

Science's First Mistake

Delusions in Pursuit of Theory

Ian O. Angell and Dionysios S. Demetis

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by

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and

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To Mary and Anna

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O sancta simplicitas! In what strange simplification and falsification man lives! One can never cease wondering once one has acquired eyes for this marvel! How we have made everything around us clear and free and easy and simple! How we have been able to give our senses a passport to everything superficial, our thoughts a divine desire for wanton leaps and wrong inferences! How from the beginning we have contrived to retain our ignorance in order to enjoy an almost inconceivable freedom, lack of scruple and caution, heartiness and gaiety of life – in order to enjoy life! And only on this now solid, granite foundation of ignorance could knowledge rise so far – the will to knowledge on the foundation of a far more powerful will: the will to ignorance, to the uncertain, to the untrue! Not as its opposite, but as its refinement! Even if language, here as elsewhere, will not get over its awkwardness, and will continue to talk of opposites where there are only degrees and many subtleties of gradation; even if the inveterate Tartuffery of morals, which now belongs to our unconquerable ‘flesh and blood’, infects the words even of those of us who know better – here and there we understand it and laugh at the way in which precisely science at its best seeks most to keep us in this simplified, thoroughly artificial, suitably constructed and suitably falsified world – at the way in which, willy-nilly, it loves error, because, being alive, it loves life.

Friedrich Nietzsche, *Beyond Good and Evil*,
Part Two: The Free Spirit, Section 24.

Preface

Human history is one long account of the success of our species, in that we have managed to survive and prosper in the surrounding hostile 'real' world. It is a tale of continuous experimentation with various ways and means of coping effectively with whatever that world has to throw at us. We approach the task by synthesizing information about things in our vicinity, and systematically applying it for our benefit, both as individuals and in groups. The latest stage in this venture has seen the use of computer-based technologies infiltrating most aspects of socio-economic and political life, and automating as many operations as possible. Consequently we find ourselves enclosed on all sides by computerized information systems. Governments worldwide are setting up huge databases to store the personal information of their citizens, all with the best intentions, albeit predicated on the most naïve understanding of the implications and consequences. Despite decades of numerous highly expensive failed projects, and the many detrimental outcomes, their faith in this particular form of information technology remains undiminished.

Granted there are many benefits, however, our lives are now severely constrained, confined by the automated preconditions these systems lay down, admittedly not always in our best interests. Closed circuit television scans city centres and motorways to watch for what is labelled antisocial behaviour. Businesses profile their customers with impunity, and then inundate them with junk mail. At the same time the corporate sector is compelled to comply with government regulations, having its technology resources drained in what is the ultimate denial of service attack. More recently, the global banking system was brought to its knees by the rocket science of computerized financial instruments. Meanwhile the Internet is welcomed into our homes and schools despite the many monsters that lurk within. Etcetera, etcetera.

Information systems are all pervasive, but what exactly is an information system? More specifically, just what is information? This book will consider such questions but from a sceptical viewpoint. Readers are provided with a theoretical description that characterizes not only the utility that comes with these technological systems, but also the futility and what the authors claim is the absurdity in much of humanity's undiminished faith in them. The authors will go much further than an analysis of mere computerization, and characterize science itself as the definitive information system. Science, supported by various types of technology, promises the Holy Grail: an

explanation of all that happens in the physical reality that is the natural habitat of humankind.

As two committed sceptics, the authors take issue with the scientific approach, pointing out some of its shortcomings. They will show that the various systems spawned by that approach, each with its own *modus operandi* for dealing with the manipulation of the vague concept of *information*, are confined by some basic restrictions that too often remain masked. For these, information systems produce constricted *explanations*: a form of tunnel vision that delivers a clear central focus, but with the ambiguity of paradoxes at the periphery. Any identified paradox can be clarified by pulling it into the tunnel with a further sophistication of the mechanisms that is used to develop the system itself. However, this process will introduce yet more paradoxes. Should these intrinsic paradoxes prove non-problematic, we can, and do, deny them. This is particularly the case if the approach taken proves nonetheless useful. Then with that denial, faith in the explanations is reinforced as we become convinced of their validity. However, step outside the tunnel of our comfort zone, and no longer in denial, the explanations will soon start to appear absurd.

By exposing the reader to the intrinsically paradoxical nature of human observation and cognition, the authors embark on their sceptical journey to describe how the absurdities behind the systems of science and technology take shape. They note that every system must include an information system in the broadest¹ sense of the term; that is, every system must contain information about itself. At the same time it collects information about its environment, and uses that information to direct its actions so that it can survive and prosper. Without this gathering of information the system would be incapable of adapting to its constantly changing environment, leading to instability that could prove detrimental to that system's performance, possibly even to it becoming terminal.

The concept of *information* entailed within the term *information system* still remains one of the most obscure in our vocabulary. Perhaps the reason for the elusive natures of both information and system can be found in the ontological stratum wherein we perceive the existence of all systems and information?

In biological systems, for example, some information contained in (and about) the systems themselves is hardwired: encoded in the form of a genetic code, the double helix of its DNA. This particular form of information contains the basic mechanisms through which these systems gain the capacity to

replicate themselves, albeit with some variation and mutation. This type of information, through what Darwin described as evolution by means of natural selection (Darwin, 1859), changed and developed over time to a degree where now it supports functions far beyond the mere reproduction and the self-sustaining of biological systems. The evolutionary process has not only sustained the primary biological instincts of organisms, but also allowed for the emergence of more sophisticated abilities in some species, and in particular that of *observation* and *cognition*: two emergent abilities that this book identifies at the core of its analysis.

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CHAPTER ONE

Introduction

Theory and Paradox

This book grew out of the authors' concerns over the popular, almost casual, use of the term 'information'. Added to that was their aversion towards the obsessive use of theory in the mainstream academic study of Information Systems (IS), and the way that enforced consistency with such theory masquerades as rigour: Structuration Theory, Neo-institutionalism, Actor Network Theory, the Technology Acceptance Model, Systems Theory etc. The authors were concerned that despite all this theoretical overkill, and possibly even because of it, the history of computerization was (and still is) one of the highly expensive failures marching alongside the computer's domination of business and society. However, the deeper they looked into the issues, the more they began to suspect an enigma, although one that did not lie with IS *per se*. They now see it as implicit in every field that makes a claim on the production of knowledge, including every scientific endeavour, and every technological development.

This book then is the authors' catharsis. Both of them eventually came to accept that all theories are limited by intrinsic paradoxes, and not just those theories favoured by their own IS Community. Consequently, this book is intended to have relevance for researchers and students of other subjects far beyond IS, by pointing out that the control the scientific establishment attempts to exercise over a myriad of human activities is both fanciful and misguided. In principle, the book reflects on the limitations in the processes of constructing knowledge, as well as in the methods used to gain that knowledge: epistemology. It sets out to describe both how the processes by which knowledge is created are infested with paradoxes and how these paradoxes come to undermine all epistemological endeavour.

In expressing their dissatisfaction with all the pretence of profundity in their own subject, and in others, the authors are not trying to undermine the utility of theory *per se*, far from it. This book itself is nothing if not theoretical. They simply, but paradoxically, want to reflect upon the processes that tend to weaken critical thinking whenever theoretical positions are treated as an incontestable reality, when at best those positions exhibit a mere internal

consistency. As Einstein observed: 'As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality' (Einstein, 1922).

Often trapped within the vast abstract realms of individual theories, the human species has created conceptually rich yet limited theoretical streams, which appear to grow, and grow, and grow in scale and influence. From such a continuing expansion springs the belief of having achieved a deeper understanding of the world of phenomena in which we are constrained to operate, rather than merely a different, albeit a more detailed and more sophisticated, description; or as Nietzsche would have it, a more 'granite foundation' of 'refined ignorance'.

To demonstrate the validity of their concerns, in this book the authors consider how scientific knowledge comes to be constructed, showing how that construction is fundamentally flawed. These flaws are not contingent on each theory in itself, rather they are a precondition for each theory to exist. Despite being flawed, communities nevertheless arise around the application of such theories. Why? Because kept within limits, each community-accepted theory is an excellent means of temporary communication within that community. There each theory, as *the chosen one*, bestows the benefits of legitimacy on any consequent analysis. However, take any theory beyond its limits, beyond its life span, beyond its utility, beyond its community, and claim for it an absolute truth, then it becomes absurd; and hubris beckons.

In order to illustrate these ideas, this book will dip into an eclectic mix of deeply theoretical issues that propagate across many disciplines, and not just those popular in study of IS, or more generally in the social sciences. Indeed, examples from physics and mathematics will be used liberally to make the point. These latter examples, guided as they are by specific theories, and with their predictive aspects, are the envy of the mere normative theories prevalent in the study of the social sciences including the so-called management sciences. However, the authors concur with Nietzsche's introductory quotation above, taken from *Beyond Good and Evil*, and insist that physics and mathematics too have 'feet of clay'. In pointing at such an irony, this book acknowledges the debate raging within the IS field, and more widely in the social sciences: namely whether the testing of hypotheses in quantitative research is 'more legitimate' than in qualitative research: a position taken by a good majority in the social science communities, at least until recently.

In a detour, the book rather grandiosely, and with not a little irony, challenges the endeavour in physics of searching out a Grand Unified Theory (science's ultimate dominion over the human condition), and to a small extent considers what such a contradiction might entail. The main message of the book itself encapsulates a paradox, entailing the rejection of the proposition that a movement towards a deeper understanding is possible, because for the authors there is no understanding, only a description constructed for the sole purpose of utility.

The authors will not be restricting themselves to physics, or for that matter to the natural sciences, which to them are far from natural. Nor are they mostly interested in the mathematical framework that supports the efforts for a Grand Unified Theory. Much more interesting is the projected purpose behind such theories, and particularly the underlying epistemological contradictions that theories inevitably entail. Actually, the authors propose that such contradictions, far from being problematic, are a necessary prerequisite for theories to evolve in the first place. They will argue that there can never be a theory of everything, for reasons based on the fundamental epistemic nature of human observation and cognition. The authors insist that there can be no separation between sensing and the making sense of things in the world. Observation and cognition are inextricably linked; they are structurally coupled. This they claim will impact the nature and scope of every scientific, indeed every theoretical endeavour that insists on such separation, and so will have profound implications for any consequent research.

Even though the authors recognize that some philosophical similarities can indeed be drawn to Gödel's Theorem of Incompleteness (Gödel and Feferman, 1986), conceptually they still argue that their thesis stretches beyond strictly formulated mathematical implications and logical consequences. This book considers how every scientific construct is formulated from interpretable observations, and the premises that guide them. Much of the work is based on an analysis of 'self-referential systems', as portrayed in the seminal works of Professor Niklas Luhmann: *Social Systems* (Luhmann, 1995), *Essays of Self-Reference* (Luhmann, 1990) and *Theories of Distinction* (Luhmann, 2002b).

The authors will postulate that there is no way out of several of these paradoxical contradictions, and describe each scientific construct as a multitude of intrinsically paradoxical and co-evolving *self-referential systems*: a phrase that hopefully will come to mean much more to the reader after absorbing the analysis of the major concepts involved.

The Delusion of a 'Theory of Everything'

The human urge to uncover the ultimate information about how 'reality' functions remains as strong in us as ever. For example, Hungarian philosopher Ervin László (László, 2007) introduced the notion of the Akashic¹ Field: the field of information that unifies all things. Many highly reputable scientists (physicists in the main) have been, and are still, optimistic about eventually uncovering such a 'Theory of Everything'. Just before the turn of the twenty-first century, one of the authors (Dionysios Demetis) was present at a physics colloquium where the distinguished professor Stephen Hawking was a speaker. Hawking outlined his vision of such a Theory of Everything, saying that we might be very close to fulfilling this promise. A decade later that promise looks equally remote; but few scientists have given up on that dream.

The authors' aim in this book is not to undermine that aspiration, but instead to demonstrate that a belief in such unification can considerably restrict other perspectives. They are not alone in claiming that humanity is incapable of articulating such a Grand Theory. Many have expressed doubts over such an endeavour (Hayek, 1952; Lindley, 1994), although most recent attention has been supportive of the notion. The authors intend that the justification of their stance will gradually become apparent as this book proceeds; all the while their treatise on self-reference, paradox and observation, and various interrelationships, will hopefully approach the subject matter in a way that will clarify the issues, although they will be the first to admit that their own underlying substance is also paradoxical.

To the authors, a Theory of Everything is the grandest manifestation of a *delusion*; they use the word delusion here to denote an epistemic position, a state of mind, and not as a derogatory expression. An epistemic position automatically implies a description of how we humans know what we know (Crotty, 1998), but this they argue occurs via a delusion that is constructed to be personally convincing; a delusion that arises from the necessity of observing, and yet all the while observing leaves much unobserved. Socrates summed it all up in his famous quotation: 'All that I know is that I know nothing.'²

This book presents the drive towards a Theory of Everything as a demonstrably impossible dream, and implies that science does not uncover 'truth'. The fundamental premise is that observation in general is an *a priori* requirement for the formulation of any theoretical construct. However,

there can be no observation without a distinction, but with that distinction other things go unobserved. Therefore a Theory of Everything, by definition, cannot take into account any difference or distinction, because then something would be left outside of the scope of the theory, and therefore would not be included in the theoretical construct itself.

Residual Category and Non-reference

Professor Niklas Luhmann captured the power of this fundamental concept in the following quotation:

When observers continue to look for an ultimate reality, a concluding formula, a final identity, they will find the paradox. Such a paradox is not simply a logical contradiction (*A is non-A*) but a foundational statement: The world is observable *because* it is unobservable. Nothing can be observed (not even the ‘nothing’) without drawing a distinction, but this operation remains indistinguishable. It can be distinguished, but only by another operation. Or to say it in Derrida’s style, the condition of its possibility is its impossibility (Luhmann, 2002b).

‘The world is observable *because* it is unobservable.’ ‘The condition of its possibility is its impossibility.’ These two apparently nonsensical sentences actually make perfect sense. What Luhmann is saying is that observation is not, cannot be, what we think it is; hence the present authors’ (over)use of the word delusion. Observation of a part is only possible because the whole is unobservable. Not that the whole in this respect can be defined, for then that whole would need to be distinguished from everything but the whole itself: namely, distinguished from nothingness. Such separation is intrinsically problematic for reasons that will be investigated in this book, starting with the impossibility of defining *nothing*, as noted by Luhmann. The *whole* therefore takes on two different meanings in itself, introducing yet another distinction: (1) the whole defined by an observation that separates that whole into what is being observed, and what is not; and (2) the whole as the external reality that cannot be investigated without the operation of observation.

By necessity, the act of observation actively involves the observer in the world so that he³ has choices, and is not at the mercy of inertia. It becomes evident that in observing, the observed part is distinguished, separated. That very act implies that the separation between what can be observed and what

must be left unobserved is more of a necessity than a mere compromise. However, such a necessity comes with problems and paradoxes. What is observed is not the thing itself, but an internalized representation of that thing, which has to fit into categories constructed for it by observation, cognition and delusion.

The cognitive sampling and categorization of things observed in the world is both the result of observation and the means whereby observation is possible. We don't observe categories, rather through categories. The very act of categorization remains an obscure selection process that is guided by the success or otherwise of previously chosen categories. Each observation categorizes things in the world via the imposition of linear distinctions. These things are separated within the observed scene, but they still remain structurally coupled to the rest of the world. These couplings are lost to the particular observer, but they remain part of a non-referential system created by the self-reference imposed by original observation (as the unobservable part of the distinction). However, they may appear as other-referential systems within the self-reference of other observers.

Whatever the scenario that comes into play, an observer creates a distinction that always leaves something unobserved as a precondition of observing the something that has been selected. Here, the word linear is used to mean the categorization on which cause-and-effect processes are insinuated, and that exhibits a directly related change; it is where action always ends with a reaction. Thus, from this perspective, linearity is unavoidably imposed by both science and technology, which derive from, and function under, the causality hypothesis. All methods are linearity imposed on a non-linear world: all observations likewise. However, the ensuing paradoxes will necessarily introduce uncertainty; should this prove disruptive then we are back to the problem of structuring the observation, which leads to yet more paradoxes.

It is erroneous/absurd to insist that a categorical representation of a thing is identical to the apparent *thing-in-itself*, because 'the map is not the terrain'. And yet this is accepted as an all too common position. Not that there is necessarily such a thing as a thing-in-itself, only that somehow an intellectual process is triggered that convinces the observer of the thing's existence. The concept of something in-itself, of something *per se*, or however that concept is stated, is merely an abstraction that removes all observers from the existence of that thing. The notion of a thing-in-itself denies the variety of categories that may be imposed on it by the existence

of different observers, and thereby allows the delusion of objectivity to enter the arena of knowledge.

Luhmann exposed the shaky basis of objectivity with his recognition of the fallacy of treating the remainder of any one thing as a separate residual category. For such treatment would imply that the structural couplings have simply disappeared in the separation, and that the two parts no longer comprise the original whole. Thus observation, by its very nature, must introduce asymmetry: couplings are made to disappear from within what is by necessity the linear representation of that observation; but those couplings are still there in the world. The couplings constitute a non-linear phenomenon existent both in what we abstract to be the thing-in-itself and in the unobserved remainder; however, they will have disappeared from the corresponding abstractions. The two artificially separated parts will continue to operate, and perhaps interact within the unobservable whole; but not in the observation. Hence, observation is conditional, but those conditions are necessarily unobservable, unappreciable, uncertain. Hidden in paradox, beyond observation, beyond cognition, beyond memory, beyond logic, steeped in uncertainty, they are necessary preconditions of observation, cognition, memory and logic.

But observe we do. As humans, we continuously observe the paradoxical residual categories of previous observations, and store them in memory. By observing, we introduce and pioneer new connections amongst our ever-expanding set of artificially introduced constructs. Piling them up, memory upon memory, paradox upon paradox, albeit each kept artificially separated. All thought of the fundamental asymmetries is conveniently ignored in our tidy linear descriptions, deluding ourselves that through observation we ‘understand’ the ‘real world’ of phenomena. However, as Lewis Carroll remarked: ‘It’s a poor sort of memory that only works backwards’ (Carroll, 1994). Consequently the authors shy away from using the word ‘understanding’. Instead, they prefer to use ‘cognition’, which for them implies only the grasping of a limited description of what is perceived. In this book, understanding is treated as an umbrella-term that represents the shared-delusions of those individuals who suppress the paradoxes they have each created in their individual observations, and who forget about the structural couplings that each has severed.

Perhaps some comment on the nature of paradox is called for here. The issue of paradox is often illustrated by reference to Bertrand Russell’s village barber who shaves all and only those men in the village who don’t

shave themselves. There is a paradox in 'who shaves the barber?'⁴ If the barber shaves himself then he shouldn't, and if he doesn't then he must. It is possible to get out of this pickle by imposing restrictions, like making the barber a woman, or making him live outside the village. A pedant could even say that shaving and being shaved are different acts. However, none of these mental gymnastics can avoid the potential for paradox in the unrestricted and unconditional situation.

The authors, however, don't want the reader to be thinking of a paradox as a mere logical conundrum. Paradox is housed partly in both what is observed and its residual category, and also partly as a non-referential component hiding in the gap between, subsumed in an assumed boundary, but with a latent potential to disrupt. This part-observed/part-unobserved and non-referential quality means that any interpretation arising from an observation will have something missing. This unavoidable misinterpretation initiated by every act of observation can and does interfere with the logical tidiness of any consequential analysis. Effects of that interference will be vaguely recognized by the observer, but will be inexplicable to him. Another observation is required to clarify the situation; however, that too will introduce new distinctions and new severed couplings, bringing with them new partially unobserved interferences.

