



ESSAY

Adversarial Collaboration on a *Drake-S* Equation for the Survival Question

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HIGHLIGHTS

There is a sizable 39% gap between the added weight of reported evidence for an 'afterlife' minus the collective power of common skeptical explanations. This finding argues for continued research on different hypotheses for anomalous experiences that suggest postmortem survival of human consciousness.

ABSTRACT

The idea of 'life after death' transcends philosophy or religion, as science can test predictions from claims by both its advocates and skeptics. This study therefore featured two researchers with opposite views, who jointly gathered hundreds of research studies to evaluate the maximum average percentage effect that seemingly supports (i.e., *anomalous effects*) or refutes (i.e., *known confounds*) the survival hypothesis. The mathematical analysis found that known confounds did not account for 39% of survival-related phenomena that appear to attest directly to human consciousness continuing in some form after bodily death. Thus, we concluded that popular skeptical explanations are presently insufficient to explain a sizable portion of the purported evidence in favor of survival. People with documented experiences under conditions that overcome the known confounds thus arguably meet the legal requirements for expert witness testimony. The equation that led to our verdict can also purposefully guide future research, which one day might finally resolve this enduring question scientifically.

KEYWORDS

Anomalous experience, empiricism, paranormal belief, probability, survival

INTRODUCTION

A rather conspicuous 'resurrection' is happening. Whether old wine in new bottles or a reverent nod to the 19th century investigations of Spiritualism that birthed psychical research and modern parapsychology, the question of *postmortem survival of consciousness* has again become a hot button topic in the social and biomedical sciences (Alvarado, 2019; Bastos et al., 2015; Hill et al., 2018; O'Keeffe & Wiseman, 2005). Unfortunately, modern treatises are limited in offering only religio-cultural overviews of related beliefs (e.g., Nagasawa & Matheson, 2017), a

single category of evidence (e.g., Gauld, 1982a; Haraldsson & Matlock, 2016; Houran & Lange, 2001), or echo chambers of skeptical (e.g., Martin, & Augustine, 2015) or sympathetic views (e.g., Storm & Thalbourne, 2006). To our way of thinking, a widely-encompassing "adversarial collaboration" grounded in strict empiricism is the best way to summarize and advance the scientific conversation on this provocative topic. This type of exercise involves researchers with opposing views who jointly construct and implement a study that fairly addresses a controversial issue while controlling for obvious biases, weaknesses, or experimenter effects (for discussions, see Kahneman &



Klein, 2009; Sheldrake, 1998; Wagenmakers et al., 2011).

No scientific consensus on survival currently exists as consensus itself is fictitious. Novelist Michael Crichton (2003) underscored this point when he noted that, “In science, consensus is irrelevant. What is relevant is reproducible results. The greatest scientists in history are great precisely because they broke with the consensus. There is no such thing as consensus science . . . period” (para. 31–32). Likewise, survival is a thorny and fuzzy proposition because the nature and limits of “consciousness” remain highly debatable (e.g., Cardeña & Winkelman, 2011; Chalmers, 1995; Parnia et al., 2014), while the apparent evidence for survival is weakened by serious confounds (e.g., Houran et al., 2017; O’Keeffe & Wiseman, 2005; Martin & Augustine, 2015). This circumstance often reduces the question to a rhetorical battle of ideologies, i.e., passionate interpretations of certain anomalies contrasted with viable counterclaims that bolster orthodox explanations for these same touted outcomes. Accordingly, this essay offers a constructive “meeting of the minds” by computing an estimated probability of postmortem survival based on information commonly cited by parapsychologists and skeptics for their respective positions. What the famous “Drake Equation” did to scientifically frame the likelihood of intelligent extraterrestrial life within the Milky Way galaxy (Burchell, 2006; Drake, 2014; Glade et al., 2012), we hope to achieve with a first approximation of a *Drake-Survival (S)* Equation for the question of life after death.

We recognize that some academics regard *all* parapsychological claims as invalid (e.g., Reber & Alcock, 2020), while others label certain witness reports as self-evident and indisputable evidence of the paranormal (e.g., Stokes, 2017). Our exercise rejects these dogmatic views in favor of a mutual decision to take survival claims seriously but not automatically at face value. Further, and akin to the myth of consensus, we stress that science is only an approach to knowledge versus a set of ‘verified truths’ or ‘conclusive evidence’ (Jevning et al., 1994; Lilienfeld et al., 2015; Psillos, 1999). Therefore, no single study, collection of findings, or forceful philosophical argument ever conclusively proves survival. Rather, the ‘best case’ in this context represents only a current estimation based on reduced errors in inference and thus a more accurate understanding of reality. In short, scientific conclusions deal with probabilities and not possibilities. Note, too, that we strongly agree with Orzel’s (2017) position that “dealing honestly with probability and uncertainty requires *quantitative* engagement” (para. 16, emphasis added). For this reason, our exercise relies exclusively on empirical research data to formulate a conservative probability model that is practical and pertinent to accepted rules of evidence in the field of law.

The *Drake-S* Equation and *Daubert* Standard of Evidence

Trial judges use the *Daubert* standard to assess whether scientific testimony from an expert witness is based on valid reasoning that can properly be applied to the facts at issue (Bernstein, 1993; Doyle, 1984; Fisher, 1994), including clinical cases (Woody, 2016; Shuman & Sales, 1999). Under this standard, the factors that may be considered in assessing the validity of a method driving an expert conclusion are: (a) whether the theory or technique in question can be and has been tested; (b) whether it has been subjected to peer review and publication; (c) its known or potential error rate; (d) the existence and maintenance of standards controlling its operation; and (e) whether it has attracted widespread acceptance within a relevant scientific community.

Due diligence is, therefore, critical to ensure that the core facts and opinions of expert witnesses or scientific evidence maintain their probative value in the face of attempted disqualification by an opposing counsel. In a case for postmortem survival, the credibility of the witness to the *Daubert* standard of ‘*as likely as not*’ or preferably ‘*more likely than not*’ represents both (a) the sum of the witness’ veracity and expertise and (b) the resistance of the testimony to cross-examination. Here, overcoming common skeptical explanations for survival-related phenomena is the prime concern. Secondly, we must consider the specific details of the witness testimony, i.e., a ‘veridical’ (or accurate) nature that reasonably supports an interpretation of postmortem survival. In other words, any case must firmly address the key counter-arguments to determine the weight of favorable testimony.

Following this process of legal reasoning, we will first quantify skeptical explanations for survival-related phenomena using simplified mathematics on a probabilistic population-level. This arguably provides first-of-its-kind empirical estimates for these common counter-arguments. We next show that these estimates cannot, in a very conservative total, account for the variety of survival-related phenomena reported by witnesses at the population-level. Particularly, we demonstrate that witnesses who satisfy these skeptical criteria would meet the *Daubert* standard of evidence. Such vetted testimony would, in fact, present a daunting challenge for anyone seeking its disqualification using empirical evidence versus ideological rhetoric.

However, we will proceed to show that the amount of variance within skeptical explanations (i.e., the percent of another variable accounted for a statistical analysis) that actually explains survival-related phenomena is considerably short of accounting for the entire population of reported witnesses (or experients). Ergo, we contend that experients vetted for these skeptical factors would repre-

sent *prima facie* testimony of postmortem survival, which would require new and probabilistically-likely alternative explanations to successfully disqualify.

Primary Assumptions and Approaches to the *Drake-S* Equation

Our exercise is rooted in three mutually-agreed assumptions. Similar to the growing trend of pre-registered research studies, it is important to set ground rules in advance to control for undisclosed flexibility that can lead to revisionist or false discoveries or rejections (Nosek et al., 2018). Thus, we each committed to accepting the results of a probabilistic exercise that conformed to the following fundamentals and parameters.

Working Assumption 1: The Meaning of ‘Survival’

Consciousness is defined by many online dictionaries simply as “sentience or awareness of internal and external existence.” The *Oxford Dictionary of Psychology* (Colman, 2015) expands this basic premise to describe it as “the normal mental condition of the waking state of humans, characterized by the experience of perceptions, thoughts, feelings, awareness of the external world, and often in humans (but not necessarily in other animals), self-awareness.” We adopted a simple, four-facet depiction of consciousness for our exercise, i.e., a state of personal existence that collectively encompasses: (a) *Identity* (personality), (b) *Perception* (awareness of stimuli), (c) *Sentience* (awareness of feelings/sensations), and (d) *Cognition* (an understanding of perceptual, sensorial, or emotional stimuli). Accordingly, any testimony in favor of survival must include these features.

The survival hypothesis posits that human consciousness can persist somehow after biological death, as opposed to the extinction (or materialist) hypothesis that assumes biological death brings a permanent end to consciousness. Martin and Augustine’s (2015) anthology gives well-informed and thorough descriptions of the presumed materialistic workings of consciousness and its implications for survival. Their text becomes quite technical, but McCormick (2015, p. 54) clarified the skeptical perspective with a simple argument:

1. Human cognitive abilities, memories, personalities, thoughts, emotions, conscious awareness, and self-awareness (in short, the features that we attribute to the personal soul) are dependent upon the brain to occur/exist.
2. The brain does not survive the death of the body.
3. Therefore, the personal soul does not survive the death of the body.

