Anomalistics

Anomalistics is the study of anomalies unexplained by science, of the kind noted and described by Charles Fort (Forteana), but with a greater emphasis on scientific evaluation.

Introduction

The term 'anomalistics' was coined by the anthropologist Roger Wescott[1] and denotes a field of interdisciplinary study that deals with anomalies unexplained by conventional science. These can be be within science or on the fringe of science, or can be labelled 'non-science' or 'pseudoscience'. ‘Anomalistics’ overlaps with ‘Forteana,’ but has a greater emphasis on scientific evaluation.

Anomalistics is multidisciplinary, because anomalies occur in every branch of science. Also, it is often unclear which discipline is needed to resolve a given anomaly. For example, an alleged UFO might be explained in terms either of psychology or of physics.

Anomalistics is generally governed by the Mertonian norms of science: communalism, universalism, disinterestedness, originality and scepticism.[2] Marcello Truzzi notes four major functions for anomalistics. It seeks to (1) aid in the evaluation of a wide range of anomalies; (2) understand better the process of scientific adjudication and make that process more just; (3) build a rational framework for understanding and assessing anomaly claims; and (4) act as a ‘friend of the court’ in scientific controversy, which is possible because anomalistics has no vested interest in the validity or otherwise of any given claimed anomaly.[3]

Truzzi wrote that ‘anomalists should stand outside the disputes and examine the adjudication process itself.’ Thus, Anomalistics is allied to the Sociology of Science. Although Anomalistics is not itself a science, it can aid science in the ways outlined above, and also call attention to new anomalies that might help renovate scientific theory

The Sweep of Anomalistics

The most prominent twentieth century collector of scientific anomalies was Charles Fort.[4] More recently, the ‘Sourcebook Project’[5] by William Corliss attempted, through multiple volumes, to collate as many scientific anomalies and mysteries as possible, culled mainly from mainstream journals such as *Science* and *Nature* (Corliss stated that he rarely used fringe magazines).[6] Corliss discovered a large variety of anomalies in archaeology, biology, astronomy, meteorology, psychology, geology and in other fields. Table 1 has some examples from selected volumes compiled by Corliss, giving a sense of the wide range of anomalies.

Table 1[7]

From *Lightning, Auroras, Nocturnal Lights:*	• Horizon-to-horizon sky flashes. • Luminous mists. • Earthquake lights. • Ghost lights*, ignis fatuus*. • Luminous phenomena in auroras. • Black auroras.
From *The Moon and Planets:*	• The ashen light of Venus. • Kinks in Saturn’s rings. • Debates about the Viking life detection experiment. • Strange grooves of Phobos. • Earth-Venus resonance.
	• Mirror-image twins. • The Sacral spot. • The supposed human aura.

From *Biological Anomalies: Humans I:*	• Human behaviour and solar activity. • Cycles of Religiousness. • Cyclicity of collective human behaviour. • Wolf Children. • Telescopic vision. • The human navigation sense.
From *Biological Anomalies: Mammals II:*	• Biochemical curiosities. • Recent survivals of mammoth, ground sloth, thylacine. • Out-of-place mammals. • Male lactation. • Microbat data processing.
From *Ancient Man: A hand book of Puzzling Artefacts:*	• Ancient Florida canals • Ancient coins in America • Ancient Greek Computer. • Costa Rica stone spheres. • Scottish fused forts. • Ancient batteries and lenses.

Corliss noted that scientists who will readily admit that anomalies exist in their fields of endeavour are often reluctant to admit that all other branches of science also exhibit anomalies.'[8] This observation points to an important fifth function of anomalistics: it helps prevent specialists become excessively focused upon their own set of anomalies to the exclusion of others, and so prevents biased or decontextualized judgments of their own particular puzzles. The wider study of anomalies in science – which is in its infancy – also alerts us to common patterns in scientific controversies.