The Point/Line/Plane Paradox

The nature of what the authors mean by paradox may be illustrated with reference to the humble 'point', 'line' and 'plane': abstractions at the core of geometry and mathematics, 'which would certainly not have originated if it had been known from the beginning that there is no exactly straight line in nature, no real circle, no absolute measure' (Nietzsche and Hollingdale, 1996); and indeed, no point. We both live and are trapped in three dimensions. There can only be imaginary and thus paradoxical excursions into lower or higher dimensions; all are flights of fancy.

A point must be imagined into existence as both a spherical (more or less) dot (albeit a very small blob), and for the practical purposes of calculation one that has no size, no dimension, no substance. How absurd? The point is simultaneously there, but not there: a paradox. A line is imagined as a very thin rectangle in an imaginary two-dimensional sheet, and that too must itself be imagined as a rectangular block in three dimensions, with length but very small breadth and depth; for if it had no breadth or depth it would disappear. The trick for the mathematician is to keep all the images in mind;

to remain in three dimensions with the dot and the block in order to stop the objects from disappearing, but to move seamlessly among the lower dimensions to undertake calculations without being dismayed by trans-dimensional travel.

Mathematicians consider the set $[0,1]$ on the *real line* of all real numbers between 0 and 1, but not including zero; whereas $[0,1]$ includes zero. Not that there is such a thing as a line, but we let that pass. How easily they drop in the number zero. Zero is simultaneously treated as both a discrete object (a thing) and a no-thing, without substance, which can be tacked onto the front of a line without extending its length. In other words they treat that zero as if it is both the presence of nothing and the absence of something.⁵ To achieve this trick, these mathematicians resort to their ‘get out of jail free cards’, using phrases like ‘tends to zero’, thereby avoiding confrontation with the paradoxes. However, if such ritual incantations do not work for you, and you are troubled by such paradoxes, if you can’t do the necessary mental gymnastics to somersault between the two situations, if in the paradoxes you cannot ignore the absurdity of two contrasted and yet inconsistent situations, then mathematics is not for you. John von Neumann summed this up nicely: ‘in mathematics you don’t understand things. You just get used to them’ (Zukav, 2001).

However, those who can do the trick are confronted by, but ignore, some very awkward questions. It also begs the question of whether anything else has been imagined into existence when denying the paradoxes. Thankfully, repeated use of the trick breeds contempt for the paradoxes; and the utility that comes with the trick only serves to justify the contempt. Of course the originators of each trick were only too aware of their paradoxical nature, but over time, at first the majority of users forget, and then eventually most latecomers never learn of the trick at all. Thus the paradoxes lie buried deep beneath familiarity.

But what if the context is such that the paradoxes cannot be ignored? Particle physics is a case in point. Researchers in this field are operating at such a miniscule scale that the notion of dimension is destabilized as the difference between nothing and something becomes fuzzy. It is apposite here that we mention the Planck length (roughly 1.616252×10^{-35} metres), the smallest measurement of length with any meaningful interpretation. Apparently ‘any device that tries to beat the limit will be crushed into a black hole of its own making’ (Calmet et al., 2004). So how then can calculus include distances that tend to zero, other than by inferring lengths that are

meaningless? Paradoxically, calculus itself was involved in calculating the value of the Planck length.

Would it be mischievous to suggest here that many of the phenomena being observed at the limits of observation are actually the products of the point paradox, and not of observation? Many researchers at the cutting edge are sensitive to this possibility, which is why they stress that they are working with theory and not truth. Not that there is such a thing as absolute truth. Although such truth is often presented as an objective description of an observed situation, the fact is that truth must involve a denial of the unobservable paradoxes that are ever present. Meanwhile, the legions of second division scientists speak only of the reality in their experiments.

The Problem with Categorization

In this section we identify a problem that occurs in all attempts at categorization. A linear choice of categories may solve preconceived problems; however, bewildering situations will inevitably arise that finesse, even reverse, the best intentions of analysts. Take, for example, DNA databases aimed at identifying and catching criminals. Television programmes like *CSI (Crime Scene Investigation)* trumpet the myth of forensic investigators vacuuming up biological material from the scene of crime, and comparing DNA samples with a computerized database, until finally out pops the criminal's name: end of story! Nothing is that simple. Low-paid hospital staff will be compromised to supply samples of blood, skin, saliva and other biological waste material. Aspiring criminals will collect cigarette ends from the street and clipped hair from hairdressers. Then, while undertaking a crime, the perpetrators will randomly scatter an arbitrary collection of DNA material all over the crime scene. Thus the whole system becomes compromised.

Paradoxes in the context always have the potential to conspire against the observer; and preconceived notions of what to expect will instead mislead. Truncated structural couplings, so casually discarded by expectation based on previous observation, stay on to haunt the observer in any further observations, and can reassert themselves in the most inconvenient ways. Arguably the best-known example of this is Heisenberg's Uncertainty Principle, which states that it is impossible to measure simultaneously with any degree of accuracy both the position and the momentum of an electron. Was Heisenberg reflecting on a far more general uncertainty principle, concerning multiple overlapping observations? Possibly! Because every time

a new particle is discovered/posited/observed (such as the Higgs boson⁶) in order to fill a gap in theory, the trailing structural couplings will interfere with empirical experiments and require even more particles to fill yet more gaps in theory.

Particle physicists tell us that our world of solid matter is actually an illusion. To them most of it is empty space, sparsely occupied by elementary particles (that, of course, are not illusions). The effect of various forces at this fundamental and miniscule scale, acting upon and between the various bits and pieces down there, is mistakenly experienced as solidity by us up here at the scale we humans inhabit.

However, we do not have immediate access to this fundamental world of particles; it cannot be viewed with direct observations, rather it has to be imagined into existence via proxies and captured in models. And there's the rub! The human imagination that created this model world of particles is founded in categorizing metaphors that must ultimately have been based upon observations experienced in this world we inhabit: a world that was rejected as being mistakenly solid. Is this a paradox? Or just absurd.

The theory that created this model world of particles is actually a refinement of another earlier theory that posited a model world composed of atoms; one that was imagined into existence as space scantily occupied with the collisions of multi-milliard billiard balls. The paradoxes in that particular metaphor of tiny spheres soon surfaced, and so it had to be replaced by another metaphor where particles were also waves (both wave and particle models were taken from the solid world), and yet more paradoxes. The function of these metaphors is to impose the illusion of meaning on the micro world with the use of models that were formed in, and thus can never fully leave, this solid macro world we inhabit. Thus we have entered a never-ending loop, where ideas based in metaphors have ultimately to deny them in a vain attempt to avoid the paradoxes and absurdities. On each trip around this loop, the denial has to be supported by the creation of an ever more sophisticated variation of the original idea; but that too must be based in metaphor, with its own paradoxes, which again must be avoided with another even more sophisticated variation. As Nietzsche would have it: 'refined ignorance', or as we would call it: *absurdity*.

When considering theories in general, the metaphor of using the scanning electron microscope comes to mind. In order to be seen, some specimens have first to be 'prepared' with a coating. They have to be altered (interfered with) and then zapped with an electron beam, before the collected feedback

is represented in a form susceptible to human observation. Raised up to, and trapped in the human scale, a picture is presented on a monitor. There the image is seen as a variety of shapes by the human observer, who then makes sense of them by categorizing the various components (using a lifetime's experience of shapes). But who knows what the process, between cleaning, mounting, zapping and projection, has added to, or subtracted from, or changed in the specimen in order to make it observable? So much for objective empirical data.

And this is without the enormous pressures and temptations placed on scientists to be 'selective' with the data so that it fits their theory better. Surely not! One still controversial assertion by the famous statistician R.A. Fisher was that the data of the original garden pea experiments of Gregor Mendel, the father of science of genetics, are statistically better than should have been expected (Fisher, 1936).

The warnings of paradox carried in the microscope metaphor are appropriate for any theory, but particularly in situations where the lens of theory brings into existence imaginary observers operating where humans simply cannot go. We have to introduce proxies to represent for example travelling near the speed of light; or tracing the remnants of collisions by the imposition of, say, magnetic fields, and all the while pretending that it is the thing-in-itself that we observe. And who knows whether the concept of *collision*, itself taken from the solid world, has any meaning at the level of infinitesimally small particles. For all theoretical 'explanations' of such alien worlds carry the baggage of being human; they are totally dependent on our 'real world', which presents a solidity that scientists themselves are so insistent on calling an illusion.

Consequently, and by necessity, every theory must inevitably interfere with the things it is striving to represent. Suffice it to say observation and paradox go hand in hand. In physics, this is never more evident than in the famous double-slit experiment that we'll be considering in Chapter 12, but only after spending the intervening pages getting to grips with observation, paradox and delusion (rather than illusion).

Luhmann's insight into 'residual category' is not just relevant at this subatomic level: it uncovers a very common fallacy, namely that of the 'universe' itself; and that's about as big as it gets. The universe, or infinity for that matter, is treated as the residual category to 'nothingness': a highly problematic, if not absurd, stance. Humanity's frail linear attempts to encapsulate the entire astronomical cosmos within that single word have

proved, must prove, futile. It is hardly surprising that physicists tend to compromise by using the phrase ‘observable universe’, in order to separate between what can be observed and what cannot. Alternatively, and as part of one of the many interpretations of quantum physics, they postulate multiple universes into existence as an explanation for quantum phenomena (Tegmark, 2003) such as multiple infinities and multiple ‘nothingnesses’. As if this latter scenario wasn’t far fetched enough, the former differentiation between observable and non-observable universes raises further issues. Here, the authors question even the use of the word observation. They insist that the notion of what is ‘not observable’ is problematic, and should not be taken as a perceived residual category. No matter what we humans do, it involves distinction, and all distinctions, as well as everything that is necessarily unobserved, have implications that will cause surprise.

Consequently, this is a book about the observation of self-referential systems and non-referential systems, and the concept of residual category will be used throughout. That concept is core to the relationship between any system and the environment in which it operates. As Luhmann remarks:

The concept of the environment should not be misunderstood as a kind of residual category. Instead, relationship to the environment is *constitutive* in system formation. It does not have merely ‘accidental’ significance, in comparison with the ‘essence’ of the system. Nor is the environment significant only for ‘preserving’ the system, for supplying energy and information. For the theory of self-referential systems, the environment is, rather, a presupposition for the system’s identity, because identity is possible only by difference... Everything that happens belongs to a system (or to many systems) and *always at the same time to the environment of other systems* (Luhmann, 1995).

A Lapse of Visual Cognition

Although this book will make use of the esoteric world of theoretical physics for many of its examples, a demonstration that observation involves separation and distinction is readily available in another far less mathematically formal discipline, and at a more human scale. Consider the experiment made available by the Visual Cognition Laboratory of the University of Illinois.⁷ An audience is shown a 30 second video-clip of two groups of three students, one in white tee shirts, the other in black. Each team has a basketball that is passed between team members; at the same

time each student moves around weaving between all the others. Prior to being shown the clip the audience is given some 'patter' about the difficulty of counting moving objects. Then they are asked to count the number of times the white-shirted team passes the ball.

On completion of the video-clip, the audience is asked if anyone has noticed anything peculiar. A few will mumble yes, and they are asked not to comment. The clip is then shown again, but this time the audience is told not to count, but to concentrate on the middle of the screen. A man in a gorilla suit enters stage right, walks into the midst of the students who are frantically passing the basketballs, stops to face the camera, beats his chest and walks off stage left. Most of the audience is amazed. They say it's a different clip; there was no gorilla first time round. However, it was the same clip. Until you've been fooled (as both authors can testify), it seems impossible that you could have missed a big gorilla ambling across the screen. But miss it you did. By concentrating on counting (as distinct from just watching), even a great furry animal can just disappear while in plain sight. Seeing – or rather not seeing – is believing (Chabris & Simons, 2010).

The remainder of this book will elaborate on these concepts of observation, paradox and delusion, and relate them to the enterprises of both scientific and general theoretical construction. If the reader follows this journey through to the end, the authors hope that she will share their sense of amazement at the sheer 'magic' of it all.

CHAPTER TWO

Divination and Theory Construction

But where to start? How can this Gordian knot, which entangles observation, cognition, memory and thought be cut so that coherent ideas about theory may be constructed? For this book, that starting point is the apparent sharing of beliefs that inform communities and cultures. The narrative then moves on in a journey, narrowing the focus as it progresses, to end with an in-depth analysis of the individual's cognition and observation.

The text will start with the claim that all human society is steeped in magic, alchemy, or more specifically, divination. The connection of divination to the construction of a theory may not be readily apparent, so it should be elucidated. No theory can exist without abstraction, and insofar as the construction of theory takes place in different ways, the first pillar of abstraction is in many cases an *inspired* guess. What is that but divination? From this position on divination, this book will claim that those others (scientists included) who refer to the process of theory construction as an *informed* guess supported by empirical and other evidence are actually operating within their own particular process of divination. This becomes apparent once that evidence is treated as the result of 'higher-order' observations: observations of observations of observations and so on. But more of this later.

To talk about divination, this book must first structurally de-couple readers from a lifetime of experiences, and take them on a journey back in time: back to their childhood, to a time before they put away childish things and before they traded simplicity for an ever-increasing complexity. Back to a time before they were jaded by disappointment and directed by cynicism. Back to a time when their world was a magical place, a place of wonder, and their roles were that of heroes at the centre of events. Back to a time before they had become overly socially constructed. Readers are asked to discard the jaundice of adult disbelief, and return to a world where the sheer amazement at the magic of it all still exists. This is a world of phenomena where, within the realm of imagination, within the realm of chance, within the realm of necessity, the improbable can and does happen. Although we should add that the impossible stays impossible and that improbability should not be confused with impossibility.

The authors hope to convince those readers who succeed in making this trip that a residue of this magical world of childhood still exists in all of

us. In that world we had not yet learned to suppress the paradoxes that surround theory, all theory. Before embarking on a theoretical analysis, the authors claim that seeing the world of grown-ups as an alien place, as an absurd place of denial for divination, is the best way to begin this journey, at a starting point that recognizes so-called scientific rationality as delusion.

Who Believes?

It is essential that readers be re-introduced to the world of divination that surrounds us all. For divination is the basis of all theory, and we deny its existence at our peril. Many of us vaguely know of this place, but we are too embarrassed to admit it. For whether we like it or not, we humans are a very superstitious lot. Even in today's secular so-called scientific and technological societies, a vast range of age-old mantic/divinatory practices, the so-called Dark Arts, are commonplace. Amongst the most popular are astrology (albeit in a relatively modern reincarnation), the carrying of lucky charms and mascots, wearing lucky colours and a belief in ghosts. Today's stage actors are a highly superstitious lot. It is bad luck to mention the Scottish play,¹ yet they wish each other well with 'break a leg'. Sports champions couldn't perform without their lucky putters and football boots. They thank God, or kiss a crucifix after each crucial putt is sunk or goal netted. Such behaviours can be merely a personal embarrassment to self-styled rational individuals, but often this can ascend to mass enchantments that profoundly influence whole populations. At the festival of Kumbh Mela when the planets are appropriately aligned, the amazing number of tens of millions Hindus make the pilgrimage to swim in the River Ganges. Every sixty years or so couples in China do all they can to avoid procreation during the unlucky Year of the Fire Horse. Such are the impacts of mystical beliefs when institutionalized into a society. As a social norm, strange beliefs become ritual, and are transported to become an accepted explanation of the world around us. Any embarrassment vanishes because we are no longer aware of the peculiarity. For how can it be peculiar when so many of one's fellows accept it? It is the basic tenet of this book that all social norms, specifically the way theory is used, as in all other social endeavours, are just mystical beliefs become sensible through shared acceptance.

No society is homogeneous in its strange beliefs. That is where tensions arise. 'My' beliefs are 'realistic': that is reasonable, true and sensible. 'Yours' are 'mystical': that is unreasonable, false and absurd. Thus begins the polarization of humanity into societies, as well as within societies.

Although most members of a society are happy to agree to disagree among themselves, there are always extremists who insist that all must follow 'the one true way'. These continually point out the ignorance of outsiders or subversives. However, there are many 'true ways', and so problems must arise when individuals, who find themselves with feet tentatively placed in a number of different camps, are harangued by true believers from one side or another. Ridicule (or worse) is heaped upon those who profess to be rational and scientific while simultaneously believing in contradictory mystical practices such as alternative medicine, or astrology, even religion.

In the UK, Prince Charles, whom many in the British press claim to have New Age attitudes, has had to develop a very thick skin to ward off jokes about him talking to plants: a story that was released when he mentioned his stance on this matter in a television interview in 1986. The unkind media onslaught that followed was unprecedented. What sensible individual could possibly believe that talking to plants was beneficial to them? Ironically, almost 20 years down the line, the National Institute of Agricultural Biotechnology in South Korea confirmed the finding by identifying that noise triggers a response in two genes in plants (namely *rbcS* and *Ald*); the possibility suddenly emerged of genetically modifying plants and making them flower by blasting sounds across the fields (Coghlan, 2007). Charles it seems has the last laugh.

There are occasions when laughable divinatory practices may retrospectively acquire some validity, even within science. There are also occasions when hypotheses created within the system of science may appear to be divinatory/absurd to the outsider, while going unquestioned by devotees, as with the case in quantum mechanics and the existence of multiple universes. It seems power, politics and economics interfere on many different fronts in the so-called rational construction of science. Prince Charles's stance on homeopathic medicine, of which he is a strong supporter, brought numerous outcries from the medical world; however, this did not stand in the way of him receiving an honorary fellowship from the Royal Society of Medicine. Such inconsistency is not unusual.

This book contends that there is nothing odd in any of this behaviour. All social norms are mystical. So why should any of us be embarrassed when caught out holding individual mystical beliefs? Why? Because 'the powers that be' tell us that only a fool would believe any belief other than theirs, and most people are distressed at being thought a fool.

The scientific community tells us that divining the future is mysticism, designed by quacks for inadequates. And yet that community too is geared to predicting the future, only they call it simulation of different possibilities and statistical designation of their respective probabilities. We have been socialized/brainwashed to feel uncomfortable when, although we are strongly allied to a particular divination (including science, for science itself is portrayed here as divination), we break its rules by contemplating an alternative and often contradictory divination: the first commandment of every divination is 'Thou shalt have no other gods before me' (Exodus 20:3).

Who Believes in Divination?

What exactly is this divination being introduced here? According to the Encyclopaedia Britannica it is 'the effort to gain information of a mundane sort by means conceived of as transcending the mundane'. Of course information gained from a transcendental consultation with the gods or some other supernatural force may be of a mundane sort, such as when we petition for information about the whereabouts of lost property, or marriage/fertility prospects, or for the possibility of riches to come. However, the requests may be as momentous as to concern the fate of nations.

From time immemorial, through the Oracle of Delphi,² right up to the present, political leaders have routinely looked for auspicious omens before every important undertaking. Hitler's inquisition of the occult is well documented, and has even found its way into popular culture via Indiana Jones and the *Raiders of the Lost Ark*, and since Hitler was 'the power', you can bet that no one dared tell him to his face that he was a fool. Diana, Princess of Wales, took her decision to assist Andrew Morton with *Diana: Her True Story* on a visit to astrologer Felix Lyle (Clayton and Craig, 2001). That book rocked the British Establishment and triggered events that culminated in the divorce of Charles and Diana. Astrologer Joan Quigley boasted of *My Seven Years as White House Astrologer to Nancy and Ronald Reagan*. She claimed that Ronald Reagan consulted her on foreign policy issues, such as the timing of a summit meeting with Gorbachev. In 1982 Nancy Reagan launched her 'Just Say No' anti-drug campaign following Quigley's advice on how to receive a better press. French astrologer, Elizabeth Teissier published a book *Sous le signe de Mitterrand (Under the sign of Mitterrand)* claiming that the President of France consulted her on a variety of issues, including the timing of the referendum on the Maastricht

Treaty for the European Union. She also supplied him with astrological data on his political opponents at home and abroad, including Saddam Hussein. The Duchess of York ('Fergie') visited clairvoyant Rita Rogers, to be told that she would marry John F. Kennedy Junior and become First Lady when he was elected President of the United States of America. Oh well, you can't win them all!

