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CHAPTER ELEVEN

Asymmetry and Self-reference

As we have seen in the previous chapter, higher-order observations carry with them a complexity that has to be suppressed by cognition if the observer is not to be overwhelmed during the act of observing. For by that suppression the observer can be comfortable in the delusion that everything is a first-order observation, which is perceived to be objective and thus order-less. Nevertheless the complexity remains, hidden and ignored, although still capable of resurfacing to confuse. That is why any serious analysis has to expose the complexity, and why that analysis must connect with the epistemic considerations laid down in the previous chapters.

Science and Truth

On the other hand, most human endeavour can only proceed by a constant suppression of this underlying complexity and by focusing instead on the appropriateness and utility of the constructs produced. This gives rise to a delusion of certainty in the knowledge produced, and ultimately harbours the belief that knowledge can be expanded so that it equates to *truth*. This belief, which pervades our every waking moment, produces further theoretical and practical constructs. Other utilities are discovered, and this somehow convinces us of the validity of the assumption that we observe the truth about the world. However, we observe things in the world not as they are, but as they are constructed from the feedback we obtain from the observations we project onto the world. This implies an unavoidable distortion of the observed reality. It is the ignoring of this distortion that constitutes what we call a delusion.

In this chapter we concentrate on confronting these assumptions of truth, and the implications for observation. First we shall tackle the relationship between science and truth head on, and then provide a simple example to illustrate some further aspects.

The enterprise behind attaining some form of truth from a reality to which we have only limited access evolves from a fundamental idea, namely that there exists some form of fixed method of achieving this. However, that reality is an emergent property of the structured coupling of observation and cognition; it is an effect of observation not its cause.

On the matter of operating in that ‘reality’, Paul Feyerabend commented:

It is clear, then, that the idea of a fixed method, or of a fixed theory of rationality, rests on too naïve a view of man and his social surroundings. To those who look at the rich material provided by history, and who are not intent on impoverishing it in order to please their lower instincts, their craving for intellectual security in the form of clarity, precision, ‘objectivity’, ‘truth’, it will become clear that there is only one principle that can be defended under *all* circumstances and in all stages of human development. It is the principle: *anything goes* (Feyerabend, 1975).

Feyerabend did not wholeheartedly believe in this principle. He clearly states in the Preface of *Against Method* that his statement was meant to be ironic, and was a response to his close friend, rationalist Imre Lakatos. Despite this, Feyerabend still delivers some devastating blows against rationalism in the final chapters of his book. He describes how:

the illusion of *rationality* becomes especially strong when a scientific institution opposes political demands. In this case one class of standards is set against another – and this is quite legitimate: each organization, each party, each religious group has a right to defend its particular form of life and all the standards it contains. But scientists go much further! Like all defenders of ‘The One True Faith’ that came before them, and those that follow, they as believers insinuate that their standards are essential for arriving at the Truth, or for getting results, and they deny such authority to the demands of the mere politician. True scientists oppose all political interference, and they fall over each other trying to remind the listener, or the reader, of the disastrous outcome of the Lysenko affair¹ (Feyerabend, 1975).

Science and the pursuit of truth: the search for an intellectual security based on objectivity dominates modern science, just as Feyerabend so clearly implies. However, the search for truth transcends the system of science, and comes to bear heavily upon many other systems within the wider society. Feyerabend goes further to claim that the education system is mostly to blame for a situation where ‘Teachers using grades and the fear of failure mould the brains of the young until they have lost every ounce of imagination they might once have possessed.’ Even worse, this loss of imagination is coupled

with a stark mechanization of thought and methodological orthodoxy. A set of fundamental principles become embedded within the cognition of those being taught, which prevent those educated from realizing that they are all thinking the same way via the same set of frames simply because they have been trained to do just that; this is particularly the case when it comes to science's function. Subsequently the fact that they all think the same way is taken as proof that the subject matter of their representation of reality is true *per se*. Surrounded by this widely accepted series of pre-constructed methodological orthodoxies, it becomes almost impossible to deny the powerful idea that we are somehow converging on truth; that it is all based on the delusion of objectivity is discounted as ludicrous.