Anomalies: Type by Context

Innovation, or attempted innovation, in science can be via novel (1) theory, (2) method or (3) data. The study of anomalistics primarily focuses upon novel data, although novel theories or 'rogue paradigms', and also novel (or at least controversial) methods are also covered. Bauer observes that in conventional science, a new idea may involve one, or at the most two sorts of innovation.[9] Theories often labelled as 'crank' – such as Velikovsky's ideas about Venus and the calamities of Ancient history – may involve the introduction of novel theory, method and data.[10]

- Novel Theories (Examples: Sheldrake's theory of morphic resonance; Velikovsky's theory of Venus as Comet; Continental drift).
- Novel/controversial Methods (Examples: Wegener's use of fossil distribution to demonstrate continental drift; use of hypnosis to uncover alleged alien abductions; use of scrying balls and Ouija boards in Psychical Research).

Although observed anomalies are usually characterised by their acceptability or otherwise by science, it is also useful to classify them by the context of their discovery. Anomalies can be:

- Observed in the course of a conventional experimental research programme (Examples: discovery of novel or unexpected characteristics of matter).
- Observed in the course of an unconventional experimental research programme. (Example: effects in parapsychology).
- Discovered during field excavations by specialists (Example: anomalous archaeological artefacts).
- Discovered during systematic astronomical, geological, ecological or other observations or surveys (i.e. Gamma Ray Bursts, discovery of novel species or phyla).
- Case-studies (i.e. spontaneous remission, stigmata, cases of reincarnation type).
- Informal eyewitness accounts by specialists (i.e. meteorologist observing unusual ball-lightning).

- Informal eyewitness accounts by non-specialists (i.e. layperson observing alleged UFO).

Typically, the only anomalies that will rank serious discussion within many mainstream sciences are either those observed during the course of a conventional research program, or discoveries made in a formal field context by specialists. There are exceptions to this rule, as with the field observations of Transient Lunar Phenomena (TLP) made by amateur astronomers.[11] Some lay-observations of novel natural phenomena, like ball lightning, have also, eventually, been accepted by specialists. Typically, however, lay observations of truly novel phenomena (alleged UFOs, poltergeists) will be ignored, rationalized or even derided by most specialists.

Relativity of Anomalies

Labelling an observation, method or theory 'anomalous' is relative to the cultural, social and scientific milieu in which the judgment is made. Most disputes over anomalies occur within the context of Western science, or just outside, and assume the conventional, current state of scientific knowledge to be normative (i.e. alleged anomalies are judged against currently accepted knowledge). Novelty shifts according to basic frameworks of understanding. For example, gravitational lensing is an expected outcome of the curvature of space in the presence of gravity, but would have been highly anomalous before the invention of the theory of relativity. Similarly, magical effects are highly anomalous within current scientific frameworks of understanding, but were frequently observed by the Azande, for instance.[12]

Scientific Status of Anomalies

In Western culture we typically assess anomalies from the point of view of science, which makes the question of the 'scientific status' of an anomaly crucial. There is a sense, however, in which, as Bauer claims, the question of scientific status is a red herring: the significant question is whether an anomaly is valid. [13] So, for example, the label 'pseudoscience' applied to telepathy is meaningless if telepathy actually occurs. Similarly, a theory labelled 'crank' might later be vindicated; or, conversely, a respected theory found to be nonsense. However, anomalies inevitably arise in a context, and these contexts can tell us a lot about their general plausibility or otherwise.

For a start, no anomalies are 'scientific,' in that an anomalous observation constitutes that which is unassimilated, and sometimes at odds with standard explanations within science.[14] However, in another sense, anomalies can occur within science (the origin of life, giant viruses), on its fringes (variability of nature's constants, placebo effect),[15] or well beyond the fringes (UFOlogy, psychic phenomena). Anomalies and controversial programs can also 'migrate' from the fringes to the heartland, or vice versa: for example, the Search for Extra Terrestrial Intelligence (SETI), which was once seen as on a par with UFOlogy, has migrated inwards; whereas Cold Fusion, a claim that originated within a 'respectable' context, has been ejected to the fringes.

Within the scientific cultures, anomalous observations are often judged in terms of the context of their discovery, and in terms of various, often tacit criteria. These criteria include (1) Continuity with a specific observational context; (2) Continuity with what is understood about nature; (3) as noted above, whether the anomaly prompts, or would prompt, innovation in theory, method, or fact; (4) the source, and whether it is considered reliable; (5) whether the novel observation, theory or method has religious, or occult taints or originates from a non-scientific tradition.