Cynics would say that, like at ancient Delphi, the really clever oracle is never too specific. Predictions must be vague enough to allow for multiple interpretations, in the sure and certain knowledge that some of the predictions can be stretched to fit observations. If we are honest with ourselves, when the oracle does deliver specific testable statements that subsequently prove to be false, as in the Fergie/Rita Rogers case, it is always the diviner who is blamed, while confidence in divination remains unscathed.

Seekers after 'Truth'

Even those who ridicule the validity of divination must still recognize it as an all too human reaction that has stood the tests of space and time. Evidence of divination, the practice of foretelling the future, or interpreting nature, curing a disease, uncovering malevolence and even solving crimes, can be found in every human culture, ancient and modern, from all corners of the Earth. It is a resounding force in every society, there at the beginning, but also at the end of every social grouping. Consider one extreme case: cosmological divination was the spark that ignited the Inca Empire of the Andes in 1440, but it was also the fatalistic seed of its self-destruction, when, on 16 November 1532, Francisco Pizarro and a tiny band of 175 Spanish conquistadores, having entered the town of Cajamarca, killed the supreme Inca, Atahualpa (Sullivan, 1996).

The rejection of mysticism by our scientific society is continually routed before the enduring power that astrology, Tarot and other forms of fortune-telling hold over the 'primitive' us, fanning the profound inner spark that makes us human, all too human.

Make no mistake, despite all the ridicule, those who consult the oracles are nevertheless seekers after 'truth'; although as Nietzsche observed, truth, all truth is merely a refinement of ignorance. Oracles are operating on a somewhat more mundane level than the inferential heights of science and logic, but they are still providing information upon which practical decisions are made in the face of a tidal wave of uncertainty. The mantic arts are diverse and yet all pervasive, as is obvious from the many forms that appear across

all human societies and across all eras. Indeed, a strong argument can be made that the use of audits and statistical models stored on computers to control the business world is just the latest mantic art.

The various methods of divination range from the inductive, through the interpretative, to the intuitive.³ Inductive divination uses fixed rules to read omens, and so a consultation is believed to be free of cynical manipulation: clients are trusting, but not stupid. However, even inductive divination will involve some form of contrivance, such as the casting of lots, watching the movement of planets, clouds or sacrificial smoke or seeing patterns in coffee grounds. Therefore it must overlap intuitive divination, as practised by a shaman who has the gift of insight and the ability to interact with a supernatural sphere. The shaman often uses trance states, spontaneously self-induced with a concoction of narcotic drugs or by some repetitive physical action, such as the frantic dancing of the whirling dervishes.

Interpretative divination, a mixture of both these methods, conforms to inductive ritualistic formulae; however, the intuitive diviner must be set apart from his fellows by a special gift: little different from a management consultant. Perhaps the amazing success of consultancy companies over the past few decades has nothing to do with scientific management. Perhaps it is all to do with the primitive hold that divination holds over us. In the particular case of consultancy, the special gift required for interpretative divination is high intelligence focused via a branded methodology onto a marketplace awash with number mysticism. Perhaps it is not the science, rather the pseudo-science of divination that makes consultancy so attractive.

So what help are diviners, who often give ambiguous, even contradictory advice? Typically, the client will ignore any advice that he finds doubtful, and continue with this or other consultations until a course of action is suggested that he can take with confidence. It is important to realize that divination itself motivates the client to act. The mumbo jumbo of divination is far more important than any message it delivers.

The information derived from divination, whether phoney or valid, must please or satisfy the client, for otherwise the client will ultimately reject the process. This previous sentence must not be read as a statement of the authors' cynicism, rather it is their sceptical recognition of divination as a social act. To them, divination has a valid utility that has nothing to do with being true or false.

True, False and Everywhere in Between

Let's get one thing clear: clients of divination are not necessarily gullible and/or superstitious as perceived by outsiders. Those clients are operating within the acceptable norms of their society. They are individuals who are at a loss as how to behave in the face of what today we would label uncertainty. In the past they had to act in response to illness, drought, death, evil or loss: when they found themselves in intransigent situations. Nowadays, clients from business face failure from shrinking markets, rampant competition, personal insecurity, a credit famine, technology out of control: what is popularly labelled *risk*. And they too feel a similar intransigence.

Thus this book starts out with the recognition that all theory is a social act of divination; that all theory has a utility that has nothing to do with it being true or false. Indeed, its utility can be simultaneously both true and false, and neither, all depending on both the observer, who is employing the operations of that theory, and the situation where he finds himself. Such operations should not be taken out of context; they are tied to the preceding observations that were unavoidably utilized for the process of theory construction. Theory therefore operates within the acceptable norms of society, and as divination, it suggests a course of action that can be taken with confidence. Theory then is all to do with uncertainty. However, be clear, uncertainty has little to do with randomness or chaos. Most of *Chaos* disappears into the background as white noise, and we pass right through it unnoticed. Uncertainty, on the other hand, is all to do with some ordered elements that have been sampled from the *Chaos*, but which appear in an unwelcome order, a strangeness that arises from an unexpected and surprising conspiracy of events.

Chaos is not disorder, not even un-order; it is pre-order. It is the multiplicity of complexities that characterizes any system prior to any distinction made by human thought. Thus any notion of a Theory of Chaos is an oxymoron, because theory already implies an order. That is why this book rejects the popular misinterpretation of chaos as disorder, and why in the text the word is italicized whenever its meaning as pre-order is intended. *Chaos*, therefore, is unapproachable by thought. Even these previous sentences, and particularly the use of the word 'because', are vague attempts at imposing order, and so are inevitably misunderstandings. All understanding of *Chaos* is necessarily misunderstanding; human thought is such absurdity piled recursively upon itself. For that recursion must miss the non-linearity in the situation: recursion is linear and thus artificial, unnatural, because it

simply flip-flops between subject and object, with the two states naturally remaining distinct residuals at each step.

The human 'understands' a 'piece of the world' as a particular categorical 'thing'. Then he recursively focuses on understanding the rest, the residual category, until by combining together the separate and separated fragments, everything deemed relevant is 'understood'. According to Bertrand Russell 'every advance in a science takes us further away from the crude uniformities which are first observed into a greater differentiation of antecedent and consequent, and into a continually wider circle of antecedents recognized as relevant' (Russell, 1954). What is this but a description of tunnel vision? However, by changing focus from the thing, onto other things (within its residual category), the original thing goes out of focus. Hence the concept of a 'thing', and thus everything else, is a fallacy. Even the 'concept of a concept' is a paradox, but one that allows cognition to function undisturbed by the peculiarities.

In thinking about thought, both the 'thinking' and the 'thought' are simultaneously and reflexively subject and object of the process: a non-linearity. However, any rational theory is linear and requires a separation between subject and object. Causality requires both a subject: the thing affecting, and an object: the thing affected. The trick is to cut through this Gordian knot of uncertainty and paradox, and just get on with living by making the most of *Chaos's* bounty.

In the academic literature, uncertainty is often related to risk and the management of risk, implying an elusive underlying assumption that uncertainty can be planned for. Apparently risk consists of a series of isolated singularities. Hence individual events, for which tactics and strategies can be developed, and thus risk, can be managed. Typical examples in the financial services industry include calculations of 'value at risk' that attempt to simulate both the amount of money put at risk for a particular course of action and its exposure. But calculations like these are just another layer of divination, masked by the delusional efficiency of mathematical techniques. The crisis of 2008 was the outcome of what this unquantifiable exposure to risk came to imply for financial markets worldwide. In a system of such complexity, control of the behaviour of the system itself becomes extremely difficult, if not impossible (Mandelbrot, 2005). This confusion is often responsible for the confounding of uncertainty and risk with 'true' *Chaos*. Even the very act of articulating a risk implies an imposition on the *Chaos*, which actually ceases to be *Chaos* when it is sampled.

The world inhabited by humanity is intrinsically strange, fantastical, magical. We are deluding ourselves if we think that we can always make sense of that strangeness. *Managing Uncertainty* is just another futile attempt at controlling the conspiracy of strangeness. There is order in uncertainty, which is unwelcome because it approaches us out of the void. It doesn't sit nicely in the authoritarian glare of some universal theory. However, there can be no ignoring that strangeness in the human condition, as it inevitably returns to bite us.

By collecting all these strange events together under the label of uncertainty, and by organizing ourselves as individuals or in groups, we hope that the surprising events will either go away or become benign/advantageous. We humans create structures that transform uncertainty into risk: a heady mix of hazard and opportunity. Thus we swap hopelessness for the optimism in a plan of action. In other words we submit to theory in order to gain a tenuous handle on uncertainty.

However, different ages have different perceptions of uncertainty; and so there are different approaches to theory construction and application, delivering different risk assessments and prompting different decisions. Note this book stresses decisions not solutions, because from its position there are no solutions, only contingent decisions. And each decision is itself a start of a new journey, not the end of an old one.

Indeed, there is no grander delusion than the production of a solution, with its linear insistence on cause and effect. A decision about a particular problem domain or a decision to act upon a situation can only trigger changes with undetermined consequences, and these in their own turn may become the basis for requiring even more decisions, and so on. 'Solutions' always 'multiply, proliferate, disperse, circulate, diversify, diffuse the original problem' (Rossbach, 1993). Cause and effect merely implies a focal point, choosing a single linear path through this multiplicity, which can only exist within the scope of either: (1) an individual observer who prescribes a solitary function for a system – a prescription that becomes self-fulfilling, and as a consequence the coupling between cause and effect appears even tighter, or (2) many observers who operate single-mindedly, with that single-mindedness predetermined by a shared belief in cause and effect.

From *Chaos* to Computers

Clearly different ages have different ways of dealing with uncertainty. Because of science and new technology we have entered one of those different

ages, where the very nature of uncertainty has changed. In describing the scientific approach to uncertainty, this book presents all scientific/technological artefacts, and indeed thought itself, as various means of both imposing linearity and denying non-linearity.

As Nietzsche so cleverly states:

One should not wrongly reify 'cause' and 'effect' as the natural scientists do (and whoever, like them, now 'naturalizes' in his thinking), according to the prevailing mechanical doltishness which makes the cause press and push until it 'effects' its end; one should use 'cause' and 'effect' only as pure concepts, that is to say, as conventional fictions for the purpose of designation and communication – not for explanation. In the 'in itself' there is nothing of 'causal connections', of 'necessity', or of 'psychological non-freedom'; there the effect does not follow the cause, there is no rule of 'law'. It is we alone who have devised cause, sequence, for-each-other, relativity, constraint, number, law, freedom, motive, and purpose; and when we project and mix this symbol world into things as if it existed 'in itself', we act once more as we have always acted – *mythologically* (Nietzsche, 1990).

For some people, descriptions that lie beyond cause and effect may appear difficult to conceptualize. This is particularly the case in the authors' own subject of Information Systems. There, many of the difficulties stem from not appreciating the problematic nature of descriptions based in causality. These problems become apparent in the failure of the prevalent and futile belief that computerization can perfect the administration of the human condition.⁴ This *pixie dust school* of technology presumes that something wonderful will happen when the magic powder of (particularly computer) technology is sprinkled over each and every problem. The result: an appalling record of slippage, price overruns and failure with large complex projects.

Today's predominant thinking focuses on computerized objectivity, and displaces/downplays the effects of the context sensitivity both of observation and the observer within the technological domain, and of the subjectivity of the underlying assumptions that operate there.

It is all too easy to forget the premises that underlie the functioning, or otherwise, of technology, leaving the observer unobserved within the technology, thereby reinforcing the perception of technology as an impervious black box. This can be seen with computer technology: for what

is an algorithm if not a transcendental observer operating within the realm of that technology? A human observer gives birth to the myriad different algorithmic representations that are utilized within the technology. Then the algorithms in themselves become observers in a world composed of bits and bytes; a world that is built around different rules, but where the principles of observation are still valid. Algorithms do have a purpose though: they sample *Chaos* into uncertainty, and further sample that uncertainty into risk, setting it down as categorized elements. Decomposition or deconstruction of such categorized elements proceeds through the possibility of them being embedded within the realm of programming languages. Problems arise whenever claims are made concerning the feasibility of describing, manipulating or even creating non-linear systems with complete disregard of the very linear way in which the process from *Chaos* to computer code is manifested, or the linear way with which technology processes information. Too often, the idea that the entire enterprise of information processing is merely a simulation is quietly forgotten, and the audience is left in awe of the temporary benefits that such a simulation provides.

Such an imposition of linearity in computation is carried out in a step-by-step process that is fundamentally restricted by both hardware and software. The construction of a technology of computer-based artefacts, which is built and must operate within a strictly defined physical domain, is therefore limiting each artefact's function for a series of reasons: physics interferes; logical operations create path dependencies; functions are performed on the basis of strictly specified rules, but how are these rules constructed?

This idea that technology is imposing and enforcing linearity is something that will be elaborated in due course. The current human perception of risk must be reformulated; old answers have themselves become hazards. The old decisions no longer work, as is apparent in the current widespread public distrust of so-called experts: shamans of discredited theories. Science too has proved a Pandora's box, releasing a swarm of new troubles into the world, as is clear with global warming, radioactive waste, etc. We will need new forms of divination, of theory, to reflect on both new forms of risk and even more importantly on the construction and utilization of current theory.

Price or Cost in a Risk Society?

For the past few centuries, at least in the West, we have deluded ourselves that our world is a rational causal system, in which social problems could be viewed *ex post*, and then treated scientifically, predominantly as sequence of

technological tasks. Our grasp of the socio-economic context within which the problems arose has been limited and inadequate. Problems were/are seen merely as a consequence of a social system's functioning, which could be 'solved' by tweaking the system. Rarely are they seen as an emergent property of reflexive interaction between various societal stakeholders and the technology they have created. The former naive stance has led inevitably to the occasional failure of so many of our systems, although 'rationalists' persist in treating each failure as abnormal. But for how much longer can science deny the clamour of doubt?

We keep hearing the word risk being identified with hazard; that risk is essential for innovation is regularly quietly ignored. There is a great deal of discussion on risk management, which shows all the signs of being just another management fad. A great deal of emphasis is being placed on auditing and the controlling of costs. Yet we cannot know the cost. The price yes, but not the cost. Cost has a life cycle. The price is here and now, the cost accrues from here to eternity: ask any owner of real estate with asbestos-lined buildings in their portfolio, or with other challenged properties; ask the Central Banks, which early in 2008 had to pump huge sums of money into collapsing financial institutions following the failure of the sophisticated financial instruments that were manipulating sub-prime mortgages in the USA, and in doing so precipitated a maelstrom of non-linear feedback. In his book *Carrying the Fire* (Collins, 2001), Gemini 10 and Apollo 11 astronaut Michael Collins showed that he, at least, could relate to the difference between price and cost. He was asked what went through his mind at 'blastoff'. His reply: 'Well, you think about the fact that you are at the top of 6 million parts, all made by the lowest bidder!'

In our unknowable future, unavoidable problems will arise. By shunning risk, members of society will refuse to admit the existence of serious social pollution, or they will refuse to accept other interpretations that could deal with it. Nevertheless, change is essential if the risk society is to survive and prosper in this future (Beck, 1992). Western society has reached that point where its means of dealing with the world have become degenerate, pure ideology, mindless chanting, which is futile against the inevitability of social breakdown. For 'the froward⁵ retention of custom is as turbulent a thing as an innovation' (Bacon, 1999). Then as the rituals fail to deliver safety, ultimately the society will lose faith in its methods for self-control, and ultimately lose faith in itself. For a point will come when that society knows something is radically wrong, but because of ritual it is blinded and unable

to recognize just what the problem is. The ritual, internally consistent yet externally absurd, often takes on a life of its own. Then what is interpreted as (scientific) reality, and therefore seen as important, is the contrivance of (scientific) ritual rather than the reality itself.

Freeze, Fight or Flee?

Nevertheless, when faced with the dangers of this uncertain world we still have the three age-old choices: freeze, fight or flee. Forget the myth of rationality; when confronting the contradictions of uncertainty, our responses tend to be impulsive and instinctive, unconscious and automatic. For we humans are first and foremost feeling animals, rather than thinking ones. Our emotions are tied inexorably into what we do when confronting the torrent of incomplete or asymmetric information all around us. And here lies the source of power that theory/divination holds over any seeker after truth.

The ritual application of theory lifts humanity out of the overload of day-on-day problems. It is a safety valve that gives us time for circumspection and clarifies our concerns. It short circuits the inertia and precipitates action. By using a theory, we are seeking a pragmatic and socially acceptable course of action. Intransigent problems are attacked with legitimate solutions in such a way that the seeker does not have to justify his actions. Theory delivers useable information. It breaks the logjam of indecision. For what is information after all? Merely the appropriate interpretation of data that forms an acceptable (legitimate) basis for decision-taking amongst one's peers. Just because scientists accept only the information from their own scientific form of divination, why should scientific data be the only form available to the rest of us who are less committed to that particular way of 'transcending the mundane'? For no matter what the theory, it is always and already beset by paradox.

Every Age finds significance in its own particular and peculiar brand of theory/divination. In *The Bible Code* (Drosnin, 2002), Michael Drosnin tells of three highly reputable Israeli mathematicians, Witzum, Rits and Rosenberg, who laid out the text of the Torah in rectangular blocks, and then checked every tenth, fiftieth (whatever) letter for omens. Using the text of the Book of Genesis they uncovered biographical details of various important medieval rabbis. Has God been waiting millennia for humanity to invent the computer for His messages to be uncovered? Furthermore, many of these messages were decoded centuries after they would have any

relevance. Surely God, if He exists, has better things to do with His time than play a *sealed envelope* type of conjuring trick? More likely this is just another demonstration of faith deluding even the most rational thinkers.

Either way, it didn't take long for the sceptics to find similar predictions by using the same techniques on other books, like *Moby Dick* (Melville, 1994). Of course, Drosnin, like all shrewd operators, says these messages are just warnings, which if heeded can stave off disaster. This is just as well for him, since his own death (in Athens of all places) has been foretold by a critic using the same decoding technique.

Apparently, the Bible's text hides predictions of the Holocaust, the Moon landing, various political assassinations and much more. Most alarming, the date for Armageddon had been set for 2006. Taking a break from their book writing, and while enjoying a very pleasant lunch in Soho in the autumn of that year, the present authors could predict quite confidently that the world would NOT end later the same year. They are equally confident in rejecting the predictions of the End of the World in 2012 that are based on spurious interpretations of the ancient Mayan calendar.⁶ In common with those who believe in the afterlife, the authors have no fear of contradiction: if the world were to end in any prescribed year, then everyone with proof to the contrary of their prediction would be dead. That they were tackling the final editing of the text in the summer of 2009 showed their confidence is well founded, at least in rejecting Drosnin's predictions. However, at the same time they do not deny humanity's enduring fascination with such prognostication.

The art of divining, or indeed theorizing, namely ritually constructing delusions, may have subtly changed its form across continents and throughout history, although there does seem to be some human universal at work; some intellectual imperative that has been delivered by our evolution from our ancestors on the savannah, and even earlier.