This search for truth is never abandoned. The scientific standards have become so ingrained in our methodological attitudes that they have diluted the very enterprise of epistemology. This is evident in the academic world where the subliminal and mystical superiority of the natural sciences over the social sciences is projected by the defenders of objectivity. Imagination is yet again restricted by the methodological orthodoxy of the natural sciences; but this difference between natural and social sciences is misplaced. The superiority of one over the other is judged on their respective projected abilities to have a predictive value over future circumstances, despite this not constituting a sound basis for comparison. The natural sciences deal with the abstract simulation of the repetitive, where the repetitive is either constructed or pre-existing, whereas the social sciences deal with the description of the complexity underpinning social systems and the ensuing emergent phenomena. They remain worlds apart.

Science as an Umbrella-term

Despite this difference, the overriding belief remains that there is a truth for which the natural sciences are predominantly responsible. Indeed, this conviction of searching for truth has been considerably reinforced, and the previous successes enjoyed by the natural sciences have greatly influenced and supported the assumptions underpinning the search for truth. However, it is not only the search for truth as advocated by the proponents of objectivity that is problematic, but also the belief that their method for approaching that truth is true in itself. How ironic that, in the case of science, a method responsible only for generating distinctions is described by many as having a single and standalone utility: the discovery of truth. The fallacious underpinning of this utility is immediately exposed when we

consider how the concepts of science and truth are structurally coupled. As Feyerabend clearly states, science 'may be a single word – but there is no single entity that corresponds to that word'.

We can therefore assert that science, as a single connecting word, acts as an umbrella-term to represent the utility of the search for truth, while at the same time there is no ontological unity behind this word; there cannot be. Scientific disciplines become differentiated as sub-systems within the projected unity of the system of science, and further differentiation occurs on the basis of different theories that are continually being introduced in each domain. That there are both competing as well as contrasting descriptions of facts by different theories, and that even more importantly the same so-called facts can be represented by, and accounted for, in different theories, points towards a non-unitary cosmos in the fabric of science. Just as no single theory agrees with all the so-called facts in its problem area, there can be no single entity that corresponds to the umbrella-term that we call science. What is science then? Is it not the umbrella-term that is associated with the utility of the search for truth? However, since no ontological unity exists behind the word science, no correspondence can exist in the projected utility of science itself. Hence there is no truth to be extracted.

To examine this situation in more detail, it is important first to understand that the categories constructed within, and for the furtherance of, scientific endeavour continue to reconstruct its epistemological foundations for the pursuit of knowledge. In other words, further distinctions are created that continue to fragment the ontological background that is projected into the supposedly unitary endeavour called science. This establishes a multitude of scientific fields for which the corresponding epistemic relationships are to be questioned, and opens up a question that becomes highly relevant for the purposes both of examining these epistemic relationships and of asking how such relationships become influenced by observation. The question then becomes: what are the epistemic relationships that are established between scientific fields.

Epistemic Relationships Between Different Scientific Fields

Various forms of this question have troubled mankind over the millennia, but always they eventually seem to be ignored, and are allowed to fade away. These questions masquerade differently in different settings, but the underlying logic is essentially the same. As physicist David Lindley notes in the opening of his book *The End of Physics*, a question still remains at the

core of all physics. Wigner and Einstein (Lindley, 1994) also posed it: ‘Why should physics be inherently mathematical?’ In his prologue to *The Lure of Numbers*, Lindley goes on to note that:

the lure of mathematics is hard to resist. When, by dint of great effort and ingenuity, a previously vague, ill-formed idea is encapsulated in a neat mathematical formulation, it is impossible to suppress the feeling that some profound truth has been discovered. Perhaps it has, but if science is to work properly the idea must be tested, and thrown away if it fails.

The expectation of uncovering profound truth is undermined by an established epistemological paradox between mathematics and other scientific disciplines. This paradox becomes strikingly vivid in the words of Richard Feynman concerning the remarkable relationship between mathematics and physics: ‘mathematics is not a science from our point of view, in the sense that it is not a *natural science* ... the test of its validity is not experiment’ (Feynman et al., 2006). When we come to realize this we are faced with an even more crucial and elemental problem: what sort of epistemic anomaly is this, whereby a science is built upon a non-science²? Clearly, the elusive character of how we know what we know is far more problematic than what simple epistemological categorizations would have us believe.