Continuity with a specific observational context

All observations take place within a context of discovery, and need to be judged against it. For example, an apparently anomalously old artefact discovered in an archaeological dig needs to be considered not just against the context of the site, but also against the wider network of knowledge about the kinds of artefacts associated with specific eras, general knowledge about (pre) history, geology, scientific dating techniques, *etc.* A major mistake made by promoters of anomalies (like anti-evolutionists, in this example)[16] is to ignore the context and focus only on the alleged anomaly.

Continuity with what is understood about nature

Many, perhaps the majority, of the anomalies listed within Corliss's various catalogues would require no major innovations in basic scientific theory or method to be assimilated within a scientific program. This often means that they can be studied by ordinary 'problem solving' science, as Kuhn termed it, rather than revolutionary science. Problems like this are likely to meet less resistance than novel facts that appear to break or contradict what is currently understood about nature, such as the claim that some children remember previous lives, which is apparently flatly contradicted by theories and observations suggesting the dependency of personality on the brain.[17]

This continuity also implies that anomalies need to fit within the broad, metaphysical framework of science.[18] These metaphysical foundations are often implicit, but have also been characterized as 'basic limiting principles' which include general principles of causation, limitations on the action of mind on matter, dependence of the mind on the brain, limitations on ways of acquiring knowledge, *etc.*[19] These limiting principles, a mix of science and common sense, tend to be determined largely by experience, including scientific observations and experiments. However, as some have noted,[20] scientific theory routinely violates common sense, and what is true on average may not be universally true.

The source, and whether it is considered reliable

Martin observes that novel ideas or observations are frequently judged on their source.[21] It matters greatly whether the person or group making the observation is considered reliable, whether they have professional standing, and what sorts of claims they have previously made. It also matters where the claim is printed: within a major scientific publication like *Science* or *Nature*, within a 'fringe' publication like the *Journal of Scientific Exploration*, or within a popular paperback.

Whether the novel observation, theory or method has religious, or occult taints

Scientific culture generally rejects anything considered 'religious', 'occult' or magical. Rational, scientific thought is considered to be diametrically opposed to the allegedly irrational and magical thinking of religious and non-rational cultures. This is a major factor in the rejection of, for example, parapsychological ideas,[22] although one that tends to be played down by advocates of parapsychological research.

Boundary Work

The problem of separating science from non-science has existed since early modern times, frequently in the context of the rejection of religion and the supernatural.[23] This was a significant reason for Hume's discourse on miracles, in which he claimed no amount of eyewitness testimony would be sufficient to establish a miracle.[24] It can also be seen in seventeenth and eighteenth century debates over alleged supernatural phenomena, as with the disputes over vampires. Rousseau noted that 'if there is in the world one attested story it is that of the vampire. Nothing is missing: official reports, affadavits of well-known people, of surgeons, of priests, of magistrates. The judicial proof is most complete. With all this, who believes in vampires?'[25] Despite the existence of widespread testimony, vampires were too incredible to seriously contemplate by the time of the Enlightenment, and this issue of basic credibility (or the extraordinariness of a claim)[26] has dogged paranormal claimants to the present day.[27]

Various strategies have been used to sort 'scientific' from 'non-scientific' claims, theories and ideas. Anomalies are frequently classified (1) by alleged likelihood and/or (2) by whether they occur within, on the fringes, or outside science. Perceived likelihood is often held to correlate with whether an anomaly is found 'within' or without 'science'. For example Shermer, invoking the idea of 'fuzzy sets', offers his own personal estimation of the *a priori* probabilities of a range of different phenomena. His assessment is based upon what he terms a 'boundary detection kit' or set of questions that he applies to each field or alleged phenomenon. Things he identifies as science include heliocentrism, quantum mechanics and evolution (assessed with a 0.9 probability), evolutionary psychology (0.5) and chaos/complexity theory (0.4). Borderlands science, according to Shermer, includes superstring theory (0.7), SETI (0.5), chiropractic [*sic*] and acupuncture (0.3). Non-science or nonsense (all with a 0.1 assessment of probability) are creationism, holocaust revisionism, remote viewing, UFOs, Freudian psychoanalytic theory and recovered memories.