So who is to say that divination/delusion, whether in its ancient, modern or soon to be future form, is inappropriate? No matter how sophisticated we are, we all have a sneaking regard for the interpretation of omens that will uncover some divine purpose in events: augury. Some forms of divination have even received certain respectability in our scientific society. After all, both Sigmund Freud and Carl Gustav Jung have given legitimacy to various kinds of oneiromancy: dream interpretation.

Meanwhile, sceptical scientists like Professor Richard Dawkins line up to ridicule the claptrap, all the while selling their equally absurd notion of the 'rational human'. However, it is not just scientists playing this game

of superior ‘understanding’. Religion too has its pedants. Like meets like whenever scientist Dawkins combats *Creationist* champions from the American Bible Belt over the latter’s denial of Darwinism and their claims of an Intelligent Design of life on earth. Apparently it’s all too wonderful to have occurred *a la* Darwin, *ergo* God did it, intelligently. The problem here is neither science nor religion, but the attitudes of scientific and religious bigots, both certain that they have all the answers, when there can be no universally applicable generic answers, only contingencies – as the present authors insist from their own bigoted certainty. That the scientists won the subsequent court battles shows only the superior legitimacy of science over religion in the American court system, despite the irony of witnesses having to swear on the Bible. However, the victory of science in the US courts had nothing to do with truth or falsity. Winning, as always, is determined by power, which is why science rarely wins in the court of public opinion.

Scientists smugly use *rational facts* to debunk astrology. According to the science of astronomy, if we insist on dividing up the heavens into the signs of the zodiac then there should be a thirteenth sign (Ophiuchus). Scientists prattle on about the *fallacy of personal validation* and of generalized, trite and bogus predictions. Of course, to a certain extent this position is valid. Humanity does have a tendency to focus on successful hits, and overlook or forget all the failures. But we still read our horoscopes.

Scientists claim that as a pattern seeker, the brain too often sees causation where there is only correlation: an assertion repeated in Chapter 5. Despite this claim, many scientists still fall into the same trap and concentrate on looking for linear causality in whatever topics interest them. Thus they fail to see the importance of non-linear effects. They could ask about any disadvantages in this tendency to linearity. Getting too involved with rational theories can also be dangerous, and even seriously jeopardize an individual’s survival prospects. Archimedes may have been the greatest thinker of his age, but streetwise he was not. During the sack of Syracuse in 212 BC he was confronted by a Roman soldier. His apocryphal famous last words were: ‘stand away, fellow, from my diagram!’⁷ By following the demands of his intellect rather than those of the soldier, he set up a chain of events that led inextricably to his death.

This feeling of superior ‘understanding’ and an overwhelming feeling of truth within the construction of theory did not even escape Einstein (who was quite modest by all accounts) in his statement that ‘Politics is for the

moment, but an equation is for eternity', made when declining the offer of the presidency of the new state of Israel in 1948.

If Galileo had been less dogmatic over his understanding of planetary motion and had signed a document stating that the sun was not at the centre of the solar system, then the Inquisition would possibly have let him off the hook. They wanted him to say that the heliocentric theory was only a model that was useful for calculating planetary motion and that it was not the truth (Feyerabend, 1975). How perverse that quantum physicists, who see a multitude of possibilities in parallel universes, have more in common with the Inquisition than with Galileo and have become far less dogmatic in their own interpretations of the world. At this stage it will suffice to mention that, at the time of writing this book, quantum reality is prone to eight different interpretations of the world. These are Quantum Realities QR1: There is no deep reality; QR2: Reality is created by observation; QR3: Reality is an undivided wholeness; QR4: Reality consists of a steadily increasing number of parallel universes; QR5: The world obeys a non-human kind of reasoning; QR6: The world is made of ordinary objects (neorealism); QR7: Consciousness creates reality; QR8: The world is twofold, consisting of potentials and actualities (Herbert, 1987).

'The Greatest Superstition'

Whatever the philosophers of science may say to the contrary, most scientifically minded individuals do delude themselves about an 'objective' reality. They have their own superstitious mantras: 'no event is without a cause'; 'given enough time and enough resources we will find the Answer'. They have no truck with the apparently arbitrary events that do occur in their apparently ordered world: events that are subject to numerous and various interpretations. Moondog, a.k.a. Louis Hardin, the blind New York street musician and poet, really got to the bottom of this situation with his observation:

What I say of science here, I say without condition
that science is the latest and the greatest superstition (Hardin, 1959).

Nietzsche was slightly more colourful in his analysis. 'When one rows, it is not the rowing that moves the ship; rather rowing is simply a magical ceremony by which one compels a demon to move it' (Nietzsche and Hollingdale, 1996). Something beyond our understanding, which he teasingly calls a demon, is

at work, and we poor humans are at the mercy of the outcome. Never able to comprehend properly, we nevertheless attempt to describe the effects such demons have on us and use those descriptions to intercede with the demons for our benefit.

Science is such a divinatory practice. Granted it is a highly sophisticated search for truth, but the ineffable demons will always ensure that science is flawed. Science is limited. It is focussed in a peculiar form of tunnel vision and can only ever describe part of the picture, at the price of unleashing numerous paradoxes.

The Absurdity of a Gravitational Force

We will illustrate what we mean by using the example of gravity: a concept that we all take for granted. Gravity doesn't cause objects to fall; objects fall all on their own. Gravitational theories are just the ways we describe what we observe: a pale snapshot of what is necessarily so. The phrase 'necessarily so' is the authors' shorthand way of stressing that 'the answer to the world, the universe and everything'⁸ does not come in an equation. Forget the answer, there is not even a question. The world, the universe and everything is *Chaos*, largely inaccessible and beyond our complete comprehension. There is no ontological substance to what is necessarily so, and in order for humanity to kick-start its cognition that substance has to be introduced. Human cognition projects metaphors onto the *Chaos*; these metaphors all echo with paradoxes. Even our use of the word *because* is paradoxical; it being just another product of our insistence on imposing causality on the world, and our willingness to be convinced by the delusions fed back through cognition. What is more, the authors themselves have to admit that the descriptions they expound in this book, and which convince them and hopefully the readers, are also paradoxical, and necessarily so.

There is no causality in the *Chaos*; causality is all in our heads. *Chaos* does not operate causally according to mathematical laws. The so-called Theory of Chaos (here Chaos is deliberately not italicized) merely meddles with non-deterministic mathematical structures. That having been said, *Chaos* itself is not arbitrary, although it does not operate 'because' of anything. It is as it is; whatever that may or may not be. We humans simply stumble around in the *Chaos*; thankfully with the capacity to project order onto it. Then we fish out regularities, but with numerous interpretations at various levels of sophistication, although all restricted by linear thinking. Causality

is a blunt instrument that convinces us of the validity of our interpretive descriptions, of what is necessarily so. This is hardly surprising since causality is the self-reinforcing argumentation we use to convince ourselves. Causality, be it in a mathematical or any other form, is merely a means of description and the basis of questioning, but one that itself cannot be questioned.

And so let us go back to gravity. Gravity is a classic example of a theory that has a utility, but no real explanation. There is no mathematics intrinsic to gravity. We merely use mathematics to describe what we choose to call gravity: the phenomenon of things falling in an apparently consistent manner. Newton's apple didn't fall because of the force of gravity described in his mathematical formulation; it fell because that's what apples necessarily do, along with all other objects on this planet. Newton came up with the concept of gravity to *explain* that necessity, and his description inevitably involved paradoxes, not least being the notion of the force of gravity. Despite Einstein having identified the problems with Newtonian mechanics, secondary schools still teach the *Inverse Square Law*. Students are still told that two bodies attract one another with a force proportional to the product of their masses and inversely proportional to the square of the distance between them.

Following the publication of *Principia Mathematica* in 1687, right up until the early twentieth century when Einstein started formulating his space curvature ideas on gravity, Newton's descriptions of the law of universal gravitation and the three laws of motion led to many useful scientific advances; and yet they are not strictly true. This must beg the question: are there degrees of malleability in scientific truth, in the way we describe, more or less accurately, the reality in which we live? With multiple descriptions being drawn for the same observable effects, isn't there an inconsistency percolating within the idea of *Truth*?

Newtonian gravity implies that the effect of gravity is an example of action at a distance encapsulated in the Inverse Square Law. Apparently, any two bodies are attracted by a *force* that is proportional to the product of their masses and inversely proportional to the square of the distance between them. How does the force come into existence, when it requires a measurement of both the masses and the distance between the two bodies, yet each body, whatever 'it' is, has no observation/cognition of the other's existence, or means of measurement? What is this but Nietzsche's description of divination as demonic action?

Apparently each body sends out mystical sub-atomic probes to every corner of the universe, enabling the body (of whatever size) to sense and ‘calculate’ the forces acting upon it from the instantaneous feedback it receives, as the gravitational force has unlimited range. How does gravity ‘decide’ what the apple is, what the unity of each body is, where it starts and ends? How does each atom or particle send out probes? The gravitational force then acts at the centre of gravity, which happens to be a point: even an atom isn’t a point! A point is a piece of space that has no size, no substance, it isn’t there, and yet gravity pulls at it, thereby dragging the whole body along. This happens even if the centre of gravity is outside the body, as in the case of a doughnut. How silly, and yet for centuries this interpretation seemed perfectly reasonable. The ideas are intrinsically non-sensical, but they have a utility. It is that utility that for centuries routed the nihilistic objections, despite the ideas being wrong.

The Newtonian interpretation of gravity was accepted because it works for most practical applications. When used as a mathematical schema by a human brain, it has great utility, enabling us to fire projectiles over large distances with great accuracy, to calculate the orbits of the planets except for a slight problem with Mercury, and to send rockets to the Moon. It works in everyday mundane experience with the notion of balance in the Principle of Moments. And because it works, few until Einstein asked how each body can sense the infinite number of others out there, and move along a mathematically prescribed trajectory. So how does gravity work? How else, than by the necessity (of a Nietzschean demon) that somehow makes what happens in the world of phenomena correlate closely with our mathematical models? Not surprisingly, we can then make the leap of faith from correlation, to a scientific causality, and insist that the world acts according to our models. Belief in Newton’s model lasted for centuries, but eventually faith in it crumbled among the scientific elite, although certainly not among the general public. Such is the ultimate fate of all models.

Quoting from Einstein and Infeld’s book on the *Evolution of Physics*, we see that:

Newton’s gravitational law connects the motion of a body here and now with the action of a body at the same time in the far distance. This is the law, which formed a pattern for our whole mechanical view. But the mechanical view broke down. In Maxwell’s equations we realized a new pattern for the laws of nature. Maxwell’s equations are structure laws.

They connect events which happen now and here with events which will happen a little later in the immediate vicinity. They are the laws describing the changes of the electromagnetic field. Our new gravitational equations are also structure laws describing the changes of the gravitational field. Schematically speaking, we could say: the transition from Newton's gravitational law to general relativity resembles somewhat the transition from the theory of electric fluids with Coulomb's law to Maxwell's theory (Einstein and Infeld, 1966).

This change in how Einstein perceived gravity demarcates a considerable shift. Gravity is now seen as the background, the continuing necessity, the eternal normality against which everything operates, and which is structurally coupled to that everything. It is a field, and not a force. An apple doesn't fall because of gravity, it falls *because* it happens to be in the vicinity of masses that create a field of gravity by bending space, and hence gravity doesn't just suddenly swing into play at the behest of a calculation. It's not the application of a force that makes the apple fall; falling is what everything on this planet does naturally, necessarily. However, the falling only becomes noticeable when whatever is blocking that necessity is suddenly taken away.

Everything in space moves relative to gravity, not because of it. What we think of as gravity is already and always everywhere. Gravity is NOT a force. At least, not in Einstein's ingenious description within the context of general relativity, where gravity is a function of mass, rather than a force exerted by the mass. Mass bends space and hence objects fall because the space they find themselves in is bent. Nobel Prize winner, physicist Richard Feynman admits that:

It was a shocking discovery, of course, that Newton's laws are wrong, after all the years in which they seemed to be accurate. Of course it is clear, not that the experiments were wrong, but that they were done over only a limited range of velocities, so small that the relativistic effects would not have been evident. But nevertheless, we now have a much more humble point of view of our physical laws – everything *can* be wrong! (Feynman et al., 2006)

The authors interpret Feynman as saying Einstein too can be wrong, although because we are currently convinced by relativity, we are blind to the paradoxes that inevitably lie at the core of that particular description

also, indeed at the core of every description. Only when our beliefs have been rattled, do we permit alternative descriptions to enter our thinking, although they too will have their flaws, but to which we will be then currently blindsided.

According to Victor Hugo ‘there is nothing more powerful than an idea whose time has come’. Nothing is more futile than defending an idea whose time has gone. Stephen Hawking⁹ in his book *The Universe in a Nutshell* tells of how the Nazis had pathetically campaigned against Einstein’s ideas simply because he was a Jew. They published a book entitled *One Hundred Authors Against Einstein* in an attempt to discredit the Theory of Relativity. When a journalist asked Einstein to comment, his devastating retort was: ‘Why one hundred? If I were mistaken, one would have been enough’.

Yet Feynman is saying ‘everything *can* be wrong’. Science is a perpetual search for new ideas. Consider the contemporary trend in re-describing gravity, where some scientists postulate hypothetical elementary particles called gravitons that must be mass-less. Here we can observe a beautiful irony: the particle that is supposed to be responsible for gravity cannot in itself be prone to it. And what of Einstein’s notion of the bending of space? How paradoxical that the model convinces us, because the metaphor that justifies its use is of objects moving along surfaces that just happen to be in our familiar three-dimensional space, which are of course under the influence of gravity.

Humanity lives in the realm of imagination, in the realm of chance, within the realm of necessity. Science deals with what is necessarily so, and requires observation for dealing with the necessity of its own evolution. However, around that, we humans can use our imagination to build the possible yet improbable. Divination is not the antithesis of science, rather it is both an extension of science and a necessity at its core. Like every other form of theoretical divination, science has its own fictitious sacrificial altar of perfection at the centre of its universe. Thankfully not all scientists are pedantic in their expressed beliefs; at least medical scientists have the intellectual honesty to call what they do *practice*, something which may appear strange since this practice actually uses a combination of biology, physics, chemistry and technology.

Self at the Centre of Everything

Actually, humanity is willing to accept any crazy idea, any absurdity, as long as it works, as long as it has a utility, and in working it makes sense,

for a while. Consider the notion of perfect competition in Economics: a classic example of absurdity. For if competition was perfect, the reason to compete (the profit) is taken away.

Sense is not uncovered, it is manufactured out of such absurdity. How paradoxical? The utility of an idea doesn't come from it being sensible; the utility must be there originally so that we are convinced that the idea in itself is sensible. That utility is mined, a gem rough-cut from the *Chaos* all around, and polished self-referentially as if by magic to a self-reinforced and self-sustaining point where we believe the polishing itself creates the utility. The proposition underlying this book is that all individual human experience, of oneself and of others in the world, is imaginary: a delusion. As humans, we create, manipulate and are manipulated by such delusions. Thus we make sense of the world so as to survive and prosper. Consequently each culture, each collective, each meeting of minds is just a common denial of absurdities that delivers the mutual benefit of utility. However, eventually in certain contexts the original utilities will fail, but we are still left with the mode of sense-making intact, albeit now non-sensical.

Age-old Mantic Practices

When scientists sneer at the absurdity they see in divination and equate it with mysticism, they fail to realize that mysticism is simply how magic is interpreted by the uninitiated. From within their own vantage point they see only the absurdity, not the utility. They fail to see that science hasn't routed divination, it remains all around us; divination is a fundamental part of human social action, and of thought itself. We must recognize that the magician/sorcerer is merely an agent of social change, and magic is the language whereby that change is achieved. We regularly reinvent many old mystical ideas without realizing that we have simply repackaged them. There are numerous examples in modern business. Age-old mantic practices lie lurking, masquerading as a management science. For example, there is the very ancient and still strongly held belief that the gods may be coerced into interceding with fate. A position not far removed from the wish lists of mission statements and strategic statements. What is bonding on management outward-bound courses but an updated version of going out into the desert to find wisdom? Dressing-down Days and the Office Christmas Party are all updated versions of age-old Mardi Gras carnival rituals. In ancient Egypt they believed that by sleeping in a temple (incubation) they would be inspired by the 'god in residence'.

Perhaps brainstorming away-days in expensive hotels is the modern equivalent.

Look closely at consultancy, and we see interpretative divination. It is no coincidence that the vocabulary of psychics, palmists and spiritualists include the words consultation and client. Nowadays, however, our diviners call their inductive rules for reading the omens a *methodology*. As was noted above, these rules are needed so that the consultation is believed to be free of cynical manipulation: remember clients are trusting, but not stupid. Consultants are today's shamans, only we don't call them that. But as everyone who has benefited from hiring a consultancy company will tell you, the intuition of an individual consultant is far more important than the branded methodology of a particular consultancy company. 'The music is not in the notes'¹⁰: it is in the musician. The sorcery is not in the ritual, but in the sorcerer.

The authors insist that underpinning all scientific prediction are the twin fallacies that the past and the future are some kind of continuum, and that the future can be linked with the past in an approximate way via a mathematical model/trend. To succeed, all we have to do is to find the parameters of this model. Unfortunately, or rather fortunately for humanity, our science and technology cannot hold the future captive in the linear chains of mathematical models. In our pathetic attempt to capture certainty, we cannot arbitrarily use such models to project the lessons of hindsight onto the future. That is nothing but walking backwards into the future. Or it's like driving a car by looking into the rear-view mirror at the road behind: fine as long as there is no bend in the road ahead.

Predictions based on the assumption that tomorrow will be the same as yesterday may be good enough in the short term. However, the simple expedient of devising formulae that 'explain' trends, and then fine-tuning the model by fitting parameters, and finally extrapolating it into the future, ignores the reality of the feedback that will always expose paradoxes and will end with observations diverging from the model.

The discipline of Econometrics immediately comes to mind in the way it tries to predict future prices, for example through regression models. The problems of this approach are swiftly exposed, even in the prologue of some introductory econometric textbooks: 'to find something meaningful in all that data for forecasting purposes must be so plainly impossible that there will always be endless scope for well-paid advice on how to do it' (Kennedy, 1998).

Divining the Future

The past and future are totally different animals. The present filters out most of the uncertainty as the future becomes the past, although even the one and only past is open to multiple interpretations. But worse, this is an irreversible process because of the intrinsic non-linearity. The very act of filtering feeds back and changes the filter. The present is an arbitrary, inconsistent and turbulent filter. Mathematical extrapolation of the past on the other hand assumes a fixed filter; it is a fixed process that constructs certainty. In times of relative stability such mathematical approximation may be justified, but in times of ultra complexity, uncertainty or catastrophe, this limited way of thinking is futile. Over 200 years ago, Anglo-Irish statesman and philosopher, Edmund Burke phrased this well: 'You can never plan the future by the past' (Burke, 1975).

The trick is not to predict the future, but to make it. To win in this *Brave New World* (Huxley, 1932) we must make our own future, our own version of truth, concerning the play-off between the contingent and the unforeseen. It's no good dwelling on the past, for the future is utterly different: a diversified set of societal patterns formed by the competing forces of political, sociological, commercial as well as technological potentials. These potentials, supplied by individuals, by business in general, by governments, by society at large, by the world at large, are the components that are all brought together by social and economic forces. From this confrontation, natural selection creates the dynamic, self-organizing mosaic that is the future.

This mosaic is no arbitrary pattern. Behind each potential there is design, and behind each design there is vision. Not that any particular vision can see into the future. It can't. The future isn't there yet. There can be no vision of the future, but there can be, there must be, a vision for the future. A future that isn't there yet can't be discovered. That future is created; created by men and women of vision: sorcerers. Whether we like it or not, we are faced with a very simple choice: create our own future, or fall into somebody else's; take control of our own destiny or be at the mercy of another's whim.

