Medicine Is Not Science: Guessing the Future, Predicting The Past

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Running Title: Towards a Theory of Irregularity

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Summary

Rationale, aims and objectives;

Irregularity limits human ability to know, understand and predict. A better understanding of irregularity may improve the reliability of knowledge.

Method

Irregularity and its consequences for knowledge are considered.

Results

Reliable predictive empirical knowledge of the physical world has always been obtained by observation of regularities, without needing science or theory. Prediction from observational knowledge can remain reliable despite some theories based on it proving false. A naïve theory

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of irregularity is outlined. Reducing irregularity and/or increasing regularity can increase the reliability of knowledge. Beyond long experience and specialisation, improvements include implementing supporting knowledge systems of libraries of appropriately classified prior cases and clinical histories and education about expertise, intuition and professional judgement.

Conclusions

A consequence of irregularity and complexity is that classical reductionist science cannot provide reliable predictions of the behaviour of complex systems found in nature, including of the human body. Expertise, expert judgement and their exercise appear overarching. Diagnosis involves predicting the past will recur in the current patient applying expertise and intuition from knowledge and experience of previous cases and probabilistic medical theory. Treatment decisions are an educated guess about the future [prognosis].

Benefits of the improvements suggested here are likely in fields where paucity of feedback for practitioners limits development of reliable expert diagnostic intuition.

Further analysis, definition, and classification of irregularity is appropriate. Observing and recording irregularities are initial steps in developing irregularity theory to improve the reliability and extent of knowledge, albeit some forms of irregularity present inherent difficulties.

Introduction

Irregularity limits human ability to know, understand and predict. It is ubiquitous [1-6]. Nature however exhibits considerable regularity. Regularity is the main means by which reliable empirical knowledge of the physical world is gained. A circumstance is regular if it occurs repeatedly or persists in or against a background of relevant supporting circumstances. Strict regularity occurs when the same outcome is achieved or persists each and every time particular specific circumstances occur or persist.

The ending of darkness and the appearance of daylight are examples of regularity. A circumstance might be inferred to persist if it is always observed when observations are made. On returning home, if the front door to one's home is as it was when one left in the morning, a reasonable inference, in keeping with other experience, is that the front door remained where and as it was, a part of the house throughout the day.

Physical science relies on strict regularity for its success in experimental verification of theories that predict reliably a wide range of natural behaviours. Physical science commands a small part of human knowledge but the success of its theories has had a remarkable and disproportionate effect in applied science and technology [7].

That nature is ordered and regular is a presupposition of scientists. RG Collingwood in '*An Essay on Metaphysics*' propounded the science of absolute presuppositions [8]. Absolute presuppositions are not verifiable, being neither provably true nor false. They do not stand as answers to questions and their value in science is their logical efficacy in enabling lines of enquiry [9]. Collingwood explained JS Mill's recognition of natural scientists' belief of his time that all events happen according to law is a presupposition of science and that Mill's attempt to prove the truth of that presupposition was bound to fail and did. It was circular, by inductive reasoning based upon evidence gained by assuming its truth [10].

The focus of science is regularity. Modern science looks for regularity and devises theories to explain, predict and reproduce it. Modern science does not seek out irregularity, nor does it record or investigate it. Anomalies are normally regularities that can be investigated because they recur. If there is some element of irregularity in nature that is absolute, science is not equipped to find, record or address it. It is considered legitimate sometimes to ignore unexplainable exceptional results.

There is as yet no irregularity theory. Seeming irregularities may be regular natural behaviours, which are rare, unexpected and go, unrecorded and investigated. Without records it is impossible to determine whether irregularities are potential regularities. Study of irregularity is thus difficult, if not impossible, yet without it science is less complete and knowledge is more limited. Through understanding irregularity it should be possible to improve knowledge.

A consequence of irregularity is that theories in medicine and **'***soft***'** sciences are commonly conjectural and probabilistic [7]. Can Irregularity Theory tell us whether there are fundamental limits to improving the reliability of knowledge or how we might improve it? Irregularity however, appears to evade ease of precise definition.

Putting knowledge into context - Prediction Without Science Or Theories

The lessons of history provide reliable knowledge that is utilised in politics: **'***The words of Lord William Pitt … in January 1770, ought to give us pause for thought. He said: "Unlimited power is apt to corrupt the minds of those who possess it" .…. A century later, Lord Acton warned…: "Power tends to corrupt, and absolute power corrupts absolutely"'* [11]. Such knowledge when applied in shaping how a country regulates itself is no less reliable or valuable than physical science theories.