However, not all authorities in consciousness studies

are certain of these tenets. Some researchers have pursued a comprehensive theory of consciousness that explains the traditional mind/body conundrum or what is now popularly called the “hard problem of consciousness.” This refers to the vexing challenge of understanding how matter (i.e., the human brain or any biological system) is capable of subjective experience (i.e., phenomenal consciousness, or mental states/events with phenomenal qualities or qualia) (Chalmers, 1995; Goff, 2017; Kleiner, 2020). The purely rhetorical definitions of consciousness presented above fail to resolve this mystery, which might involve the complex roles of quantum mechanics (Hameroff & Penrose, 2014; Li et al., 2019; Penrose, 1989) or resonance and phase transitions (Hunt & Schooler, 2019; John, 2002; Melloni et al., 2007; Singer, 2001; Zeman, 2001). In fact, some authorities question whether consciousness is even a brain- or biological-based property at all (e.g., Kleiner & Tull, 2021); instead, it could be an emergent phenomenon extant with the universe as in ‘panpsychism’—the idea that the cosmos is alive or at least contains the seeds of aliveness or consciousness (Jawer, 2020).

But that is only the *local* version of the ‘hard problem of consciousness.’ It can be argued that science must also contend with what can be described as the *non-local* version of the hard problem. Here, we mean how consciousness sometimes seems to display non-locality by becoming “entangled” with seemingly independent physical systems, inorganic and organic alike. Non-locality is a physics phenomenon that involves ‘(spooky) action at a distance,’ i.e., the concept that an object can be affected without being physically touched by another object. In short, we may be dealing with the non-local interaction of objects that are separated in space or time (for a discussion, see Stapp, 2011). Researchers in consciousness studies have increasingly adopted Larry Dossey’s term ‘non-local mind’ (e.g., Dossey, 2014; Laszlo, 2008; Tressoldi & Storm, 2021; Walach, 2000) when discussing apparent psi effects from experimental research or outcomes from meta-analyses of past studies. Indeed, the journal *Explore: The Journal of Science & Healing* even devoted a special issue to this concept and its implications (2015, Volume 11, Issue 2).

To clarify, meta-analysis is a statistical approach that combines the results from multiple studies to increase power (over individual studies), improve estimates of the size of empirical effects, and to resolve uncertainty when reports disagree. Several meta-analyses have been published in both niche and mainstream journals documenting potentially non-local effects related to human consciousness (e.g., Bem, 2011; Bem & Honorton, 1994; Honorton et al., 1992; Mossbridge et al., 2012; Mossbridge & Radin, 2018; Sarraf et al., 2020; Schmidt, 2012; Storm & Tressoldi, 2017; Tressoldi & Storm, 2021). However, this litera-

ture is criticized on methodological and statistical grounds (e.g., Houran et al., 2018; Hyman, 1994; Rabeyron, 2020; Ritchie et al., 2012; Wagenmakers et al., 2011), as well as on conceptual grounds in the absence of empirical explanations that square the proposed phenomena against well-established scientific models (Houran et al., 2017, 2018). That said, some researchers are diligently striving to close this apparent gap (e.g., Marwaha & May, 2019; Sheehan & Cyrus, 2018; von Lucadou, 2011).

Working Assumption 2: Human Observation Is Reasonably Reliable

Our interpretation of the *Drake-S* Equation must conform to logical and empirical assumptions that are standard in the scientific community. The first of these is the textbook premise that human observation, though subject to error, is reasonably reliable (Morris & Maisto, 2005). By this, we mean that regardless of the object or event being observed, the process of perceiving and interpreting the event is relatively fixed (Chakravartty, 2017; Psillos, 2005; Votsis, 2015). To assert otherwise would cast the entire body of scientific knowledge into doubt, nullify people's everyday experience of reality, and trap humans within an extreme philosophy of existential relativism. This argument likewise includes paranormal experiences, which are merely one kind of stimulus available for observation. However, mainstream scientists tend not to equate paranormal experiences phenomenologically with other types of witnessed events. An obvious example of this prejudice is the trite phrase, 'extraordinary claims require extraordinary evidence' (see e.g., Deming, 2016; McMahan, 2020),

Of course, 'extraordinary claims require extraordinary evidence' merely follows what is ideologically acceptable (or possible) within the belief system evaluating the claimed event (Hill et al., 2018, 2019; McClenon, 1994). To our knowledge, there are no philosophical or empirical arguments that human perception of, say, an 'office building' is fundamentally or factually different from the perception of an 'apparition,' with the exception of the perceptual or attributional errors that we address in this essay. And note that the *rarity* of a particular phenomenon does not negate its reality, only the likelihood of its occurrence or detection as exemplified by the study of extremely rare events or 'black swans' (e.g., Balesdent et al., 2016; Desirée O, 2020; Taleb, 2007).

People immersed within their belief systems are often unable to recognize their biases due to social forces and the acceptance of norms provided from birth. This situation can lead to functional fixedness, or the inability to appreciate alternative functions, ideas, or concepts due to pre-existing embedded schemas. Worse still, it is well-

established that ideological beliefs or norms can have great power regardless of their validity (Merton, 1995). 'Popular makes correct' as the saying goes, and we have addressed the cultural biases *for* and *against* the paranormal in previous works (Drinkwater et al., 2019; Hill et al., 2018, 2019; Houran et al., 2020).

Mindful of the preceding, the quantitative exercise in this essay follows simple logic. We will examine the overall percentage of evidential survival-related phenomena that remains after mathematically adjusting for major sources of error. We contend that this 'purified' percentage of observations has *prima facie* evidential value as it inherently defies—if not outright contradicts—skeptical (materialist) interpretations of the core stimuli that were initially observed or experienced.

Working Assumption 3: Defining Suitable Data for Analysis

A classic issue in statistics is the 'reference class problem,' or deciding what class to use when calculating the probability applicable to particular cases. Any attempt to formulate a *Drake-S* Equation would ideally utilize the latest and most rigorous and comprehensive information, such as from meta-analyses and systematic literature reviews that retrieve, synthesize, and appraise existing knowledge on a particular topic (Moller & Myles, 2016). Of course, such a Herculean effort would require many months, if not years, to faithfully complete. We have thus chosen to develop a first approximation of a *Drake-S* Equation by sourcing data via scoping reviews of empirical studies using keyword searches of the Google Scholar, PsychInfo, and ResearchGate databases. We then visually inspected the resulting outputs for their relevance to the four-facet definition of consciousness noted earlier.

Such reviews are extremely useful for gaining broad perspectives on topics and are comparable to textbook chapters including sections on the etiology or epidemiology of subjects (Green et al., 2006). Our reviews were further guided by Baethge et al.'s (2019) standards for high-quality reviews, namely those containing explanations of (a) the importance of and aims of the review and (b) the literature search itself while (c) referencing and presenting the (d) evidence level and (e) relevant endpoint data. We thus conducted a series of scoping reviews to identify noteworthy studies on *Anomalous Effects* (AEs) that are interpreted as evidence for survival and *Known Confounds* (KCs) that might counter this data, especially targeting information on the presence and impact of the KCs in the context of the respective EAs. The idea was to source representative, peer-reviewed evidence for and against survival using literature mutually agreeable to the authors.

Empirical Findings Consistent with the Survival Hypothesis

Preliminaries

A relevant estimate to consider first is the incidence rate of experiences in the general population that directly references either non-local mind or survival. Surveys indicate that between 36% to 65.7% of the general population has had at least one ‘paranormal’ experience (Castro et al., 2014; Dagnall et al., 2016; Gallup & Newport, 1991; Hay & Morisy, 1978; Irwin & Watt, 2007; Ross & Joshi, 1992; Schmied-Knittel & Schetsche, 2005). Aggregating these rates over the last several decades gives a reasonable estimate of 46.74% of people reporting these occurrences. This sizable proportion of American and UK populations unquestionably establishes paranormal experiences as *social facts* (Hill et al., 2018, 2019).

Within the large rubric of the paranormal, five categories of observations are routinely cited in support of postmortem survival of consciousness (Cardeña et al., 2014, 2015; Irwin & Watt, 2007): (a) haunt-type episodes, (b) mental and physical mediumship (including possession), (c) near-death experiences, (d) reincarnation, and (e) anomalous experiences of veridicality and independent agency. Particularly, these anomalous experiences seem to suggest the existence of discarnate “identity, perception, sentience, and cognition.” We define these phenomena below, and while any of them might alone be sufficient to explore the likelihood of survival, all five categories are included here to establish the most precise probability via the collective weight of direct and conceptual replications within and across different subject areas.

Haunt and Poltergeist Episodes

From a phenomenological standpoint (Houran et al., 2019a, 2019b; Houran & Lange, 2001), *poltergeists* can be described as clusters of unusual ‘subjective (S) experiences’ (e.g., apparitions, sensed presences, hearing voices, and unusual somatic or emotional occurrences) and ‘objective (O) events’ (e.g., apparent object movements, malfunctioning electrical or mechanical equipment, and inexplicable percussive sounds like raps or knocks), which seemingly coalesce around certain people (for a recent discussion, see: Ventola et al., 2019). Similar *S/O* anomalies that tend to persist at specific locations are called *hauntings* (Gauld & Cornell, 1979/2017; Roll & Persinger, 2001). Parapsychologists typically differentiate *haunts* and *poltergeists* (e.g., Gauld & Cornell, 1979/2017; Roll & Persinger, 2001) or suggest that they involve a constellation of different phenomena (Cardeña et al., 2014; Houran & Lange, 1996).