By the end of this book the authors hope that like them, readers will answer the question of why they believe in divination by saying that delusion is not mysticism. Then they will come to agree that divination is critical in the development of every theory, and see the purpose behind the authors' confrontation with so-called 'rational thinking' as an attempt to re-ignite critical thinking, which is often lost amongst a myriad of scientific enterprises, evolutions and assumptions that modernity takes for granted.

CHAPTER THREE

Delusion

The first two chapters hinted at the importance of *delusion* in the development of the divination that underpins human cognition, and by implication observation. The term delusion is used here to mean an imagined contrivance: an intellectual construction by an individual regarding both the self and entities outside the self, which is taken to be true, believed and used to impose meaning on the world of the senses. Delusion then is the basis of cognition and thought, and so no delusion can be fully appreciated. Delusions are states of mind, dynamically stored in the memory for future reference, but as such they are not completely approachable by the mind. Any attempt to do so is futile. Delusions must remain partly accessible and partly inaccessible. They can only be accessed by other modes of observation that in turn create further distinctions, and further delusions.

However, and most importantly, some limited and inert forms of regularity emerge within an individual's intrinsically dynamic delusions. These stable linearities, we will call them *frames*, may be externalized and then propagated amongst that individual's fellows. The term frame is used because it captures the idea of some regularity within an individual's perception of meaning being framed, so that part of that meaning can be externalized using some form of notation, and subsequently communicated to others. As for delusions themselves, they must remain very private, personal and unknowable experiences, yet which are nevertheless formative of an individual's knowing about the world. We may think that we share common views of the world with others; however, a fundamental premise of this book is that we may share similar, but never the same delusions. Each delusion is unique but unknowable to its particular deluded possessor.

The relationship between frame and delusion is readily appreciated by any serious mathematician/scientist. Every member of these peculiar offshoots of humanity has at some time experienced a *eureka moment*: the personal enlightenment that comes with a flash of 'understanding' when the meaning of a mathematical theorem/scientific theory is grasped with an intensity and clarity far deeper than its superficial expression when written down as a frame. The theorem/theory itself, a limited expression in mathematical/scientific notation, can never come even remotely close to the explosion of 'meaning' and potential, the euphoria and sense of one-ness with the

world, the ‘understanding’ – the delusion – that is released in the head of a mathematician/scientist once he ‘gets’ that theorem/theory. That same sense of one-ness with the world, of clear-sightedness, is not the sole prerogative of scientists/mathematicians, for it is there in every taken-for-granted and mundane observation of our everyday reality. We will find that delusion is there underpinning every observation; and that we communicate our observations to others via the medium of frames expressed in likewise drab and limited notations.

Delusion is a decoding of an individual’s sense data that filters, and consequently alters that data on the basis of some predisposition to belief, giving meaning to the world of experience, and thereby enabling non-arbitrary and meaningful personal action. Past delusions are stored in memory, and regularities within them can be encoded in part, as frames, and re-transmitted both to others and to oneself for reconsideration as ‘information’. The term sense data is used here as a shorthand reference to the input and output of observation, in a way that avoids any reference to external stimuli in the outside real world, with all the epistemological problems that entails, recognizing it all starts and ends in the senses of the individual observer.

And there are some very deep epistemological problems. For we can only sense/observe the world by influencing that world as individuals, each of us sampling what is fed back through our senses. Then we are deluded into believing that the disturbances we have introduced into the world in order to observe have no consequence for both that world and what we are observing in it. We overlook the fact that we have no notion of how that world would be if undisturbed; we can have no such notion. However, we all subtly change the world when observing it: something that is exposed by quantum mechanics, and shows up clearly in the double-slit experiment described in Chapter 12. This is a never-ending story, where all answers are phrased in terms of yet more, but unsaid, questions.

This book will be using the concept of delusion in many different contexts to mean many different socially and individually driven interpretations of perception: imaginings, including myths, social norms, faiths, ideologies, beliefs, theories and models, as well as deceit and self-delusion; the latter pair being the usual pejorative forms of the word. This present chapter will be concentrating on societal shared-delusions, and then Chapter 4 will consider how these communal delusions derive from delusions in ourselves as individuals.

Why Delusion?

The word delusion is used in preference to any of the words from the above list because it doesn't carry the baggage of truth and lies of these others, and so all their subtle differences of meaning can be treated on an equal footing. Any idea of an objective truth is discounted. Instead truth is recognized as a formal tautology: a 'suitably falsified world' of refined ignorance. The axiomatic position of this book is that there is no true or false, no right or wrong way, only consistent and inconsistent interpretations of phenomena within the reflexive closure of systematic rules that we humans ourselves lay down in our delusions, and by which we convince ourselves of the rationality of our position. The authors insist that all that matters is whether such interpretations are appropriate. Their intent is for readers to avoid the flush of self-satisfaction that comes with simplistic truths, in which all complexity is unwittingly ignored. That is why they find themselves taking the Inquisition's side against Galileo Galilei, and support the Church's insistence that his theories weren't the truth, but simply delusions that were appropriate in calculating apparent planetary motion.¹

Whether we like it or not, however sensible our present view of the world may seem, each of us can be sure that this view will appear weird to others. For why should it be that what makes sense to us, makes any sense at all? 'Make' being the operative word. Alexander Pope is often misquoted as having said: 'all chaos is order misunderstood'²; but this insight should be inverted. All order is *chaos* misunderstood, deliberately misunderstood as delusions, to our advantage. Order (what makes sense to us) is not in the world out there somewhere. That order is artificially constructed by us as a nebulous pattern, a delusion, supposed, and then imposed on the world: 'supposed' is used here in both its senses, in that the delusion is inferred and being the way we believe the world to be. 'Understanding does not draw its laws from nature, it prescribes them to nature' (Kant, 1999).

At each stage in the feedback of human development, and this includes the present (and will be so in any human future), delusions are formed that are sufficient for the effective interpretation of sense data. 'Not to know but to schematize – to impose upon chaos as much regularity and form as our practical needs require'. Furthermore 'rational thought is interpretation according to a scheme that we cannot throw off' (Nietzsche et al., 1968). 'Everything that distinguishes man from the animals depends upon this ability to volatilize perceptual metaphors in a schema, and thus to dissolve an image into a concept' (Nietzsche and Hollingdale, 2005). Here

Nietzsche's use of the word 'schema' corresponds closely to the authors' use of 'delusion'.

Meaning is created by delusion: delusion is the basis of personal cognition and observation. Cognition, therefore, is built on what is taken for granted in an ever-expanding set of delusions that creates a set of reflexive and convincing descriptions in the mind of the individual. Any analysis, therefore, requires a consistency between what is necessarily so (the authors' shorthand for the unknowable 'real world' of phenomena) and the delusions used to give that world meaning. That meaning doesn't uncover causes in the world, for causality is not in the world, rather a delusion for imposing meaning on what is necessarily so; a pre-requisite/a building block of meaning/logic.

A Community of Shared-delusions

However, humanity treats the world of appearance, the world of the senses, 'as if' it is the world in itself. Nevertheless, we must ultimately accept that there is a difference, albeit one that is impossible to distinguish. Hence there can be no objective significance in any meaning derived from a delusion. The appropriateness of a delusion is to be found solely in its personal utility in a world that is brought into existence through a singular imagination. This book treats delusions not as the sinister deceptions by others, rather as possibly beneficial self-deceptions. For delusions are spontaneous bubbles of sentiment; they enable ways of looking at the world, enthusiasms that move people's minds as individuals. Delusions are necessarily very private nebulous things, generated from reflection on a lifetime of personal experience. They may not be shared with others; indeed they are not even shared fully with oneself.

We label delusions in some vague way; each is unformed, unknown and unknowable. And yet mysteriously they are an individual's personal basis for making sense of the world. How they work is inscrutable; we only know that delusions are the way by which we each individually construct order in our perceptions of the real world, and thence make our way in it. It is only through our acceptance of what our imagination tells us, supposes for us, that we as individuals are even able to make our way in the world. We have no choice other than to be deluded. Deluded by what we are, in what we are as humans.

The regularities that are extracted from an individual's delusions may be externalized, but only in part. These are the frames, the maps, ciphers,

filters, patterns, suppositions, norms, rituals, behaviours; the linear forms that may be communicated/shared with others. The individual also receives the frames of his fellows, which are then absorbed into, and extend, that individual's private delusions.

Each society, each community, is the result of compromises made in response to such forms received over the years between members of the group. It is this result that differentiates and separates that community from other groups. Through shared frames, and the feedback that reinforces and supports them, we bond with our fellows. We come to believe that from that feedback we can share commonly accepted regularities that have been extracted from the delusions of ourselves and others. However, this belief in shared-delusions is of course itself a delusion, because every delusion is unique to the individual; similar but never quite the same as every other's. Shared-delusions can be labelled, and their regularities further communicated amongst the collective. Such a process only adds to the belief in, and the utility of, the delusion of sharing. Indeed, when the authors write the word 'we' in this context, they are indulging in a shared-delusion that they and their readers all individually interpret (absorb into their private delusions) the identical ideas. Impossible of course, but hopefully similar and consistent enough to be meaningful within the delusions of each reader.

Some shared-delusions are short-lived, mere passing fancies, like the mass hysteria and greed of Amsterdam's tulip frenzy of 1637, and the Mississippi and South Sea Bubbles of 1720, and all the other speculative turbulence that has occurred since, including the nonsense of the dot.com bubble and the period of communal greed preceding the Credit Crunch of 2008. Other shared-delusions are almost permanent, lasting for eons, such as nationalism, religion, money or taxation. Why is that? The longer we have been convinced by the shared-delusion, the less we have to justify it; and the more it becomes the *de facto* truth among our group, the morality for our group and the reference point around which new shared-delusions emerge.

Every group must reinforce its shared-delusional messages in a drive for permanence. Faith in the system ensures the total and unqualified acceptance of a group's shared-delusions. Therefore, the ultimate goal of a society is the creation and maintenance of the shared-delusion that such faith has a utility. For that faith deflects criticism, and indeed is immune to criticism. Hence, there is a hidden agenda in the mental programming, the brainwashing of the impressionable young mind, by the state, the church and a hundred-and-one other herds that conspire in promoting their cultural norms (frames that

the individual absorbs as shared-delusions) via their teaching institutions. Cultures all have one aim, to create what Nietzsche called an ideal 'herd animal' (Nietzsche, 1990), by inducing in each of us a self-hypnosis that makes us observe in certain ways, think in certain ways, even suppose in certain ways. We are taught to stop asking those awkward questions about the dark side of our collective, whatever the collective, restricting and self-censoring ourselves to ask only politically correct un-embarrassing ones. We must stop at, go no further than, the most appropriate point, namely that point our society calls truth. Therefore, in order for the shared-delusion to be convincing/self-reinforcing, anything, everything, contrary to the belief must be denied, must be made to disappear.

Delusions or Illusions?

Hence, this book is *not* proposing that shared-delusion is merely the trickery of stage magicians, like those who seem to be able to make solid objects disappear. David Copperfield, the world famous illusionist, once made the Statue of Liberty disappear in front of a live audience, with millions more watching on television. How did he do it? The audience gazes at two huge towers that support a gantry. Both the audience and towers sit on a giant Lazy Susan: a large stage that could rotate slowly, unnoticed by anyone standing or sitting on it. The Statue of Liberty was clearly visible, positioned between the towers, all brightly lit up by high intensity lights.

Suddenly curtains came down, and unknown to the audience the stage is rotated; the TV cameras too are on the stage. Simultaneously the lights on the Statue, but not on the towers, were turned off. When, almost immediately, the curtain was raised again, the audience didn't realize that they were now looking out to sea. The Statue had disappeared, blocked from view behind a giant tower. The many blinding searchlights ensured that even if members of the audience had been looking directly at the tower, they wouldn't catch a glimpse of the darker Statue tucked behind. The trick had to take place at night for otherwise the audience would have received visual clues to the rotation. The darkness also justified shining the bright lights on the towers, another necessary part of the subterfuge.

This 'is not magic but illusion', Copperfield says. 'It is a question of money and technology.' Ironically, this is essentially the same as the process of scientific construction and the specific corridors of self-reference within which it too is trapped. Illusion is a deliberate misrepresentation that is known to create a false perception of sense data. In this quotation

Copperfield does himself a disservice. Of course it is magic! For all magic is shared-delusion, and in his illusion he is projecting a frame that triggers a shared-delusion. Like every shaman, with the razzmatazz of ritual, he prepares the ground, prepares the audience, prepares their expectations, and then amidst smoke and mirrors, he pulls off the shared-delusion. David Copperfield is not just an illusionist, he is a delusionist. His audiences know that they are witnessing a performance, an illusion, a shared-delusion, but that does not necessarily reduce the power that the shared-delusion has over them. How ironic!

The audience has to be positioned in just the right place for the delusion to work. Should they move out of position, deliberately or accidentally, they will see how the trick is done. Then the shared-delusion will unravel. Most audiences enjoy the show and don't want to be disillusioned. Similarly most people feel safe and secure within their society's delusions. They don't want to move outside the lies their collective tells them, and see through the comfortable subterfuge. That is not altogether a bad thing, provided the trick works for them, provided the membership of the collective is appropriate for them.

Although this illusionist metaphor is informative, the human condition is much more complicated. Illusionists like Copperfield work on one level of trickery, and below that level there is a rational explanation. However, society's delusions, the products of many past tricksters, are far more subtle. These shared-delusions are made private and added to personal delusions. They are tricks within tricks within tricks *ad infinitum*; nothing but the tricks: the delusions we play on ourselves. The delusions masquerade as reasons, built on reasons, built on reasons; the whole edifice eminently reasonable. However, none of these reasons can bear too close a scrutiny, for then we would see them for what they are: delusions circumscribed by, and dependent upon, paradoxes.

Conspiring with Delusions

Look too closely at any believable private delusion, and it will all fall apart. Suddenly it no longer works for us, it becomes inappropriate, it becomes absurd. None more so than the delusion that words hold meaning, where we hide our misunderstanding behind the categories of a linguistic schema. Humpty Dumpty was quite categorical: 'When I use a word ... it means just what I choose it to mean – neither more nor less' (Carroll, 1994). 'Every word is prejudice' (Nietzsche, 2006). We treat words 'as if' they have meaning,

and indeed through familiarity, through habit, they acquire meaning. However, words are where confusion begins, not ends; they are the place where questioning stops, so that communication and action can begin.

There can be no definition of words, except as private delusion. Language is a self-referential system (Barthes, 1969). A dictionary is a magical document that convinces us that it is the place where words are defined. Nothing is defined there. We just think it is: such is the dictionary delusion. Using the dictionary as a recursive stack, words are defined in terms of other words: 'big fleas having little fleas upon their backs to bite 'em, and little fleas have lesser fleas, and so *ad infinitum*'. Where does an individual stop in this explosive recurring sequence? There is no set of absolute and fundamental words to terminate the potentially infinite recursion. Instead each individual chooses to stop when the totality of descriptions he has are given in terms of words he thinks he understands. But does he 'understand'? Just try finding an applicable definition of 'a' and 'the' without using 'a' and 'the'. The infinite regression must somehow be halted. The individual stops at some point appropriate for him, and beyond that he does not question. Then, as long as he deludes himself into thinking he 'understands' the meaning, he can slice right across the paralysis, and just get on with it. After a certain point, it becomes impossible to see that the constitution of language itself, like any other system, is self-referential. The emergent phenomenon called 'meaning' is introduced by combining words; and the necessary and concomitant asymmetry created in that combination is lost and forgotten.

If the individual does not initially understand particular words then the solution is simple: the same words are repeated over and over again, and through this continuous mystical re-iteration that resembles a ritual at the most profound level, the individual internalizes words (that previously made no sense) as if they are now meaningful. Through the unstoppable repetition of such words over time, and in a particular context, the individual makes the necessary associations that pre-construct his delusions. The frail ground upon which these concepts have originated suddenly disappears, and communicating these concepts amongst the collective reinforces a now shared-delusion. This educational method of learning something by heart hammers the message home.

Ultimately humanity has reached the greatest self-delusion of them all: we stopped looking for delusions, both private and shared. For there is a utility in being tricked, or should that be 'convinced': 'what convinces us is not necessarily true, it is merely convincing' (Nietzsche et al., 1968).

We have to be convinced of what we perceive in order to act, in order to make our way in the world, both as an individual and as part of a group. However, humanity is limited by the way it thinks. Such conviction may enable us to make our way in the world, but it also restricts us in how we do it. Our world is unknowable, and yet variously interpretable, both individually and uniquely. There is no one meaning behind it, rather a myriad of imposed meanings, each an internally consistent form, although not necessarily mutually consistent with the others.

Through education, we subscribe to internally consistent frames. From pre-school, through infants, primary and secondary schools and then (for some) university, we ostensibly gain an academic, some would claim an objective, education. But do we? We learn at an early age the so-called *facts*, the shared-delusions of truth and objectivity by attrition. A young child keeps asking, why? why? why? about the frames laid before him. Incessantly why? A potentially infinite recurrence. Exasperated, the parent clips the child around the ear: that's why! In other words: accept the shared-delusional truth of society, as understood by your parents, by your teachers, by your elders and betters, or else this is what you can expect. The same goes for much of formal education, and its examined qualifications³: socializing by another name, the rites of passage into a society. The unstated message is 'accept the group for what it is, or else!' And what is 'it' exactly? It is the way the group teaches the student to think about both itself and its world. Education systems everywhere give priority to 'sciences' like physics and mathematics in their curricula, whereas social sciences are downgraded, and the arts and humanities often ignored. This is how the natural sciences have become preminent in our schools, and consequently in society. Many critics have raised concerns about this distorting of our society's value systems, fearing that children are being *educated out of their creativity* (Robinson, 2006).

The child learns to believe a host of things. i.e. it learns to act according to these beliefs. Bit by bit there forms a system of what is believed, and in that system some things stand unshakeably fast and some are more or less liable to shift. What stands fast does so, not because it is intrinsically obvious or convincing; it is rather held fast by what lies around it (Wittgenstein et al., 1969).

In other words, elements within a belief system remain intact not because they are true or convincing, but because they fit coherently into the

overall system of self-reference that is used to observe and interpret the environment; and in the process they don't cause any disruptions.

The building of this thinking process starts around the birth of each individual, as a seed: a mere potential, a will to delusion, and at the same time as a surrender to the power of delusion. Each life story is one lifelong sequence and consequence of absorbing frames, and subsequently forming them into delusions, bootstrapping from that potential to a complex structure of self-reinforcing delusions. That is why childhood is a time of magic; why magic plays a major role in the stories of and for that time; and why children do not question the fact that the world is a magical place. Through the eyes of a wise child there is no difference between reality and the world of magic ... because there is no difference: reality is the product of the magic of delusions. Children have no preconceived notions of appropriateness (significance, relevance, what works best); they are ready and willing to accept whatever they are told. For there is danger in a world that is arbitrary, and so there is a survival advantage in developing a personal sense of appropriateness. That is why society, in perpetuating itself, sets about socializing the child with the one true way: the set of shared-delusions that identifies him/her as a member of that particular society.

