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EDITORIAL

'Fringe Science'—A Tautology, Not Pariah

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This joint Editorial is uncustomary but motivated by the authors' shared concern about the problem of *scientism*, i.e., the excessive belief in the power of scientific knowledge or techniques (Bauer, 2014; Gasparatou, 2017; Pigliucci, 2018) or what some authors have described as the arrogance of scientific authority (Butler, 2015). On this issue, Frank (2021) noted that

> The most important reason [scientism] is a mistake is because it is confused about what it's defending. Without doubt, science is unique, powerful, and wonderful. It should be celebrated, and it needs to be protected. Scientism, on the other hand, is just metaphysics, and there are lots and lots of metaphysical beliefs. (para. 7)

We further think that scientism involves rigidity about what research topics are branded 'acceptable' vs. 'heretical.' The implication here being that some issues are offensive to orthodox sensibilities because they presumably (a) have no value in generating *new* scientific knowledge, or (b) undermine confidence in the evidence for *current* scientific thought.

To clarify, orthodoxy is simply the majority view of present-day professional experts or what scientific institutions assert; it is not guaranteed to be faithful to Nature's reality. In criticizing anything contrary to mainstream thinking, the belief is implicitly conveyed that the currently held majority view in science is always to be trusted and used as the basis for important actions. Explicitly, of course, even the most fervent science groupies will admit that the scientific process is not infallible. But as everything unorthodox is denigrated and faulted, it is subliminally asserted that the reigning scientific views can always be trusted; thus, a conviction of certainty is expressed even when actual certainty is lacking (Bauer, 2014) and with apparently an overt deniability that this is being done deliberately.

Those seduced by scientism certainly mirror passionate advocates with uninformed or unexamined beliefs about mysterious phenomena (Irwin et al., 2017). The 'true believer' vs. 'ardent skeptic' dichotomy, thus, is contrived, if not patently false. To our way of thinking, every measured researcher is inherently part *believer* (i.e., has confidence in the relevance of research results) and part *skeptic* (i.e., adopts procedures and controls to reduce errors and bias in inferences). The most maverick investigators also seem to exhibit high levels of curiosity and humility in their pursuit of knowledge, especially about their own blindspots in research. This latter characteristic—*intellectual humility*—comprises a budding movement in academia and reflects the simple recognition that the things you believe in might, in fact, be wrong (Bąk et al., 2022; Fetterman et al., 2019; Pennycook & Rand, 2019; Porter & Schumann, 2018; Rohrer et al., 2018). As such, this essay addresses three questions that came to us when we pondered the scientific community's historical quest to balance conviction and humility in the light of discovery.

Are 'Fringe Topics' Truly Heretical in Mainstream Science?

The key issue is not why everyday people "believe weird things" as Shermer (1997) put it, because scientists likewise have convictions about many bizarre sounding and scientifically unresolved concepts including the Big Bang, dark energy, multiverse theory, and quantum gravity and entanglement. A more cogent question might be "What is the merit of studying weird things?" Here we mean unusual or unexplained observations that cynics variously describe as being fanciful to delusional (e.g., Carroll, 2003; Novella, 2018; Shermer, 2002) but are nonetheless popular within lay and technical sources on unexplained phenomena. Before delving into the potential benefits of researching such anomalies or aberrations, we should first address whether the academic community actually thinks there *is* any merit to be had.

For a preliminary answer, we devised a 'Five-Minute Search' quasi-scoping exercise to gauge mainstream science's engagement with unsolved mysteries in the public's awareness and imagination. Scoping reviews are commonly used to examine the extent, range, and nature of research activity in a topic area and to determine the value and potential scope and cost of undertaking a full systematic review (Pham et al. 2014). Accordingly, we searched the broad scholarly literature via Google Scholar, PubMed, Scopus, ResearchGate, and Academia.edu for 'recent and accessible' peer-reviewed articles that matched 76 keywords across nine groups of popular anomalies (cf. Table 1).

We confined the search to articles that (a) preferably were published within the last *five* years (2017—2022) but were (b) not more than between *six* and *ten* years old (2012—2016); and (c) appeared in *mainstream* journals versus niche periodicals catering to anomalists (e.g., *Journal of Parapsychology*, *Cryptozoology*, or *Journal of UFO Studies*). To measure the ease of accessibility of the literature, we also searched for only 5 minutes per each keyword. This time limit seems arbitrary and restrictive, but one researcher of online consumer behavior noted that ". . . a reasonable benchmark for average session duration is between 2 and 3 minutes. A good average session duration, then, might be anything above 3 minutes. In fact, 55% of the marketers we surveyed reported an average session duration greater than 3 minutes, and 27% reported average session durations greater than 4 minutes" (Albright, 2021, para. 25–26).