Still, a firm distinction is problematic due to their over-

lapping characteristics (Houran et al., 2019a; Ventola et al., 2019) and a shared set of *S/O* anomalies that forms a single, probabilistic hierarchy (Houran et al., 2019b). Thus, a common phenomenon or set of mechanisms likely underlies both types of anomalies. The mystery obviously centers on what it might be. Skeptics contend that many episodes are readily explained as fraud or misinterpretations of ambiguous or unexpected events (Houran & Lange, 2001), whereas many parapsychologists argue that the best cases in this category involve some form of psychic energy emanating from living individuals (Roll & Persinger, 2001) or the actions of discarnate entities (Betty, 1984; Maher, 2015; Roll, 2006; Stevenson, 1972; Storm & Tilley, 2020).

Prevalence rates for haunt-type episodes in the general population are elusive. However, Dagnall et al. (2015) reported hauntings at 14%, whereas other sources give substantially higher estimates specifically for haunts versus poltergeists. To this point, Laythe and Owen (2012) found that 60% of their survey respondents reported some type of haunting experience, and Laythe et al. (2018) similarly reported that 51% of survey participants reported haunt phenomena. More recently, in the development of the Survey of Strange Events questionnaire (Houran et al. 2019b), approximately 83% of respondents who were recruited in a quasi-random manner reported haunt experiences across varying contexts. We estimate, therefore, that haunt-type episodes are a relatively frequent occurrence, calculating an average of these sources at 52% of the population. While this rate is higher than the overall estimates for general paranormal experience, it must be noted that estimates vary widely based on the specific details or operationalizations used across the pertinent studies.

Mental and Physical Mediumship

Gauld (1982a) described mental mediumship as communication with deceased persons that is experienced “through interior vision or hearing, or through the spirits taking over and controlling their bodies or parts thereof, especially . . . the parts required for speech and writing” (p. 4). Several authors advocate a parapsychological interpretation of these perceptions, since mediums sometimes seemingly provide specific or veridical information under blinded conditions (e.g., Beischel et al., 2015; Beischel & Schwartz, 2007; Jensen & Cardeña, 2009; Kelly & Arcangel, 2011; Roy & Robertson, 2004). Conversely, other researchers have noted the controversial methods and mixed results of research in this domain (Bastos et al., 2015; O’Keeffe & Wiseman, 2005), as well as the apparent dissociative nature of these particular experiences (e.g., Maraldi, 2014; Maraldi & Krippner, 2013; Ross & Joshi, 1992; Seligman, 2005; Wahbeh & Radin, 2017).

Physical mediumship, on the other hand, involves “paranormal physical events in the medium’s vicinity” (Gauld, 1982b, p. 4). This can include disembodied voices, raps on walls or tables, and the materialization or displacement of objects (Bocuzzi, 2017). Physical mediumship flourished in the mid-nineteenth century in the United States during the Spiritualist movement. It was supported by the belief that personal consciousness persisted after death and that gifted mediums had a direct connection to the deceased (Braude, 2014). Research into mediumship over the last century has waned due to an impasse reached by the academic community about whether the alleged phenomena are attributable to deceased agents or living agents (Cunningham, 2012; Rock, et al., 2021). While physical mediumship has been on the decline throughout the 20th century, it is still practiced and researched as seen with the popular SCOLE (Solomon & Solomon, 2006) and SORRAT (Richards, 1982) ‘sitter-groups.’ Web searches also reveal that there are many active physical mediums with devoted supporters.

However, physical mediumship has a reputation for being rife with fraud, as well as vulnerable to strong suggestion effects that induce people to perceive events that did not objectively happen (e.g., Wiseman et al., 2003a; Wiseman & Greening, 2005). The occurrence or circumstances of sitter-group phenomena has correspondingly been criticized (Bierman, 1981; Grattan-Guinness, 1999; Hansen & Broughton, 1991; Wiseman et al, 1992). Furthermore, most mediums avoid producing their phenomena under controlled conditions, or those that do agree to controls only perform in situations that can be easily manipulated (Braude, 2014). Murdie (2015) noted that the number of mediums willing to be subjected to rigorous controls has declined since 1945. This coincides with the availability of infrared photography that allows observers to document sittings in the dark (see e.g., Bocuzzi, 2017). This supposed need for darkness at séances immediately incriminates a medium’s motives and activities. Physical mediums claim the reason for darkness during sittings is that their “spirit controls” communicate to them that it is a requirement (Keen, et al., 2011; Nahm, 2014).

There are important exceptions, though. Modern medium Kai Mugge allowed for a strip search and continuous hands-on control while phenomena were occurring at a distance. Anomalous events spanned raps and knocks, object movement, and table levitation (Braude, 2014; Nahm, 2014). Anthropologist Jack Hunter (2011) similarly documented his experiences as a sitter at séances conducted at Bristol Spirit Lodge, a center focused on the development of trance and physical mediumship. He recalled one séance where he witnessed strange lights, mists, and a change in the physical appearance of the medium. After the séance,

he listened to other sitters talking about how they saw the medium ‘transform’ into a bald Chinese man. This was exactly what Hunter himself experienced. Since he did not divulge his own perceptions, he pondered how the entire sitter-group witnessed this same extraordinary event (assuming fraud was not at play).

Population prevalence rates for mediumship-related experiences are severely lacking in the scientific literature. The only population-level estimate we deemed appropriate was Gallup and Newport’s (1991) finding that put ‘trance channeling’ at 2% of the overall population.

Near-Death Experiences (NDEs)

It is well-established that some adults and children suddenly faced with the prospect of death experience a distinctive state in which their consciousness is apparently unbounded by the physical body or earthly environs (e.g., Greyson, 2001; Greyson et al., 2009; Ring, 1980). Termed an NDE, this state is defined as a transcendental experience precipitated by a confrontation with death; it does not seem to be adequately explained as the phenomenology of a dying or medically-compromised body (for a review, see Greyson et al., 2009). NDEs are among the most dramatic of anomalous experiences (Holden et al., 2009), with many percipients interpreting them partly or wholly as ‘mystical, spiritual or paranormal’ occurrences (Greyson, 2021). To be sure, the type of brain activity necessary for complex conscious experience is assumed to be abolished during the psychophysiological conditions in which NDEs are commonly reported (Greyson et al., 2009; Parnia et al., 2014).

Other findings further underscore the anomalous character of some NDEs. Notably, Lange et al. (2004) found that for those with ‘true’ NDEs (versus “false-positives or false-negatives”), Greyson’s (1983, 1985, 1990) NDE Scale satisfactorily conformed to a probabilistic Rasch (1960/1980) model. With increasing intensity, these NDEs reflected peace, joy, and harmony, followed by mystical or religious insight, while the most intense NDEs referenced an awareness of things occurring in a different place or time. Their perceptions were also consistent across the individuals’ gender, current age, age at time of NDE, and latency and intensity of the NDE, thus characterizing NDEs as core experiences whose meaning is unaffected by external variables. ‘True’ NDEs are likewise quantitatively detectable within the verbal reports of witnesses (Lange et al., 2015).

However, false-positives and false-negatives are known to arise when assessing NDEs (Greyson, 1985, 1990; Lange et al., 2004). NDE-type experiences also occur in a variety of situations, ranging from cardiac arrest and brain dysfunction to extreme fear, with no physical alteration in

brain function. Spontaneous NDEs also can occur during full consciousness and without brain pathology; such occurrences are more akin to transpersonal or mystical experiences. In other words, severe brain damage or complete loss of vital signs are *not* prerequisites for NDEs. These patterns suggest to skeptical researchers that NDEs are not paranormal perceptions indicative of postmortem survival but instead are natural events that are somehow generated by human physiology (for discussions, see: Blackmore, 2012; Facco & Agrillo, 2012; Vanhaudenhuyse et al., 2009).

The prevalence of 'true' NDEs has not been investigated using large-scale representative surveys, and the few studies that have estimated a general frequency often report different results. Ring (1980) provided a large estimate positing that one-half of all severe medical traumas would report an NDE; however, other authors provide more conservative figures. Research by Greyson (1998) and van Lommel et al. (2001) offer estimates of 10 to 15%, whereas Locke and Schontz (1983) and Parnia et al. (2001) each assessed the rate of an NDE with physical trauma patients at 6 to 7%. More recently, Dagnall et al. (2016) found that 9% of survey respondents reported an NDE within their larger sample of 42% who reported general paranormal experiences. We conservatively aggregated the percentages of NDEs by first removing Ring (1980), and thereby obtained the average rate of 9.4%.