Mass-delusions

So where do these delusions, both private and shared, come from? From past insights. Some insights were deliberate, some accidental; some contrived, some emerged spontaneously; some straightforward, some subtle; some conscious, some subconscious. However, all delusion was, and is, first imagined into existence by individuals. The magician in society is always questioning the appropriateness of prevalent shared-delusions and their external descriptions. These schemas, maps, theories, methods, procedures are all suppositions in themselves. He and his like make the changes that are new private delusions, and then export them to their community, whereas the rest of us just make our way in the world by sharing in the framed delusions of the past. In doing so, we join the common culture, the imagined community (Anderson, 2006), of that mass-delusion. These theoreticians, innovators, magicians, alchemists, sorcerers, or whatever else we choose to call them, imagine new delusions into existence, and in doing so reinvent, redefine, change and may even destroy the nature of their community.

As individuals, we experience the phenomena around us through subtle and some not so subtle variations in the nebulous clouds of shared-delusions

that agglomerate as common cultures: the multiple overlapping cultures of a country, a club, a workplace, a family ... of every community and institution to which we belong. Because we observe through delusions, there can be no one absolute/objective way of looking at the world. We are swimming in an ocean of past delusions, both shared and private. Meanwhile, vast numbers of new shared-delusions rain down on us, invented by others with their own differing interpretations of the world, each with their own purposes and agendas. At the same time some old shared-delusions evaporate.

In all this buffeting, the unique set of private delusions, accepted and developed by each individual in becoming an individual unlike any other, is subtly changing all the time. The changes set in train are not always to his advantage: he can win, lose or be unaffected by each delusion. He tends to embrace those groups of shared-delusions that he perceives to be most appropriate for his needs; although even that perception is based on delusion. Furthermore, nothing is guaranteed.

New-born with an apparently clean sheet, but prepared with a will to be deluded, the individual arrives into a family, into communities. In his formative years he is powerless to choose. He spends his early years being habituated with the prevalent shared-delusions, although in becoming the individual that he is, his delusions become privatized, as they are always personalized through the uniquely private experience of living. Similarly new communities develop, their developmental phase tainted by the shared-delusions of the powerful groups around them.

As they grow, the choices of appropriateness for both individuals and groups will depend on what they have become, as a consequence of all the previous appropriate choices they have made. An individual's delusions may reinforce the group's positions, or they may metamorphose, mutate and coalesce with the shared-delusions of others to form a new community of belief, which thereby separates what is now a new society from the many unbelievers around. In this way new groups of people start self-selecting, polarizing into collectives, each with their own norms for viewing the world that members hope will maximize benefit for both themselves and the group. Each individual will belong simultaneously to a number of different groups. Some groups are limited by identifying with very specialized shared-delusions, like those who find comfort in an obsession with collecting, be it teddy bears, stamps or ceramics. Others affect large swathes of humanity, such as nationalism, communism, capitalism, globalization and the world's religions.

Those most likely to benefit from a shared-delusion will continue to push it onto the world. Those who fear having the effects imposed upon them will alienate themselves around an anti-delusion, itself another shared-delusion. For example the dread of a new capitalist world order driven by globalization and supported by technology has sparked the anti-capitalism riots in London, Vancouver, Washington, Gothenburg, Genoa; and the many more riots to come. That technology alienates was recognized by Karl Marx a century and a half ago. We are alienated from technology, and by technology, and thereby alienated from each other. Technology creates winners and losers, and this places enormous stresses on the institutions of the status quo. The behaviour of today's anarchists is very similar to that of the nineteenth-century Luddites who saw their own world being destroyed by the shared-delusion of industrialization. The use of the phrase 'shared-delusion of industrialization' is intentional. Not the fact and function of industry, but how industrialization replaced the way humanity saw its place in the world: the impact that industrialization had, not only on social and economic institutions, but also on the ecology of the world of phenomena itself.

Meanwhile, there are those who don't care one way or the other, and they just sit on the fence; that is if they are allowed to.

Spontaneous Combustion

No matter on what aspect of the human condition we focus, for whatever reasons, be it philosophy, education, work, ecology, nationality, trade, sport, gardening, food, entertainment, money and of course science, they all have their theorizers sustaining former delusions, developing new ones, and then sharing these with others. On the basis of what they deem to be appropriate, these creators of new delusions launch actions into the world. Subsequently natural selection takes over. Unknowable systemic forces in the environment of phenomena, that realm of necessity, will ultimately arbitrate, and will decide on success or otherwise.

Unfortunately, no shared-delusion is controllable, or even constant. Once it is communicated, released into the collective, it mutates as it is assimilated within each individual's persona, and in doing so it takes on a life of its own. The circumstance of what a society has become will allow some events to happen, and will banish others. A mass-delusion, more or less the same delusion to all individuals of the mass, although invented by individuals, can trigger a spontaneous communal choice, which is unprompted for whatever dynamic shared-delusional reasons and motives

are already present in society. For example, in every human society there are numerous examples of a spontaneous communal amnesia, an unspoken almost psychic agreement across the whole of a society to leave some embarrassing or unwanted things unsaid. This is how each society, each community, becomes the result of compromises made over the years between members of the group, which differentiates and separates it from other groups.

The mythologies that underpin the creation of every national identity or national pride contain classic examples. The sorcery that creates a nation will insist that a national hero must not have feet of clay. For much of the nineteenth century in Britain, the relationship between Emma Hamilton and Admiral Lord Nelson simply disappeared from the national consciousness. It was not allowed to tarnish ‘The Immortal Memory’ recalled for posterity in London’s Trafalgar Square. Even Horatia, the offspring of this illicit liaison, never came to realize that Lady Hamilton was her mother. The leaders of society (those in the know) chose to ignore the facts. However, among the general citizenry of the British Empire there was no deliberate conspiracy. The silence was deafening when they chose not to confront the prevalent morality and hypocrisy. They would rather not know about any damning evidence, and so the ‘problem’ simply disappeared. The population wanted to believe the lie; needed to believe the lie. They were buying into the unspoken norms and moralities of the group, as an investment in the benefits of a coherent and cohesive society. The statements of later historians who revisited the scandal were met with total disbelief by much of the population.

No nation’s great heroes or its myths can bear too great a scrutiny, whether it be the Boston Tea Party, the storming of the Bastille, the Alamo or the Winter Palace, or Mao’s Great March. It is well to remember that the sensitivity of the population to their national plaster saints can still provoke a violent response towards anyone who points out the shortcomings.

The underlying assumptions that inform such processes are social constructions. However, the result can be devoid of the original intentionality, and in ways far more complex than can ever be originally comprehended. Every shared-delusion is just a shadow of what it attempts to represent, and actions based on that delusion will inevitably cast off some debris, some form of pollution that will surface as side-effects, error, fault, damage, absurdity. This opens the door to diminishing returns, which is why every

shared-delusion eventually loses its appropriateness. Then whole sectors of society finally choose to jump ship because they no longer commit to sharing that delusion. This may be why a number of scholars have commented that the value systems of many in developed countries have become alienated from those values implicit in the default national culture (Hofstede, 2001).

That having been said, the fact that the old values have survived thus far shows that these *Imagined Communities* (Anderson, 2006) are held together with very strong glue indeed, and that they won't be blown apart that easily. Inertia, not money, makes the world go round.

CHAPTER FOUR

Individual Allusions that Limit Sensory Overload

Delusions Make Sense

Now we delve even deeper into delusions, specifically personal delusions. This book will claim that delusion is the very basis of thought, intelligence, cognition and observation, and even that humanity itself is predisposed to believe in such delusions. Delusions aren't nonsense; quite the opposite. They are the means whereby we sidestep any absurdity in our modes of analysis so that we can glean the benefits. Delusions affect every individual, and consequently the world of any society, any collective. These delusions 'make sense' to the deluded individual since delusion is the mechanism through which the individual internalizes an important part of the world he strives to describe, all the while ignoring the unimportant. When questioned, the validity of these internalized descriptions often remains untouched; and hence, only those elements that can reinforce the established delusion are accepted. These are further internalized within the descriptions that the individual pursues. But these descriptions do not exist in a void; they are usually externalized as part of a community of shared-delusions, represented within communities of practice. In this way conviction is reinforced among the deluded. To the outsider the shared-delusions are absurd, but the deluded choose to stay deluded because of the perceived benefits that accrue to them within their chosen collective.

From their experience of discussing this topic with graduate students, the authors have learned that some are very uncomfortable with this sceptical interpretation of how we humans think about the world, and how we project cognition (so-called understanding) onto it. Some students, particularly those with a scientific background, insist that they perceive what is 'out there' in the physical world of phenomena, exactly as it is. They do, however, have far fewer objections to the idea of shared-delusion when it comes to social constructions. For example they have little difficulty in going along with statements that money is a belief system, or that history is the reflection of data from the past in the mirror of contemporary concerns.

However, to the sceptic, everything is delusion: from the formation of cultures to our very individual and private perceptions of 'being-in-the-world'

(Heidegger, 1962), to the way science is constructed and has evolved. For it is impossible to tell whether reality is as it is personally experienced in sense data. There is a world of difference between any reality out there, whatever 'out there' is, and the imagined reality formed by what the individual being does with both sense data and methodological representations of reality. Heidegger's concept of being-in-the-world and the perception of being there are definitely not the same. We cannot even know if reality is consistent with sense data, because we only perceive what is already consistent. After all, under hypnosis we can be jabbed with a needle and yet feel no pain, or smell disgusting imaginary odours, or consider ourselves nailed to the spot unable to move, or a million and one other sensory sensations impressed on us by the hypnotist.

So what if our society is the hypnotist, and we experience everything in a way that we have been pre-programmed and disposed to expect? What if there are other dimensions, available only to senses we do not have? That possibility is of no consequence. It is our blessing, and our curse, to be trapped in three dimensions with the senses we do have, or rather with the senses we have been deluded into having.

Keys to the Kingdom of Knowledge

Therefore the individual must resort to allusions¹ in order to arrive at the truth about things, or rather an allusion of truth. Such *a priori* truths are mere provisional assumptions. Allusions are unverifiable suppositions about the world: implied or indirect references. The individual treats such conceptions of entities in the world with the use of metaphors, as if they are the entities themselves, and in doing so he dissolves his sensations into metaphor. In this way he projects his suppositions out onto the world, to collect and feed back sense data, which he then uses to project his suppositions out onto the world, to collect and feed back sense data, and so on

It is the fundamental human delusion to treat such dynamic allusion as truth. Each individual life and each human community is a journey of construction, building on these allusions to form a system of complex claims (personal truths = delusions) concerning the world. These claims are broad-ranging, more or less consistent, rationally defensible, and most importantly communicable to others; although this too is a delusion; albeit a shared one.

Each of us is unable to find any ultimate truth, except as a private delusion. Our very personal experiences are not open to any form of external enquiry,

as every human being is inevitably cut off from having knowledge of the mind of another. It is not at all clear to what extent we even have any knowledge of our own mind. How can any system fully describe itself? Consequently we must abandon any search for certainty in human knowledge. We have to act 'as if' we are in the world of phenomena, 'as if' that world is real, 'as if' we are not self- or socially hypnotized. Why? Because we are unable to operate in any other way. Why is that? Because this is what we humans do.

Existence has 'neither cause, nor reason, nor necessity' (Sartre, 2003). The sceptic's position is that there is a fundamental flaw in all theorizing, including what the authors are doing when writing this book, namely the deluded search for description/explanation/truth. How can we humans find what isn't there? Nevertheless, we must persevere with our existence. In order to do that, we must impose meaning on the world with allusions. These unverifiable interpretations are contrived into private delusions that are themselves a leap of 'animal faith' (Santayana, 1955); delusions that are ultimately based on biological and social factors. Such a leap of faith, the total and unqualified acceptance of delusion, is only justified and justifiable by the actions it inspires, and the appropriateness of those actions within a personal meaning. The only utility in the futility of searching for the truth is that it may help each of us develop a workable clarification of personal appropriateness.

Humanity has not captured the keys to the kingdom of knowledge. 'Only very naive people are capable of believing that the nature of man could be transformed into a purely logical one' (Nietzsche and Hollingdale, 1996). 'The world is logical because we made it logical' (Nietzsche et al., 1968). We made it logical with both hardware: our evolving genetic makeup, and the stabilizing physical artefacts we place in the world to reduce its apparent complexity; and software: data and institutions transferred across the generations. We made it logical in the eons of feedback that is life on earth. We are trapped in this mode of thinking; forced to build within a framework of ciphers that is 'knowledge', a cage set down before the dawn of intelligence. 'Just as certain human organs recall the stage of evolution of the fish, so there must also be in our brain grooves and convolutions that correspond to that cast of mind: but these grooves and convolutions are no longer the riverbed along which the stream of our sensibility runs' (Nietzsche and Hollingdale, 1996). We have merely developed upon the fishes' eye view of the world, and cultivated a more sophisticated schema. We place our intelligence on top of what is 'always and already' there (Heidegger, 1962).

If Darwin was right, then the simple organism in the primordial soup has certainly come a long way within its self-reference, self-replication and self-preservation.

No Knowing About Knowing

So how then can there be any knowing about knowing? The problem with answering questions like 'who are we?' or 'where does the world come from?' is that we only have ourselves as the means of answering. 'How should a tool (our intellect) be able to criticize itself when it has only itself for the critique?' (Nietzsche et al., 1968) How can we 'look around our own corner?' (Nietzsche, 2006) For we, as individuals, are simultaneously the observer and the observed in each observation; the subject and the object of each description. In observing, the observer changes what is observed, and is also changed by the observation. Irrevocably intertwined, these schizophrenic pairings compel us to accept an inevitable uncertainty principle in all that we do. There can be no superiority in theoretical reflection. There is no detachment from the world no matter how much we contemplate, theorize or introduce principles; for we are both the subject and predicate of every sentence.

We each have inherited repetitive and unthinking skills, everyday practices within our private and shared-delusions for coping with the world, although we have no exact way of representing them explicitly. Our brains and thoughts are themselves an epiphenomenon, the result of what we have become through the reflexive operations of cognition and observation. But in that becoming they are the culmination of a 'curriculum of an earlier mankind' (Nietzsche and Hollingdale, 1996), even a pre-mankind. There remains a residue of the past in all of us, a reptilian brain forming aquatic behaviour patterns: and it cannot be ignored by an act of rational will, whatever we would like to believe. In times of sensory overload, of pressure, of fear, the throwback in us will always reappear.

Plato considered the human condition to be in a permanent state of flux, regardless of how the world appears to our senses. The metaphor he used was of a community living in a cave, observing flickering shadows from the real world of phenomena projected onto the cave wall (Plato and Lee, 1974). Plato went on to raise a whole range of issues; however, this is where he and the authors part company. To them the big question is whether it is possible for an enlightened individual to go out of the cave into the sunshine, and see the 'reality' other than as vain shadows, other than as imposed projections

(as delusions)? This book's sceptical position in this human dilemma is unequivocal: we are trapped as individuals inside a cave of private sensory experience, of delusions. Our heads are the cave, and the shadows are the projection of our senses; senses that form the cave entrance. There is no going outside of consciousness and directly accessing reality. Within that trap, we develop a temporary niche. We adjust to the circumstances of our experiences and convince our intellect accordingly, so that these circumstances do not interfere overmuch with the process of developing and sustaining that niche.

In Plato's example, even though the collective is trapped inside the cave, each member watching the passing shadows projected onto the wall, one individual does make it outside. Plato mentions that he breaks free from his trap, exits the cave and is faced with the marvel that is *reality*. That individual goes out into the sunshine, but finds it difficult to adjust. It takes him a considerable amount of time to develop a new but temporary niche; but he is under the impression, momentarily at least, that he has escaped his trap. Convinced of the validity of his belief system, now that he has seen the light, he feels he must go back into the cave to set his fellows free so that they too can see the light. But a number of problems must appear. He has developed a new and different perspective on the world, and so it is not easy for him to go back into the cave. What is more, his fellows are not easily convinced that they should abandon their own niche for this new one. Of course the enlightened individual could himself start thinking of the new/outside world as yet another cave, another trap.

Thankfully, for most practical purposes the existence of these traps doesn't matter. Each individual simply adjusts his behaviour to find and take advantage of a new niche within his own trap. This is just as well since there is no escaping outside the cave of being that is 'I'. There is no going outside into an enlightening sunshine. Each of us is forever trapped in our unique personal world of shadows.

Nevertheless, what we can achieve by manipulating those shadows is truly magical. I myself am a being-in-the-world, and so I am not just a passive observer of the shadows. Yet I may appreciate no more than my interpretation of what my senses tell me: *nihil in intellectu nisi prius in sensu*. 'Nothing in the intellect unless first in the senses': an old empiricist aphorism. Therefore, I have no option other than to describe that unknowable terrain in terms of the delusional interpretations of my sense data, my observations and cognition. My descriptions are the product of my imagination. It enables

me to make my way in the 'natural world' by interpreting not only my sense data but also my considered actions within this crazy 'unnatural' artificial (linear) world of my own creation, individually, not knowing and never knowing what 'natural' (non-linear) is. It is all impossible to describe, other than through delusions. What is more: "There is nothing either good or bad, but thinking makes it so."²

By considering different biological organisms, the paradox of objectivity quickly exposes itself. When observing a tree, the different sensory data systems of different organisms (say a human being, or a cat, or a butterfly) will 'see' a completely different tree, which renders the question 'what does the tree actually look like?' totally meaningless. What could the underlying substance, the hypostasis, be for the tree to allow all these different interpretations? The 'real world' is there not to be real, but to permit a series of different reflexive constructions/frames that will emerge out of delusion: in other words, to permit description via a multiplicity of simultaneous delusions, each being species-specific.

When joined together in groups, we suppose that humans communicate via the same *understanding* (rather cognition) of the world, when we are merely sharing similar frames emerging from our delusions. For this unknown and unknowable domain is always one step beyond our imaginings, despite our belief that our reach can go beyond our grasp. Whatever the ultimate social construction among groups of people, whether it relates to the fate of nations, of companies, of families or of friends, everything comes back to the individual and the interpretation of personal sense data. Not only the five senses³ of touch, smell, taste, hearing and sight, but also the sixth sense of awareness/cognitive reflection, of being-in-the-world, which we mistakenly identify as thought. Even knowing what our senses are is a delusion. All attempts to understand ourselves are in vain; the eye cannot see itself, except as a reflection; nor can the other senses sense themselves. It is all smoke and mirrors. It is the fallacy: 'I think, therefore I am knowing',⁴ and ultimately futile. What do I know and how do I know it, when 'all that I know is that I know nothing?'⁵

An Evolutionary Advantage

'I would like to treat the question of the value of knowledge as it would be treated by a cold angel who sees through the whole shabby farce. Without anger, but without warmth' (Nietzsche and Breazeale, 1999). Thinking is an artificial arrangement for the purpose of intelligibility. Thinking about what

we know, and how we know it, is an indulgence, is an irrelevancy. How magically amazing it is to believe that thoughts can trigger other thoughts: yet another self-reference. What is important is not how or why we derive these delusions from our sense data, rather that we do create them. Through our thought-created delusions of what we think we know (an epistemological delusion), we are able to make our way in the world. Our particularly human mode of thinking, the general way in which *homo sapiens* implements this process, is what separates us from other species, and makes humanity what it is. We do not know the truth about things, but thankfully these delusions deliver an evolutionary advantage for operating in our ever-evolving self-selecting niche.

So if it is not truth, what exactly is this information we glean about our world? Mere data that lends support to delusion; evidence consistent with delusion, and that reinforces delusion. And why? Because considered action can stem from delusion; the alternative is immobility or arbitrary action.

