Rao, Morrison, & Davis, 1977; Rao, Morrison, Davis, & Freeman, 1977; Roll & Persinger, 1998; Stanford, 1970). Memory seems to serve the function of organizing stimuli and responding to those considered important (Roll & Persinger, 1998), the importance being based primarily on relevance (Carpenter, 2005; Irwin, 1978b). The information is then processed to determine whether it emerges in consciousness (Irwin, 1978a) as a visual image (Broughton, 2006). It has been suggested that ESP and memory are parallel processes (Carpenter, 2005).

The aim of the proposed neurophysiological account of visual experience is to identify the locations where the perceived information is integrated and stored.

## **Visual Imagery and Retrieving Memories**

Visual imagery occurs when perceptual information is retrieved from memory; this process is often referred to as "seeing with the mind's eye" (Kosslyn, Ganis, & Thompson, 2001). The visual representation of a perceived object is considered to "depict" the object rather than describe it, leading to a picture-like reconstruction (Kosslyn, 2005). The physical qualities of the object (shape, color, and texture) are stored in long-term memory, the locus of which is believed to be the inferior temporal lobes (Thompson, Kosslyn, Sukel, & Alpert, 2001). The posterior parietal cortex is believed to be where spatial properties (the relative positions of objects in space) are processed (Kosslyn, 2005).

Neuroimaging studies of visual imagery indicate that activation occurs in the primary visual cortex (V1 or V2; Kosslyn et al., 1999; Kosslyn & Thompson, 2003; Thompson et al., 2001). This part of the brain receives input from the eyes via the lateral geniculate nucleus (LGN; Tong, 2003), suggesting that V1 processes perceptions and low-level images. The visual image of an object's properties activates the visual cortex. On the other hand, the visual image of a spatial representation does not activate the primary visual cortex because it is stored in the posterior parietal cortex (Kosslyn & Thompson, 2003). Following the processing routes noted before, the visual information is carried to the posterior parietal cortex, where the spatial properties of the object are processed. This discovery of the role of activation in V1 has led to the conclusion that the primary visual cortex supports representation during visual imagery (Kosslyn, 2005; Kosslyn & Thompson, 2003), implying that we can create an image through volition or will, without perception.

Kreiman, Koch, and Fried (2000) found that approximately 90% of single neurons demonstrated the same selectivity during perception as in the generation of visual imagery. Similar results were obtained in an fMRI study, where over 90% of the locations across the brain were activated at the same time (Ganis, Thompson, & Kosslyn, 2004). Cortical stimulation of V1 in the blind leads to the experience of a spot of light (Brindley & Lewin, 1968; Dobelle & Mladejovsky, 1974; Merabet, Rizzo, Amedi, Somers, & Pascual-Leone, 2005). Taken together, this evidence supports the existence of a real image appearing in one's mind (Kosslyn & Thompson, 2003).

A possible explanation of visual imagery is that the anticipation of seeing an object leads to the priming of the representation of the object's properties in the brain (Kosslyn, 2005). Visual imagery occurs when one expects to see an object, with the result that a depictive representation of the object is created in the primary visual cortex. First, the frontal lobe processes the stored structure in cortical areas devoted to memory. A signal is then sent to the inferior temporal lobes to activate representation of the object (Kosslyn, 2005). This activation propagates backward to form a depictive representation in the visual cortex.

The primary visual cortex may be activated by anticipating perception of an object. Thus, visualizing what one desires can easily create or distort a perception (Kosslyn & Thompson, 2003).

#### The Roles of V1 and the Higher Visual Areas

Which locations in the brain are best suited to receive perceived information and integrate stored information? The best candidate for receiving perceived information is V1 and the best candidate for integrating stored information is the higher visual areas, which include the posterior extrastriate areas V2, V3, V3A, V4, V5, as well as the parieto-occipital and posterior intraparietal visual areas.

Visual stimuli are absorbed by photoreceptors in the retina, and then the output neurons of the retina transmit the input to the primary cortex in two major ways. About 90% of the output from the retina flows to the LGN and then to V1, whereas the remaining 10% is projected to the superior colliculus and then to the pulvinar, reciprocally connecting with the extrastriate areas surrounding the primary visual cortex (Tong, 2003).

The brain is a very highly connected network that is subject to feedforward and feedback connections, leading to a high degree of interaction (Crick & Koch, 2003). V1, in particular, has well-organized connections with multiple areas in the brain. It connects not only with the higher visual areas, but it also receives feedback exclusively from the motion-sensitive areas of the extrastriate cortex, the superior temporal sulcus, the superior temporal polysensory areas, the inferotemporal cortex, the parahippocampal gyrus, the lateral intraparietal area, the frontal eyefields, and the auditory cortex (Tong, 2003). In other words, there is a very complex neural network that reaches out to other cortical areas. The detailed functions of V2, V3, V3A, V4 and V5 are described in a review paper by Grill-Spector and Malach (2004).

Evidence shows that the primary cortex is the place that integrates stored information. Activation of V1 has been observed in the blind during Braille reading (Cohen et al., 1997; Sadato et al., 1996), suggesting its functional involvement in tactile processing (Cohen et al., 1997). In other studies (Amedi, Raz, Pianka, Malach, & Zohary, 2003; Raz, Amedi, & Zohary, 2005), the possibility of visual imagery was ruled out by employing congenitally blind participants, as well as using abstract verbal tasks and episodic retrieval instead of Braille. The results show that V1 was activated during these verbal tasks, and there was a positive relationship between the magnitude of V1 activation and performance in the verbal memory tasks.

There is considerable evidence that the primary visual cortex is involved in the processing of tactile, auditory, and linguistic information in the blind (Merabet et al., 2005). Visual imagery has been implicated in the normal tactile perception of certain object properties (Klatzky, Lederman, & Reed, 1987; Sathian & Zangaladze, 2002; Sathian, Zangaladze, Hoffman, & Grafton, 1997). In these studies, normally sighted participants were asked to evoke visual imagery while touching objects hidden from their view. Visual imagery was found to enhance successful identification of the objects' spatial properties, such as shape and size. These processes provide the opportunity for information stored in memory and perceived information to interact with each other.

#### Visual Images of Targets in ESP Tasks

As earlier noted, the most convincing ESP evidence comes from studies using the ganzfeld technique, remote viewing, and certain spontaneous cases. Visual imagery induced by the ganzfeld has been associated with decreased alpha, or alpha suppression (Wackermann, Putz, & Allefeld, 2008; Wackermann, Putz, Buchi, Strauch, & Lehmann, 2002). There is also evidence from these studies that the primary visual cortex was activated at the time of the imagery. Moreover, alpha rhythms in the occipital lobe were elicited in a pair of proximal identical twins, and matching alpha rhythms were observed between distant identical twins (Duane & Behrendt, 1965). Other promising evidence comes from studies of presentiment (Radin, 1997, 1998), in which slow cortical potentials (SCPs) in the primary visual cortex are commonly used to predict future acquisition of information. SCPs were also shown to be significantly different in response to a light flash than in response to no flash (Radin & Lobach, 2007).

It is logical to infer that V1 is activated while participants experience visual images of targets during an ESP task, followed by activation of the higher visual cortex. ESP experiences are well known to be linked to temporal lobe activation (Persinger, 1984, 1989; Persinger & Valliant, 1985). Palmer and Neppe (2004) reported a positive relation between EEG anomalies in the temporal lobes and ESP in female neuropsychiatry patients. When 5 Hz, 8 Hz, 10 Hz, or 15 Hz flashing lights were presented to one of a pair of unrelated people, correlated EEG patterns over the right parietal region were found in response to yoked circumcerebral magnetic fields (Persinger et al., 2010).

There is evidence that the right hemisphere of the brain might be particularly involved in psi (Broughton, 1976, 1978; Ehrenwald, 1984; Roll & Persinger, 1998). Such right hemisphere involvement has been observed in ESP tests with the psychic Sean Harribance (Roll & Persinger, 1998). Along with the idea that the brain is a very highly connected network, it is reasonable to assume that the right temporo-parietal junction might be involved with various kinds of ESP experiences.

At the beginning of an ESP task, participants try to imagine and anticipate seeing a target. This leads to the priming of the representation of the target's ostensible properties in the brain. The role of success-related expectations can be seen in research on the "sheep-goat" effect (Schmeidler, 1952; Thalbourne, 1981). Sheep (who believe in the possibility of ESP) were found to score better on ESP tasks than goats (who do not believe in the possibility of ESP) in a meta-analysis (Lawrence, 1998). Sheep expect that the emerging of visual images will lead them to make a correct response which, in turn, makes them more willing to wait passively for potentially psi-mediated images of the target to emerge in consciousness, thereby reducing the signal-to-noise ratio (Bem & Honorton, 1994). Similarly in spontaneous cases, people may consciously or unconsciously anticipate relevant imagery.

Next, the frontal lobe processes the stored structure in memory's cortical areas and sends a signal to the inferior temporal lobes to activate a representation of the target, creating a visual image. This image is formed when visual memories are activated, which activation serves as a precursor of the visual experience in an ESP task. Activation of V1 is followed by activation of the higher visual areas.

In the meantime, this activation interacts with perceived information gathered from sensory input and/or associated thoughts in the cortical areas, although it is still unclear what this sensory input consists of. The primary visual cortex perceives sensory input, after which the visual image propagates backward to construct the image of the ESP target. It can be plausibly hypothesized that this visual imagery is equivalent to the visual experience in successful ESP performance, providing a meaningful representation of subtle paranormal and normal information from perception and memory. Visual imagery serves a functional role in enhancing the likelihood of successfully identifying targets by integrating the information flow from both sensory input and memory.

## **Conclusions and Future Research**

The generation of visual imagery is a good way to extract information from normal and/or paranormal sensory input and memory. The diverse and rich cortical response interconnections to and from the primary visual cortex make this area a plausible locus for representations derived from information stored in memory and representations that have been activated by a currently unknown, but subtle, process. This process serves to construct visual ESP experiences.

Neurological data on the role of the primary visual cortex and temporo-parietal cortex in ESP are needed to test this assumption. One such test involves the use of transcranial magnetic stimulus (TMS). Given that TMS provokes long-term inhibition or facilitation of cortical excitability (Pascual-Leone et al., 1998), it would be very interesting to test people whose primary visual cortices are temporarily impaired or excited. Such a study would support the functional involvement of the primary visual cortex. Because this area is functionally involved in the visual ESP experience, TMS should either impair or enhance the experience. For example, a repetitive 0.33 Hz TMS has been shown to create deficits in visual perception tasks (Kammer, Puls, Strasburger, Hill, & Wichmann, 2005), and repetitive 1 Hz TMS has been shown to impair performance in visual imagery tasks (Kosslyn et al., 1999). Repetitive 10 Hz TMS has been used to increase cortical excitability in the motor cortex (M1) but decrease cortical activity in the supplementary motor area (SMA) of the cortex (Pascual-Leone et al., 1997). In the same study, repetitive 1 Hz TMS increased cortical excitability in the SMA but decreased it in M1. Researchers can test the effect of TMS on ESP using any test paradigm aimed at evoking visual imagery, such as the ganzfeld, remote viewing, or dream research.