Reincarnation

The concept of reincarnation—or rebirth of the soul—is ancient, nearly universal, and ostensibly backed by a wealth of empirical research (e.g., Kelly, 2013; Matlock, 2019; Pasricha, 2008, 2019; Playfair, 2006; Shroder, 1999). This evidence often centers on recalled memories of past lives (Dunlap, 2007). Perhaps the largest body of research was conducted by Ian Stevenson and his colleagues, who studied more than 2,000 cases of children who claimed to remember past lives (for reviews and discussions, see: Stevenson, 1997, 2001, 2003). Numerous replications have supported his findings (e.g., Haraldsson, 1995; Keil, 1996; Mills, 1989; Mills & Lynn, 2000; Tucker, 2005). This work continues to be conducted by James Tucker at the University of Virginia. As of this essay, the number of aggregate cases was between 2,700 and 2,900 with the number of "solved" (i.e., verified) cases at about 1,500. A case is considered 'solved' when a child's statements, behaviors, or memories strongly match the lived experiences of the deceased person who the child claims to be. This is determined through meticulous documentation of the child's statements and determining whether they align with the facts or testimonies of those who knew or lived with the deceased person.

Stevenson and many fellow researchers (e.g., Haraldsson, 2008; Keil & Tucker, 2000, 2005; Ohkado, 2017; Olesen, 2020; Pasricha, 2019; Pasricha, et al., 2005; Stevenson, 1990, 1997; Stevenson & Haraldsson, 2003) suggest that reincarnation is a viable explanation for such cases given: (a) the large number of witnesses and the lack of apparent motivation and opportunity for fraud (due to the vetting process), make the hypothesis of fraud extremely unlikely; (b) the large amount of information possessed by the child that is unlikely to have been obtained from his/her family (due to its being rarely if ever divulged) or from the family of the deceased person whose life is ostensibly being remembered; (c) demonstration of similar personality characteristics and skills not learned in the child's current life; and (d) the correspondence between birthmarks or birth deformities of the child and the location or shape of wounds or other marks found on the deceased person.

Nonetheless, some critics (e.g., Angel, 2015; Edwards, 1997; Wilson, 1981) have raised serious concerns about Stevenson's work and that of other reincarnation researchers. This includes charges of sloppy methodology and control procedures that allow personal biases to affect the outcomes, and too readily dismissing the possibility of fraud on the part of the children or their parents making these claims. Additionally, Wilson (1981) emphasized that inadequate information is presented in the studies about vital informants, pointing out that some of Stevenson's investigations used interviewers (including Stevenson) who did not speak the language of the interviewees. This might have led to misinterpretation that further supported personal biases. Skeptics also argue that most of Stevenson's cases occurred in cultures supportive of reincarnation, which could have affected testimony as the children and parents had a traditional cultural framework through which to interpret events (Dunlap, 2007; White, 2016).

The reincarnation hypothesis has not, to our knowledge, been assessed for overall prevalence with the exception of Barker and Pasricha (1979), who tentatively estimated out of five hundred (.002) as a general rate of occurrence.

Veridical Anomalous Experiences

Two types of death-related experiences predominantly define this category, which seemingly involve discarnate (i.e., independent) agency or veridicality (i.e., an accurate or factual basis). First, survey research suggests that veridical apparitions might be more than merely hallucinations (e.g., Haraldsson, 2009) but could be related to an external event and hence meaningful to the percipient. In cases of this kind, people have a vision of someone they know, and they learn later that this person unexpectedly died at the

time of their vision or impression. In veridical hallucinations some information unknown to the percipient is apparently gathered in an inexplicable manner. Some veridical hallucinations are even collective, that is, they are allegedly witnessed by more than one person at the same time. Second, *after-death communications* (ADCs) are spiritual experiences that occur when a living person is contacted “directly and spontaneously” by a family member or friend who has died (e.g., Kamp et al., 2020; Woollacot et al., 2021). ADCs are described as direct experiences because no psychics, mediums, therapists, rituals, or devices are needed. ADCs are also said to be spontaneous, as the deceased who seemingly control the timing and manner of their contact.

We ignored research on sleep-related anomalies when estimating effect sizes for this evidence category, as these reports often reflect experiences of sleep paralysis that are misconstrued as encounters with anomalous beings or sentient forces (Hufford, 2001; Jalal, 2016; Jalal & Ramachandran, 2017). Veridical apparitions, on the other hand, are rather well documented though somewhat scarce. Palmer (1979) found that 17% of his southern U.S. survey respondents reported apparitional experiences, while Irwin (1985) reported a 20% rate in an Australian sample. Haraldsson et al. (1977) reported a 31% rate of seeing ‘the deceased’ in his study of northern Europeans. Ross and Joshi (1992) placed apparitional experiences at 11.8% when combining all spectral events, but Gallup and Newport (1991) only found a 9% rate. New research shows a 44.5% average for survey respondents reporting ADCs (Woollacot et al., 2021), although previous studies present lower numbers. Specifically, Persinger’s (1974) survey found that 32% of respondents acknowledged apparitional experiences, and Haraldsson (2009) reported a 27.5% averaged occurrence of “visitations of the dead.” These metrics agree with Cooper’s (n.d.) intriguing survey of funeral directors, which found a 32% occurrence of anomalous auditory or visual phenomena. More recent studies offer average incidence rates between 26% and 38% for the same types of perceptions (Laythe & Owen, 2012; Laythe et al., 2018). These estimates produce an overall aggregated percentage of 26.1%.

Empirical Confounds Undermining the Survival Hypothesis

Importantly, our approach relies on the principles of probability as well as an honest application of the scientific process. An inferential statistics model dictates that an alternative explanation (i.e., a cause other than ‘paranormality’) is not an ‘either/or’ proposition. That is, a viable skeptical explanation is not necessarily a comprehensive one that *can* or *does* apply to all cases under scrutiny.

Rather, it is more accurate to say that a viable explanation can account for a varying number of paranormal reports based on its scale or scope of influence. This statement is not controversial: It reflects the standard understanding of effects and effect sizes in inferential statistics. Per the scientific process, an alternative hypothesis is not formally disproven until and unless mainstream claims can fully account for the observed phenomenon.

Along these lines, there are six basic categories of KCs (recall that this stands for ‘known cofounds’) levied against spontaneous experiences or academic studies pertinent to the survival hypothesis (e.g., Houran & Lange, 2001; O’Keeffe & Wiseman, 2005; Martin & Augustine, 2015): (a) expectancy-suggestion effects, (b) environmental influences, (c) fraud, (d) measurement error, (e) mental illness, and (f) susceptibility factors, i.e., psychological variables that can predispose healthy individuals to perceptual errors or misinterpretations of non-paranormal events. In other words, these issues can individually or collectively undermine the statistical reliability or validity of survival-related studies and hence obfuscate clear interpretations of their relevance or meaning. We, the authors, agreed that these KCs are often viable explanations for many witness reports when considered theoretically or on a per case basis.

In clustering and aggregating findings on these KCs, we treated all publications as one observation or outcome regardless of whether the report was a meta-analysis. However, meta-analyses are clearly indicated within the respective Tables by the presence of multiple studies. We reiterate that it is preferable to have meta-analyses or systematic literature reviews for all KC categories, but, as we demonstrate, research in many of these domains offers insufficient data for a meta-analysis. Thus, it would be disingenuous to weight these papers by the number of studies—as opposed to the aggregates of findings *per* published study (including meta-analysis)—since the averaged weight of additional single studies covering related phenomena that we cluster within our KC categories would be consistently less than the bulk of studies within one single meta-analysis. We repeat our assertion that percentage or variance estimates derived from a meta-analysis provide an inherently better estimate than individual studies.

Belief/ Expectancy/ Contagion Effects

The prevalence and impact of paranormal belief has a long history in social science research (e.g., Houran et al., 2002a; Kumar & Pekala, 2001; Lange & Houran, 2000; Laythe et al., 2018; Laythe & Owen, 2012; for a review, see Irwin, 2009), as well as in laboratory or fieldwork studies in parapsychology (Dagnall et al., 2015; Houran, 2002; Houran et al., 2002b; Irwin, 2015; Wiseman et al., 2002). A

wealth of studies consistently demonstrates that such beliefs preferentially influence the interpretation of certain events, sometimes even overriding people's natural physiological reactions to otherwise calm and peaceful settings (Escolà-Gascón & Houran, 2021). These social interpretation effects are generally referred to as *confirmation bias* (Hergovich et al., 2010; Klayman & Ha, 1987; Nickerson, 1998; Palmer et al., 2012) and *belief perseverance* (Ross & Anderson, 1982; Ross et al., 1975). Partiality is not limited to paranormal believers, however, as avid skeptics often incorrectly assume that confirmation bias only applies to groups with which they disagree. Instead, it is a pervasive phenomenon within the general population.

Equally important is the role of suggestion or expectancy as a result of paranormal beliefs, which can initiate or exacerbate interpretations of events as anomalous. Consistent with classic studies on conformity and peer pressure (Asch, 1956), *psychological contagion* involves the unconscious transmission of ideas, perceptions, or behaviors from person to person, from one person to a group, or from a group to a person or group of people (e.g., Freedman et al., 1980, Gump & Kulik, 1997, Lorber et al., 2007). For example, research shows that emotions often transfer across individuals (Bruder et al., 2012; Howard & Gengler, 2001; Levy, 2001; Neumann & Strack, 2000; Parkinson & Simons, 2012). Contagion can induce differing goals and produce changes in behavior (Leander & Shah 2013), including perceptions of the paranormal (Drinkwater et al., 2019; Lange & Houran, 2001). Laboratory studies have similarly demonstrated physical or somatic transference effects (Lorber et al., 2007). Although the mechanisms are poorly understood, it certainly seems that contagion can produce extreme effects as with outbreaks of mass psychogenic illness (e.g., Powell et al. 2007; Radford & Bartholomew 2001; Ryan & Morrow, 1992).