Why are the authors so insistent about delusion, and exactly what is its utility? Being in the world of phenomena, we humans negotiate our way by acting upon and reacting to data received from our senses. In response to that data, each of us must resort to one of 'the 3f's': freeze, fight or flee; but which one? Unfortunately the world has always and will always overwhelm the senses of the unprepared with a vast overload of data. It was the same when humanity roamed the savannah, or when Nietzsche's pre-human fish swam the riverbed. Today we complain of a computer-generated-information overload, but it is no different from all the other previous cognitive overloads: we just think it is different because we haven't learned to cope with it yet, because we haven't learned a simple means of (the delusions for) coping.

We may construct search engines that operate in this technological realm in the hope of cutting down on the underlying complexity, but in doing so we fail to realize that these possibilities are restricted both by the choice of algorithmic representations and by the interaction that human activity systems have with those technologies. It is not only reality, but virtual reality too that becomes constructed. However, far more important than the simplistic analysis of these two and/or other realities being socially constructed is this book's insistence that all reality is observationally constructed.

But why are we not aware of that tamed information overload from yesterday's complexity, or if aware why do we choose to ignore this? Because our delusions, our belief in internally created schemas of the world, protect us. We can't take in everything; there's just too much. We'd be swamped.

Cutting down on complexity becomes a necessity. The structural coupling of an individual's observation and cognition acts as a filter, and thereby simplifies the data. The data is reduced into categories, and by contriving patterns/frames around those categories we can reflect on that data, make decisions and/or communicate it with others.

'The map is not the terrain.' Nevertheless, the individual can benefit by arranging, simplifying, supposing and schematizing, and interpreting sense data as a delusion (a map) appropriate for dealing with the context in which he finds himself. There is an advantage in ignoring the fallacy of residual categories that would otherwise disrupt our mapmaking. The overall approach is essentially a sympathetic magic, very little different to divination described previously. Such magic is a belief that ritualistic behaviour, which promotes the validity of delusions, can represent and then replace the world. Ritual acts are supposed somehow to instigate a causal chain of events that ultimately affect the real world and deliver the contents of an advantageous wish list. This is what Nietzsche meant in the quotation mentioned earlier: 'When one rows, it is not the rowing that moves the ship; rather rowing is simply a magical ceremony by which one compels a demon to move it' (Nietzsche and Hollingdale, 1996). By manipulating structures/categories on the map, namely the frames within a delusion, we assume that this will affect both the terrain and the artefacts we place in it, in an equivalent way, and that consistencies/regularities in the frame will carry over onto the terrain. That this seems to work, and that empirically we sense objects in the world behaving exactly as expected, most of the time, is truly magical.

These delusions need not remain inside our heads. Not only can we humans externalize the regularities in our delusions in the form of frames suitable for communicating, but also we can make them physical, tangible, as artefacts. We place these frozen and hence stable frames in the world, where we believe they stay unchanged exactly as we made them. There they deny the complexity in the *Chaos* and the ensuing uncertainty by reinforcing our interpretation of the world. Order coalesces around these physical artefacts, thereby seeming to make the world tidy. Our delusions, both the frozen and the communicated, both the shared and the nebulous cerebral kinds, form a pragmatic sink for the noise surrounding our senses, as well as a springboard for opportunistic action. We make the world even tidier by placing structures in the world; however, that too is nothing but a short-term delusion. Breakdown and noise are inevitable, and a measure of the ultimate failure of every delusion.

Making Sense with Delusions and Frames

Nevertheless, it all seems to make sense to us. Even the words 'it makes sense' imply that to an individual 'it' is consistent with his accepted set of personal delusions. The individual ritualizes away all recognition of this belief system, pushing it into the background of thought so as not to interfere with cognition. Thence all projected assumptions look eminently sensible and self-evident. The individual no longer needs to be convinced by his delusions. Indeed, in the process we call learning, such self-evidence is used to justify acceptance of the next shared-delusion/frame to come along. If the individual is convinced, then that too is absorbed into the unquestioned and unquestioning background of all his thinking. That it is all delusion doesn't really matter, because there is an evolutionary advantage in such delusions, in that not only do they impart the ability to act by creating options, directions, consistency of behaviour, predictability and repeatability, but also they are the means whereby we humans adapt to our ever-changing surroundings.

The individual must use the delusions at his disposal to sample the context in a form of spontaneous matching. By contrasting the matches against the options available, he limits both the input of sense data and the choice of action. In other words, he jumps to conclusions, for his is no passive, impersonal or objective analysis. His particular purposes and preferences arbitrate in the continuous feedback until a choice is made. In this way his delusions (hopefully) disperse irrelevant information, so that he can deal with what he considers the important events at hand, and in an appropriate manner. The individual observer selects amongst the data. He cannot but be partial, and hence he disregards much. In doing so he simplifies, and he then deludes himself that he has clarified the situation. Everything irrelevant just disappears. As Einstein commented to Heisenberg during the latter's Berlin lecture in 1926: 'whether you see a thing or not depends on the theory which you use. It is theory which decides what can be observed' (Salam, 1990).

Frames, a delusional way of externalizing regularities within the meaning that is buried in a delusion, are fundamentally impelled by the human *will to categorize*. They filter out the overload of sense data by limiting the flow of information, and enable our thoughts to crystallize on a course of action. And the plural is used here: frames. No single frame can be a complete description of the terrain; nor can the delusion generated by an observer of the terrain. Each frame is linear, simplified and partial, in the sense that the need for action delimits what data is included, and what excluded. Therefore,

we humans must develop numerous frames corresponding to different conditions, each limited from its very inception by the appropriateness of its application in different situations. They are all superimposed onto a totality of delusions from which we as individuals operate, so that we may both reflect on and consequently deal with any particular situation in the best possible way (a subjective decision of course), and communicate those reflections to others or reflect on it ourselves.

But it must be made clear: there is no ultimate sense in our bizarre world. There is no Akashic Field we can aspire to. Hence, individually and in groups, we must make sense of the world by categorizing it with all-encompassing labels synthesized from the previously potent delusions that have come down to us as individuals. What makes sense? Any situation where what we make of the input from our senses conforms to preconceived notions. The delusions are then individually built up by each of us in becoming what we are, what we have become. Through early childhood we gradually come to believe that these delusions tell us the truth about things, the meaning of things; that the world is as it appears to us via our delusions. Like a caged tiger, we each stalk up and down, penned in by delusions, in a display of displacement activity.

We can do nothing about the delusions built into the physical functioning of being human: into what can be called human hardware or more colourfully 'wetware'. However, the delusions in human software, both private and shared (e.g. ideas, culture), are there for the taking, for the making. For these delusions, the products of the past, are the ways in which we deal with so-called reality in becoming what we are. This sceptical position is not nihilism. The sorcery of delusions does not deny that a 'universal' is out there; however, it asserts that any universal (if there is one) is an unknown and unknowable terrain. We can never understand what that reality is, because we are limited by the reach of our senses, by our representation of such a reality, and ultimately by our cognition of it.

Plato and Bishop Berkeley

We are back in Plato's cave, or with Bishop George Berkeley's old chestnut: 'if a tree falls in a forest, and no one is there to hear it, it makes no sound'. Following Berkeley's sceptical logic to its ultimate conclusion, who is to say the tree has fallen, and did not come into existence at that moment and in that position? Eighteenth-century cleric, Berkeley, would argue that a room disappeared when he left it: '... all those bodies which compose the

mighty world – have not any subsistence without a mind’ (Berkeley and Dancy, 1998). In other words, there is no existence of matter independent of mind: ‘to be, is to be perceived’. Whether or not the room is lying dormant somewhere in the background, it (if there is an it) is unperceived because there is no sensory contact. Ditto the fleeting sound in the forest. Does the tree make a sound? Does the room exist? Who cares? Let’s operate as if they do. In this respect Berkeley is typical of many of today’s sceptics who dismiss the existence of objects outside of experiencing them.

Actually, Berkeley was alluding to what today is called orders of observation. The act/process/operation of observing the tree is called a first-order observation. However, in the case where the tree is unobserved and only imagined/remembered or communicated by another observer, a second-order observation is brought into play. Here the observer creates an abstraction that is inferred to be a third party who is observing the tree. However, as Berkeley is reminding us, an abstraction doesn’t have any senses, only ones imagined by the cognitive observer.

We are biologically constrained to interpret phenomena in the world, like the room and the falling tree, as sight and sound, as sense data. However, there is no colour or sound in the world, only unknowable sources that trigger our senses; the colours and sounds are all in our heads. They can only exist as first-order observations. Does it actually matter if the sources are really out there? Berkeley’s message is not that we magic sense data out of a void; rather, by our senses (that for him proceeded from God), we interpret phenomena that are necessarily as they are. These phenomena, whatever they are, lie in the realm of necessity, what are necessarily so, but which are unknown and unknowable, although variously interpretable. That interpretation occurs in the realm of imagination inside our heads, where the phenomena become transformed as sight and sound etc. There we imagine into existence an interpretation of the phenomena as a reaction to our sense data, but that data are necessarily separated from the fabric of their source. Since there is no evidence of either the room or the tree, other than in sense and memory, they are devoid of the existence conjectured (conjured up) by human interpretative delusions. To the Bishop, existence is sensory awareness in the present (or rather the immediate future) via mental schemas, not a prior placement in a terrain previously imagined into existence. In deluding ourselves in this way so as to avoid sensory overload, all irrelevant data become inconvenient background noise and simply cease to be noticed.

A similar idea surfaced in the nineteenth century when Lord Kelvin stated:

I often say that when you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind; it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science, whatever the matter may be (Kelvin, 1883).

This persistence in the intrinsic validity of mathematical notation becomes more evident in another quote from Lord Kelvin: 'Do not imagine that mathematics is hard and crabbed, and repulsive to common sense. It is merely the etherealization of common sense' (Thompson, 2006). This assertion alone signifies both how persistent the delusion of measurement has become in modern thought and how the world as we know it is seen through the delusion of measurement. Thus, Lord Kelvin went further than Berkeley in saying that for a phenomenon to exist at all it is not sufficient that the phenomenon be sensed; it must also be measurable, and on being measured, turned into a number. Protagoras then brings us back full circle: 'man is the measure of all things'.

Trapped in the world of our senses, our thought-created and thought-limited consciousness builds up an edifice of delusions from the distorted fragments of frames that others have communicated to us, and that we ourselves develop. We have produced a highly complex and internally consistent toolkit of delusions: the aforementioned mental schemas, descriptions, predispositions. We project those delusions onto the real world, and we each traverse that universal terrain of phenomena according to what we infer from our personalized sets of delusions.

From this perspective, any sophisticated theory, be it the product of science or mathematics or philosophy, can only ever exist as an expression of the frames that emerge from shared-delusions, as a description. It is *not*, and can never be, the essence of the terrain itself. The imagined world of theory is always removed from the 'real world'; it is full of absurdities that must be ignored for the theory to be useful. The reason why not everyone is proficient in the intellectual disciplines of science may not be because of any fundamental deficiency on their part, but rather a superficial one, in that their personal maps are not, and may not be, designed in a particular

requisite way that is capable of denying the absurdities in the theory. We all have deficiencies in some respects, but the only question worth asking is about the appropriateness of our personal maps; whether our deficiencies limit our ability to operate in our own particular niche in the world, and whether there are more appropriate shared-delusions and frames to help us operate better.

Map as a Metaphor

In considering a frame, the linear and restricted form of a delusion, the authors are using the age-old concept of a map as their metaphor; but they will be ignoring the post-medieval fetish for geometrical accuracy. The map (the frame, or hypothesis, or filter, or metaphor, or whatever else we may wish to call it) must aid the synthesis of what is important, and represent/describe the situation in a way appropriate to tackling the tasks at hand. We can never explain anything; we merely describe convincingly. It is dealing with the world through metaphor 'as if' it is something else: a something we are more comfortable with. Observation and cognition then is self-reference in operation.

Anyone who has navigated the London Underground using a revision of Harry Beck's famous original map will know exactly what is meant. In Beck's design masterpiece distances are distorted, and relative positions of Tube stations on the map bear little relationship to above-ground compass bearings. Yet it has the utility of being far more meaningful than any geographically accurate map. So much so that its style has been copied all around the globe. Why? Because travellers in the subterranean world have realized that by restricting concepts of truth to the consistency of structures on the map, their journeys are made much easier. Just like Beck's design, each mental map is merely an evolving generality, the delusion that we impose on ourselves in order to move around the terrain.

However, we should never forget that 'all generalities are misleading, including this one'.⁶ Misleading? Yes and No! Let us reiterate: delusions are not nonsense. The sorcery of delusions is emancipating, because it creates a surreal view of the world where anything, within reason, is possible. Like in the Bugs Bunny cartoon, how often do we think that we have painted ourselves into a corner in some personal, business or social context? The corner is just a metaphor for inertia: that we have frozen, instead of choosing to fight or flee. Alternatively, we can decide that the room will not constrain us, and use our imagination to create a different room, a different situation.

Just like Bugs Bunny, we can overcome the inertia by painting a door on the wall, opening it and escaping. Our actions do not contradict the constraints of the old room, for by choosing from a different set of delusions we are in a different situation. Such sorcery is a convincing rhetoric that enables us to treat every situation in this opportunistic way, and it therefore promises huge scope for manoeuvre. What it doesn't do, however, is promise miracles; but as long as we don't contradict what is necessarily so, we are constrained only by the limits of our imagination.

Avoiding Sensory Overload

Imagination then projects these delusions, some as framed linear patterns, in a way that variously interprets the context in which we operate. For mankind is a pattern-making animal. Those patterns (both linear and non-linear, although we can only reflect on the linear) do not just exist in the brain, and not just in the individual's software. 'Every inquiry is seeking. Every seeking gets guided beforehand by what is sought' (Heidegger, 1962). There are patterns in every aspect of our reaction to the environment around us, including the genetically concocted hardware that separates our species from others. All the remainder of God's creatures and plants, humanly created artefacts too, are systemically disposed to project niche-appropriate patterns around them, only they aren't human patterns. This is the way dolphins, porpoises and bats use their own species-specific sonar (as we humans interpret it) to survive and prosper in their particular worlds. The particular human approach, the delusion of self-consciousness, does not make us superior to these other species, only different; although in one very important respect we are no different. A human, a cat, an amoeba, a worm, a tree, even a grain of rice, all have to respond to their environment with their own category/species-unique set of senses, via their predisposition to sense data (or not) in context, and thereby survive and prosper. Each species has to make its own way in the world, but differently, with different dispositions evolved to fit species-particular surroundings.

That human dispositions involve consciousness is just human peculiarity. A response to prevalent conditions does not have to do with thought: a fairly obvious conclusion in the case of the tree and rice grain. It is only human arrogance that places our rational thought above all the other ways and means of dealing with events in the world. After all, we breathe without thinking about it; the required patterns are constructed in human physiology. Thought is just one among our human pattern projection systems, although

we do tend to posit it at the centre of all things. Why are we surprised that our brain is so wonderful, when the brain itself is telling us this? Rational thought is not even a primary aspect of our own thinking.

The reason this book puts so much emphasis on delusions is because delusions are not a failure of rationality, quite the opposite. Delusions, and building on allusions, are primary. Rational thought came late into our picture, as a side-effect of our imagination, which itself has emerged out of the evolving complexity of pre-human delusions. At its core, rationality is nothing more than a self-referential system of both pre-cognition (that is the collection of individual delusions that construct the possibilities of various responses to external stimuli) and cognition (that is the application of pre-cognition to an event before what results from that application becomes internalized by the human observer and is fed back to support a re-application of the function of pre-cognition).

Thought is a delusion that contemplated itself into existence as the basis of action and communication, which is why we are self-aware, and don't merely think. In turn, that side-effect has convinced us that we sense the truth about things, and as intelligence, it tells us how to act on that constructed truth. This is what we humans do. Other species approach the world differently and in their own appropriate ways. Each species has its own way of delusion, is its own way of delusion. Whatever that way may be, it must result in *The Will to Power* (Nietzsche et al., 1968) for each species, because otherwise extinction beckons. What sublime irony, that the discoveries of the Human Genome Project, the ultimate arrogance of human intelligence, the very intelligence that distinguishes humanity, should lead us to realize that the DNA of humans is less complex than that of rice (Venter and Craig, 2001). 'Although humans are normally thought to be considerably more complex than organisms, such as plants, rice, yeast and earthworms, this is not reflected in their number of genes, with humans having less genes than other supposedly less complex organisms' (George, 2002).

Any creature that can avoid the deluge of data, and cope with the sensory overload, is obviously at an evolutionary advantage. We could just ignore all the noise around us; however, not only would we then miss out on the advantages out there, but also we would be oblivious of imminent danger. The trick is to cope by denying the apparent complexity in the 'real world' of phenomena, so as to maximize the benefits and minimize the hazards, by living in a tidy world previously mapped by carefully crafted delusions, both private and shared. The noise around us is not totally dispersed by a logical

reality, rather it is ignored by the delusion that the intellect is telling us the (whole) truth about things. However, it is worth reiterating that pattern matching is not only cerebral, but also a visceral interpretation by our whole being. It is just that awareness places thought, the means of that awareness, above everything else.

In the next chapter we will look at patterns in more detail, and then in Chapter 6 we will consider the implications of the absurdity of implying tidiness in the world, when that world is anything but tidy.

CHAPTER FIVE

Patterns of Categorical Delusions

Man is a pattern-making animal. We advance through the world, sensing the way by means of patterns: multiple schemas, fictions, ‘synthetic judgments *a priori*’ (Nietzsche, 1990), ‘a selective system of cognitive orientations to reality’ (Parsons and Shils, 1954). Each is a *partial* guess about the unknowable reality around us, which focuses the senses: the word *partial* is used here to mean both biased by previous experience and incomplete. However, cognition can be misled by our delusions just as we are fooled by optical illusions and other observational paradoxes, which trick us into misinterpretations (Lotto, 2009).

All individual interpretations of sense data start with provisional approximations. These enter a dynamic feedback loop that is the individual’s continuous negotiation with his sensing of the environment, where he often subconsciously re-collects and synthesizes perceived regularities in that sense data. These regularities then progressively and recursively adjust themselves. This on-going feedback loop is not only part of that individual’s experience of the physical world as it is, but also the culmination of the natural selection of the experiences of both the species and the social sub-groups to which he, as an individual, belongs. Mostly this sampling of regularities delivers useful data that enables him to make choices, although sometimes he can be tricked, as with the optical illusions.

Of course the process itself is one of self-delusion. Optical illusions should remind us that feedback does not deliver an explanation of our world, merely a description. As Nietzsche so eloquently put it:

We call it ‘explanation’, but it is convincing ‘description’ which distinguishes us from earlier stages of knowledge and science. We describe better – we explain just as little as any who came before us. ... An intellect which saw cause and effect as a continuum and not, as we do, as a capricious division and fragmentation, which saw the flux of events – would reject the concept cause and effect and deny all conditionality (Nietzsche, 2006).

From this position, a sceptic would therefore reject Popper’s assertion of explanation as description with some form of predictive element (Popper,

2002). Prediction too is a description, but of the shapes of things to come; a description, albeit falsifiable, of a trajectory of regularities within our descriptions.

The situation is further complicated because a specific frame may be used by different people. That is, they may think they are gleaning the same meaning when using the same frame, but at the very least there will be slightly different interpretations, and therefore there will inevitably be different outcomes from applying it. The reader should acknowledge that these differences are the result of subtle differences of interpretation; they are not mistakes. Mistakes can be identified. On 23 September 1999, much to the embarrassment of NASA, the Mars Climate Orbiter burnt up in the atmosphere of the Red Planet. It turned out that the engineers who worked on the project used imperial units of measurement (feet and inches), whereas the scientists whose job it was to get the spacecraft into orbit around Mars were using metric units. When the data needed to control the flight path was transferred between the two teams, nobody thought to convert from inches to centimetres. The multi-million dollars craft went up (or rather down) in a cloud of smoke. Now that really was a mistake.