Beyond the example of this epistemic interaction between physics and mathematics, if we confront this anomaly in other epistemic interactions, say between mathematics and Information Systems within the context of positivist research, or between mathematics and management, then many problems arise. How current research into Information Systems, or management, or knowledge management, or financial markets and the like have become so heavily influenced by mathematical techniques is something that the authors of this book find to be utterly puzzling, quite fascinating, and bizarre. They point at the chaos of September 2008 in the financial markets that resulted from applying sophisticated mathematical techniques, and note that this has led to a rejection of particular mathematical instruments in this context, but not of the validity of applying mathematics itself.

This influence of mathematical representations in different and differing scientific fields must be questioned if we are to make sense of this fallacy for the search for truth, a search that is usually underpinned by a belief system that drives the mathematical descriptions. It is indeed no accident that fields like chemistry, or physics, or any other domain within the natural sciences

utilize mathematical schemas to communicate theories/empirical data, both within a domain and across domains. In what follows we use the example of the Pythagorean Theorem to describe how this relationship plays out in the case where a geometrical entity is given a mathematical description. Certainly, amongst the complexities of modern science and the multitude of differentiations now available, this might appear to be a simple example, and indeed it is; but readers are asked to consider this example within the context of the arbitrary nature of mathematical descriptions and the search for truth that is projected by objective and rational thinkers.

Before going into the details of this brief example, let us first take a step back and clarify both the position we are taking and the stage of development of this particular argument. We have thus far described how rationality and objectivity become associated with the discovery of truth. Furthermore, we have seen that the enterprise of science becomes associated in itself with the discovery of truth and, within the enterprise of science, that the belief that a mathematical description of the relationships uncovered by science is what is supposed to give substance to the quest for truth. Even though there is no single entity behind the umbrella-term of science that can functionally represent this quest for truth, it is still surprising to note that the belief in this quest remains undiminished. Science is projected to function as a unity in its quest for truth. Because there is no single entity behind the umbrella-term of science, mathematics as a schema acts as a replacement for this function of unity. In other words, mathematics, by having the potential of establishing communication amongst different sub-systems within the system of science, assumes the role behind the quest for truth. Mathematics is actually the only notational schema that has acquired such a function, and hence any pursuit of truth that is claimed by science must consider this relationship.

Quality Versus Quantity

In plain terms, what we have here is a game played out between science and truth, underpinned by the functionality that mathematical schemas establish between them. This setting is rarely fully questioned by scientists. Even though mathematics is utilized throughout the natural sciences as a common schema of communication, and science itself propels the quest for truth, the underlying distinction remains largely unexamined. This underlying distinction can be set down in the form of a question: can truth be quantified? If such a thing as truth were to exist, and science was to be the

formal enterprise that could attain its quantification, then we must accept from fundamental observational premises that quantification is just one part of a distinction. The other part of the distinction ought to be included, or ought to be a property of truth.

If any distinction could exist to include both these aspects then that would be the distinction between qualitative/quantitative. We will straightaway see why this distinction is problematic and insufficient. To shed some light on this issue we can immediately observe one major difference between the two terms. Whereas quantification denotes a process of abstraction and formalization onto a mathematical schema of representation, an equivalent term is not available for the concept of quality; we do not speak of *qualitification*, and the possibility of creating a process that can infuse quality into an *entity*. Ontologically, it is assumed that quality exists, and is intrinsic to an entity that we attempt to describe. Indeed, this is denoted by the origin of the word quality (ποιότης in Greek) that implies the substance of the entity, or its essence. But there cannot be only one quality for each examined entity simply because the concept of isolating one entity does not exist. An observer is required and the function of the observer is to create a distinction between what can be observed and what must by necessity be left unobserved; in doing so, the observer re-arranges the ontological stratum upon which an entity is perceived. The concept of quality is then fragmented into a series of qualities, which can yet again be further fragmented. The same is valid for quantification, but here this variation is hidden by the exactness of a numerical representation.