Human knowledge is obtained necessarily in the present. It accumulates over time. Humans have a passive non predictive knowledge of the present as it happens and of the past from experience, providing understanding. This is observational knowledge requiring no scientific understanding, no explanations and no theories. It enables humans to survive, predict, and accommodate or understand some change even if relatively unpredictable.

Knowledge from observation alone has been applied in the physical sciences. Properties of matter (e.g. density, pressure, electrical resistance, etc.) were accepted without further analysis. Theories came later which explained and predicted them [12].

Humans can predict reliably the future occurrence of circumstances which they know from observation and experience are regular. Prior regularity and rarity of irregularity are guides to judging the reliability of a prediction. Predictive certainty can be absolute, all else being equal, or it can seem to be so, or it is probabilistic.

That planting and cultivating seeds results in mature plants is a generalisation requiring only observation and experience. If cultivated, it is known from experience that the majority of seeds germinate and grow into mature plants, even if some fail. It is also possible without science to predict plants cannot grow anywhere the circumstances needed do not prevail.

Reliable observational knowledge in medicine

The history of reliable knowledge from observation in medicine is long. Sophisticated traditional medical systems have existed for thousands of years based on using plants for medicines [13]. Many species of animal have developed independently an ability to use specific natural substances to self medicate. It has been inferred this has arisen over millions of years of natural selection and coevolution [14]. There is an abundance of widespread anecdotal human reports of this phenomenon in published literature [15].

Corresponding human knowledge of this kind may be beyond the ancient. There is evidence to support speculation the medicinal use of natural products considerably precedes recorded human history [16]. The finding in Iraq of an unusual abundance of pollen in a seeming ritual Neanderthal burial chamber of a child, two females and a male dated approximately 60,000 years ago was considered unusual. The association with flowers in burial suggested Neanderthal man was closer in spirit to humans than had been thought previously. The flowers were then [1975] still found in Iraq. Seven of the eight types were listed in an Iraqi government published reference work as having known medicinal qualities [17].

Human knowledge from longstanding experience and use such as knowledge of self-medication using naturally occurring products can be reliable. The former German Health Agency evaluated the therapeutic use of some 400 medicinal herbs from 1982 to 1994 and recommended approximately 250 of them [18]. By 1990, about 80% of conventional drugs were either natural products or analogs inspired by them [19]. *'….a quarter of the drugs used in high tech medicine are derived from the natural world and our ancestors' experiments…...'* [14].

The demise of natural remedies in developed western economies in the late 19th Century lay in public and practitioner response to and demand for medicines in more convenient and more palatable forms [the emergence of convenient tablet medicines had a substantial effect]. This was coupled with new more effective marketing (and some questionable practices) [20].

Chinese, Asian and Islamic medicine using naturally occurring sources for treatments flourished long before and thus have endured longer than modern western medicine. When European civilisation languished in relative intellectual stagnation, Islamic civilisation developed and expanded during its Golden Age from C7th to C15th, extending from Spain, across other parts of Europe to Central Asia and India. The achievements, including scientific expansion, are considered to have saved knowledge of ancient Grecian medicine from oblivion and developing it with knowledge from India and China [21]. Between 700 to 800 of 3600 plant species found in the eastern region of the Mediterranean are noted in medieval medical books as medicinal herbs, with ethnopharmacological studies recording 450 are still used medicinally within the Mediterranean and most Islamic countries [22].

Improving the Reliability of Knowledge

Whilst humans devise theories, reliable prediction from observation remains possible whether or not theories are valid. Effects may be real even if a theory is doubted. Qi theory may be unconvincing to western scientific thinking but there is conventional trial evidence acupuncture can be an effective treatment modality [23, 24]. The theory Beri Beri was a disease of a general nutritional deficiency initially succeeded but failed when diets were deficient in thiamine [25].

Soft science theories must predict reliably at least what is predictable from ordinary human observational knowledge alone. To be of utility they must improve that knowledge.

For medicine and other soft sciences improvement is dependent upon current and future means to increase its extent and reliability. Human observations are made from single points in time and space, making the future unknowable empirically save for whatever means can be devised and employed to know and to predict reliably.