Nevertheless, many basic but important questions remain. What percentage of participants report visual experiences in ESP experiments? How often are such visual experiences associated with success on the ESP test? Some participants might express ESP in nonvisual ways, such as through feelings (Broughton, 2002; Stanford, 1990), intuition (Broughton, 2006; Broughton & Bourgeois, 2001), thoughts (Stanford, 1990), or presentiment (May, Paulinyi, & Vassy, 2005; McCraty, Atkinson, & Bradley,

2004a, 2004b; Radin, 1997, 1998, 2004; Radin & Lobach, 2006; Sartori, Massacessi, Martinelli, & Trissoldi, 2004). As noted above, it is common in presentiment research to use the skin conductance response (SCR) to detect precognitive information. Other measures that have been used are heart rate (McCraty et al., 2004a, 2004b; Sartori et al., 2004) and eventrelated potentials (ERPs; McCraty et al., 2004a, 2004b). Many researchers have successfully replicated these results (Bierman & Radin, 1997; Bierman & Scholte, 2002; May et al., 2005; Radin, 2004). These studies provide a possible explanation for how the emotional system perceives paranormal information (Broughton, 2004, 2006). In an fMRI distant healing study (Achterberg et al., 2005), recipients of healing intention from distant healers were shown to have activation of the anterior and middle cingulate area, the precuneus, and the frontal area. Additional research is needed to determine if ESP functions intrinsically in a perceptual-emotional-cognitive manner that is nonvisual. However, the possibility that these nonvisual ESP pathways might support the creation of visual ESP experiences cannot be disregarded.

According to one neuroscientific review of sleep (Hobson, 2002), dreaming is an illogical, hallucinatory, and emotional state. It involves widespread and complex networks that have been found in the primary visual cortex, prefrontal cortex, amygdala, anterior cingulate, ventral striatum, posterior cortices, thalamus, hypothalamus, pons, and hippocampus. The most intense dreaming occurs during rapid eye movement (REM) sleep. During this stage, there is widespread activation of the brain, and imagery is generated internally, while external sensory input and motor output are effectively blocked (Hobson, 2004). This blocking of external sensory inputs suggests that REM might not be the best state for eliciting ESP and that other stages, particularly stage 1, might be more suitable. However, it must be noted that high-quality ESP during REM sleep was demonstrated in the famous Maimonides dream studies (Ullman, Krippner, & Vaughan, 1973).

In summary, I propose that visual ESP experiences result from the creation of imagery through the parallel interaction of normal/paranormal perceptions and information retrieved from memory. Further exploration of this topic would be of interest because it has the potential to advance our understanding of the ways in which humans take in and interpret information. This proposed process for the creation of genuine visual ESP experiences is intended to set the stage for uncovering important clues about the neural mechanisms that underlie the interaction of sensory information flows.

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#### Acknowledgments

I gratefully acknowledge the Koestler Chair, the Parapsychology Foundation, and the British Society for Psychical Research, as well as Andy McKinlay and Si-Chen Lee for their support on my Ph.D. work that led to the ideas presented in this paper. I am also grateful to the Editor and anonymous referees for their helpful comments.

#### Abstracts in Other Languages

Spanish

## UN POSIBLE PROCESO EN LA EXPERIMENTACI'ÓN DE IMÁGENES VISUALES DURANTE UNA TAREA PES

RESUMEN. El experimentar una imagen visual de un objetivo se produce en los experimentos de ganzfeld y visión remota, así como en casos espontáneos. Sin embargo, poco se sabe sobre cómo generan los participantes estas imágenes. En el comienzo de una tarea PES, los participantes tratan de imaginar y anticipar ver al objetivo. Esto lleva a la estimulación de la representación de las propiedades aparentes del objetivo en el cerebro. La corteza visual primaria cumple la función de enlazar la información perceptual a través de las distintas áreas del cerebro

para construir una imagen del objetivo. A continuación, el lóbulo frontal procesa la estructura almacenados en las áreas corticales de la memoria y envía una señal a los lóbulos temporales inferiores para activar una representación del objetivo, creando una imagen visual. Esta imagen se forma cuando las memorias visuales se activan, como precursoras de la experiencia visual. La activación del área V1 es seguida por la activación de las zonas visuales superiores, que crean la experiencia visual PES. Proporciono conclusiones y sugerencias para futuras investigaciones.

## French

## PROPOSITION D'UN PROCESSUS POUR FAIRE L'EXPERIENCE D'IMAGES VISUELLES DE CIBLES DURANT UNE TACHE D'ESP

RESUME : Faire l'expérience d'une image visuelle d'une cible se produit dans les expérimentations de Ganzfeld et de Remote Viewing ainsi que dans les cas spontanés. Toutefois, on sait peu de choses sur la façon dont les participants génèrent ces images. Au début d'une tâche d'ESP, les participants essayent d'imaginer et d'anticiper la vision d'une cible. Cela mène à une amorce de représentation des propriétés ostensibles de la cible dans le cerveau. Le cortex visuel primaire a pour fonction de relier l'information perceptuelle à travers différentes zones du cerveau pour construire une image de la cible. Ensuite, le lobe frontal traite la structure stockée dans les aires corticales de la mémoire et envoie un signal au lobe temporal inférieur pour activer une représentation de la cible, créant une image visuelle. L'image est formée lorsque les souvenirs visuels sont activés, ce qui est un précurseur de l'expérience visuelle. L'activation de l'aire V1 est suivie par l'activation des aires visuelles supérieures, qui crée l'expérience visuelle d'ESP. Des conclusions et des suggestions pour la recherche future sont fournies.

## German

## VORSCHLAG, WIE SICH DIE AUFNAHME VISUELLER BILDER VON ZIELOBJEKTEN WÄHREND EINER ASW-AUFGABE ERFASSEN LÄSST

ZUSAMMENFASSUNG: Visuelle Bilder von einem Zielobjekt werden im Ganzfeld, bei Fernwahrnehmungsexperimenten wie auch bei Spontanberichten erfahren. Jedoch ist wenig darüber bekannt, wie bei Teilnehmern diese Bilder zustandekommen. Zu Beginn einer ASW-Aufgabe versuchen die Teilnehmer, sich das Sehen des Zielobjekts vorzustellen und zu antizipieren. Dies führt im Gehirn zum Aufruf der Repräsentation der scheinbaren Eigenschaften des Zielobjekts. Zu den Aufgaben des primären visuellen Cortex' gehört das Verknüpfen wahrnehmungsmäßig gewonnener Informationen über verschiedene Hirnareale hinweg, um das Bild des Zielobjektes zu konstruieren. Als nächstes von Areal V1 hat die Aktivierung der höheren visuellen Gebiete zur Folge, was zur visuellen ASW-Erfahrung führt. Schlussfolgerungen sowie Vorschläge für künftige Forschungen werden unterbreitet.

## **BOOK REVIEWS**

CONSCIOUS CONNECTIONS: ABOUT PARAPSYCHOLOGY AND HOLISTIC BIOLOGY by Göran Brusewitz. Saarbrücken, Germany: VDM Verlag Dr. Müller GmbH & Co., 2010. Pp. 100. \$68.00 (paperback). ISBN 978-3-639-29114-8.

Goran Brusewitz has been President of the Swedish Society of Psychical Research for over two decades and is a member of the Parapsychological Association. This short book is divided into three chapters: the first presents Brusewitz's master's thesis, the second is devoted to a review of parapsychological research (explicitly excluding research into psychokinesis), and the third is devoted to a summary of research on "biomagnetism, biofields, and holistic biology."

This book borders on self-publishing. VDM Publishing House offers free publication with remuneration to authors of bachelor's and master's theses and doctoral dissertations, or other scientific monographs (if this publishing option interests you, you may contact them at info@ vdm-publishing-house.com). There are pitfalls in self-publishing and this book falls into several of them, including poor proofing, poor editing (Brusewitz acknowledges that he is not fluent in English, and it shows), and most importantly, lack of constructive peer review. The book is riddled with errata and sloppy formatting. (It should be noted that this review is based on the e-book version of this book rather than the paperback edition cited in the header above.)

The volume starts with a short foreword by Stanley Krippner and an introduction by Brusewitz, who outlines the contents of the book and provides a review of the Swedish and international skeptical movements.

The first chapter presents Brusewitz's master's thesis, which is the report of a nonsignificant attempt to replicate an experiment showing a psi effect on electrodermal activity (EDA). Brusewitz's experiment was well done from a methodological standpoint. In this chapter, he also reviews the literature on psi experiments involving the influence of EDA, as well as investigations of direct mental interaction with living systems (DMILS) in general. His coverage is thorough, and even includes some as yet unpublished reports. He also reviews what he sees as an inconsistent pattern in the statistical meta-analyses of research in these areas.

Chapter 2 consists of a review of parapsychological research in general (excluding PK, as noted above). Brusewitz begins with a discussion of the research on presentiment. Next, he compares the results of ganzfeld studies to studies not involving a ganzfeld but involving noise reduction (such as dream studies), as well as to studies in which the subject is in the waking state without noise reduction (such as standard free-response experiments). His review is thorough and includes literature outside of the main parapsychological journals. He also provides a detailed review of meta-analyses in these areas. He notes that meta-analyses of forced-choice experiments indicate that precognition effects are just as strong as real-time (clairvoyance) effects. He cites Lance Storm and Adam Rock's view that the passivity of the ganzfeld procedure may not be an ideal means of eliciting psi, and that a more active approach may be required.

Brusewitz then reviews research on remote viewing, communication between neuron assemblies in separated Petri dishes, and Sheldrake's experiments involving telephones and pets. With regard to the last, there is no mention of Wiseman's criticisms of Sheldrake's research, and in general, his coverage of skeptical evaluations is inadequate in this chapter.

He goes on to discuss research relating psi success to local sidereal time as well as the possible mechanisms underlying these results, such as atmospheric disturbances.

He then reviews a striking case of spontaneous psi in which the twin sister of a girl whose chest was crushed in a nighttime car accident was awakened from her sleep by sympathetic chest pains at that moment. These sympathetic pains were so severe that the second sister had to be rushed to the hospital by ambulance but died before she got there. Her death occurred within a few minutes of her twin's death.