Truth as an entity, if such an entity could exist, finds no connecting value within the distinction established by the perceived existence of a qualitative nature of entities and the formal enterprise of their quantification. On one aspect of this matter Feyerabend remarks:

wherever we look, whenever we have a little patience and select our evidence in an unprejudiced manner, we find that theories fail adequately to reproduce certain quantitative results, and that they are qualitatively incompetent to a surprising degree. Science gives us theories of great beauty and sophistication. Modern Science has developed mathematical structures, which exceed anything that has existed so far in coherence generality and empirical success. But in order to achieve this miracle, all the existing troubles had to be pushed into the relation between theory and fact, and had to be

concealed, by *ad hoc* hypotheses, *ad hoc* approximations and other procedures (Feyerabend, 1975).

The problem is, we can never select our evidence in an unprejudiced manner. Observationally, we interfere in the act of selection, and hence we infect these processes of selection with paradox and the delusion of certainty. The problems that exist between theory and fact are masked, and approximation establishes itself as the only true fact of any scientific enterprise.

Pythagorean Quality

The relationship between the qualitative nature of a described entity and the quantitative abstraction that gives rise to the entities' mathematical representation stands central in this debate. The authors assert that mathematics is itself an ever-expanding self-referential system that emerged from the phenomena of categorization and pattern matching within human cognition. It is *not* the stuff of which some Akashic Field is composed, and to which humanity has somehow been granted access. Mathematics is *not* something outside of cognition that we latch onto. It is an abstract product of cognition, a self-referential description with which to describe scientific descriptions, and as such it is human, all too human.

Starting with a vague primordial notion of category, humanity's various means of describing (mathematics is one such means) set out on the road from the *Chaotic* natural non-linear world in which we exist to the unnatural linear world of our constructed abstraction. Travelling along this unending path of developing abstractions we add layer upon layer of sophistication, because eventually we manage to rationalize away any paradox or absurdity that pops up, only for new ones to appear.

This problem of acquiring a mathematical description has manifested itself in many different ways, and has replicated itself in a self-referential manner throughout all scientific disciplines. There was a time when this problem was exposed to a different/lesser degree of detail: namely at the school of Pythagoras (late sixth century BC). The example of the Pythagorean Theorem can shed some light on this matter. This most famous of all mathematical formulae states that if α and β are the two shorter sides of a right-angled triangle, and γ is the longest side (the hypotenuse), then $\alpha^2 + \beta^2 = \gamma^2$.

Pythagoras and his school attempted to balance the perceived qualitative nature of a geometrical entity and its quantitative representation. For all geometrical entities, they maintained that rationality as a quality intrinsic

within their geometrical examinations could only be expressed quantitatively by integers or ratios of integers: the so-called rational numbers of modern mathematics. For instance the length of a triangle's side or that of any polygon ought to be expressed by an integer or by a ratio of integers. To them anything else was considered to be irrational, quite absurd: an interesting insight into the notion of quality within their particular self-referential group.

The Pythagoreans would have been horrified by the existence of irrational numbers, namely numbers that cannot be represented as a ratio of integers. What would they have made of the following theorem that is taught early on every undergraduate mathematics course?

Theorem

- (a) *between any two different rational numbers there is at least one other rational number;*
- (b) *between any two different rational numbers there is at least one other irrational number;*
- (c) *between any two different irrational numbers there is at least one other rational number;*
- (d) *between any two different irrational numbers there is at least one other irrational number.*

Recursive application of this theorem indicates that in all these statements the assertion of the existence of a single number can be replaced with that of infinitely many numbers. What is perfectly reasonable to an undergraduate would have rung alarm bells with the Pythagoreans, a group that was exploiting a lesser form of self-referential mathematics.

Granted the Pythagoreans in their teachings³ had made the journey to a self-referential denial of the absurdity of integers, but they had not yet added to their self-reference the denial of the absurdity of infinity that is implicit in irrational numbers as highlighted in the above theorem. They had accepted the instrumental fiction of the integer, but their level of abstraction had yet to move further along the road from the natural non-linear world to the linear and unnatural. In their sense-making, the utility of the irrational number had yet to overcome its absurdity.