Finally, persuasion itself is relevant to this category. In fact, contagion could be redefined as either unintentional or passive marketing if viewed predominantly as an action that changes the perspectives and goals of others (Berger, 2013). The Elaboration Likelihood Model (Cacioppo & Petty, 1984; Petty & Cacioppo, 1986) has consistently shown that peripheral cues—e.g., environmental factors or other features independent of the content of a persuasive argument—can alter people's beliefs, experiences, and mood. Case in point: Laythe et al. (2017) found a statistically significant and moderately strong correlation ($r = .61$) between one person's verbal report of experiencing séance phenomena and the other group members reporting anomalous experiences within a five-second window in a well-controlled environment.

To compute an aggregate effect size for this category, we considered several meta-analyses in the contagion and

persuasion literature, as well as single studies of paranormal belief relative to paranormal experience. We made the ultra-conservative (and likely incorrect) assumption that paranormal experience is wholly explained by paranormal belief, for the sake of modeling all paranormal experiences as outcomes of bias. We combined all these studies to approximate the aggregate variance accounted by expectancy-suggestion effects as a function of the transferral of paranormal belief to others and the interpretation of environments as evidencing paranormal activity. We again note for this particular category that we make an explicit assumption in favor of skepticism with paranormal belief, i.e. that such belief leads to misinterpreting a given experience as paranormal. While this assumption may not be warranted, it serves the goal of an overall conservative estimate of survival-related phenomena.

Table 1 provides relevant details on the studies cited above; their effect sizes are shown as percentages. We correspondingly obtained an estimated incidence rate of 9.7% for the general population.

Environmental Factors

Environmental psychology is an interdisciplinary field that focuses on the interplay between individuals and their surroundings. It examines the way in which natural and built environments can unwittingly shape people's perceptions, attitudes, or behaviors (Allen & MacComber, 2020; Donohoe, 2014; Goldhagen, 2017). We recently published two thorough reviews of environmental factors related to haunt and poltergeist episodes, which revealed an urgent need for additional research due to the paucity of highly relevant studies (Dagnall et al., 2020; Jawer et al., 2020). These reviews provide the first authoritative appraisal of physical factors relative to survival-related experiences such as haunts. These include 'embedded cues, lighting levels, air quality, temperature, infrasound, and electromagnetic fields.' Gestalt-type effects also can contribute, such as "affordance, atmosphere, ambiguity and threat anticipatory processes, immersion and presence, legibility, and perceptible memory and associations." These latter variables help to form people's holistic impressions of natural or built environments.

Table 2 summarizes much of the available data on this KC, but out of all of the estimates in our *Drake-S* Equation this particular error factor requires new research to gain more robust estimates. The lack of usable data (due to low sample sizes) from published studies has forced us to rely on a few key studies that contain estimates judged to be generalizable. These studies—the best empirical research available at this time—give an estimated incidence rate of 7.8% for the general population.

TABLE 1. Estimated Effect of Expectancy/Suggestion Aggregated from Representative Studies

Source	Variable	Studies	Estimate*
Kierein & Gold (2000)	Persuasion	13	0.141
Clarkson et al. (2020)	Contagion	25	0.053
Wilson & Sherrell (1993)	Persuasion	114	0.045
Hullett (2005)	Persuasion	14	0.122
Shen et al. (2015)	Persuasion	25	0.004
Dagnall et al. (2016)	Paranormal Belief	1	0.09
Laythe et al. (2018)	Paranormal Belief	1	0.031
Gallagher et al. (1994)	Paranormal Belief	1	0.21
Laythe & Owen (2012)	Paranormal Belief	1	0.18
AGGREGATE			0.09733

TABLE 2. Estimated Effect of Environmental Factors Aggregated from Representative Studies

Source	Variable	Studies	Estimate*
Ding et al. (2016)	Air Quality	1	0.05
Wiseman et al. (2002, 2003b)	Air Quality	1	0.108
Wiseman et al. (2002, 2003b)	Lighting Levels	1	0.33
Braithwaite (2008)	Electromagnetic Fields	1	0.04
Wiseman et al. (2002, 2003b)	Electromagnetic Fields	1	0.013
French et al. (2009)	Electromagnetic Fields	1	0.002
French et al. (2009)	Infrasound	1	0.0025
AGGREGATE			0.07793

Fraud

Deliberate deceit—lying or hoaxing by experiencers or researchers—is a feasible explanation for survival-related claims, particularly if social or financial benefits are involved (for a review of general fraud motivations, see Kakati & Goswami, 2019). Braude (2014) nicely summarized the issue of fraud potentially mixed with ostensible mediumship phenomena. Cox (1961) and Roll (1977) likewise discussed ‘imitative fraud’ by people involved in putative poltergeist cases. Other, more skeptical investigators (e.g., Nickell, 2001) assume that all survival-related experiences are directly (i.e., fraud), or indirectly (e.g., through delusion or ignorance) a function of KCs. Yet, for all the emphasis that some authors place on fraud, there seems to be a critical lack of empirical data on the topic. This leads us to question whether the general incidence rate of fraud in society can be used as a reasonable estimate of deliberate deceit in survival-related accounts.

We say ‘yes,’ as two primary motivations recur for paranormal fraud. First, and perhaps most importantly, fraud requires effort toward a specific gain. The sensationalized 1975 “Amityville Horror” haunt case is a cautionary tale in this respect (Kaplan & Kaplan, 1995). Second, the gain is typically money or some form of social prestige resulting from money. Among our investigations of alleged haunts, we have twice debunked claims related to the reported occurrences (Laythe & Houran, 2019; Laythe & Owen, 2013). Both instances involved “historical fraud” by the proprietors to market the locations to paying tourists and investigators. Even so, we still documented anomalous S/O phenomena at both locations and under quasi-controlled conditions.

It is important to understand that psychics and spiritualists are consistently unregulated, which permits a greater opportunity for fraud. Laws against fraud exist in every US state, but few actually have statutes addressing scams by professional psychics or kindred practitioners. It is a vexing challenge to regulate an ‘industry’ that can charge hefty fees for services but calls itself ‘supernatural’ and thus beyond scientific understanding—and while having no educational requirements for practitioners. Some psychics claim that they perform religious activities and that their earnings should be treated similarly to donations made to other faith-based organizations. In any case, it seems reasonable to apply findings from generalized fraud research to paranormal-related claims or events.

To determine a baseline of fraud, we relied on governmental fraud analyses in Europe (Button et al., 2009; Ipsos, 2020), meta-analyses of experimental studies on lying

(Gerlach et al., 2019), a large sample study on the frequency of lying within normal populations (Serota et al., 2010), and smaller meta-analyses on fraudulent behavior (Burnes et al, 2017; George, 2016). Additionally, we reviewed Roll’s (1976, 1977) examination of documented or suspected fraud in poltergeist cases. As shown in Table 3, we derived an aggregated estimate of 20% (or approximately 1/5 of the population) for lying, general fraud, and deliberate deceit in paranormal-related claims.

Measurement Error

Social scientists, ironically via the scientific process itself, have shown that human perception is often incomplete or inaccurate. As such, both observation and measurement within the scientific process are subject to distortion due to perceptual errors, experimenter and observer biases, and the inherent imprecision of scientific instrumentation to measure various physical and psychological variables. The issue becomes even more challenging given the inaccuracies across our five senses in registering changes in light, weight, decibels of sound, degrees of smell, and intensity of taste (e.g., Stern & Johnson, 2010). Furthermore, the sensitivity or accuracy of our senses (including proprioception, i.e., self-movement and body position) varies based on both biological and psychological processes. These are not radical concepts—they are all standard reading within college-level textbooks in social science (Rosenthal & Fode, 1963; Stern & Johnson, 2010; Stevens & Marks, 1999).

Measurement error is infrequently reported in quantitative studies and often not properly addressed in research reports on standardized questionnaires. However, recent work has increasingly applied leading-edge Modern Test Theory (MTT) methods to create more reliable and valid survey and assessment tools in anomalistic psychology and parapsychology (cf. Lange, 2017; Lange et al., 2019b). We have leveraged this body of psychometric research to estimate measurement error in paranormal-related contexts. We analyzed eight MTT-based measures, taking the average for the standard error of each item within each measure. The aggregated standard error for each MTT-based measure is displayed in Table 4. These eight sources represent an average measurement error rate of 6.7%. This will serve as the initial estimate for this KC in our *Drake-S* Equation. It should be noted that measurement error can work for or against the accuracy of the measure being employed. However, we deploy this particular estimate with the assumption that measurement error always works *against* the premise of survival.