Brusewitz then reviews near-death experiences, the "hard problem" of how consciousness arises from the brain, quantum mechanical effects on biological systems, and reincarnation cases. He relates cases in which heart transplant recipients take on the personality of their heart donors, and he proposes the existence of a type of cellular memory based on neuropeptides. He goes on to discuss research on apparitions, hauntings, phantom hitchhikers, poltergeists, mediumship, and electronic voice phenomena. His coverage of many of these topics is quite brief. In places, he relies primarily on secondary sources, such as David Fontana's book *Is There an Afterlife?* and primarily seconds the opinions expressed in such sources. Thus, in many instances, the reader would be well served to read the secondary source instead of reading Brusewitz's book, which amounts to a tertiary source. Seasoned parapsychologists will find little that is new in Brusewitz's review of these topics.

In chapter 3, Brusewitz provides a review of research relating to "biomagnetism, biofields, and holistic biology." He begins with a discussion of animal migration, citing Sheldrake's view that such migrations are based on "morphogenetic fields," as well as other, more orthodox, views regarding the mechanism underlying such migrations. He asserts that the magnetic sense in animals is "unconscious," without providing a discussion of his grounds for this conclusion. He goes on to provide a somewhat vague discussion of research on dowsing, suggesting that dowsing phenomena may be based on electromagnetic energy. He cites (with a straight face)
claims by Jeffery Keen that dowsing may be used to determine the structure of spacetime as well as the values of universal physical constants.

He then discusses the use of magnetism to detect or influence the human aura, as well as the evidence that cell phones and television radiation can cause cancer. In this context, he cites the fact that one of the authors of a study on the effects of radiation has appeared in the media and has been invited to an international conference as evidence for the legitimacy of the research. He later bases a positive assessment of a research finding regarding biofields on laudatory remarks made in the foreword to the scientists' book. These are shaky grounds on which to conclude that a research program is valid.

He then discusses Becker's research on the use of electromagnetic fields in healing, relating this to research on acupuncture. He notes that Swedish scientists have stimulated cells with red and infrared light as a means of treating ulcers and sores. He asserts that the electromagnetic fields of the heart may be a synchronizing signal for the entire body and that the heart may have a form of emotional intelligence. In support of this contention, he cites Gary Schwartz's investigations of cases in which heart transplant patients have taken on the personality of the heart donor. He also cites research by McCraty that suggests that hearts may also have precognitive ability in the form of "presentiment."

He goes on to cite studies in which viral diseases have resulted even when the subject is not exposed to the virus but only to the electromagnetic fields left by the virus. He concludes with a discussion of "bioplasma," Gauquelin's research on "astrobiology," and other forms of "subtle energy."

It should again be noted that this review is based on the e-book version of Brusewitz's book rather than the paperback version. The e-book version comes complete with subject and name indices. The bibliographies, however, are not integrated into a single list.

In this book, Brusewitz demonstrates that he has a good knowledge of the professional literature. However, the book suffers from the lack of a good copy editor as well as a thorough peer review process, which may have improved the text considerably. As the publishing of e-books without any thorough review process becomes increasingly common, more and more books with similar defects may soon flood the market, and it may become increasingly difficult for a discerning reader to find the wheat among the chaff.

DOUGLAS M. STOKES

424 Little Lake Drive, #3 Ann Arbor, MI 48103, USA Dstokes48103@yahoo.com YOGA AND PARAPSYCHOLOGY: EMPIRICAL RESEARCH AND THEORETICAL ESSAYS. Edited by K. Ramakrishna Rao. Delhi, India: Motilal Banarsidass Publishers, 2010. Pp. 516. \$74.00 (hardcover). ISBN 9788120834736.

As world political and economic events outside of the academy continue to ramp up the booty for the deepening of *real* and lasting East-West communication and understanding, it may be an especially propitious time to do so within the academy as well. K. Ramakrishna Rao has become a passionate and indefatigable leader in this great endeavor. He has published in recent years several important contributions toward an East-West bridge on academic topics, including Consciousness Studies: Cross-Cultural Perspectives (Rao, 2002), Towards a Spiritual Psychology (Rao & Marwaha, 2005), and the outstanding and sorely needed Handbook of Indian Psychology (Rao, Paranipe, & Dalal, 2008). Now he follows this with an edited volume aimed squarely at the specific field with which his name was most closely associated for so many years—parapsychology. It is at once a parting shot—in the sense that it summarizes the locus of his life's work in this small field-as well as an opening shot in the sense that it includes the inaugural lectures Rao gathered to launch his Institute for Human Science & Service (IHSS) in Andhra Pradesh, India, in 2006.

In Rao's preface, he clearly states why he believes yoga and parapsychology need to be studied together: "A serious and scientific study of the two and the resultant synergy of their confluence could result in resolving many of the riddles that puzzle parapsychology today and be the harbinger of a vibrant science opening to new frontiers. Further, it could be seen as a productive East-West meet in a profound sense" (p. xv). But the real message lying just beneath the surface is that western parapsychologists need to pay more attention to eastern approaches to this topic. I couldn't agree more! Specifically, India offers a virtual treasure chest of gifts for the field of parapsychology, if westerners would only "wake up" to it. Some already have.

Rao takes on the role of guru to wake us up to the all-too-painful fact that western parapsychologists try to ignore in what must be the ultimate case of collective denial in the history of science. "Wake up," Rao seems to say, and open your eyes to the elephant in the room. Western science does not want us! How many carcasses of brilliant and creative colleagues must we see strewn by the roadside before we'll wake up? In fact, *mal* parapsychology (as represented by the PA) is not wanted in the West by science, religion, or society (except perhaps as a titillating back alley for selling horror films through unbelievably bizarre fantabulations and distortions of psi phenomena). In India, on the other hand, real parapsychology is welcomed, respected, and even revered. Of course, I am stating this much more strongly than Rao does, but that is, in my opinion, the key take-away message of this tome.

Rao's introductory chapter, "Yoga and Parapsychology," sets the tone by reviewing the current state of parapsychological research separately from western and eastern viewpoints. Rao here establishes the chorus that will be repeated throughout this book—that western science suffers from an assumptive base which rules outpsi, thus forcing parapsychology into the paradox of using science to demolish the very assumptive base of science itself.

After Rao's intro, the volume continues with two substantial contributions from state-of-the-art western parapsychologists, Jim Kennedy and Jim Carpenter. I've always enjoyed Jim Kennedy's thoughtful work and this piece is no exception, although I was puzzled why it is featured in this compendium. Kennedy wrestles with the sticky problem of the evasiveness of psi in research settings, and then takes the reader on a tortuous romp through a hodge-podge of parapsychological topics in search of a crack in the wall that might shed some light on the topic. This leads to the connections between psi, mysticism, and spirituality, which is clearly relevant to the current volume. As I ponder Kennedy's chapter, I wonder if Rao chose this, in part, as an example of how "pure" western dualistic science deals with psi and spirituality. It is an excellent illustration of just that. For example, Kennedy concludes, "Further exploration of the relationship between spirituality and psi may find that the most appropriate model is to view the source of psi as largely external to living persons" (p. 60). By contrast, nondualistic Indian psychology is unlikely to highlight such separations. This is classic western thinking-the separation (analysis) into elements, the "who's doing it?" approach to psi.

What a fine choice Rao has made in selecting the next chapter, Jim Carpenter's outline of his "first sight" model of psi and the mind, which is a tour of Carpenter's many-mansioned and very deep mind. Carpenter certainly—and thankfully—puts the *psychology* back into parapsychology at a time when straight western psychology (whatever that is!) has all but abandoned mind, spirit, and consciousness to philosophers, physicists, and neuroscientists. Carpenter, a personality theorist and clinical psychologist, talks and listens to his human clients and engages in parapsychology the same way.

A great discovery here is just how closely attuned Carpenter's thinking is with the Hindu Vedas. Carpenter's first sight conception of human nature is, "each person is not contained within personal, physical boundaries, but ontologically and epistemologically extends beyond that into intimate commerce with all the rest of reality, including all other persons" (p. 99). And like the Hindu scriptures, Carpenter's model does not deal with (or even concern itself with) "proof" of the existence of psi. Neither does he try to solve the problem of the connection between mind and body—rather, "the split between them is not assumed to begin with" (p. 72). By not assuming the separation, he has no conceptual problem with the "possibility" of psi phenomena.

This is *nondualism*, which is at the core of many East-West misunderstandings regarding mind and spirit. Stated simply, western dualists tend to forget/ignore that "separation" is an assumption that is added on. Or, as Carpenter phrases it, "In a phenomenological approach, a dualistic split between the subjective and objective aspects of experience is eschewed, and the need for providing some sort of physical mechanism linking mind to world or present to future event is avoided" (pp. 100–101). This key foundational brick is right out of the Hindu Advaita Vedanta (= nondual philosophy), even though Carpenter is not a Hindu devotee, nor even an Indophile.

This chapter is the best and most compelling explanation I have come across of Carpenter's first sight model. I look forward to the book Carpenter will soon be publishing on this issue, and I hope he'll include reference to its reflections in eastern philosophy.

Now this volume comes to the most fascinating and challenging part of this East-West dialogue, a sequence of seven chapters that triangulate upon the nitty-gritty of the Indian perspective on psi phenomena. For a quick reading of this section, one could—without loss of generalization—read Richard Hartz's piece on Aurobindo (*Normality of the Supernormal: Siddhes in Sri Aurobindo's Record of Yoga*), then Sangeetha Menon's magnificent philosophical summary of the Sutras, and then William Braud's commentary on the Sutras from an experimental science perspective. The remaining chapters by Cornellison, De Zoysa, Nagendra, and Tripathy can be saved for later when you have more time, and you'll want to come back to reread the former three pieces anyway, if you are at all serious about deepening your understanding of Yoga.

Taking these seven chapters sequentially, Cornelissen and Hartz both deal with India's most famous philosopher guru, Sri Aurobindo, whose life story should be required reading for parapsychologists. Mattijs Cornelissen and Richard Hartz are westerners who are both affiliated with Aurobindo's ashram in Pondicherry, India, where they assist in the editing of Aurobindo's diaries for publication. In his chapter, Cornelissen lays out the problems of western experimental science as well as I've seen them laid out. He holds western science responsible for ignoring the empirical validity of psi. He challenges western science to look at itself, to coolly and objectively observe the limitations of its own theoretical framework. He attacks and taunts current "mainstream" western science because: "... the long period during which science has neglected the subjective domain has led to a conceptualization of reality that is almost unbelievably one-sided, and compared to the Indian viewpoint, its understanding of consciousness is amazingly naive" (pp. 137-138). Cornelissen likens the current western scientific mainstream view to the Flat Earth view of a few centuries back.