This exercise produced some sobering outcomes that undercut our expectations. Table 1 shows that out of the 76 'fringe' topics: (a) Only 3 (i.e., 4%) were *not* found in mainstream sources; (b) 12 (or 16%) were represented in studies published more than a decade ago; (c) 19 (or 25%) were published within the last 6 to 10 years; and (d) 42 (or 55%) were covered by studies within the last 5 years. This suggests that anomalies characterized as 'pseudoscientific, conspiratorial, or junk science,' in some circles are actually well represented in the recent, peer-reviewed literature. This finding softens some of the suspicions about heretical topics that we held earlier in this Editorial. That is, we found no evidence that mainstream science has ignored or dismissed out of hand these lines of study. It seems therefore that the phenomena listed in Table 1 are plainly not 'off limits, irrelevant, misguided, silly, or taboo.' Rather, academia seems to agree that controversial or hot-button topics can and should be studied or contextualized scientifically. But accusations that such anomalies can be 'strange, amusing, or dangerous' (cf. Carroll, 2003) are fair and appropriate, as their mere presence or connotation ostensibly challenges some of the orthodoxy. Moreover, the skeptical literature clearly shows that debunkers regard it as dangerous, even an existential threat, when the contemporary, mainstream scientific consensus is not fully accepted as true for all practical purposes. Such 'pseudo-skeptics' are, in fact, merely acolytes of scientism (Truzzi, 1987).

How Do Scientists Deal with 'Fringe' Observations?

Our cursory findings do not imply that *all* journal editors, reviewers, or authors are open-minded to fringe areas. Sadly, like many of our *Journal* authors, we too have experienced irrational responses or feedback when submitting papers to some mainstream periodicals. But our exercise indicates that these topics are not systematically disliked or shunned. It seems to us that the real targets of ire or scorn in mainstream academia are the 'unorthodox' interpretations or conclusions about anomalies proposed by some authors. This is to say that academic authorities typically resist such claims. True enough, published research about an anomaly is neither always synonymous with its confirmation nor an endorsement of a particular interpretation.

Hence, Table 1 also indicates how many of the cited studies reached 'favorable, unfavorable, or neutral conclusions' about the scientific validity of the subject under scrutiny. For ease, an independent party rated the articles so that the trends would not reflect our personal biases. Of those topics with corresponding references (n = 73), the rater noted that 46 (63%) of the studies drew neutral conclusions, 17 (23%) seemed favorable, and 10 (14%) were clearly unfavorable. The scoping exercise revealed that a large variety of fringe topics appear in the mainstream literature, but these latter results suggest that the respective authors' interpretations or conclusions are mixed albeit certainly skew toward open-mindedness or agnosticism.

TABLE 1. Illustrative Studies of 'Fringe' Topics Published in Mainstream Academic Journals