TABLE 3. Estimated Effect of Fraud Aggregated from Representative Studies

Source	Variable	Studies	Estimate*
Gerlach et al. (2019)	Lying	565	0.3225
Serota et al. (2010)	Lying	1	0.4
Burnes et al. (2017)	Fraud	12	0.011
Button et al. (2009)	Fraud	1	0.005
George (2016)	Fraud	21	0.02
Ipsos (2020)	Fraud	1	0.56
Roll (1976) — Review	Poltergeist Fraud	1	0.15
Roll (1976) — Personal Cases	Poltergeist Fraud	1	0.2
Roll (1977)	Poltergeist Fraud	1	0.163
AGGREGATE			0.2035

TABLE 4. Estimated Effect of Measurement Error Aggregated from Representative Studies

Source	Measure	Studies	Estimate*
Lange et al. (2000b)	Revised Transliminality Scale	1	0.037
Lange et al. (2004)	NDE-Scale	1	0.105
Houran et al. (2022)	Enchantment-Adjective Checklist	1	0.066
Houran et al. (2019b)	Survey of Strange Events	1	0.038
Lange et al. (2019b)	Survey of Anomalous Experiences	1	0.106
Lange et al. (2000a)	Revised Paranormal Belief Scale	1	0.04
Lange & Thalbourne (2002)	Australian Sheep Goat Scale	1	0.05
Lange & Thalbourne (2007)	Mystical Experience Scale	1	0.095
AGGREGATE			0.06713



Mental Illness

According to the continuum model of psychosis, anomalous perceptions fluctuate within a quantitative and qualitative symptomatic gradient applicable to the field of psychotic disorders (e.g., Capra et al., 2013; Chapman & Chapman, 1980; Kwapil et al., 2020). The most severe or dysfunctional perceptions are present in schizophrenics or individuals with any related psychiatric disorder (Wright et al., 2018). In contrast, less intense anomalous perceptions would be present in healthy people from the general population (van Os et al., 2009). But having attenuated anomalous perceptions implies a risk for mental health, given that they may predispose the individual to future psychotic conditions (Shapiro et al., 2019).

As we previously argued (Laythe et al., 2021), hallucinations are rarely, if ever, a feature of mental illness without substantial and persistent cognitive and affective symptoms that also often cripple the person's life (American Psychiatric Association, 2015). The exception to this rule is Delusional Disorder, which affects an exceedingly small sample of the population (see Table 5) and manifests with no cognitive or affective symptoms but otherwise

causes individuals to believe that they are seeing or hearing things that are culturally taboo. Conversely, all other psychotic disorders (which also involve hallucinations or delusions) affect a relatively small percentage of the population, well below the incidence rate of paranormal experiences in general (e.g., Laythe et al., 2021).

Table 5 shows estimates from the *DSM-5* (American Psychiatric Association, 2015) for all psychotic disorders that contain features of delusion and hallucination. Schizotypal Personality Disorder represents the largest percentage in the population (i.e., 3.9%), whereas Delusional Disorder has the smallest estimated occurrence at .002%. Notably, hallucination is not consistently present within Schizotypal Personality Disorder and often is an extreme version of this personality disorder. Nonetheless, to create a conservative error estimate of this known confounder, we summed (as opposed to averaging) the overall prevalence rates of these disorders to obtain an estimate of the probability of mental illness as a viable explanation for survival- or paranormal-type encounters.

We emphasize the descriptor 'conservative' in this case, as we used the prevalence rates for diagnosis of Schizotypal Personality Disorder itself versus the preva-

TABLE 5. Estimated Effect of Mental Illness from the *DSM-5* (APA, 2015)

Mental Disorders with Hallucinations	Percent Prevalence
Schizotypal Personality Disorder	3.9
Delusional Disorder	0.002
Brief Psychotic Disorder	Overlapped with other diagnoses
Schizophreniform Disorder	0.007
Schizophrenia	0.007
Schizoaffective Disorder	0.003
Substance Induced Psychotic Disorder	Overlapped with other diagnoses
Psychotic Disorder Due to Another Medical Condition	0.0054
Bipolar I Disorder with Psychotic Features	0.006
Depressive Disorder with Psychotic Features	0.009
SUM TOTAL	3.9394

lence within the disorder for hallucinatory tendencies. However, we did include the prevalence rates for bipolar and depressive disorder with psychotic features. We emphasize that for a conservative estimate we assume hallucinatory symptomology within *all* of these summed disorders, though in actuality hallucinations are not necessarily present within some of these diagnoses. As such, the total prevalence of mental illness equates to approximately 4% of the population. Given our conservative parameters, we thus assume that mental illness is not necessarily a factor within the population of those who report paranormal experiences.

Susceptibility to Perceptual or Cognitive Aberrations and Errors

Anomalous perceptions are clinically defined as perceptual disturbances that are present in people with and without psychiatric histories (Bell et al., 2006; Davies et al., 2017; Shapiro et al., 2019). Thus, the terms *psychotic-like* experiences and *anomalous* experiences are often used interchangeably (Brett et al., 2013). But some authors push to differentiate anomalous/parapsychological experiences from the disease model of mental illness (for a discussion, see Johnson & Friedman, 2008). To be sure, several conceptual frameworks other than the psychosis continuum model might more appropriately describe general susceptibilities to perceptual or cognitive aberrations. Among the most popular alternatives in the literature are (a) *dissociative tendencies* (Ross & Joshi, 1992), (b) *mental boundaries construct* (Hartmann, 1991), (c) *sensory-processing sensitivity* or *SPS* (Aron & Aron, 1997), and (d) *temporal lobe lability* (Persinger & Makarec, 1993). This latter concept has been argued to have particular merit relative to some survival-related experiences (Persinger, 1983; Persinger & Koren, 2001).

Arguably these four frameworks can be subsumed within the perceptual-personality variable of *transliminality*, or a “hypersensitivity to psychological material originating in (a) the unconscious, and/or (b) the external environment” (Thalbourne & Maltby, 2008, p. 1618). Basically, this is a refinement and extension of the Mental Boundaries construct and its proposed continuum within the general population along which normal and extraordinary forms of perception and cognition may be mapped (for overviews, see: Evans et al., 2019; Lange et al., 2019a). This might work either by looser neurological gating or hyper-connectivity among brain areas. While the exact mechanism(s) are un-

certain, research suggests that the onset or outcomes of transliminal perceptions can be exacerbated by poor emotion regulation (e.g., Aron & Aron, 1997) or a low “analytic cognitive style,” i.e., the willingness or disposition to critically evaluate outputs from intuitive processing and engage in effortful analytic processing (e.g., Ross et al., 2017).

In order to derive estimates that remain pro-skeptical, we used prevalence rates for *DSM-5* somatoform disorders which include Somatic Symptom Disorder, Conversion Disorder, and Factitious Disorder, but not Illness Anxiety Disorder as this represents anxiety about a legitimate medical diagnosis. The other somatoform disorders considered here can produce psychosomatic effects, with the conservative assumption that all diagnoses of these disorders will produce such complaints. We also included (a) information on transliminality and putative psi outcomes under the conservative assumption that transliminality alone accounts for paranormal experiences as perceptual aberrations or cognitive errors, and (b) data on Aron and Aron’s (1997) SPS measure, especially relative to anomalous experiences and neuroticism and similar sub-clinical measures of mental illness or distress, with the conservative assumption that these measures are equivalent (Ahadi & Basharpour, 2010; Lionetti et al. 2019; Smolewska et al., 2006; Takahashi et al., 2020; Vander Elst et al., 2019). Research on SPS and paranormal belief/experience is highly limited, and we only know of one moderately strong correlation ($r = .50$), as reported by Williams et al. (2021).

For the sake of conservatism, however, we have calculated this KC category by departing from some statistical rules and knowingly adopting a pair of erroneous assumptions. Our first model assumes that (a) paranormal belief and paranormal experience are perfectly correlated, and that all such experience is a product of belief alone (a likely false assumption), and (b) all forms of mental illness and distress, including neuroticism, are equivalent, and serve as direct measures of aberrations or errors misattributed as paranormal experience (also a probably false assumption). In other words, neuroticism is equal to paranormal belief, which is equal to paranormal experience, etc.—a highly presumptive model that stipulates the correlation between each of these variables is ‘1.’ To these we add findings with transliminality and psi, again assuming that all psi effects are transliminal perceptions, as well as a direct relationship between paranormal experience and transliminality (cf. Thalbourne & Houran, 2003; Thalbourne & Storm, 2012; Ventola et al., 2019). This highly conservative model yields a final estimate of 13.4% (see Table 6).

TABLE 6. Estimated Effect of Susceptibility to Aberrations and Errors Aggregated from Representative Studies

Source	Variable	Studies	Estimate*
DSM-5: somatoform disorders	Sensitivity	*	0.08
Ventola et al. (2019)	Transliminality	19	0.017
Laythe et al. (2018)	Transliminality	1	0.16
Carr et al. (2021)	Sensory Processing Sen.	1	0.06
Lionetti et al. (2019)	Sensory Processing Sen.	1	0.13
Ahadi & Basharpour (2010)	Sensory Processing Sen..	1	0.28
Smolewska et al. (2006)	Sensory Processing Sen.	1	0.2
Vander Elst et al. (2019)	Sensory Processing Sen.	1	0.041
Williams et al. (2021)	Sensory Processing Sen.	1	0.25
Takahashi et al., (2020)	Sensory Processing Sen.	1	0.124
AGGREGATE			0.1342

Synthesizing the Scoping Reviews via the *Drake-S* Equation

Background and Rationale

Proposed by astronomer and astrophysicist Frank Drake in 1961, the Drake Equation is a probabilistic argument used to estimate the number of active and communicative extraterrestrial civilizations in our galaxy. It was not intended to yield a precise number but to serve as an approximation that would stimulate debate at the first scientific meeting on the search for extraterrestrial intelligence (SETI) (see, e.g., Billings, 2013). This formula identified the main factors that must be considered in any assessment of the likelihood of sufficiently advanced alien life (SETI League, 2002). Criticisms of the Drake Equation have focused less on the equation itself and more on the estimated values for several of its variables being highly speculative; the combined multiplicative effect is that the uncertainty associated with any derived value is so large that the equation cannot be used to draw firm conclusions. Putting aside its limitations, we settled on the Drake Equation as a useful mode for our adversarial collaboration because its format can easily be modified to account for both assumed evidential effects and likely countervailing variables in the context of postmortem survival of consciousness.