Cornelissen then provides a very interesting outline of Aurobindo's philosophy, theory of knowledge, and interpretation of the Vedic view. However, he does not offer a serious alternative to western science. He concludes, weakly, that the "most appropriate technology ... is Yoga ... a time-tested psychological method for arriving at reliable knowledge about

the whole of reality, inclusive of the subtle domains that are not accessible to the physical senses on which modern science so far exclusively relies" (p. 146). In this way, he only widens the chasm along the troubled front lines of East-West discussion. He doesn't acknowledge the positive contributions of science, the shortcomings of yoga, or the possible synergy between them. This seems more like religion than science, much like western scientism.<sup>1</sup>

On the other hand, Richard Hartz's chapter grounds us with the wonder of Aurobindo's homegrown quest for science. While Cornelissen leads us away from the deepening of East-West dialogue, Hartz brings us back. He grounds us with the nitty gritty facts, and this opens us to a new and healthier view of Aurobindo, who he was, and what he did that we should know about. For anyone who hasn't already encountered Aurobindo, be prepared for a brief but compelling glimpse of a delightful sage and secker who will grab your attention, respect, and admiration. If this chapter doesn't make you rush to your bookstore to order your copy of *The Complete Works of Sri Aurobindo*, nothing will.

In Sangeetha Menon's chapter, we come to the piece de resistance of this seven-chapter sequence on yoga philosophy-The Rain Clouds of Mind Modifications and the Shower of Transcendence: Yoga and Samadhi in Patanjali Yoga-Sutras. This chapter is really central and pivotal in this volume. The reader who has moved sequentially through this book has been "spoonfed," so to speak, like the infant whose digestive system must adapt step by step into this new kind of food. Ready or not, philosopher Sangeetha Menon now takes us for our first full meal. It is a stunning experience as enlightening as it is humbling, and will no doubt leave some western readers feeling like babes in the woods. Here we glimpse just how complete, complex, and bottomless Indian philosophy is. This will also-correctlyraise questions in the western mind because Indian philosophy often lacks-or seems to lack-well-defined boundaries. There are exceptions to everything. A foundation stone of Indian thought is that the perceived world is unstable, in flux, and always changing. Any specific "truth" may be true at some time, or from some perspective, but not from others. If "A" is true, it may be that "not-A" is also "true." So Menon acknowledges that there are a variety of different interpretations of the Yoga-Sutras and they are all just fine and "correct" in this relativistic sense. She is clear to cite Samkya as the source of her interpretations, but even that is subject to interpretation! The western mind might feel as if the ground beneath it has been pulled away. The Indian philosopher might tell the westerner that there never was any ground to begin with! It was only an illusory assumption, an assumption which Indians do not make, or feel a need to account for or correct.

Wisely, Menon points out that the serious study of consciousness and/or psi demands a prerequisite—one must first specify who's asking the question, who's listening, and to whom is this question addressed. That

<sup>&</sup>lt;sup>1</sup> Scientism is the idea that natural science is the most authoritative worldview or aspect of human education, and that it is superior to all other interpretations of life (Sorell, 1994).

is, any understanding or interpretation of psi phenomena is necessarily a function of the underlying philosophy from which it sprouts, just as the fruit of a plant reflects the earthy environment in which the plant grows. In this chapter, there are several other key concepts for the western scientist to ponder, bespeaking the rich, diffuse, varied, and precise thought left by ancient Vedic thinkers. This, of course, is not a new idea. Buddhist psychologist B. Alan Wallace (Wallace, 2000; 2006) makes the point of showing how castern sages long ago dealt more deeply with the topic of "attention" than does modern western psychology, which sees it simplistically as either normal or abnormal, completely ignoring the enormous potential of attentional training, hyper-normal states, and the impact of these on learning, creativity, problem solving, interpersonal communication, health, and productivity. In fact, Wallace's writings make for good reading to supplement Rao's book.

Next up, sequentially, is de Zoysa's piece on Self, Non-self, and Rebirth: The Buddhist Outlook. This is a short contribution reminiscent of (and actually using) some of Ian Stevenson's reincarnation case collection. It is based in Buddhist philosophy, according to which there is no "essence" or permanence to anything in this world, including the human self. This contrasts with the orthodox Hindu view that the "self" has an immortal part, Atman, that's part of an infinite and immortal Brahman.

H. R. Nagendra, a former mechanical engineering researcher at the University of British Columbia, Harvard, and NASA, writes about The Panca Kosas and Yoga, in which he outlines the Indian theory of the five layers or sheaths of which the human being is composed. Nagendra is currently president of Vivekananda Yoga Anusandhana Sanshana (VYASA), having returned to India to deepen his involvement with Yoga. The emphasis here is that contemporary science and classical Indian thought "... are not mutually exclusive, as both are interdependent and play an equal role in understanding different aspects of the world" (p. 213). While this chapter fills in another interesting aspect of Hindu philosophy, it fails to bridge the East-West divide because it does not cite any data that the western researcher can sink his/her teeth into. Instead, the author shows how the Integrated Approach of Yoga Therapy (ΙΑΥΓ), which is practiced at VYASA, makes use of the ancient understanding of the five sheaths (panca kosas). Although this chapter is of possible interest for healing, remote sensing, or other research involving physiological assessment, I found myself disappointed that a researcher with Nagendra's impressive West-East connections, failed to provide a taste of experimental data, testable hypotheses, or suggestions for future research.

The next chapter, *Cognitive Processing as Depicted in the Yoga Sutras* by K. M.Tripathi, similarly contains a great deal of interesting information with no handle for the western scientist to grab hold of. It comprises 14 infopacked pages belying a reference section with a measly five entries. Here, Tripathi interprets the orthodox Hindu concepts of consciousness, being,

and becoming, in the physical, mental, and spiritual domains, as laid out in Patanjali's Yoga Sutras. The discussion includes such fascinating topics as mental phenomena, psychic states, components of cognition, awareness, and super-cognitive states. The strict western research mind will ask, "Where is the data to support this? Where is the documentation? Where is the critique? Where are the limitations and delimitations?" Here we come into grand central station for East-West misunderstanding. In Indian science, I suggest, the documentation is actually built into the internal process that the interpreter(s) go through in putting this down on paper. It's not an externally rule-based system but an internal, contemplative one. One must trust one's guide and guru, trust the process.

In the last of this seven-chapter sequence, Patanjali Yoga-Sutras and Parapsychological Research: Exploring Matches and Mismatches, William Braud advances the work of bridging the cultures. This isn't an entirely new contribution as a similar earlier version appears in Rao's Handbook of Indian Psychology, and an even earlier and more extensive version is available on the Infinity Foundation website (http://www.infinityfoundation.com/ mandala/inner sci essays\_frameset.htm). This chapter provides the (largely) western research data that supports the Yoga-Sutras. After a brief intro to the sutras and to the aims of parapsychological research, Braud discusses at length the relationships among the sutras, yoga practices, and psi research, documenting the extensive matches between the scientific research and the yogic philosophy. This is a good read, and quite focused on this topic (unlike his rambling piece on the Infinity Foundation website). Braud has a special message for western researchers. Stop trying to prove psi; understand that the siddhis (psi powers) "may serve very different purposes for different times, cultures, persons, and phases of life"; be mindful that using yoga-related processes to produce psi for your laboratory is like stealing jewels from temples; and, be prepared for (and welcoming of) changes in yourself that should and probably will accompany your sincere and open-minded immersion in Indian perspectives. This chapter is a "must-read." It is truly a bridge between eastern and western approaches to parapsychology.

The next two chapters deal with survival research. Rao, not especially known for survival research, starts his chapter with a nice historical review of parapsychology's attempts to deal with the problem of survival, including a more-extensive-than-usual consideration of reincarnation studies. Then the chapter turns to the yoga perspective on survival, with special focus upon karma and rebirth. Rao departs from typical summaries of survival research by elaborating on some potentially misunderstood issues around karma, discussing its many types ("twelve kinds of karmas, distinguished from three different viewpoints"), outlining Hinduand Buddhist differences, and ending with a special tribute to Carl Jung's fascination and struggle with reincarnation and karma. This is an excellent contribution which I hope Rao will soon make available to a wider audience. is, any understanding or interpretation of psi phenomena is necessarily a function of the underlying philosophy from which it sprouts, just as the fruit of a plant reflects the earthy environment in which the plant grows. In this chapter, there are several other key concepts for the western scientist to ponder, bespeaking the rich, diffuse, varied, and precise thought left by ancient Vedic thinkers. This, of course, is not a new idea. Buddhist psychologist B. Alan Wallace (Wallace, 2000; 2006) makes the point of showing how eastern sages long ago dealt more deeply with the topic of "attention" than does modern western psychology, which sees it simplistically as either normal or abnormal, completely ignoring the enormous potential of attentional training, hyper-normal states, and the impact of these on learning, creativity, problem solving, interpersonal communication, health, and productivity. In fact, Wallace's writings make for good reading to supplement Rao's book.

Next up, sequentially, is de Zoysa's piece on Self, Non-self, and Rebirth: The Buddhist Outlook. This is a short contribution reminiscent of (and actually using) some of Ian Stevenson's reincarnation case collection. It is based in Buddhist philosophy, according to which there is no "essence" or permanence to anything in this world, including the human self. This contrasts with the orthodox Hindu view that the "self" has an immortal part, Atman, that's part of an infinite and immortal Brahman.

H. R. Nagendra, a former mechanical engineering researcher at the University of British Columbia, Harvard, and NASA, writes about The Panca Kosas and Yoga, in which he outlines the Indian theory of the five layers or sheaths of which the human being is composed. Nagendra is currently president of Vivekananda Yoga Anusandhana Sanshana (VYASA), having returned to India to deepen his involvement with Yoga. The emphasis here is that contemporary science and classical Indian thought "... are not mutually exclusive, as both are interdependent and play an equal role in understanding different aspects of the world" (p. 213). While this chapter fills in another interesting aspect of Hindu philosophy, it fails to bridge the East-West divide because it does not cite any data that the western researcher can sink his/her teeth into. Instead, the author shows how the Integrated Approach of Yoga Therapy (IAYT), which is practiced at VYASA, makes use of the ancient understanding of the five sheaths (panca kosas). Although this chapter is of possible interest for healing, remote sensing, or other research involving physiological assessment, I found myself disappointed that a researcher with Nagendra's impressive West-East connections, failed to provide a taste of experimental data, testable hypotheses, or suggestions for future research.

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Next up is a hodge-podge of four chapters by western parapsychologists. Roger Nelson's update on his Global Consciousness Project (GCP) clearly belongs here, given its hypothesis of "global consciousness," or mind-field. Nelson's work also departs from proof-oriented research, although not much—it may be simply an extension of "proof" of individual psi to "group" psi. Nelson briefly outlines the highly significant overall results of the first 8 years of GCP, for a total of 226 "major events" for which formal predictions were made.