Even naïve consideration of irregularity show there is more to be known. Where a treatment effect appears to be exhibited by 10% of participants in a randomised controlled trial ['RCT'] is the 10% irregular compared to the 90% and the 90% regular? Which part should medicine concentrate on? Why is there an effect in the 10% or no effect in the 90%? If 90% of relevant patients are potential drug recipients who will not benefit, should adverse events be more carefully investigated? Can characteristics of the 10% of treatment responders be identified to reduce risk to the 90% and improve the numbers needed to treat?

Is Irregularity Merely Relative Ignorance?

Is nature absolutely theoretically predictable and the irregular a limitation of human ability to know and predict? Henri Poincaré noted: '*Probability is the opposite of certainty; it is thus what we are ignorant of, and consequently it would seem to be what we cannot calculate.'* [26].

'S*oft sciences'* cannot emulate the success of the physical sciences. Where experiment is possible soft sciences do not achieve strict regularity. This results in probabilistic theories which are falsified as generalisations by any irregular outcome. There is a numerical probability any theoretical prediction will fail. Experience, judgement and other evidence are needed when assessing the validity of and in applying soft science theories [7].

Fields like geology, astronomy, atmospheric and space physics are observational because experiments are normally impossible. Tests of theories are dependent upon an accretion over time of observational data and assessing the evidence to judge whether observation and theory are consistent [27].

Probabilistic Theory & Reliability of Prediction

In many fields, irregular outcomes are common, with regular trends in repeated examples of the outcome concerned. These trends lead to what may be called statistical laws, permitting approximate prediction from the trends of behaviour. Irregular variation in the physical sciences is attributed to factors varying independently of and peripherally to those investigated. These kinds of irregular variations are so widespread that the phenomenon is enunciated as the principle of randomness. Randomness in this sense means the independence leads to fluctuation in outcomes in complicated wide ranging ways but statistical averages for the outcome concerned have a regular and approximately predictable behaviour [28]. This is known, expected and predictable *'regular irregularity'* within the bounds of expected statistical variation.

If hypothetically an event depends upon three soft science theories all being true with respectively the following chances: 70%, 65% and 85%, the overall probability of all being true once and the event occurring is 39% [ie. 70% x 65% x 85%]. If the event is to occur once every weekday, it is nearly certain it will fail at least once each week [ie. 99% or 1 - $(39\%)^5$].

Henri Poincaré 1854-1912 & The End of The Clockwork Universe

Regardless of whether nature is deterministic and all behaviours are law-like or not, reductionist science cannot predict the behaviour of complex systems. During the 20th Century it became recognised that the 19th Century classical scientific perception of a predictable *'clockwork universe'* is not how real systems behave.

'Soft' science is *'soft'* because it is impossible to ensure observations are made in circumstances in which strict regularity of outcome is possible. Biological systems are too complex to measure one variable whilst keeping all else equal. Exact theories of behaviours and precise mathematical prediction become impossibilities [7].

Henri Poincaré explained as early as 1908 in '*Science et méthode'* and with deceptive ease and clarity for the layman why classical science will always fail to predict the weather. Extremely small errors in measuring the state of a system prevent reliable prediction of its state at any future time. Poincaré wrote: '*…… that small differences in the initial conditions produce very great ones in the final phenomena. ….. Prediction becomes impossible….'* [29]. For molecules of a gas Poincaré noted three aspects of relevance to modern chaos and complexity theories: complexity, small deviations with immediate substantial effect and infinitely small deviations having substantial effects over time [30].

Chaos & Complexity - Looking Through The Other End of the Telescope

The living human body is an exceptionally complex set of inter-related biological sub-systems functioning as one overall complex system. Real systems are complex and can be chaotic, both terms being used here in a specific technical sense. Complexity theory is addressed to the behaviour of any system, which could be the human body, a hospital, a corporation, a financial market, a country or an economy [31].

The future behaviour of a chaotic system is completely determined by its present state but as tiny measurement errors in determining the present state grow rapidly, future states are unpredictable beyond a *'prediction horizon'* [32]. It is therefore wrong to assume that irregular effects necessarily have irregular causes [33].

Chaos is one form of a wide range of behavior that extends from simple regular order to systems of great complexity. Chaotic and complex systems behave as non-linear dynamic systems. A well-known simple example is a compound pendulum. This can exhibit regular or chaotic behaviour depending upon the initial condition when set in motion. Even a smoothly operating machine can become chaotic when pushed too hard (chaos out of order). Chaotic systems can also become regular, exhibiting ordered behavior (order out of chaos). Chaos theory explains how natural and social systems organize to be stable entities and resist small disturbances and perturbations. When put into extreme conditions they can remain stable although close to chaotic or with just a small further change they can take on a new form of behavior including chaotic [34].