However, such assessments tend to be subjective, dependent upon implicit assumptions.[28] There have been attempts to make this process more objective by making those assumptions more explicit. For example, Matthews suggests the use of Bayesian statistics when evaluating the reality of an unlikely or anomalous claim, considering them useful because non-Bayesian approaches tend to exaggerate significance for very unlikely effects.[29] With Bayesian methods, the researcher needs to include a quantitative estimate of the likelihood of the effect they are looking for. Although Bayesian techniques have been criticized for this subjective element, they do make a researcher's bias explicit.

Pathological science, Pseudoscience, Junk Science, Voodoo science

Bauer suggests that terms like 'pseudoscience' are better understood as a social reaction by the scientific community than as a term possessing substantive evaluative power.[30] Nonetheless, there have been numerous attempts to fix the boundaries of science by identifying the anomalies and knowledge areas that lie outside it. Two examples are so-called 'pathological science' and 'voodoo science'.

'Pathological science' is a phrase coined by Irving Langmuir. Langmuir suggested six features of pathological science:[31]

1. Effect magnitude is significantly independent of intensity of causal agent.
2. Effects close to the limits of detectability, or many measurements are needed due to low statistical significance of results.
3. Claims of great accuracy are made.
4. Fantastic theories contrary to experience.
5. Criticisms met by *ad hoc* excuses.
6. Ratio of supporters rises to about fifty percent then declines to nothing.

Langmuir's criteria are interesting, but imperfect as a distinguishing tool. For example, (4), 'fantastic theories contrary to experience' (ie. contrary to common experience) have been claimed to characterize science at its most fundamental.[32] (2), concerning marginal effects, could include a multitude of claimed effects in mainstream medicine, food science and psychology (this is why statistical meta-analyses are routine in these fields). As for (1), biological systems routinely amplify or respond to very weak environmental stimuli, which can be magnified into (dis)proportionally large effects.[33] In short, Langmuir's criteria do not allow us to distinguish 'genuine' from non-science.

'Voodoo science' is a term coined by physicist Robert Park, which he subdivides thus:

1. Pathological science – scientists deceive themselves.
2. Junk Science – speculative theorizing which bamboozles rather than enlightens.
3. Pseudoscience – work falsely claiming to have a scientific basis, which may be dependent on supernatural explanations.
4. Fraudulent science.

Park asserts that people 'judge science by how well it agrees with the way they want the world to be.'[34] And that'[P]ractitioners [of pseudoscience] may believe it to be science, just as witches and faith healers may truly believe they can call forth supernatural powers.'[35]

Park's examples of 'Voodoo science' include Cold Fusion, the Mars effect, human space flight, space colonization, parapsychology, alternative medicine, placebos and the Roswell UFO incident.

Anomalies and the Demarcation Problem

The challenge that Park, Langmuir and Shermer attempt to resolve is one of demarcation: how to distinguish science from non-science. Anomalies are often judged against what is considered to be 'good science', and good science depends upon what the judge considers to be 'scientific'. The problem here is that philosophers of science have put forward widely divergent ideas about what should or should not be considered scientific, and have approached the status of anomalies in very different ways, according to their ideas about science.

Anomalies in Popper and Kuhn

Karl Popper proposed that scientific theories must be falsifiable, making specific predictions that can be confirmed or disconfirmed by experiment. [36],[37] By contrast, non-scientific theories cannot be disconfirmed, either because they are potentially compatible with all observations (like Marxism) or because they are consistent with all possible observations (like psychoanalysis). [38]

Popper's criteria have been used to assess novel theories and anomalies. For example, Blackmore rejected transcendental theories of NDEs as unscientific because they explained anything and everything and because they didn't generate specific predictions.[39] Popper himself cited sea-serpent reports as an example of unfalsifiable observations;[40] and many reports of transient phenomena seem unfalsifable in the Popperian sense.