It is less clear why Suitbert Ertel's profound reminder is in this book: "Parapsychologists have not yet realized that proper test construction in their field is a crucial demand" (p. 348). Ertel takes a full frontal assault on this issue, but hardly resolves it. The issue may be irresolvable given psi's lack of positive definition, with "extra-chance" outcomes being its primary indicator. We can't tell if an individual "hit" is chance or extra-chance. Summing across trials gives us some comfort, but when we come right down to it, even an exceptional performance (such as Ertel's 32% hit criterion) still has a nonzero probability of occurring by chance alone. Ertel discusses the minutiae of run-by-run and trial-by-trial scoring by the participants in his trademark ball-drawing ESP test. Ertel's numbers are impressive, especially his split-half reliabilities, but seem to cry out for interpretation as a sophisticated experimenter effect, which Ertel doesn't mention. While it's a welcome reminder of the importance of psychometrics, it's really not clear how this essay fits into this book.

May, Paulinyi, and Vassy present a fine, if highly technical, chapter on their continued studies of *Anomalous Anticipatory Skin Conductance Response to Acoustic Stimuli*. This fits nicely into this volume because they find support in this data for their Decision Augmentation Theory (DAT), that experimenters use their own intuition to sort the data so that the experimental results mimic a physiological response. This is a detailed description of their experimental series, as well as a good explanation of the DAT model. It exemplifies where research melding Indian and western perspectives might move—to the investigation of the role of experimenter. However, it doesn't go far enough East, in my opinion. The authors still stand at a proper western dualistic distance—engineer-like—from that which they investigate. They refuse to explore themselves (as Braud and Menon suggest) or to make use of subjective assessments of any sort. Thus, they discuss "intuition" and experimenter effects as vague, undefined, and essentially mechanical effects from which they—the researchers—are divorced.

After that four-chapter sequence (the missing one is my own chapter, with Serena Roney-Dougal, on Psi Performance of Experienced versus Novice Yoga Practitioners) the book moves on to its final three chapters, all of which are very much back on topic. Rao himself chimes in once again, this time with the chapter Cognitive Anomalies: Developing Tests for Screening and Selecting Subjects. Although Rao doesn't specifically bill it this way, this chapter is essentially a model or example of what East-West collaborative research might look like. Rao takes a very Indian approach by assuming that psi exists, develops a novel, well-conceived, and methodologically water-tight ESP test involving both free response and forced-choice responses, administers it to large samples in groups (total = 1,600+) together with a 10-minute Yoga relaxation exercise, and presents detailed and exhaustive statistical analyses of the item-by-item outcomes. The net result is overall statistically significant extra-chance, itself an anomaly with this large unselected sample. This is the early phase of an ongoing long-term attempt to select "star" subjects, presumably for practical applications that Rao argues are imminent. This chapter is good reading and stimulates interest in more projects like this one.

The final two chapters, by Jackson and Marwaha, and Hill-Clark, are a natural continuation of Rao's chapter. Jackson and Marwaha piggy-back on Rao's above-mentioned large sample study, but focus on the participants' self-reported religiosity, paranormal experiences, and Myers-Briggs questionnaire responses. Lynne Hill-Clark replicates the Jackson and Marwaha study, administering the same questionnaires to 282 primarily Christian university students in the southeastern United States. She addresses the same hypotheses as Jackson and Marwaha, but with vastly different results.

This pair of chapters may be well suited to end this volume because they leave the reader confused and in "a cloud of unknowing," to borrow the title of a famous anonymous text on Christian mysticism. The truth is that doing a definitive cross-cultural study of religiosity, psi beliefs/experiences, and cognitive styles is like jumping willingly into a bucket of worms. As just one of many possible conundrums, I note that the 218 Christians in the Jackson and Marwaha study did not at all resemble the Christians in Hill-Clark's study. The latter were probably native English speakers and members of the dominant socio-religio group in their society, while the former were probably not native English speakers, nor were they part of the dominant socio-religio group in their society (according to a 2001 census, India is 80.5% Hindu, 2.3% Christian, and 13.4% Muslim. See https://www.cia. gov/library/publications/the-world-factbook/geos/in.html, accessed Nov. 1, 2010). These factors may make measurable differences in cognitive style self-reports, openness to anomalous experiences, and even perceptions of one's own religiosity (e.g., Thompson, Bogen, & Marsh, 1979). This is one of the places where standard western research methodology breaks down and where East-West collaboration may be especially beneficial. Greater understanding may bloom from the marriage of self-reflective, contemplative activities with western science.

In summary, the prospect of deepening East-West collaboration in the pursuit of a parapsychological breakthrough is very exciting. I am grateful to Professor Rao for producing this book. It addresses a *huge* topic, whose time, I believe, is nearing. Rao's personal contributions to this volume are consistently excellent and the other chapters were, on the whole, well written. However, I hungered for transitions or summaries from Rao. I hungered for a section describing why these particular chapters were selected and how he envisioned them to push the agenda forward. I also longed for a chapter devoted to nondual science, a burgeoning topic these days, and especially important for deepening East-West understanding.

This book reminds me once again that I need to take a course in Sanskrit, and I longed for a chapter or section on the importance of Sanskrit to Indian thought and philosophy. Sanskrit is like a communal well from which cultural sustenance is drawn. It quenches the thirst for a language that facilitates the expression of psychospiritual philosophical ideas we thought we had no words for.

I also longed for the craftsmanship of this volume to be more enduring. The physical quality of the book was disappointing. My review copy is already tattered, binding coming unbound and ink noticeably lightened on some frequently referenced pages (e.g., table of contents). In addition, it is in desperate need of English editing, although I must admit that this was more of a curiosity than a distraction in my reading. In the entire volume, only once or twice did I have a serious question about an author's intended meaning. Still, one expects more from Motilal Banarsidass, one of the premier Indian publishers of English language books about India.

Despite these issues, I applaud this book and recommend it to parapsychologists, Indologists and forward thinking philosophers and scientists. It should at least have a place in one's personal or corporate reference library as it has a great deal of material which is not easily found elsewhere. But I would hope that it would not just sit on a shelf, but be widely read and discussed. The topic is timely, I believe, especially as the need for improved East-West communication deepens daily.

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ELECTRONIC VOICES: CONTACT WITH ANOTHER DIMENSION? by Anabela Cardoso. Hampshire, UK: O-Books/John Hunt Publishing, Ltd., 2010, Pp. 236. \$24.95 (paperback). ISBN 978 1 84694 363 8.

Anabela Cardoso, a high-ranking Portuguese diplomat, has written a remarkable book about instrumental transcommunication (ITC), *Electronic Voices: Contact with Another Dimension?* ITC refers to electronically received forms of apparent communication of unexplained origin. Although ITC phenomena include voices, images, and texts, Cardoso has focused primarily on voices. The voices state that they are deceased, and their speech often seems to come in direct response to experimenters' questions and comments. They range in length from one or two words to several sentences. Voices vary in strength and seeming gender. Some seem to lack characteristics of a human voice and some seem robotic.

Cardoso describes her three goals for the book: (1) to help readers try to receive the voices themselves; (2) to contribute to a better understanding of processes which seem to encourage reception of voices; and (3) to encourage the scientific community to study and analyze these phenomena, using sophisticated technical methods of voice analysis she says are now available.

She very effectively achieved her first goal: she describes conditions and equipment she's used over the years as she's received a tremendous number of voices. An entire chapter is devoted to details of how to prepare an environment conducive to the reception of voices. A descriptive booklet and CD accompany the book. The CD contains a large number of voices, most in Portuguese, along with the Portuguese and English translations Cardoso has assigned to each. The 30-page booklet is extremely interesting. It includes very detailed descriptions of the setting in which the voices occurred, such as the content of researchers' conversations before reception, and content of voices received before and after the featured excerpts. The author comments on the similarity between voices she's received and those received by others around the world.

Cardoso states that one challenge in this field is that listeners may have a tendency to think they've identified a meaningful phrase out of meaningless sounds. A great many of the voices featured in the CD are quite strong and seem clearly to be saying the words ascribed to them. In most examples, the author's interpretation of a phrase is featured first, followed by the sounds as received. I thought that perhaps it might be helpful to first play a series of sounds as they were received, maybe repeating them two or three times, before there is any suggested interpretation given, of the words it might represent. That would give the reader/listener the opportunity to listen without any suggestion as to possible content. However, I learned that the author carefully considered that option and decided against it as she felt that most prospective listeners would be English-speaking, unlikely to understand Portuguese. Thus, she felt that if voices were initially presented without any interpretation, they would be just meaningless sounds to the listeners.

In addressing her second goal, she has presented several compelling ideas as to processes associated with voice reception. She has made a strong contribution to the research conversation about possible sources of the voices. She has discussed the possible importance of synergy between experimenter, equipment used, and the source of the voices. She has found that voices are easier to receive and of better quality when background noise is used. She prefers a radio's "white noise," which plays during the tape recording. She suggests that the background noise may provide an acoustic carrier from which communicators might modulate or construct their own voices. She believes that the voices captured on tape consist of electromagnetic frequencies sent into the ether by some kind of power source.

She disagrees with the so-called "psychokinesis explanation," which posits that the communications are "created" solely through the psychokinetic action of the experimenter's mind on the electronic equipment. However, she speculates that the experimenters' keen interest in listening to the voices may somehow "transfer" the "wave" so that the signal (information) it carries becomes available and audible.

Cardoso has observed that many of the voices sound as if they're being produced with great effort. She posits that the communicators seemingly behind the voices experience difficulties in providing the sounds in an understandable form. Several voices say that "this is difficult." Further, Cardoso feels that the voices, based on the content of many, seem to have a purpose—namely to convey that life doesn't end at death and that the world can be healed by love.

But her personal theories aside, Cardoso's overriding passion is to see an unbiased investigation undertaken by scientists with the highest credentials and expertise in acoustics, electronics, and related fields. They would examine the evidence, rule out any conceivable normal explanation for the production of the voices, and supervise further reception at their origin. She emphasizes that although the phenomena can't be received on demand, they are repeated frequently around the world. Results are objective and can be subjected to scientific scrutiny. She asserts that sophisticated tools already exist for such rigorous study, including electroacoustic processing software to determine whether a voice is really there, and decoding techniques that she feels will help interpret what was said.

I certainly hope that Cardoso's overriding goal will be realized that the scientific community will begin to take a serious look at ITC. I certainly applaud her work and highly recommend this most unique book and CD.

Cardoso's life has been dramatically affected by her years of experimenting with the voices. She says that she feels "immensely proud ... to be involved in an enterprise of unparalleled significance."