'Today uncertainty and chaos are seen as essential to the hidden order of the cosmos' [35].

Chaotic and complex systems share common features. Chaos is the generation of complicated, aperiodic, seemingly random behaviour from the iteration of a simple rule. This is complex in that it is chaotic in a very precise mathematical sense. Complexity is the generation of rich, collective dynamical behaviour from simple interactions between large numbers of subunits. Chaotic systems are not necessarily complex, and complex systems are not necessarily chaotic although they can be or become chaotic for some conditions [36].

Complexity is holistic. The behaviour of the component subunits of a complex system is together different from their behaviour alone. Complex systems have characteristics which cannot be predicted by reduction to and analysis of the parts; contain many constituents interacting nonlinearly and interdependently; possess a structure spanning several scales; are capable of emerging behavior; and involve an interplay between chaos and non-chaos, cooperation and competition [37].

Consequences of Chaos & Complexity for Regularity & Irregularity

The inability to predict the behaviour of complex systems in a classical scientific Newtonian sense is as good as if absolute and regardless of whether the universe is absolutely ordered and regular. Complexity and chaos theories teach that we cannot make one set of measurements at just one moment and then, from just that one set of observations, predict the behaviour of complex or chaotic systems for all time, shutting our eyes to future behaviour for eternity. The knowledge required for prediction of that kind is beyond human ability to know. The observable regularity of such systems is limited and predictability according to classical laws of science is correspondingly curtailed.

It is however believed simple comprehensible laws exist such that the dynamics of complex systems are founded on universal principles that may be used to describe behaviours ranging from those observed in particle physics to the economics of societies [38].

Thus, if true, whilst chaotic systems may retain a '*prediction horizon*', complex systems not in chaos should be more predictable and controllable. Understanding even probabilistically the ranges of behaviour of a complex system may enable it to be controlled and managed actively. That is despite an absolute inability to predict its behaviour for all time from a single set of observations taken at one instant. Clearly, if this were not so, the practice of medicine would be impossible.

Guessing the Future by Predicting the Past – Medical Expertise

The interrelationships between complexity, chaos, regularity, irregularity and limited abilities to predict according to classical sciences suggest the role of expertise, intuition and judgement in decision-making applied to a complex system may need reassessment. In medicine, diagnosis and treatment of humans, as similar but heterogeneous complex biological systems, is necessarily probabilistic and can involve trial and error. A consequence of theories predicting probabilistically is that human experience and judgement, particularly in fields like medicine, are necessary when making decisions about how and when to apply medical theories in any particular case [7].

Intuition is one of two primary mechanisms humans have for addressing the complexity they experience in nature. The other mechanism, deliberative thought is responsible for methodical analytical thinking [39].

Kahneman & Klein have shown that expert intuition can be reliable when practiced in an environment of strong regularity [high validity] whereas true skill cannot develop in irregular or unpredictable environments. An environment of high validity is a necessary condition for the development of skilled intuitions, with adequate opportunities for learning (prolonged practice and rapid unequivocal feedback). Skill and expert intuition will eventually develop in individuals of sufficient talent [40].

Medical professionals predict the past will recur in the patient before them by applying expertise gained from knowledge and experience of previous cases. With the benefit also of probabilistic medical theory and all other available evidence, they in effect make an educated guess about the future [prognosis] for that patient.

Means to reduce irregularity or increase regularity should increase the reliability of intuitive and deliberative expertise and judgement and hence of predictive reliability in medicine. Obvious known examples in medicine and other fields are long experience and specialisation. It has also been proposed intuitive judgement can be trained [41]. The acquisition of expert skill and judgement from long experience highlights also the importance of knowledge of prior cases.

Training in expert decision-making and developing supporting knowledge systems with libraries of prior cases and clinical histories may assist. Greatest benefit may be for medical practitioners who gain little or no feedback on the reliability of their diagnoses, such as radiology [39].

Irregularity, Determinism, the Principle of Causation & Quantum Mechanics

Brady discusses and compares the four main theories of causation noting *'A really good causal inference should satisfy the requirements of all four approaches'* and that *'Philosophers debate which theory is the right one.'* [42]. Regularity is necessarily here the present focus. It is the fundamental means for obtaining human predictive knowledge of the material world, irrespective of which theories of causation may be preferred.