General Topic	Conclusion **Pro, Con,** or **Neutral**	Reference
Parapsychology—Spontaneous Cases		
Apparitions / visions	Neutral	Castelnovo et al. (2015)
Haunted houses	Neutral	Dagnall et al. (2020)
Macro-psychokinesis	Neutral	Wiseman & Morris (1995)
Near-death experiences	Neutral	Moore & Greyson (2017)
Out-of-body experiences (OBEs)	Pro	Smith & Messier (2014)
Precognitive dreams	Con	Valášek et al. (2014)
Reincarnation / past life memories	Neutral	Moraes et al. (2021)
Parapsychology—Experimental		
Mental mediumship	Pro	Sarraf et al. (2021)
Physical mediumship	Neutral	Wiseman et al. (2010)
Precognition / predictive anticipatory activity	Pro	Mossbridge & Radin (2018)
Telepathy	Con	Rouder et al. (2013)
(Entity) Encounter Experiences		
After-death communications	Pro	Woollacott et al. (2021)
Alien abduction experiences	Neutral	Forrest (2008)
Electronic voice phenomena	Neutral	Williams et al. (2021)
Entity encounters and DMT	Neutral	Davis et al. (2020)
Fairy encounters	Neutral	Young (2018)
Instrumental transcommunication	Pro	Laszlo (2008)
Mirror- and eye-gazing experiences	Pro	Caputo et al. (2021)
"Old Hag" attacks—sleep paralysis	Neutral	Jalal & Ramachandran (2017)
Sensed presences	Neutral	Barnby & Bell (2017)
Cryptozoology		
Dragons	Neutral	Cheetham (2014)
El Chupacabra		---
Jersey Devil	Neutral	Regal (2015)
Loch Ness monster	Neutral	Moir (2015)
Mutagens	Neutral	Anderson (2021)
Sasquatch	Con	Sykes et al. (2014)
Sea serpents	Con	France (2018)
Unicorns	Neutral	Kosintsev et al. (2019)
Ufology		
Anomalous implants	Con	Perrotta (2020)
Belief in UFOs	Neutral	Escolà-Gascón et al. (2021)
Cattle / animal mutilations	Neutral	Goleman (2011)
Implications of extraterrestrial life	Pro	Andresen & Chon Torres (2022)
Missing (or altered) time experiences	Neutral	Stanghellini et al. (2016)
Physical traces of UFOs		---
Techno-signatures	Neutral	Mannings et al. (2021)
Unaccounted for pregnancies		---

TABLE 1 (*continued*)

Biomedical & Bioenergy Phenomena		
Acupuncture	Neutral	Ji et al. (2020)
Color effects on human functioning	Neutral	Elliot (2015)
Kirlian photography	Neutral	Rastogi et al. (2021)
Music effects on human functioning	Neutral	Manikandan & Akshaya (2021)
Reiki (therapeutic touch)	Neutral	Thrane et al. (2017)
Spontaneous human combustion	Con	Koljonen & Kluger (2012)
Spontaneous Remissions	Neutral	Radha & Lopus (2021)
Superhuman physical abilities	Neutral	Kozhevnikov et al. (2013)
Anthropology, Ethnography, & History		
"Antikythera mechanism" (ancient Greece)	Neutral	Freeth et al. (2006)
Bermuda Triangle	Neutral	Neilsen (2000)
Crop circles	Neutral	Northcote (2006)
Dracula mythology	Neutral	Akeroyd (2009)
"Jack the Ripper" serial murders	Neutral	Louhelainen & Miller (2020)
Kennedy assassination	Con	Linsker et al. (2005)
King Arthur legend	Neutral	Breeze (2015)
Lost Continent of Atlantis	Neutral	Rapisarda (2019)
Pope Joan	Neutral	Noble (2013)
Shakespeare authorship question	Neutral	Leigh et al. (2019)
Shroud of Turin	Neutral	Casabianca et al. (2019)
Stonehenge monument	Neutral	Cox et al. (2020)
Vampirism	Neutral	Browning (2015)
Werewolf mythology	Neutral	de Blécourt (2007)
Physics, Cosmology, & Nature of Reality		
Ball lightning	Pro	Keul (2021)
Cold fusion	Pro	Freire & de Andrade (2021)
Observer-based reality	Pro	Proietti et al. (2019)
Simulation hypothesis	Pro	Bostrom & Kulczycki (2011)
Teleportation	Pro	Langenfeld et al. (2021)
Time travel	Pro	Tobar & Costa (2020)
"Warp drives" (faster-than-light travel)	Pro	Lentz (2021)
Religious or Occult Phenomena		
Astrology	Con	Helgertz & Scott (2020)
Curses or hexes	Neutral	Waters (2020)
Demonic possession	Con	Perrotta (2019)
Exorcism	Neutral	Giordan & Possamai (2016)
Marian apparitions	Pro	Krebs & Laycock (2017)
"Miracle of the Sun" at Fatima	Con	Wirowski (2012)
Power of prayer	Pro	Simão et al. (2016)
Stigmata	Neutral	Kechichian et al. (2018)
Voodoo	Neutral	McGee (2012)
Witchcraft	Neutral	Conti (2019)
Zombiism	Pro	Nugent et al. (2018)

As for believers, an initial curiosity about any mystery is surely a natural characteristic of humans. The desire to find an answer likely predisposes these individuals toward accepting positive evidence perhaps too readily. But why should anyone be passionately determined that no one else should take mystery-pursuits seriously? Here some skeptics echo the Velikovsky Affair, whereby people purporting to speak for 'science' declared Velikovsky wrong while also admitting they did not read his book (Bauer, 1984). But this pessimism is too broad of a stroke to characterize all or even most researchers. The reality is that the broad scientific community seems quite comfortable, at least in some contexts, confronting unusual or disruptive information. There are even formal names for some of these observations or data—i.e., *outliers* and *fringeliers*—although these concepts have important similarities and differences.