Sudduth (2016) reviewed various arguments for survival, some of these being probabilistic and grounded in Bayes Theorem (cf. Crichton, 2003; McMahon, 2020). However, our approach to the survival question differs in important ways from the typical logic- or philosophy- driven arguments (e.g., Braude, 2009). A careful and rational critique of arguments for and against survival has substantial value, but there is a major difference between the analysis of *epistemic probability* (the theoretical estimation of one probability given another probability, see: Sudduth, 2016, p. 6.) versus *factual probability* (the calculation of actual estimates of variables in order to reach a predictive mathematical conclusion). Our adversarial collaboration lies firmly in the latter camp and, while not minimizing the former is meant as an initial pragmatic framework based on the best probabilistic estimates we can obtain. Of course, our approach to practical statistical estimates of postmortem survival cannot be completely independent of theoretical probability arguments. Indeed, the material contained in this essay can be re-purposed as an empirical approach to reliably quantify a posterior probability within a Bayesian framework. Or, at least as a means to reliably quantify a posterior probability of consciousness surviving based in actual empirical estimates as opposed to logical argument alone.

Technical Approach

Our proposed *Drake-S* Equation essentially adds the ‘effect sizes’ associated with the five categories of survival evidence (the AEs) and subsequently reduces this cumulative effect using the estimated influence of confounds (the KCs). This approach is based on the sound assumption that a paranormal experience is an *interactionist effect*, where a person perceives and subsequently interprets a phenomenon, and is thus subject to psychological, environmental, and trait-related effects (O’Keeffe et al., 2019; Lange et al., 2020; Laythe et al., 2021). For simplicity, we will use ‘paranormal experiences’ interchangeably with ‘survival-related phenomena’ in our subsequent descriptions.

Ultimately, the ‘purified’ probability of a genuine paranormal experience (P_p) is the probability of any given paranormal experience (P_R) minus the additive effects of error or alternate causes. For our formula, we mathematically defined alternate causes by taking the maximum covariance (as r^2) for any given alternative explanations via meta-analysis or an aggregate series of empirical findings, placed within the appropriate section of Error (E_N), then subsequently subtracted to each raw probability of P_R . Where population or sample percentages are available, we use the percentage provided. As such, the error terms of this model represent *either* the maximum covariance estimate or the percentage of occurrence of the particular type of error in the population based on the best empirical estimates available.

This yields the simplified equation:

$$P_p = (P_R * [1 - \sum E_N]) \quad (1.1)$$

which represents an adjustment of P_R from deriving the remaining percentage of P_R by subtracting all error covariance from one and multiplying, which provides the remaining percentage of P_R theoretically pure from the covariance of the proposed error effects (P_p).

E_N for our purposes represents six broad factors applied as alternative explanations for paranormal experience:

- E_M = Measurement Error
- E_E = General Expectancy Effects (Contagion, Memory, Persuasion)
- E_V = Environmental Effects
- E_F = Fraud
- E_M = Mental Illness (Hallucination)
- E_S = Susceptibility

Thus, the expansion of $\sum E_N$ is the covariation represented by the above six factors, specifically ignoring covariation *between* these six factors and treating each as an independent and additive reduction of the P_R raw paranormal probability reported by subjects. This creates a markedly conservative estimate of potential alternative causes.

Thus,

$$P_p = (P_R * [1 - \sum E_N])$$

is expanded within the sum error term as:

$$\sum E_N = (E_M + E_E + E_V + E_F + E_M + E_S) \quad (1.2)$$

Note that each factor of E may be individualized for a particular type of paranormal experience, or a constant that can generally be applied.

The equation can be expanded to include multiple types of paranormal experiences, which for the purposes of our exercise include:

- P_D = Near-Death Experiences
- P_H = Haunt-Poltergeist Episodes
- P_M = Mediumship
- P_A = Veridical Anomalies
- P_N = Reincarnation

P_p represents the sum of these five categories of survival-related phenomena whereby each type has its error covariation removed. As each type of ‘purified’ experience would constitute an ‘or’ scenario within probability theory, e.g., the purified probability of a haunting or reincarnation, each represents a valid experience of an event of a legitimately anomalous character. These terms are additive once estimated error has been removed from each occurrence. Expressed mathematically, the expanded formula is represented in Equation 1.3—where P_p represents the sum probability of paranormal experience occurring in the population, constrained by cases which probabilistically would not contain the controlled or error factors:

$$P_p = ((P_D * [1 - \sum E_N]) + (P_H * [1 - \sum E_N]) + (P_M * [1 - \sum E_N]) + (P_A * [1 - \sum E_N]) + (P_N * [1 - \sum E_N])) \quad (1.3)$$

This formula is a general approximation designed to be *maximally conservative* in quantifying its core components.



The strongest assumption in the model concerns the error estimates, which, as we detail below, were derived from as many valid meta-analyses and empirical sources as possible. As 'Cohen's *D*' (an effect size that indicates the standardized difference between two means) can be easily converted to a correlational (*r*) statistic, and subsequently squared, the model assumes that: (a) the covariation estimate is fixed and independent, whereas in real-life covariation may be less than the provided covariation statistic for each individual case but is ignored in the case of the formula (as a maximum conservative estimate); and (b) each component error term covariation or percentage is not correlated to the other error terms in the model (although this is highly likely, as we will discuss later). Hence, this model provides an overly conservative estimate, as we treat each covariance or percentage term for each error estimate as independent and additive.

Calculating the Drake-S Equation

The estimates from our narrative reviews allow us to compute a 'purified' percentage of survival-related phenomena. This yields an approximation of witness testimony that is unduly unaffected by (a) *expectancy-suggestion* effects of various kinds ($R^2_{est.} = .097$), (b) *environmental variables* that can be misattributed ($R^2_{est.} = .077$), (c) *fraud* ($R^2_{est.} = .20$), (d) *measurement error* ($R^2_{est.} = .067$), (e) all forms of diagnosable *mental illness* that can induce visual or auditory hallucinations ($R^2_{est.} = .039$), and (f) *psychological susceptibility factors* that can cause perceptual aberrations or cognitive errors ($R^2_{est.} = .134$).

As a grand aggregate, these alternate explanations sum to 61.4% using a set of assumptions highly favorable to skepticism. This leaves 38.6% of survival-related evidence free from these factors and thus unscathed by the cross-examination of known confounds. Accordingly, *this sub-group of witnesses and case material provide a reasonable inference of ~39% probability of postmortem survival of human consciousness*. These estimates are applied both to general paranormal experience and the sub-types outlined below in Table 7.

As shown above, the overall 'purified' rates for occurrence of these phenomena are estimated to be .16 for general paranormal experiences, .036 for NDEs, .077 for hauntings/poltergeists, .008 for mediumship, .100 for VAEs, and .001 for reincarnation. A significant percentage of various types of paranormal experiences in the population are thus unaccounted for by existing explanations in mainstream science. *This approximation—roughly 1/6.25 cases—represents prima facie evidence of parapsychological, and more specifically, survival-related phenomena.*

Expert Conclusion per the Daubert Standard

Federal Rule 702 (cf. Michigan Legal Publishing, 2021) permits individuals who are qualified as experts based on knowledge, skill, experience, training, or education to offer expert opinion testimony. We submit that the results of this adversarial collaboration are sufficiently credible to serve as such testimony based on scientific evidence. Specifically, the methodology used to form our opinion strongly satisfies the Daubert standard of evidence:

TABLE 7. Rates of Survival-Related Phenomena "Purified" of Known Confounds

Survival-Related Phenomena	Reported Population Rate	Error Factors Subtracted	Purified "Paranormal" Percentage
General Paranormal Experience	0.415	0.614	0.160
Near-Death Experiences	0.094	0.614	0.036
Hauntings/Poltergeists	0.200	0.614	0.077
Mediumship	0.020	0.614	0.008
Veridical Anomalous Experiences	0.260	0.614	0.100
Reincarnation	0.002	0.614	0.001

— Our techniques followed tested principles and approaches in inferential statistics.

— The Drake equation scheme and the underlying data used in our analysis have both been subjected to peer review.

— The outcomes produced estimated error rates.

— The standards used in the creation of the model adhere to the laws and practices of probability and inferential statistics; deviations from those rules were purposefully used for the maximum conservative estimate of the survival argument.

— The data and analytical procedures that produced our conclusion are generally accepted by researchers in anomalistic psychology and consciousness studies.