ELIZABETH E. MCADAMS

President International Foundation for Survival Research 848 Ronda Mendoza, #P Laguna Woods, CA 92637 expbeyond@aol.com DEBATING PSYCHIC EXPERIENCE: HUMAN POTENTIAL OR HUMAN ILLUSION? edited by Stanley Krippner and Harris L. Friedman. Santa Barbara, CA: Praeger, 2010. \$44.95 (hardback). Pp. 236. ISBN 978-0-31339-261-0.

Whatever your prior view of the debate over psi, this book is an absolute requirement if you wish to be kept updated. The current status of differing views on scientific arguments for and against the existence of psychic phenomena is debated in this volume. The only risk is that it is easy to choose whom to believe and thereby find your own personal biases confirmed. On the other hand, should you be open-minded and hoping for a resolution, you may at first be disappointed with the stagnation. Nevertheless, I am convinced that the seeds for synthesis are actually there, although hard to find. Debates are actually not the best way of encouraging progress in a controversial subject. Inevitably, even without our biases, it is the most persuasive and eloquent debaters who are deemed the winners, whereas in this case the only winner should be science. It becomes, then, this reviewer's difficult task to try to bring fairness back to the forefront, but ultimately in a case like this impartiality is an ambitious goal. Even so, I prefer to think that I share the attitude of most serious researchers in this area: If I am being fooled, I want the critic to tell me how.

The book contains chapters written by some of the most vocal experts in this field. Dean Radin and Chris Carter are the proponents presenting the case for psi having now been established, while the critics Ray Hyman, Jim Alcock, and Christopher French take the opposing view. I am going to allow my own bias to immediately discount the chapter by Michael Shermer, the editor of *The Skeptic*, on the grounds that it is not science; rather, it is based mainly on his personal experiences with tarot readings, accompanied by tales provided to him by the maverick English journalist Jon Ronsson (producer of the film *The Men Who Stare at Goats*). The chapter does fulfill a function—as a shop-window example of what the proponents in the book complain about: arrogance, in this case assuming psychical researchers know nothing about cold reading.

I shall not attempt a summary and evaluation of each chapter, because this is more than adequately provided by the editors in the form of their own introduction. Instead, I will look at the main issues per se. Harvard psychiatrist Ruth Richards provides a fair-minded introduction to the topic, after which the major contributors present their cases. The contributors then all come back for round two, rebuttals in which they evaluate their opponents' chapters. Finally, epilogues are provided by the critic Richard Wiseman, the proponent Stephan Schwartz, and the editors themselves.

The confrontation gets heated and personal at times. Frustrated at the lack of appreciation for the enormous effort they expend to fulfill the critics' demands with the limited support available, the proponents begin to see the critics as outmoded die-hard believers in materialism. They are seen as being left behind by recent developments in quantum physics and consciousness studies. Consequently, several of the proponents label the critics now as "psi deniers," in much the same class as consciousness deniers and climate change deniers. Whatever one thinks about this labeling, it needs to be said that while much has been written on the psychology of belief in the paranormal, very little is known about the opposing polarized disbelief. Even if it causes some offence, it is therefore of value that Carter contributes a section of his chapter under the rubric "Psychology of the Dogmatic Critic" (p. 96).

And offence it does cause. Hyman claims he has always, in his role as a member of the Committee for Scientific Inquiry and through his papers in the *Skeptical Inquirer*, made a distinction between his treatment of parapsychology and other paranormal claims, recognizing that the former are based on scientific procedures. He is clearly offended by the allegations of unfair treatment made particularly by Carter and Schwartz. Likewise, Alcock recoils against this treatment as "ad hominem attacks" and "reviling the messenger." Naturally, many parapsychologists who have been subject to vile attacks might relish this, but Hyman and Alcock can hardly be held directly responsible for these attacks.

Hyman points out that some critics are in fact not materialists but religious—I presume he means mainly Christian. This may, however, only serve to illustrate that there is often an unholy alliance between orthodox religion and orthodox science against what is seen by both to be preenlightenment pagan beliefs. As Dean Radin once remarked to me, only Jesus and saints are allowed to perform miracles.

Having realized that a resolution is far from possible, the editors suggest that a détente be declared. However, given the heated and often personal nature of some the exchanges, this seems to me to be a forlorn suggestion. The editors of the *Journal of Consciousness Studies* made a similar effort for a truce 8 years ago when they produced the volume *Psi Wars*. In lieu of this, the current editors finally find a calmer haven in which to anchor the debate, in the form of the more temperate postscripts provided by the eminent psychologist Elizabeth Loftus and by the communications expert Daniel Broderick.

But are the issues as irresolvable or even intractable as this book suggests? It may be instructive to see the debate first in a larger historical context.

A similar book entitled The Debate for and Against Psychical Belief, with chapters by academic and other contemporary experts, was published 84 years ago (Murchison, 1927). In terms of the present debate, I found it particularly relevant to read the chapter by Gardner Murphy about what impressed him personally about psi research. He was impressed by what were probably the first-ever experiments in what we now call remote viewing: These were carried out by two women, Clarissa Miles and Hermione Ramsden, with rather spectacular results. But what is just as interesting, as Murphy notes, is the importance Miles and Ramsden gave to the hypnagogic state. They regarded this state as a psi-conducive state because it represents a borderline between unconscious and conscious processes (these experiments are reviewed in Parker, 2005). So here we have already a foundation for later research. But Murphy had further prescience. He was also impressed by the quantitative experiments of Coover, Warcollier, Brugmans, and Estabrooks, and he helped set the stage for what were soon to become the classical experiments of J. B. Rhine and his coworkers. This background and his own research enabled him to put his finger on what can be seen as the source of the conflict that underlies the present debate. He writes (p. 275):

> The attempt to control all sources of error at the beginning is not only futile because of the impossibility of foreseeing all sources of error, but prejudicial to obtaining the kinds of occurrences that one is out to

observe. Tenseness, distrust, and apathy are but three of many ways of becoming negatively conditioned to a long series of laboratory experiments. . . . The task before the investigator is not a polemic one: It is simply the task of steadily improving the quality and quantity of experimental work, the task of controlling more and more of the variables involved and working towards a thorough understanding of the physiological and psychological factors which underlie the phenomena.

Now let's move on 60 years to 1986, when Ray Hyman reviewed the first real attempt to control some of the variables for capturing psi in the laboratory in the form of the initial series of ganzfeld experiments. Hyman became very critical, if not outright disparaging, about the possible sources of errors that he found. He complains now, looking back, that parapsychologists showed little interest in finding these flaws, but Nils Wiklund and I actually spent months doing just that (Parker & Wiklund, 1987). Nevertheless, history followed Murphy's recommendation and in one of the most constructive collaborations, not just in parapsychology but also in psychologyas a whole, Honorton and Hyman (1986), after evaluating the experiments, agreed in their "joint communiqué" on the requirements for improvement. This led to the successful autoganzfeld series and the publication by Bem and Honorton (1994) in *Psychological Bulletin*.

Much of this history, as reflected in this article and its immediate successors, still forms part of the current debate, and some of the same issues that appeared then are repeated here in Hyman's chapter "Parapsychology's Achilles Heel." Hyman agrees that the effect is "too large and consistent to be discounted as statistical flukes" but he presents two major criticisms he sees as damning. He objects that the effect found in the later experiments did not replicate the original findings with static (picture card) targets, because it was shown only to be present with dynamic targets. Equally damning is that the psi effect was limited to only a few experimenters.

The first objection seems now adequately answered in the rebuttal chapter by Carter, who points out that included among the static targets was a set of halfway dynamic targets—View Master stereoscopic slides. As these gave significantly better results than the purely static targets, modern dynamic targets in the form of movie clips can be seen as an extensionreplication of these View Master slides. But leaving Carter's point aside, surely common sense says one should look at the context. Participants in psychology experiments are not like objects in physics experiments. In psychology, the use of vintage equipment in an experiment is bound to influence the participant's expectancies. Art prints are today no longer as engaging as they once were to students. I have found that even showing the same film clip to students on an old video player, compared to showing it as DVD, produces markedly different reactions. Using overheads instead of a power-point presentation is guaranteed to provoke a groan from today's students.

The second objection, concerning the experimenter effect, is now the major issue for Hyman. Indeed, he writes in his rebuttal (p. 146): "I now believe that my original critique of the ganzfeld experiments, as well as my unpublished follow-up, were misguided.... I should have made it clear that the striking experimenter effects in the database indicated a failure to replicate."

These internal effects are claimed by Hyman to have violated the basic requirement for homogeneity and rendered the meta-analyses invalid. I would disagree with Hyman on the homogeneity issue (and even checked this with an expert in meta-analysis for pharmacological research). Metaanalysis is used to discover hidden effects that may not be apparent in one set of data. When differences are seen across numerous experiments, they are nearly always found to be the effect of some specific variables; indeed, it is the purpose of meta-analysis to identify these. The effects in this case, of the type of target and of the experimenter, are of course important and can guide further research. To then argue that this invalidates the findings, Hyman is not so much shifting the goal posts as turning them round such that the net now faces inwards.

Of course, it is important to know just how many successful experimenters were responsible for the effect, and Hyman is right to raise this issue. It was particularly poignant in the first meta-analysis, when there were only a very few successful experimenters and the questionable work of Carl Sargent was in the forefront. Carter, in his rebuttal, provides the reader with a table showing the later replications, but the data in his table still contain only a few successful experimenters, namely, Dick Bierman, Kathy Dalton, and myself.

A much more promising updated picture is provided in a publication by Lance Storm and coworkers in *Psychological Bulletin* (Storm, Tressoldi, & Di Risio, 2010). This important paperwas published too recently to be discussed in the present book. Ironically, given its importance, it received little interest in the media compared to Daryl Bem's (2011) paper "Feeling the Future," to which the critics seem to react as if it were the first-ever successful series of ESP experiments carried out and published in a mainstream journal.

As well as presenting meta-analyses suggesting that the work on psi and altered states gives, in general, replicable and highly significant effect sizes, Storm et al. (2010) updated the ganzfeld meta-analysis from 1992 to 2008 and found a further 30 studies. The overall hit rate and effect size were highly significant and showed superiority for participants selected for psychic experiences and/or meditation practices. Most important, however, is that the number of experimenter/laboratory groups was seven, and there were no significant differences in effect size between the groups.

Of course, it could still be argued that even the contemporary ganzfeld experiments have potential flaws; what occurs is a replication of errors rather than psi. To my knowledge, there is no recent analysis of the quality of the replications in terms of potential flaws in relation to the outcomes. Surprisingly, critics do not seem to have picked up on this.