However, they had moved someway along that road. In their particular self-referential world the absurdity of how a physical object could have a dimension that was an exact integer multiple of a fixed unit just didn't occur to them: namely that all measurement is approximation. The particular

absurdities of their position had been ring-fenced and absorbed into the background that was their understanding of mathematics. That the best they could hope for was a close approximation to multiples of a length taken from a measuring rod may have occurred to them, but that wasn't taken into consideration. The impossibility/absurdity of ever having a physical example of a triangle with sides exactly 3, 4 and 5 units other than as an abstraction was never an issue.

Anyway, and ignoring this problem, the story goes that when Hippasus, a disciple of Pythagoras, took that extra step and extended the self-referential system of mathematics by uncovering such an irrationality, some of his fellow students took drastic action ... they drowned him at sea (Singh, 1997). By considering an application of the Pythagorean Theorem in the case where both α and β equalled 1, Hippasus allegedly came to a solution for γ in which $\gamma^2 = 2$; he has since been attributed with the discovery of irrational numbers. This discovery clashed with the idea that the geometrical entity of the hypotenuse could be expressed as a ratio of integers, thereby contradicting the basic qualitative principle of rationality laid down by the Pythagoreans.

Skirting around an even more elemental issue, namely the arbitrary designation of distance with numbers, Hippasus had raised an important question. How could it be that a fixed length, something (namely the square root of 2) that by definition should be rational and expressed only with integers, has a quantitative representation as an infinite number of decimal digits instead of a ratio of integers? With his drowning, this absurdity was swiftly suppressed, ... but not forgotten. The rot had set in.

An Imbalance

Within the notational schema of mathematics, another notational distinction appears. Even though the symbol '=' pre-constructs the expectation that the two respective parts distinguished by it ought to be found equal, this is not the case. Within the very same mathematical notation, if we substitute the symbol for the square root of 2 with the actual number that any square-root algorithm throws up (1.412... to whatever finite accuracy), and multiply that finite decimal with itself, the equation is transformed into a non-equation since the result is not the number 2.

For practical applications, this error is tolerable, depending on the degree of accuracy being pursued in any given context. But for epistemic considerations it comes to imply much more, namely that with the exception of tautologies, where things are axiomatically designated to be as they are,

everything else constitutes an approximation; this approximation is an unavoidable occurrence in the conceptual leap from an issue of tautology to an issue of asymmetry. This asymmetry implies that there is an imbalance between the axioms that constitute starting points of exploration and the output of operations that, based on the axioms, are applied in different contexts.

This imbalance between the axioms and the output of operations is experienced by any self-referential system in attempting to gain information from its environment. A self-referential system is based on such operations. With their utilization via the axioms that constitute its starting point, the self-referential system exposes itself to its environment and manages to exchange information with it. It is in this sense that the system is operationally closed but informationally open. Otherwise, it cannot sustain its self-reference and internalize further operations, and it cannot expand beyond the level of tautology. The example of the Pythagorean Theorem is indicative of this. A new operation, that of applying the square root of 2, is constructed and internalized, but its internalization is only made possible by moving beyond the level of tautology. The possibility arises by the arbitrary designation of a further construct, namely square root. This same asymmetry had also occurred with the accepted assumption that there are physical objects with exact integer dimensions.

This comes to imply an inescapable conclusion for the epistemic relations developed within self-referential systems, namely that asymmetry is a fundamental prerequisite for self-reference. Without an asymmetry that covers up an absurdity, nothing would be constructed beyond a tautological form. Ultimately, this asymmetry is ignored by those that 'crave for intellectual security in the form of clarity, precision, objectivity, truth': as Feyerabend so eloquently put it. With asymmetry at the core of self-referential operations, absurdity and paradox are inextricably but imperceptibly intertwined. But with the useful application of theories in the real world, utility prevails over absurdity, and the greatest delusion is forever masked: the road is now open for some to claim that they are the seekers after scientific truth, and grand super-theories that explain everything, ... etc. And yet all is epistemic dogma, suppressing the stratum of absurdities, in order to underpin the utility.

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