By contrast, Thomas Kuhn saw science less as an incremental process than as a matter of conceptual revolutions - or changes of paradigm. He believed that anomalies – what he called 'novelties of fact' – were produced inadvertently as the result of a game played under a particular set of rules.[41] The ability to assimilate a new sort of fact requires not merely an adjustment of an existing theory, but coming to look at nature in a whole new way. Until then, the new fact is not regarded as being 'scientific'.[42]

Kuhn argued that novelties that arose outside of conventional scientific research would be resisted, while new facts that

emerged within a standard research programme would be easier to assimilate.

On the other hand, Kuhn's work on anomalies is congenial to anomaly hunters, because it emphasizes their fundamental importance to scientific progress. His accounts of how novelty was often resisted by mainstream scientists – whose work within conventional paradigms made them blind to the possibility of psi - has also proved helpful to those who promote fields like parapsychology.[43] The latter tend to ignore the stipulation that anomalies should arise within the confines of a paradigm-led research program, although Kuhn did allow that sciences had a pre-paradigmic stage.

'Vigorous' versus 'Stagnating' Research Programs

An alternative approach to the demarcation problem, put forward by Lakatos, involves rival research programs in science.[44] In his view, some programs are vigorous, whereas others stagnate, and progress occurs as the more vigorous research programs supersede stagnating ones.

Blackmore believes Lakatos's theory has clear implications for parapsychology, which she views as a stagnating research program with little or no theoretical growth, unrepeatable findings, and a lack of problem-shift.[45] She writes: '[A]fter one hundred years we still don't have answers to the most preliminary questions. We haven't progressed at all. Parapsychology is a stagnant research program.'[46] This lack of progress might be contrasted with the relative success of parapsychology's sometime rival, anomalistic psychology, which, arguably, has made significant progress since the early 1980s.[47]

Boundary Work as Scientific Censorship

However, Lakatos also spoke against using 'demarcation criteria' for excluding supposed 'pseudoscience,' stating that 'The new liberal Establishment of the West…exercises the right to deny freedom of speech to what it regards as pseudoscience and that '[a]ll these judgments were inevitably based on some sort of demarcation criterion.'[48] This idea was vigorously pursued by Lakatos's colleague, Paul Feyerabend.

Feyerabend's work essentially deconstructed the idea that there could, or should be, any demarcation criteria for science and non-science, or that science succeeds by the way of a fixed or unique method.[49] Anomalies and excluded knowledge form an important part of Feyerabend's arguments; for example, in one of his 1970s works, he critically examines humanist arguments against astrology,[50] and also claimed that that imposition of rationalism in the West and amongst traditional cultures had resulted in the elimination of whole fields of knowledge and experience.

Feyerabend's ideas concerning the elimination of knowledge-systems raise disturbing questions not only for science, but also for the treatment of anomalies: boundary work, according to Feyerabend, amounts to a form of censorship at best, and violent suppression at worst. He wrote that '[i]t is necessary to re-examine our attitude toward myth, religion, magic, witchcraft and towards all those ideas which rationalists would like to see forever removed from the face of the earth….'[51]

These sort of approaches have been strongly criticized by advocates of more traditional, rationalist programs.[52] However, it remains true that scientific knowledge often functions by replacing other knowledge systems by force rather than co-existing, and that this process includes the exclusion of anomalous experiences and extra-scientific frames of explanation.[53]

Anomalistics and Science as a Knowledge Filter

'Science as knowledge filter' is one approach that seems especially germane to understanding the place of anomalistics. According to Ziman[54] and Bauer,[55] the social organization of science, along with the multifarious, empirical methods of science and its technological base, acts as a long-term filter that sorts robust knowledge from spurious. The model rejects the idea of a special scientific method: Ziman observes that science uses cognitive strategies and functions that are continuous with non-science, and Bauer emphasises the importance of trial and error and seeking practical results.

Bauer extended this picture by emphasizing the contrast between what he termed frontier and textbook science.[56] 'Textbook' science operates within well-defined norms and is reliable to a high degree of certainty (relatively 'filtered' knowledge). By contrast, frontier science tends to be unreliable and uncertain (Relatively 'unfiltered' knowledge). Bauer stated that at the frontiers of science (almost) anything goes.[57]

Bauer also contrasted Natural Science with Social Science and Anomalistics (Table 2), suggesting that social science tends to be intermediate between natural science and anomalistics.