An objection related to participant selection is raised by Richard Wiseman in his chapter "Heads I Win, Tails You Lose." It concerns how a ganzfeld experiment is defined. Although the early work did not often specify selection criteria, one meta-analysis did find that selection criteria were important. Wiseman objects to how in a reanalysis of the nonsignificant results of the smaller meta-analysis by Milton and Wiseman (1999), Bem, Palmer, and Broughton (2001) used judges to re-evaluate the data but also defined subject selection criteria. By defining the ganzfeld experiments this way they were able to find an effect size within the expected range.

What seems clear from the debate is that the ganzfeld does not work consistently enough to satisfy the critic. The fact that it does not succeed with all participants should not, however, present an insurmountable problem. The effect size is such that sample sizes must be larger than 100 participants to favor significance. Having come this far causes Carter, Schwartz, and Radin to argue in their chapters that parapsychology has implicitly fulfilled all the requirements for replication and that the critics are an "Antique Road Show" (the title of Schwartz's chapter) showing "Persistent Denial" (the title of Carter's chapter). Hyman would still maintain there is something weird afoot in the form of the experimenter effect, and he may just be right. Hyman requires that for parapsychology to be a true science it should be able to specify how to get positive results, and this inconsistency and lack of prediction is its "Achilles Heel"— part of his chapter title.

A general recipe for success can be and has indeed been proposed (Parker, 2000b). Yet, to be fair to Hyman, it has not been found to work all the time. Anneli Goulding, as part of her doctoral thesis at Gothenburg, followed this recipe and found a significant negative effect using the conventional analysis (Goulding, Westerlund, Parker, & Wackermann, 2004). In the most recent study, Björn Sjödén and I used a complicated and cognitively demanding series of comparisons between subliminal primed and nonprimed targets. This time we obtained no psi effect whatsoever (Parker & Sjödén, 2010). Nevertheless, what I still find remarkable in these last results is the complete absence of the so-called real-time hits that objectively earmarked our successful series. If our first results had all been due to artifacts, then these artifacts should still be present, causing us to subjectively validate the same spurious real-time correspondences. This time, neither the hits nor the misses showed this. But even leaving these hits aside, what strongly suggested to us that we were dealing with apparently causal effects in the earlier studies was what happened when I surreptitiously, without telling anyone involved, suddenly introduced a change in procedure. In this case, I unexpectedly brought a friend of the receiver into the sender's room to take over the role of sender. This action immediately evoked the following remark from the receiver, which was recorded as a real-time match: "Where have you been?"

What is the explanation then for the inconsistency of replication? Hyman refers to what he sees as the more esoteric explanations of Jim Kennedy (2003) in terms of a cosmic "intelligent mischief" or of Walter von Lucadou (2001) in terms of a conservation principle in natural law that interferes with psi, so as to make it impossible to capture it in the laboratory. Hyman uses these notions to discredit the field as too esoteric. But less farout explanations may be possible and even plausible, even if they might need to be extended to include the experimenter's own psi. It is surely the ambience of the experiment that is crucial and difficult to replicate. In the case of the above-mentioned Goulding at al. (2004) experiment, there had been a strong dispute at the time over whether the participants themselves or a judge should carry out the evaluation, and this may have spoiled the positive atmosphere. In the case of our last experiment, the shortage of funding and the radical and unexpected change in the research climate in Sweden meant that I frankly no longer had the spirit and zeal needed to obtain positive results.

Now having said that, I can almost hear my friend Alcock protesting that this is all contrived post hoc attribution. Of course he may well be right, but in a frontier field, speculation can be a valuable tool which may stimulate creativity in research. The experimenter effect is, despite Alcock's objections to its use in parapsychology, firmly established in psychology. I would also assert that there is sufficient evidence provided in the classical literature reviews of Rhea White (1976a; 1976b; 1977) to substantiate the occurrence of such effects in psi research. And if this is not enough, an excellent example of the role such factors play is one of psychology's most cherished effects, the conformity effect. This effect is actually found in Alcock's own coauthored *Textbook of Social Psychology* (Alcock, Carment, and Sadava, 1998).

Much of the current debate in the book centers on the ganzfeld, but Dean Radin's initial chapter presents an iconic review of the history of psychical research and parapsychology, in much the same manner that his book *Entangled Minds* (Radin, 2006) does. Likewise, Stephan Schwartz in his chapter attempts to place psi as a natural phenomenon in the wider context of creativity and altered states. Damien Broderick describes this in his postscript as a "nonlocal apprehension of a larger reality."

But of course the critics will have none of this. In particular, Alcock re-presents his 13 reasons for rejecting parapsychology and psychical research. Some of these reasons concern the lack of lawful relationships, of predictability, of accepted theories to integrate the area with normal science, and the speculative nature of research projects. These criticisms are obviously to some extent valid, but they are equally valid for many areas of frontier psychology, and they will remain so as long as there is virtually no funding for major research on *understanding* psychic phenomena. So Alcock is merely illuminating the vicious circle that he and other critics helped to create and could actually help break. Other reasons given by Alcock, such as parapsychologists' disinterest in normal explanations, are not entirely true and certainly not for me (Parker, 1999; Parker, 2000). Many parapsychologists, including myself, have taken an active interest in magic tricks; in my own case, these were actually inspired by Alcock's own skills in this area.

Alcock's only remaining reason concerns assuming causality from correlations and the role of attribution. Concerned that we derive causal explanations where there is only chance coincidence at play, he reiterates the criticism from his *Psi Wars* publication (Alcock, 2003) that we should "give the null hypothesis a chance." Clearly there is good reason to be skeptical about attributing psi to the claims of most spontaneous cases. On first opening this book, I was struck by the first illustration accompanying the chapter by Krippner and Friedman, which is titled "Cradle Song." I was amused by the thought that Krippner's name is derived from his Norwegian ancestry in the form of *Kribbmakare*, which means crib maker. The occurrence may, of course, have been intentional or coincidental, but in either case such attributions are part of normal life and may express a biological preference to seek out such meaningful relationships in our environment.

However, when these events concern parapsychology, we can actually turn to the laboratory for their validation. Parapsychology is then surely not anomalous psychology, but rather a controlled study of normal experiences that challenge our view of reality. The ganzfeld, especially the real-time version we developed at Gothenburg, is specifically designed to reproduce the contingencies for psychic experiences in the laboratory, and the causal conclusions from statistics are usually clear. It becomes then almost self-contradictory that in "giving the null hypothesis a chance," both Alcock and Hyman in their chapters appear to downgrade the value of statistics and meta-analysis in drawing conclusions about phenomena and their causal relationships in the real world.

Richard Wiseman in his chapter also refers to the history of the field in an attempt to show how researchers are constantly, as he describes it, changing ships and cherry-picking new procedures. He finds a notable quote from Gaither Pratt about how from 1882 onward a succession of practices for getting replicable results has fallen in and out of fashion, without any tangible, replicable results. Yet one should not overly exaggerate this. Carter reproduces a table from Honorton showing that the frequent claim by critics that Rhine's work was never replicated by other psychologists is actually false. Moreover, it can be argued that the ganzfeld procedure is a natural and systematic evolution from earlier methods and findings. This is shown in the flow diagram adapted from Honorton in Parker (2005, p. 74).

Of course, Wiseman is correct that some methods seem at first to mysteriously work and then decline. But this may have to do with the ambience of the laboratory, as mentioned earlier. In his joint chapter with Harris Friedman in the book, Stanley Krippner gives us an account of such a positive ambience. It concerns the successful Maimonides series of dream telepathy experiments. The attempts he mentions to meet the criticisms were extensive, and the Maimonides work (if seen generally) has continued to enjoy consistent replication. It is noteworthy that no mention of these experiments is made by any of the critics in this book, whether it be Alcock, Hyman, Wiseman, or French.

So where are the seeds for future dialogue? French suggests breaking down the barrier between critics and proponents and concentrating on collaborating to develop a specific standard and repeatable design. But is this so easy in practice? The collaboration between French and Sheldrake on telephone telepathy experiments, which was heavily supported by the Perrott-Warrick Fund, seems to have been in all respects a dismal failure, at least as far as hands-on cooperative willingness was concerned (Skeptiko, 2009).

When I had funding available, I suggested a joint project with Jim Alcock, but his preference was to remain an armchair critic. It is evident from this book and his previous writings that he is influenced by the failure of a physicist colleague, Stan Jeffreys, to obtain positive results. However, if Carter is correct in his rebuttal, then this is no longer the case. Likewise, French denies having ever found any evidence of psi, despite the efforts of his students. Here we go again. If the recent report by Suitbert Ertel (2010) is also correct, then this is not so. Moreover, I know personally that Chris French was very impressed by the performance of the British medium Diane Lazarus. Even Wiseman, who is famous (some might say infamous) for his categorical statements of never having encountered any evidence of the paranormal, was one of the joint authors of the security setup for the successful ganzfeld experiment with Kathy Dalton (Dalton, Morris, Delanoy, Radin, Taylor, & Wiseman, 1996) and succeeded with Marilyn Schlitz (Schlitz, Wiseman, Watt, & Radin, 2006) in replicating their experimenter effect findings in two of three studies. He has also been able to follow the occasional successes of his partner, Caroline Watt (Watt & Ramakers, 2003).

It would therefore be ideal if both proponents and critics could avoid categorical statements such as there is "no scientific evidence for ESP" or "ESP experiments are consistently replicable." Indeed, considering the above, it might be considered disingenuous to continue this polarity.

It is clearly also important to maintain a dialogue. Elizabeth Loftus, who is a major figure in mainstream psychology, provides a postscript chapter where she admits being impressed by Ray Hyman's contributions, although she is a supporter of meta-analysis, which he nowadays is less than enthusiastic about. She also freely admits that replication is a problem in psychology as well as parapsychology. Naturally, her own research on false memory has led her to doubt the eyewitness reports in psychical research. These effects may not, however, be entirely in the direction that Loftus might suppose. There is some evidence that, depending on a person's belief system, extraordinary events are not exaggerated but tend instead with the passage of time to become downplayed and normalized. Obviously, this would be a fruitful area for collaboration. Having attended and received a favorable impression of the *Meeting of Minds* conference organized by Dean Radin, Loftus expresses a desire for future meetings. I hope her wish is fulfilled.

Given its funding, parapsychology has apparently come as far as it can as regards replication, and it has to await the solution to the critics' other major objection: a theory integrating it with normal science. This was also the view of one of the great optimists in the field, Ed May, expressed in his farewell speech to the Parapsychological Association in 2008.

In view of the above, it is interesting that Carter cites (p. 165) another paper written by Gardner Murphy, this time published in 1969, in which he urged parapsychologists to become better acquainted with the findings of modern physics. The June 2011 issue of *Scientific American* concerns how entanglement effects have been found at a biological level. If their presence is confirmed in the brain, maybe the critics will be demanding that for our worldview to make sense, psi phenomena must be acknowledged to actually occur. If so, real collaboration can then begin on understanding more about what these phenomena mean.