In simplest terms, an outlier is a data point that differs significantly from other observations. Osborne and Overbay (2004, p. 1) nicely summarized some nuances about its meaning or relevance:

> Although definitions vary, an outlier is generally considered to be a data point that is far outside the norm for a variable or population (e.g., Jarrell, 1994; Rasmussen, 1988; Stevens, 1984). Hawkins (1980) described an outlier as an observation that "deviates so much from other observations as to arouse suspicions that it was generated by a different mechanism" (p. 1). Outliers have also been defined as values that are "dubious in the eyes of the researcher" (Dixon, 1950, p. 488) and contaminants (Wainer, 1976).

Understand that outliers are inherently different from *noise*. An outlier is part of the data, but noise is a random error that could involve mislabeled, mistaken, or even missing information in a dataset. Wainer (1976) also introduced the related idea of the fringelier. This term denotes "unusual events which occur more often than seldom" (p. 286). These points lie near three standard deviations from the mean and hence may have a disproportionately strong influence on parameter estimates yet are not as obvious or easily identified as ordinary outliers due to their relative proximity to the distribution center.

And then sometimes we have completely new and potentially disruptive observations that can spark paradigm shifts in scientific thinking (Kuhn, 1962/1996). We liken these types of anomalies to a 'Nolan Ryan fast ball'—high, hard, and you did not swing because you did not see it coming. It is also worth noting that such discoveries certainly help to promote intellectual humility. In the end, though, scientists seemingly deal with 'fringe' or 'anomalous' looking information like any other data point, i.e., by using repeated or iterative testing to determine whether unusual, unexpected, or unexplained observations are due to *error* ('noise'), *aberration* (e.g., 'outlier or fringelier'), or an *a-ha* ('breakthrough').

How Can Science Best Learn from Fringe Topics?

This question has the most straightforward answer. Consistent with the above, Wuestman et al. (2020, table 1) explained how scientific breakthroughs stem either from questions or observations. For example, *charge-type* discoveries are driven by a question, be it a new or known question, and are in line with existing literature. This first category addresses "known unknowns" (Logan, 2009) and might describe most studies and their conclusions. But then we have two other categories that are observation-based versus question-based. *Chance-type* discoveries are driven by new observations or evidence that could agree with existing literature or not. *Challenge-type* discoveries are driven by new or existing evidence that bucks the existing literature.

The discovery of a new explanation for certain 'facts' (i.e., valid and replicable observations) is most critical for challenge-type discoveries, not the uncovering of the facts per se. So, studying the nature and meaning of anomalies directly relates to quality control in scientific model-building and theory-formation. That is, outliers, fringeliers, and other unexpected or non-standard observations are especially valuable because they can indicate crucial errors with accepted data, analysis, or interpretation (a chance- or challenge-type discovery). This view of 'anomalies as object lessons' nicely parallels the approach of modern technology firms and their mantra of 'fail fast' and a striving to 'break things' to learn information as quickly and intelligently as possible (for a discussion, see Draper, 2017). But noted physicist John Archibald Wheeler (1911–2008) should be recognized as possibly the first to voice this basic insight with his recommendation that "In any field, find the strange thing and explore it."

SOME CLOSING THOUGHTS

The term *fringe* (or *edge*) *science* is undeniably a tautology because the process of knowledge accumulation and scientific discovery—by definition—is always on the boundary of current understanding and thus on the brink of the unknown. Although all of science is ultimately fringe, this does not imply that all topics are automatically appropriate for the *Journal*. Our periodical targets questions, and especially observations, that are "ignored or studied inad-