Given the available empirical evidence of alternative or skeptical explanations of survival-related experiences or observations, our Drake-S Equation empirically demonstrates that known confounds are insufficient to explain approximately 39% of the entire body of survival-related phenomena reported in the literature. In other words, while skeptical explanations have strong merit, they unquestionably fail to discredit all favorable evidence at the population level. Despite the hundreds of empirical, peer-reviewed studies that point toward the maximum viability of skeptical explanations, we conclude that *it is less likely than not* that skeptical explanations can account for parapsychological- or survival-related evidence.

Furthermore, based on the same mathematical calculations, and combined with established empirical research attesting to the neurobiological, psychological, environmental, and psychosocial contributions to human perception, any witnesses who are sufficiently vetted and thereby excepted from the various skeptical explanations described in this essay represent testimony that is *more likely than not* to support a ‘purified’ *prima facie* case of postmortem survival. Alternative explanations for such witnesses’ presumed veridical experience are, therefore, lacking. While the paranormal experiences of these particular witnesses undoubtedly constitute very rare or “black swan” events, their testimony is nonetheless valid and arguably meets the legal definition and standard of ‘beyond a reasonable doubt.’

DISCUSSION

Our essay confronted the pointed question, “*What is the best available evidence for survival?*” The answer was, perhaps, hidden in plain sight. Much intriguing literature has addressed lone categories of evidence for and against life after death, but never was it empirically meshed into a holistic and compelling picture. Now, a fresh synthesis

of representative information reveals a high probability of postmortem survival. Of course, a complete and intellectually honest statement about our exercise, or any related endeavor, is that “no evidence to date scientifically proves the ontological reality of survival.” Indeed, we have only faithfully calculated but not definitively solved the *Drake-S Equation*. Like the many experiments and meta-analyses published in support of putative psi, our evaluation has produced a tantalizing empirical anomaly, namely that 39% of survival-related phenomena are in need of a comprehensive explanation beyond the obvious and often hackneyed assortment of known confounds.

We are shocked by this high percentage left unaccounted for by skeptical explanations—and contend that the results have strong probative value for a legal argument favoring postmortem survival. On one hand, and consistent with Martin and Augustine (2015), our findings clearly suggest that current scientific models can explain most survival-related reports. On the other hand, the alternative explanations we reviewed—despite their blanket application by skeptics (e.g., Cabbolet, 2014; Hansen, 1992; Martin, 1998; Truzzi, 1987)—simply cannot resolve the *Drake-S Equation’s* potential implications for survival. A sizable amount of witness testimony remains not only legitimately anomalous but in direct contradiction to conventional scientific wisdom. We thus reject any attempt to dismiss the outcome of our exercise as merely being a synonym for ‘unexplained’ (Houran et al., 2017, 2018), because we have identified an empirical effect that frankly should *not* exist if biological death marks the end of human consciousness, i.e., personal identity, perception, sentience, and cognition. This outcome might represent a type of ‘proof by contradiction.’ Our collaboration as friendly adversaries further points the way, we humbly suggest, toward further initiatives that draw together skeptics and believers in a joint pursuit of greater clarity on this essential question.

As with Drake’s (1961) original equation, ours is an initial approximation based on selective variables and data. Future iterations of our proposed solution using ever-improving datasets will, no doubt, refine the estimates to yield a more precise probability that also reflects ongoing research and indicates new research directions. To this point, our estimates highlight “haunt/poltergeist episodes” and “veridical anomalous experiences” (e.g., ADCs) as having the most promise for obtaining witness testimony that can withstand counter-arguments and cross-examination. Additionally, while we confined ourselves to peer-reviewed studies in order to expressly meet the Daubert standard, doctoral dissertations might offer broader literature reviews. Examples that we could have leveraged include Streit-Horn’s (2011) systematic review of ADCs or

Sapkota's (2017) in-depth study of psychological contagion. Also, areas we deemed suitable to cluster the findings may seem to other researchers to deserve their own section within the formula for independent error calculation. Last and most importantly, some parts of our equation that are viable contributors to perceptual error (e.g., environmental effects) desperately require additional studies and replications to gather a reliable set of empirical data to improve our estimates. This is probably the case for every area considered in our analysis.

Limitations and Future Refinements of the *Drake-S* Equation

As repeatedly noted, we used extremely conservative methods that skewed to skepticism. This introduced limitations or caveats that future refinements of our equation should remedy. Most notably, many of the error factors that we discussed here are likely to co-vary, which our current formulation willfully ignores. Measurement error would have been more accurately applied by nesting it within each of the other five error terms and deducting the appropriate variance to represent the amount of measurement error inherent in the calculation of the individual error factors themselves. Additionally, variables linked to mental boundaries, such as transliminality and sensory-processing sensitivity, surely also relate to expectancy effects—and co-vary to an extent with mental illness. Environmental effects could also co-vary with expectancy effects, although this is only hypothesized, as controlled studies with strong external or ecological validity have not, to our knowledge, been conducted.

Moreover, when aggregating error components, we clearly indicated assumptions that are highly unlikely (e.g., a correlation between two variables as '1'), and/or are contrary to the data (e.g., paranormal belief and experience neither correlate perfectly nor should this be expected; see e.g., Laythe et al., 2018). Given sufficient time and effort, partial correlations can be calculated to obtain more precise aggregated estimates by controlling for partial interrelations between and within our error clusters. It should be noted, however, that use of this process would strongly decrease the conservative percentage estimate of the alternate explanations presented.

We also note that our current formula is suitable for a posterior calculation of probability in a Bayesian calculation, which, given our conservative mathematics, arrives at previously a priori philosophical estimates of the posterior probability for survival at 50% (Sudduth, 2016). From a legal perspective, a conservative estimate in favor of skepticism clears an even higher bar when 'survival' witnesses meet a higher standard after vetting than is actually

needed. Thus, our current estimate likely provides a good general basis for vetting cases of putative survival in a legal context. Due to its conservative slant, it ought to be resistant to last-minute attempts at invoking other sources of explanation.

Where Do We Go from Here?

Researchers should certainly search for other empirical factors that could contribute to alternative explanations for survival-related phenomena. By the same token, there will come a point where the model we used to calculate our estimate (i.e., the loose assumption of independence between error factors) will have to be addressed in order for the formula to remain meaningful (i.e., sum to less than '1' as a necessary function of a probability equation). First and foremost, ignoring covariation both between error terms and within error terms still only provides a combined potential effect of approximately 61% for skeptical explanations, which is markedly less than the claims of debunkers who generally rely on materialism to explain paranormal experiences.

We can confidently assert two things about our *Drake-S* Equation and future modifications. First, considering the fact that covariation is ignored in the current model, additional research and in-depth analyses are needed to compute accurate covariation estimates between these factors. Once accomplished, we expect that our conservative (i.e., favorable) estimate of error factors will be reduced by 15–20% due to the recognized intercorrelations noted earlier. Second, the variables considered in this exercise are reasonably comprehensive and sympathetic to the materialist perspective. As such, we humbly posit that skeptical critiques will need to find new and robust alternative explanations with powerful effect sizes to fill the remaining percentage of witness testimony or study outcomes that is probabilistically free of known confounds. At the moment, we are uncertain of what other factors should be addressed to make the *Drake-S* Equation a more rigorous guide to vet survival-related phenomena with evidentiary value.

Our Closing Argument

Human consciousness is a fantastically complex phenomenon, and our exercise provides sound statistical reasoning to think that biological death does not extinguish it. Even so, a 39% chance of postmortem survival might seem modest or below the threshold of 'beyond a reasonable doubt.' But potential jurors should ask themselves what decisions they would make based on this same probability.

To illustrate, would you hold an outdoor wedding with a 39% chance of thunderstorms . . . or gamble your entire

life savings on an investment that has a 39% chance of going bust . . . or skydive with a 39% chance of the parachute malfunctioning? Practical questions like these quickly contextualize the impact of odds well surpassing one-third. In fact, our estimated probability far exceeds the likelihood of many established but rare events (Sepulveda, 2021), including (a) finding a four-leaf clover (.0001%), (b) bearing twins in natural pregnancy (.004%), (c) being audited by the IRS (.005%), (d) having your car stolen (3% chance), (e) becoming a millionaire (6%–22%), (f) dying in a plane crash (1 in 11 million), or (g) your even being born (1 in 5.5 trillion).

The parachute and plane scenarios above are admittedly macabre, but death eventually comes to everyone. Thus, it offers some hope and comfort to the skeptic in this adversarial collaboration that the prospect of survival is not relegated to philosophical or religious rhetoric but can be tethered to expert testimony using scientific evidence.

IMPLICATIONS AND APPLICATIONS

Drawing on published precedents (e.g., Cowan et al., 2020; Honorton & Hyman, 1986; Lange, Greyson, & Houran, 2004), our study underscores the feasibility of adversarial collaborations for normalizing and advancing research on controversial topics. The Drake-esque approach of empirically calculating a net probability for a hypothesized occurrence or event by adding the cumulative weight of conducive conditions or putative evidence and then deducting the maximally established influence of known confounds contributing to Type 1-related errors can likewise help to (a) structure and contextualize the study of many issues in edge science given that proposed explanations are limited by their effects sizes and probabilistic strength, (b) better understand the role of perceptual and cognitive processes within meaning-making of anomalous experiences, and (c) identify and prioritize areas of investigation with perhaps the strongest evidential value for provocative hypotheses.

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