Table 2. Selection of Bauer's demarcation criteria for Natural Science, Social Science and Anomalistics [58]

Natural Science	• Consensus over what is worth doing. • Proven means no exceptions. • Relevant discipline is obvious. • Much normal science. • High probability of useful results. • Progress steady with occasional leaps. • Anomalies are ignored. • Controversies handled internally.
Social Science	• Proven means convincing, but can be opposing schools of thought. • Relevant discipline is obvious. • Much normal science. • Sense of progress less than in natural science. • Anomalies tend also to be ignored. • Controversies handled internally.
Anomalistics	• Little known. • No consensus over what is worth doing. • No accepted standard of proof. • Relevant discipline not obvious. • No normal activity. • Low probability of useful results. • Anomalies the focus. • Hoaxes and fraud common. • Controversies often public.

Bauer's classification of anomalistics actually marks primarily cultural differences, contrasting the organized natural and social sciences and the relatively disorganized fields of anomalistics (which in effect accommodates both advocates and counter-advocates). The different cultures are in part shaped by their objects of study: the high standards of evidence possible in natural science are often not practical in the social sciences, and still less so in anomalistics.

Bauer calls disputes over knowledge in anomalistics 'knowledge fights,' stressing their deeply political nature. Ziman recognized the scientific norms of fierce competition for credibility and mutual critiquing restricted by institutional restraints like peer review.[59] Extra-scientific fights over anomalies often mimic this process, but can be unconstrained because of a lack of institutional controls. The fierce disputes over the paranormal can be seen as fights over credibility, as advocates and counter-advocates jockey for the position of expert.[60]

Struggles with Evidence

Typically, advocates and counter-advocates of particular anomalies display a naïve attitude to both evidence and science: there are frequent appeals to science as an arbiter of truth, and an expectation that any evidence speaks for itself. And in some cases, these expectations do seem borne out: Bauer points out that in some circumstances, a consensus can be forced because of the strength of evidence.[61]

One example might be the debate over the existence of *canali*, or linear channels on Mars, first recorded by Giovanni Schiaparelli in 1877, and claimed to be evidence of a Martian civilization by Percival Lowell. The debate over marginal telescopic and photographic data took decades, and was only resolved with the advent of the space age, and close-up photographs of Mars from the 1960s onwards, which seemed definitively to rule out these canals.[62]

However, in controversies the situation is often not ideal. Firstly, it is important not to underestimate the difficulty of

obtaining data. Second, it is important to acknowledge Michael Polanyi's observation that things are not labelled 'evidence' in nature, but are evidence only to the extent to which they are accepted as such by us as observers.[63]

Brian Martin notes that (1) 'new evidence seldom makes a difference in controversies,'[64] (2) when new evidence emerges, each side tends to use, and even manipulate it in their own way, and (3):

> All evidence can be challenged. No evidence is definitive. Ultimately, it's impossible to know whether evidence is correct or relevant. There are too many examples of bias and distortion, especially when vested interests are involved, to rely on any findings.[65]

Controversies over evidence tend to end when one side runs out of steam, or becomes inactive, or a view becomes generally accepted without significant dissent.

Often in frontier science, these political issues are complicated by the marginal nature of the evidence. As Bauer notes, evidence can often be interpreted in different ways. This was evident in the geophysical debates over continental drift, where the disputants not only 'appealed to different facts and classes of facts' but also 'interpreted that same data in different ways'.[66] This should not be taken to mean that evidence does not count (because it should be the main consideration), but it does introduce an 'uncertainty principle' regarding knowledge that should be more widely recognized.[67] In anomalistics, a combination of caution, humility before nature and an appreciation of one's own prejudices seems the wisest course.

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Footnotes

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64.^ Martin, B. (2014) *The Controversies Handbook*, Sparsnäs, Sweden, Irene Publishing, p .33.
65.^ Martin, p. 33.
66.^ Le Grand, H.E. (1988). *Drifting Continents and Shifting Theories*, Cambridge, Cambridge University Press, p. 1.
67.^ Northcote, 2007 uses this phrase.