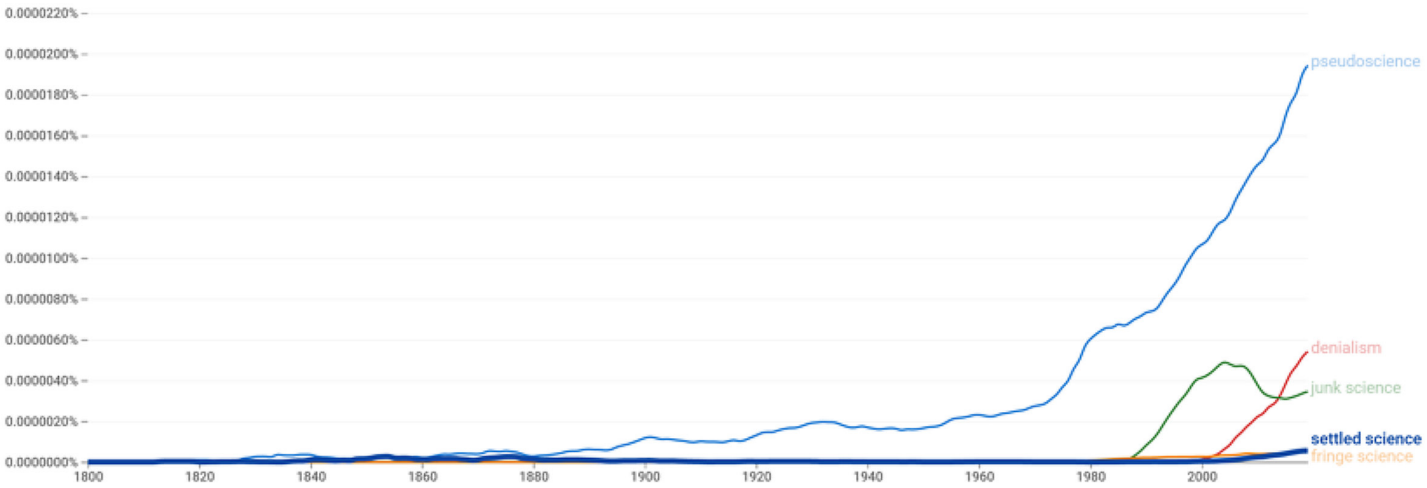

Figure 1. Google Books Ngram Viewer Results for scientism-type terms (1880–2019, English). Note: Analysis conducted July 3, 2022.

equately within mainstream science." Thus, its authors and readers represent a community of students and scientists in the doorway of potentially chance- or challenge- type discoveries. For this reason, we personally prefer the all-inclusive term *frontier science* (and frontier scientists) to describe the interests and activities of the Society for Scientific Exploration (SSE).

Contrariwise, we wonder how often pejorative phrases such as 'pseudoscience' or 'junk science' are used by those with low intellectual humility to ignore fundamental questions of truth and falsehood. For instance, Figure 1 shows a Google Ngram of the frequency of usage of such terms in English books. This graph is not specific to adherents of scientism, but it does arguably reflect an increased influence of scientism on society. After all, the central question is whether particular research activities characterized in negative ways are properly science or not. Pseudoscience originally referred to the reasonable concern about claims of using scientific methods when these were not actually used. Rigorous frontier science instead involves applying the scientific method appropriate to the topic and maintaining clarity about any biases that prevent or support a particular interpretation of the results. It also includes creating applications that can further inform us about the underlying mechanisms of a frontier science topic.

We therefore encourage frontier scientists not to focus on short-term efforts to convince myopic debunkers or disinterested mainstream researchers about the respectability and value of studying various kinds of anomalies. Any corresponding results would be akin to wisdom falling on deaf ears. Likewise, we agree with Braude's (1998, 2020) concerns over attempts to rename or rebrand frontier science topics as more 'acceptable' subjects versus plainly declaring what they are. This tactic is unnecessary. Our cursory review indeed shows that mainstream academia knowingly confronts frontier topics, although individual authors still hotly dispute their nature or meaning. But this longer-term system of peer review and debate to verify observations and conclusions is how science is supposed to work; taking the necessary time to distinguish true discoveries from false ones.

Published findings on frontier science topics are well-positioned to engage and inform the one audience that conceivably matters most, i.e., the assemblage of future researchers who will be guided by the cumulative and evolving empirical literature. Our collective energies are thus better spent celebrating and 'owning' our unique and valuable place in the scientific arena. To be sure, we deem anomalistics and frontier science as something more than a field of study; it is actually a practiced philosophy that balances verifiability in science with vigorous intellectual humility toward chance- and challenge-type discoveries. In this spirit, we modestly propose that another term and associated ideology is the real pariah and threat to scientific progress—namely, statements of *settled science*. This oxymoronic phrase never seems to be used to advance inquiry and understanding, but rather only as a weak argument to shut it down.

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