Bohm describes how physicists concluded no precise detailed causal laws could be found, leading them to renounce causality in connection with the atomic domain. This was in consequence of quantum mechanics which gave only statistical predictions without addressing physical laws and Heisenberg's uncertainty principle as a fundamental limit to knowledge from observation. Bohm however propounded an alternative approach to quantum mechanics which was deterministic [43]. Physicists holding a deterministic view consider physical systems are completely determined by the arrangement of their particles and thus, if known for everything fully articulates reality [44]. In over eighty years since the development of quantum mechanics there has been no verifiable experiment or astrophysical observation conflicting with its predictions [45].

Theoretical physicist Stephen Hawking wrote in 1988 of the anticipation among physicists of a Theory of Everything, uniting all theories in physics with a single theory [46]. However, Nature in 2008 published a paper entitled '*Theories of almost everything*' reporting a published mathematical demonstration the previous year by David Wolper that the entire physical Universe cannot be fully understood by any single inference system that exists within it [47]. By 2010 Hawking abandoned the '*Theory of Everything*' in favour of a family of different theories called

M-theory, acknowledging there is no single theory that is a good representation of observations in all situations [48].

On The Origin of Regularity - The Mathematical Universe Or the Ordered Universe?

Whilst Abbott argues mathematics is a mere tool to describe universal regularities, he notes there is wonderment nature appears to obey abstract mathematical conceptions quoting Albert Einstein: '*How can it be that mathematics, being after all a product of human thought which is independent of experience, is so admirably appropriate to the objects of reality?'* [49]. He also notes Eugene Wigner in 1959 coined the phrase *'the unreasonable effectiveness of mathematics'* to describe this *'miracle'*, conceding that it was something he could not fathom [49].

If the question instead is: '*why does nature exhibit order and regularity?*' and mathematics is viewed as a precise formal language capable of describing many forms of order and regularity, then it is not startling. It appears to be a logical consequence of order and regularity such that nature is neither the creation of the human mind nor the slave of mathematics. It does not change when human minds create a new form of mathematics or devise and prove new theorems, and nor does every form of mathematics and theorem have a physical world corollary which they can describe and predict.

The presupposition nature is the slave to mathematics and mathematics' adequacy are put in question by Godël's theorem. Godël's proof suggests mathematics cannot be innate to nature. '*Gödel had shown that mathematics is both incomplete and inconsistent. Mathematics must be incomplete because there will always exist mathematical truths that can't be demonstrated. Truths exist in mathematics that do not follow from any axiom or theorem. Mathematics is also inconsistent because it is possible for a statement and its negation to exist simultaneously within the same system. Kurt Gödel's result staggered the world of mathematics. His proof appears irrefutable. The final refuge of certainty had been mathematics, and now Gödel had kicked away* *its last prop.'* [50]. *'Goldbach's Conjecture'* appears an example of an unprovable mathematical statement thought by mathematicians to be true but never proven, viz that every even number is the sum of two primes: '*Why not incorporate it as one of the underlying axioms of mathematics?..... Does this get us around Gödel's theorem? No, for Gödel's theorem states that once you add a new axiom, further unprovable truths will arise…..mathematics is inherently incomplete.'* [51].

What does this mean for Irregularity Theory and for the presupposition of universal regularity?

What is the origin of Nature's order and regularity?

Order and regularity is essential to existence. Without order there can be no stable fabric to the universe; only nothing or chaos. No thing can exist without order. That order must be stable, thereby requiring regularity. If nature were otherwise then every *'thing'* down to its most elementary components could be constantly changing from instant to instant. All '*things'* could be constantly irregular and unpredictable. Without stability permitting any '*thing'* to exist for even the briefest moment, there could be no such thing as a '*thing'*. There would be no order and no regularity without order.

Gödel's theorum indicates potentially infinite sets of mathematical descriptions are possible. The material universe cannot however exhibit simultaneously all conceivable mathematical forms. An infinity of competing universal co-existing forms of order would be chaos. Nature exhibits seemingly exclusively instead a limited range of ordered regular behaviours requiring only a subset of mathematics to describe them. If correct, then how did the form of universal natural order come about from a potential infinity of forms? Gravity, electric and magnetic fields behave according to a $1/r^2$ dependence: the effect of the field diminishes proportionately to the second power of the distance from the source of the field. Why is it not a $1/r^3$ or some other dependence?