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## GLOSSARY

The definitions of most of the following terms have been borrowed or adapted from A Glossary of Terms Used in Parapsychology by Michael A. Thalbourne (republished by Puente Publications, Charlottesville, VA, USA, 2003). We highly recommend this book to those who seek a more complete glossary of parapsychological terms.

- AGENT: In a test of GESP, the individual who looks at the information constituting the target and who is said to "send" or "transmit" that information to a percipient; in a test of telepathy and in cases of spontaneous ESP, the individual about whose mental states information is acquired by a percipient. The term is sometimes used to refer to the subject in a test of PK.
- ANOMALOUS COGNITION (AC): A form of information transfer in which all known sensory stimuli are absent; that is, some individuals are able to gain access to information by an as yet unknown process; also known as remote viewing (RV) and clairvoyance.
- ANOMALOUS PERTURBATION (AP): A form of interaction with matter in which all known physical mechanisms are absent; that is, some individuals are able to influence matter by an as yet unknown process; also known as psychokinesis (PK).
- CALL: (As noun), the overt response made by the percipient in guessing the target in a test of ESP; (as verb), to make a response.
- CLAIRVOYANCE: Paranormal acquisition of information about an object or contemporary physical event; in contrast to telepathy, the information is assumed to derive directly from an external physical source and not from the mind of another person.
- CLOSED DECK: A procedure for generating the target order for each run, not by independent random selection of successive targets, but by randomization of a fixed set of targets (e.g., a deck of 25 ESP cards containing exactly five of each of the standard symbols).
- CONFIDENCE CALL: A response the subject feels relatively certain is correct and indicates so before it is compared with its target.
- CRITICAL RATIO (CR): A mathematical quantity used to decide whether the size of the observed deviation from chance in a psi test is significantly greater than the expected degree of random fluctuation about the average; it is obtained by dividing the observed deviation by the standard deviation; also called the z statistic.

*Critical Ratio of Difference* (CR<sub>d</sub>): A critical ratio used to decide whether the numbers of hits obtained under two conditions (or by two groups of subjects) differ significantly from each other; it is obtained by dividing the difference between the two total-hits scores by the standard deviation of the difference.

- DECLINE EFFECT: The tendency for high scores in a test of psi to decrease, either within a run, within a session, or over a longer period of time; may also be used in reference to the waning and disappearance of psi talent.
- DIFFERENTIAL EFFECT: In an experiment where the subjects are tested under two different procedural conditions: (i) the tendency of subjects who score above chance in one condition to score below chance in the other, and vice versa; (ii) the tendency of one condition to elicit psi-hitting from the group of subjects as a whole and the other condition to elicit psi-missing.
- DISPLACEMENT: A form of ESP shown by a percipient who consistently obtains information about a target that is one or more removed, spatially or temporally, from the actual target designated for that trial.

*Backward Displacement*: Displacement in which the target extrasensorially cognized precedes the intended target by one, two, or more steps (designated as -1, -2, etc.).

*Forward Displacement*: Displacement in which the target actually responded to occurs later than the intended target by one, two, or more steps (designated as +1, +2, etc.).

- ESP CARDS: Special cards, introduced by J. B. Rhine, for use in tests of ESP; a standard pack contains 25 cards, each portraying one of five symbols, viz., circle, cross, square, star, and waves.
- EXPERIMENTER EFFECT: An experimental outcome that results, not from manipulation of the variable of interest itself, but from some aspect of the experimenter's behavior, such as unconscious communication to the subjects, or possibly even a psi-mediated effect working in accord with the experimenter's desire or motivation.
- EXTRASENSORY PERCEPTION (ESP): Paranormal cognition; the acquisition of information about an external event, object, or influence (mental or physical; past, present, or future) in some way other than through any of the known sensory channels.
- FORCED-CHOICE TEST: Any test of ESP in which the percipient is required to make a response that is limited to a range of possibilities known in advance.
- FREE-RESPONSE TEST: Any test of ESP in which the range of possible targets is relatively unlimited and is unknown to the percipient, thus permitting a free response to whatever impressions come to mind.
- GANZFELD: Term for a special type of environment (or the technique for producing it) consisting of homogeneous, unpatterned sensory stimulation; an audiovisual ganzfeld may be accomplished by placing halved ping-pong balls over each eye of the subject, with diffused light (frequently red in hue) projected onto them from an external source, together with the playing of unstructured sounds (such as "pink noise") into the ears.

- GENERAL EXTRASENSORY PERCEPTION (GESP): A noncommittal technical term used to refer to instances of ESP in which the information paranormally acquired may have derived either from another person's mind (i.e., as telepathy), or from a physical event or state of affairs (i.e., as clairvoyance), or even from both sources.
- GOAL-ORIENTED: Term for the hypothesis that psi accomplishes a subject's or experimenter's objective as economically as possible, irrespective of the complexity of the physical system involved.
- MACRO-PK: Any psychokinetic effect that does not require statistical analysis for its demonstration; sometimes used to refer to PK that has as its target a system larger than quantum mechanical processes, including microorganisms, dice, as well as larger objects.
- MAJORITY-VOTE TECHNIQUE (MV): The so-called repeated or multipleguessing technique of testing for ESP. The symbol most frequently called by a subject (or a group of subjects) for a given target is used as the "majority-vote" response to that target on the theory that such a response is more likely to be correct than one obtained from a single call.
- MEAN CHANCE EXPECTATION (MCE): The average (or "mean") number of hits, or the most likely score to be expected in a test of psi on the null hypothesis that nothing apart from chance is involved in the production of the score.
- MICRO-PK: Any psychokinetic effect that requires statistical analysis for its demonstration. Sometimes used to refer to PK that has as its target a quantum mechanical system.
- NEAR-DEATH EXPERIENCE (NDE): A predominantly visual experience undergone by persons who either seem to be at the point of death but then recover, or who narrowly escape death (as in a motor car accident) without being seriously injured. NDEs often incorporate out-of-body experiences.
- OPEN DECK: A procedure for generating a target order in which each successive target is chosen at random independently of all the others; thus, for example, in the case of a standard deck of ESP cards whose target order is "open deck," each type of symbol is not necessarily represented an equal number of times.
- OUT-OF-THE-BODY EXPERIENCE (OBE): An experience, either spontaneous or induced, in which one's center of consciousness seems to be in a spatial location outside of one's physical body.
- PARANORMAL: Term for any phenomenon that in one or more respects exceeds the limits of what is deemed physically possible according to current scientific assumptions.
- PARAPSYCHOLOGY: The scientific study of certain paranormal or ostensibly paranormal phenomena, in particular, ESP and PK.
- PERCIPIENT: The individual who experiences or "receives" an extrasensory influence or impression; also, one who is tested for ESP ability.

- POLTERGEIST: A disturbance characterized by physical effects of ostensibly paranormal origin, suggesting mischievous or destructive intent. These phenomena include such events as the unexplained movement or breakage of objects, loud raps, electrical disturbances, and the lighting of fires.
- POSITION EFFECT (PE): The tendency of scores in a test of psi to vary systematically according to the location of the trial on the record sheet.
- PRECOGNITION: A form of ESP involving awareness of some future event that cannot be deduced from normally known data in the present.
- PROCESS-ORIENTED: Term for research whose main objective is to determine how the occurrence of psi is related to other factors and variables.
- PROOF-ORIENTED: Term for research whose main objective is to gain evidence for the existence of psi.
- PSI: A general term used either as a noun or adjective to identify ESP or PK.
- PSI-HITTING: The use of psi in such a way that the target at which the subject is aiming is "hit" (correctlyresponded to in a test of ESP, or influenced in a test of PK) more frequently than would be expected if only chance were operating.
- PSI-MISSING: The use of psi in such a way that the target at which the subject is aiming is "missed" (responded to incorrectly in a test of ESP, or influenced in a direction contrary to aim in a test of PK) more frequently than would be expected if only chance were operating.
- PSYCHOKINESIS (PK): Paranormal action; the influence of mind on a physical system that cannot be entirely accounted for by the mediation of any known physical energy.
- RANDOM EVENT GENERATOR (REG): An apparatus (typically electronic) incorporating an element capable of generating a random sequence of outputs; used in automated tests of psi for generating target sequences; in tests of PK, it may itself be the target system that the subject is required to influence; also called a random number generator (RNG).
- RECURRENT SPONTANEOUS PSYCHOKINESIS (RSPK): Expression for paranormal physical effects that occur repeatedly over a period of time; used especially as a technical term for poltergeist disturbances.
- REMOTE VIEWING: A term for ESP used especially in the context of an experimental design wherein a percipient attempts to describe the surroundings of a geographically distant agent.
- RESPONSE BIAS: The tendency to respond or behave in predictable, nonrandom ways.
- RETROACTIVE PK: PK producing an effect backward in time; to say that event A was caused by retroactive PK is to say that A would not have

happened in the way that it did had it not been for a later PK effort exerted so as to influence it; sometimes abbreviated as *retroPK*; also referred to as *backward PK* or *time-displaced PK*.

RUN: A fixed group of successive trials in a test of psi.

- SHEEP-GOAT EFFECT (SGE): The relationship between one's acceptance of the possibility of ESP's occurrence under the given experimental conditions and the level of scoring actually achieved on that ESP test; specifically, the tendency for those who do not reject this possibility ("sheep") to score above chance and those who do reject it ("goats") to score below chance.
- SPONTANEOUS CASE: Any psychic occurrence that takes place naturally, and is often unanticipated—psi in a real-life situation, as opposed to the experimentally-elicited psi phenomena of the laboratory.
- STACKING EFFECT: A spuriously high (or low) score in a test of ESP when two or more percipients make guesses in relation to the same sequence of targets; it is due to a fortuitous relationship occurring between the guessing biases of the percipients and the peculiarities of the target sequence.
- TARGET: In a test of ESP, the object or event that the percipient attempts to identify through information paranormally acquired; in a test of PK, the physical system, or a prescribed outcome thereof, that the subject attempts to influence or bring about.
- TELEPATHY: The paranormal acquisition of information about the thoughts, feelings, or activity of another conscious being.
- TRIAL: An experimentally defined smallest unit of measurement in a test of psi: in a test of ESP, it is usually associated with the attempt to gain information paranormally about a single target; in a test of PK, it is usually defined in terms of the single events to be influenced.
- VARIANCE: A statistic for the degree to which a group of scores are scattered or dispersed around their average; formally, it is the average of the squared deviations from the mean; in parapsychology, the term is often used somewhat idiosyncratically to refer to the variance around the theoretical mean of a group of scores (e.g., MCE) rather than around the actual, obtained mean.

*Run-Score Variance*. The variance around the mean of the scores obtained on individual runs.

*Subject Variance*. The variance around the mean of a subject's total score.