How did order and regularity in nature come about? Did the simplest and most efficient form of order and regularity prevail from a potential mathematical infinity of competing forms?

There are many cosmological theories about the universe, its form and other universes [52]. Irrespective of which, if any, might be sound, order and regularity are essential for the continued existence of anything with a potential infinity of mathematical forms from which to choose.

Irregularity Theory

If the presupposition is correct that nature behaves solely according to a causal or law-like universal order and regularity then all irregularity must be the outcome of causal or law-like behaviour and thus is '*regular irregularity*'. That appears impossible to establish or disprove empirically, leaving open whether there could be '*irregular irregularity*', viz behaviour which is neither causal nor law-like and thus potentially not even theoretically predictable.

Complexity theory cannot be verified by observation. It may therefore be impossible to know whether within any chaotic or complex systems no '*irregular irregularity*' occurs, thus leaving causal or law-like determinism a matter of belief. A mathematical formula posited to predict the behaviour of a complex system presupposes underlying regularity. Even if reliable such a formula will fail to predict a complex system's behaviour because infinite accuracy is required to establish an initial state of the system upon which to base prediction. Thus complex behaviour appears unpredictable for more than a relatively brief period before predictions become so inaccurate they are of no benefit.

'*Regular irregularity*' will remain observable fact even if it may be indistinguishable from '*irregular irregularity*', so the need to understand regularity and irregularity remains. Definition of irregularity becomes a matter of identification and classification of **'***regular irregularity***'**.

It is conceivable there are events of such rarity they appear absolutely irregular but are theoretically predictable in a classical scientific sense, viz are '*regular irregularity*'. Irregularity in the form of seeming anomalous behaviour which recurs can be investigated. However, even a well documented anomalous phenomenon like ball lightning, with thousands of examples reported, remains inexplicable by science [53]. The **'***regular irregular***'**, such as ball lightning, might be attributable to relative ignorance, and potentially overcome through improved methods of observation and measurement. When a patient recovers against all expectations, how should that be viewed in medicine?

Physical science experiments require the strictly regular. There are random variations in scientific observations attributed to factors varying independently which are peripheral to those investigated. The **'***regular irregular***'** includes behaviours of complex and chaotic systems which appear irregular and unpredictable in a classical Newtonian sense, whilst believed to be law-like and deterministic. Gases observed in physical science appear to behave macroscopically strictly regularly with the law-like behaviour of measurable regular pressures, temperatures and volumes whilst on an atomic and molecular level behaving in a seeming random chaotic manner [54]. Radio-active decay appears regularly irregular, being according to theory and observation for any individual atom absolutely unpredictable as to when it will occur. Yet on a macroscopic scale the time for a radio-active element to decay to half the measurable radio-activity, viz its half-life, is predictably and measurably the same at any moment [55].

Defining and classifying irregularity and the observation and recording of irregularities are initial steps in developing irregularity theory. Any Irregularity Theory is confronted by intractable questions. The idea of '*irregular irregularity*' within an ordered universe begs the questions is absolute irregularity or even an absolute lack of order possible within or outwith an ordered universe?

An Irregularity Theory might posit that to a material universe observer absolute disorder appears to be nothing. Absolute disorder may however be that which cannot be observed from an ordered regular universe. An absolute lack of order appears to be beyond description. Within an absolute lack of order there can be nothing ordered and so no existence, time, space, matter or energy nor any material universe. This is not chaos. Chaos theory suggests chaos is a seemingly-disorganised-order-within-order within a material universe. In absolute disorder there is no thing within it which mathematics can describe. Mathematics itself can '*exist*' only in the domain of order. Alternatively, if an absolute lack of order is instead the simultaneous presences of every kind of order, these must be in conflict and perhaps even in competition with each other, having overall the same appearance of nothing. There can be no material existence of any kind and thus no thing to describe mathematically or otherwise [unless or until one form of order prevails]. It appears a legitimate view in modern physics that '*something is the more natural state than nothing'* with claimed empirical observations of the spontaneous generation of particles and anti-particles from nothing [56].

Mathematics uses unprovable axioms analogously to science's use of absolute presuppositions. Axioms are not products of mathematics. Their use implicitly acknowledges an innate order not originating within mathematics and that without axioms, mathematics alone cannot describe and predict the behaviour of the universe. Mathematics' dependence upon axioms must therefore reflect an innate universal order external to it.

Perhaps, as these considerations of irregularity suggest, physicists must first understand universal order if they are to attempt to explain the material universe.

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