It is worth repeating, the differences in the personal delusions that are extracted from frames are not mistakes. They are so subtle, and indescribable, that we don't even realize there is a difference; hence our belief in shared-delusions, such as the so-called fact that we all grasp the same meaning from verbal and textual communication expressed in frames formed from language. The authors claim that a reader of this book will never grasp exactly what they are trying to say; every reader will impose her own unique interpretation on the words. This is not because the ideas in the book are poorly expressed (at least the authors hope not), but because the same word can never mean exactly the same thing to everyone. We each overlay personal baggage on any particular word when we continually learn its 'meaning'. Hence, even the authors themselves must admit that each of them never fully grasps the other's meaning.

Categories

Any particular delusion, that is necessarily private to an individual, may be very similar to those of other people. However, be very clear, the delusion is unique to that individual. What is more, there is no single delusion for each individual, rather a whole raft, gleaned from personal experience and communicated from others as frames. These frames give that individual a whole multitude of perspectives on the world, not all of them mutually

consistent or compatible. Over the years there have been many attempts to see common factors within this variability in order to categorize human behaviour into a small number of substantially different labels. By pigeonholing the complexity of a given individual's set of delusions under a single heading, that individual can be contrasted with his fellows, and his actions 'explained'. But this is just another frame among many others.

Such is the human lot. 'He who considers more deeply knows that, whatever his acts and judgments may be, he is always wrong' (Nietzsche and Hollingdale, 1996). But is being forever wrong a problem? No! 'The falseness of a judgment is to us not necessarily an objection to a judgment ... The question is to what extent it is life-advancing, life-preserving, species-preserving, perhaps even species-breeding' (Nietzsche, 1990). Perhaps falseness is too harsh a word here. Far better to use Nietzsche's term 'instrumental fiction': a fiction possibly appropriate for our needs, and thus appropriated by us, but a fiction nonetheless. Why useful? Because it overcomes rigid inertia, helps us make decisions and spurs us on to action.

Before continuing the authors must pre-empt an inevitable criticism of the above statements. Surely, if categories are just delusion, then by going on and on with intellectual arguments that in themselves categorize our universe of discourse, are they not just deluding themselves? Guilty as charged. But they have no choice. All cognition is self-referential. They too are human, all too human, and are stuck with the dominant strategy of our particular species, the human condition.

Thus the authors argue that the only way humanity can analyse any particular situation is by calling upon the delusion that thought has access to the truth about things, and by manipulating that 'truth' through frames and categorization. This stance is only a problem to those who believe in an objective reality. The authors won't freeze or flee from this criticism. They will fight back with the answer that they are pragmatic enough in their scepticism to prosper within their own personal subjective human realities. Not convinced? 'What convinces us is not necessarily true, it is merely convincing' (Nietzsche et al., 1968).

Categorization is internal to any observer who is observing, and who is thus, wittingly and unwittingly, creating categories. What we may refer to as categorization incorporates a series of differentiations that invariably remain invisible, because the choice of any particular category is being made individually with our impositions as observers guiding the creation of categories. We categorize without even thinking. Categorization is

subliminal, the very essence of thinking. However, it is in the social nature of humanity that we do try to share our categories with others, along with the frames and shared-delusions; thence arise language, rituals and other forms of social intercourse. There categorization is externalized, made concrete, as with plans of action, ideologies, and in its most solid of forms, namely artefacts and technology.

Appropriate or Inappropriate?

Any category and any framework of categories, used either to identify or to extract 'useful' information from what has been observed, cannot hide its artificiality indefinitely. Even though such frameworks are contrived, some critics would say simplistic, they can prove successful in that they are useful in particular contexts. However, the appropriateness of applying any particular framework is a conclusion that can only be made after the fact. Nevertheless, following previously successful applications, a particular categorization is often taken to be appropriate in itself.

A very important point is being made here: whether or not the categories are valid is not the issue; rather that we humans have the tendency to categorize in order to 'understand and explain', to reflect, thereby changing uncertainty into perceptions of risk, and freeing us to act. By accepting any frame as a working hypothesis, we can formulate 'answers' to the problems we ask ourselves. Of course, the extent to which the formulation of each particular problem is guided by the possibility of containing answers of pre-determined exploration paths is quite another matter. In other words, the very act of formulating a question creates the residual category of an answer, and that in turn is probed through well-structured pre-determined paths. These deviate as the quest for answers is infused with yet more questions, and the whole process repeats itself endlessly.

Not that there is such a thing as the answer. There can only be an answer, and another, and another: contingencies all, which may or may not be valid within any particular logical framework, or from any particular perspective. They may not even be mutually consistent. Perversely, in some situations an invalid answer may be more appropriate than a valid one.

The quest to categorize tends to assume that human behaviour fits into boxes with neat and discrete labels. However, these categorical boxes, whether internal and subliminal, or conscious and external, are not truth. They are merely an act of choice; an atomism, imposed by the observer/thinker and restricted because that choice needs to be aligned within the

notational frames and categories whereby the observer operates. Otherwise his own constructions, his own categories cannot be communicated. Once we escape from any notion of truth or validity, then we can see those choices as arising from the purposes and priorities of the observer. Hence, even though it is possible to separate the observer from the observed, such a separation is artificial, lying as it does in the head of a third person doing the separating. Interacting with the world for the discovery of 'truth' unveils the impossibility of separating the structures/frames within a personal delusion from the interpretations made from that delusion. This interdependence merely intensifies the myth of objectivity. But how can there be objectivity when objectivity requires an object, which requires an observer? How can there be anything other than the delusion of objectivity?

Sameness = Similarity?

Each of us sees a different world, albeit with similarities. This book is using the idea of similarity in two different ways here, and that ambiguity can and should be resolved. On the one hand 'I' can consider my delusions as similar to yours. On the other, within 'my' personal delusions 'I' can choose labels that group 'things' together, and which according to 'my' senses are similar. Things appear similar because the result of 'my' sampling of them with 'my' personal delusions throws up very little that is different; differences that 'I' choose to ignore. Whether those things in themselves are similar to one another is quite another matter. However, similarity is not sameness, although it is the human condition to treat similarity 'as if' it is sameness, and then to assume that all comparisons between such sense data choices are *absolute facts*. Italian playwright Luigi Pirandello summed it up well in saying that 'a fact is like a sack. It won't stand up until you put something in it' (Pirandello and Bentley, 1998).

A *fact* is merely an approved communal judgment, positioned within a context. A fact does not exist for any particular 'me' until the 'I' places it among his personal and individual frames, and then delusions. Everything then occurs within the present context. We humans are trapped because the self-evident categories that we choose are the fundamental building blocks of our delusions; they are our way of differentiating meaning and identifying such facts. As the context changes, so does category, and so does meaning. That ever-changing meaning can only ever be uniquely individual; similar, but never the same as meaning inferred by others. And even individual meaning is inconsistent over time and place.

Therefore, even those who share the same(?) social systems do not necessarily share exactly the same(?) perspectives on those systems. A supposedly shared-delusion is actually a private delusion, because it is uniquely interpreted by each individual. Although there is a general cultural commonality of meaning within social groupings, each delusion is truly individual, reflecting how that individual became what he is, not only because of all the groups to which he belongs, but also despite them. Individually, we are what we have become, and what we will become, in the dynamic feedback of both systemic and environmental influences that result from a lifetime of experiences. However, each individual has to cope with multiply overlapping perspectives that need not even be mutually consistent; they certainly aren't rigidly fixed. Naturally the events that 'I' sense in the world are in flux, but more importantly 'I', the sensor, too am in flux.

In creating their individual delusions, most people vaguely follow the agglomerated structures/frames laid down in the past, either directly by interpreting writings and other knowledge artefacts or second-hand via family, friends, fellows and teachers. Mostly the education we get from these role models is in essence the development of personal but socially acceptable shared-delusions. Humanity has no choice in the way we create these stable delusions. We are predisposed to a linear form of atomism in which we create cognitively convincing categories. To do this we separate things from other things; entities are separated by a void, designated, distinguished and hence differentiated. This is the fiction underpinning the edifice of classification, which itself drives the thinking of man, the rational being who 'places his behaviour under the control of abstractions' (Nietzsche and Breazeale, 1999).

Category is not truth, but merely a cognitive fiction: an act of choice. This choice, not necessarily conscious, demands that it is acceptable, appropriate even, to treat similar things as if they are the same, and then to assume that all comparisons between subsequent data choices are absolute facts. Why do we ignore this fundamental absurdity? Because the assumption of *sameness* throws up temporary regularities, nonetheless useful, which can support the decision-making that will guide us through the turbulence of existence. However, every time we conspire with the absurdity of sameness, whenever we compare and in particular measure,¹ we inadvertently scatter a debris of detail all around. For in observing the world out there beyond us, we are squeezing the square pegs of reality into the tidy pre-prepared round holes that are the intellectual abstractions with which we describe it. That debris

is the accumulation of the differences between individual occurrences of items in the external world, and the ideals with which we choose to classify them. Despite what we take to be clarity of thought, we are left obliviously wading in a sea of white noise accumulating from the paradoxes formed when we accept residual categories. These unobserved paradoxes lie on the edge of *Chaos*. Mostly they collapse into an ignorable nothingness, but every so often they conspire in the feedback, and emerge out into the open where they cannot be ignored. They force themselves to our attention, and disrupt our tidy well-made plans.

Nevertheless, the use of names, words, categories are our way of differentiating meaning. As category changes, so does meaning. The first lines of the *Tao Te Ching* sum up our dilemma: ‘the way that can be spoken of is not the constant way; the name that can be named is not the constant way’ (Tzu, 2005). For

man has for long ages believed in the concepts and names of things as in *aeternae veritates* he has appropriated to himself that pride by which he raised himself above the animal: he really thought that in language he possessed knowledge of the world. The sculptor of language was not so modest as to believe that he was only giving things designations, he conceived rather that with words he was expressing supreme knowledge of things (Nietzsche and Hollingdale, 1996).

We would go further than Karl Mannheim, who says that ‘even the categories in which experiences are subsumed, collected, and ordered vary according to the social position of the observer’ (Mannheim, 1985). It is not just the social position of the observer, it is the uniqueness and singularity of the observer and of all the groups to which he belongs, and where he is standing at the moment of observation that delivers these categories.

Logic

Once categories have been launched onto and into the world, they blur the difference between similarity and sameness. Under the umbrella-term of each designated *category*, similar yet different things find shelter. The very act of having created a category for these things creates the delusion that these things, considered at the level of the category, are to be treated as if they are the same thing. Thus the category takes over, and it is treated as the representative abstraction for all things that are similar but not the same.

There is no stopping. We can ask if two particular 'things' are the same, or different, by questioning their representative categories. Truth is now the answer to whether those two 'things' belong to the same category. The door is open for the creation of logic and mathematics.

But it was the prevailing tendency to treat the similar at once as identical, an illogical tendency – for nothing is identical – which first created all the foundations of logic... Logic too depends on presuppositions with which nothing in the real world corresponds, for example on the presupposition that there are identical things, that the same thing is identical at different points of time ...' (Nietzsche and Hollingdale, 1996).

The perspective presented in this book is not saying that the laws of mathematical logic are wrong and have no utility, rather that the utility is restricted by the necessity of creating categories. Of course the logical operators equals (=), AND, OR, NOT are valid for the manipulation of our categorical abstractions within the self-reference of mathematics, but without the construction of categories they are intrinsically useless, since their function is to regulate the interaction between categories. It is the abstractions and not the 'things' themselves that are treated as equal (in the case of =), as synthesized (AND), as alternated (OR) and as excluded (NOT): as a precondition, all operations act on abstractions that in each case necessarily omit the residues and differences of the operands and the 'things' they represent. What is left un-equal, un-synthesized, un-alternated and un-excluded does not only become an act of choice for particular observers that use the operations differently, but also become an unavoidable necessity in the application of the categories themselves. But how do the operands in such logical operations fit the 'things' into each chosen category, once and for all time? Are we to believe that the interacting complexities of our representations can be reduced to such operations that ultimately ignore the 'debris of detail'? For that is where the trouble with categories lies: '... we see opposites instead of transitions' (Nietzsche and Hollingdale, 1996). We see false opposites, unaware of what Watzlawick calls the 'excluded middle' (Watzlawick, 1983), unaware that there is a continuum, and that we humans attempt to split that continuum between uniquely different and discrete objects. Furthermore, each time we split the world into a logical operand and its complement we have ignored the fallacy of the residual category.

The Absurdity of Numbers: The (F)Laws of Numbers

Once category and logic are in place, then numbers soon raise their ugly heads: counting the elements that conform to a category. Starting with integers, the instrumental fictions of real and complex numbers, rational, irrational, algebraic, even transcendental numbers appear. How peculiar that complex numbers are also known as imaginary numbers, as if all numbers aren't imagined into existence. Then there's the thorny problem of infinity, although we will keep quiet about which of Georg Cantor's multiple infinities we are talking about. Although to the authors, any infinity is absurd: it is an unnatural/artificial concept invented to cover up inconsistencies at the margins of the abstract worlds of mathematics and, by extension, of theoretical physics. Infinity can have no natural real world equivalent since it is beyond counting and bigger than anything we can perceive.

The fallacy of the residual category is immediately apparent with positive integers as they 'tend to infinity'. Let's start with I_{2n} the set of positive integers not greater than $2n$: $\{1,2,3,\dots,2n-1,2n\}$. This set can be divided into two sets of equal size (n): the even numbers E_{2n} , namely $\{2,4,\dots,2n\}$ and the odd O_{2n} : $\{1,3,\dots,2n-1\}$. In other words, O_{2n} is the residual category when E_{2n} is taken away from I_{2n} . No problem!

But what happens when n shoots off to the magical realm of the infinity of integers? What happens when considering O , the set of all positive odd numbers, the residual category of E (all the evens), when taken away from I , the set of all positive integers? You would expect E to be the same size as O , since for every even integer x there is an odd integer $x+1$, and vice versa. Since together E and O make up the integers I , there should be twice as many integers as there are even integers. But no. The sets E , O and I are isomorphic: that is for every x in I , there is an even integer $2x$ in E , and an odd integer $2x+1$ in O ; for every x in E there is an x in I , and an $x+1$ in O ; for every x in O there is an x in I , and an $x+1$ in E . So the sets are of the same size.

Of course, the word *size* is the problem here; but the concept of infinity was invented in order to distract attention away from the problems that arise when the notions of addition, multiplication and division break down, and size has no meaning. The weasel words 'tends to infinity' are always used to keep us within the realm where addition and multiplication still work. Because if there is no addition/multiplication, then statements like 'for every integer x there is another $x+1$, or $2x$ ' also have no meaning. Yet in

the above proof of isomorphism we treated them as if they were meaningful. In the shift from finite to infinite, the residual categories of odd and even integers themselves break down.

This disruption was quietly overlooked in the claim to have captured 'all' the integers in the sets O and E , and I . For in these closures of the finite sets E_n , O_n and I_{2n} as n 'tends to infinity' something qualitatively different is going on. Unlike the cases of E , O and I , there are values of x in each of the corresponding finite sets where the values $x+1$ or $2x$ are not members of the set itself.

The term infinity covers a multitude of sins. As long as n is reasonably small, then in principle it is possible to test the above hypotheses empirically, simply by counting. However, an infinite (or even an extremely large) set of things is only countable by inferring a hypothetical superhuman observer who is able to add and multiply things as they 'tend to infinity'. Then the phrase 'the set of all the integers' does not seem problematic; and we can ring-fence infinity in sets E , O and I . There is a difference between, on the one hand, a more pragmatic and empiricist approach limited to finite counting and, on the other, a hypothetical entity like 'infinity' that is mathematically represented as if it is of tangible nature. This produces intrinsic paradoxes that surface as subtle qualitative differences (as in the example above). These difficulties/absurdities should not be underestimated.

We don't have to go as far as infinity to see the problematic link between observation and numbers. The difficulties start with zero (Kaplan, 2000). Roman numerals do not contain a zero²; perhaps those ancients were sensitive to a paradox that we tend to ignore? For zero can be considered in two different ways. On the one hand it can be taken as the representation of the void, the complement of everything, the residual category of the universe ... what is so casually defined as one divided by infinity: although whether division is meaningful here and which of Cantor's infinities is being used are moot points? On the other hand, rather than the presence of nothing, zero can also be defined as the absence of a particular something, which is how it occurs with subtraction: namely the absence of an abstraction, of the very numbers being used to count, which paradoxically include zero. In this latter case there must have been a residual memory of a previous observation of something, a unit, a something that is not there now, so that there can be a zero. 'Nothing can be observed (not even the 'nothing') without drawing a distinction' (Luhmann, 2002b). And yet in our mathematical calculations

we merrily switch between the two meanings without giving the paradox a second thought; which is why zero divided by infinity is undefined, as the expression implies the simultaneous use of both definitions.

Of course, these problems aside, once the benefits of numbers were out of the bag, humanity soon lost sight of the fundamental absurdity: that sameness is equal to similarity. However, we should not forget that counting is problematic in itself: what the authors label *the absurdity of integers/numbers*.

For the invention of the laws of numbers was made on the basis of the error, dominant even from the earliest times, that there are identical things (but in fact nothing is identical with anything else) ... The assumption of plurality always presupposes the existence of something that occurs more than once: but precisely here error already holds sway, here already we are fabricating beings, unities which do not exist (Nietzsche and Hollingdale, 1996).

...[A]nd our fundamental tendency is to assert that the falsest judgments (to which synthetic a priori judgments belong) are the most indispensable to us, that without granting as true the fictions of logic, without measuring reality against the purely invented world of the unconditional and self-identical, without a continual falsification of the world by means of numbers, mankind could not live – that to renounce false judgments would be to renounce life, would be to deny life (Nietzsche, 1990).

Measurement, Statistics and Other Useful Absurdities

Once we have numbers, then we have units, and measurement: measurement of the ‘real world’ by numbers, and the concomitant utility. But we are back with ‘the presupposition that there are identical things, that the same thing is identical at different points of time’ (Nietzsche and Hollingdale, 1996), the idea of ‘sameness’, the seed of equality and enumeration, and thus of logic, the basis of rational thinking. We forget the lessons learned about observation on the edge of *chaos* that is life, or that identifying ‘similarity’ with ‘sameness’ is a trap that leads to inevitable ambiguity and paradox. We must accept ‘sameness’, and hence ‘number’, as a practical choice of representation, but with circumscribed appropriateness; while at the same time we must deny its universal validity when accepting its useful absurdity.

For with category we have set out on the self-referential road: from the natural non-linear world in which we exist to the unnatural linear world of our perceptions. At each stage along this road the utility delivered overcomes all objections concerning absurdity. Eventually the absurdity is absorbed into the background of thought, as being sensible, so that subsequently it is itself used spontaneously in sense-making, rather than being seen as something bizarre. Here paradox lies concealed on the self-referential path between the natural and the unnatural. Only by stepping outside the self-reference (as we recommend in this book) does the absurdity reappear.

The reader may ask at this stage: how do I step outside of my self-referential system? The answer is that this is only possible if the reader observes herself observing. A set of simple questions put to oneself can clarify this point. What distinctions do I use when I observe? What categories do I create? What schemas/frames do I employ when observing? What do I gain, and what do I lose in maintaining these distinctions, these categories and these schemas? And even more importantly, what distinctions can I use differently in my observing?

Does this highly sceptical stance on numbers cause difficulties? Only for those who insist that the logic of false opposites, grounded as it is in 'sameness', must be all-encompassing. There are a number (sic!) of problems with category. Everything that is given the category's label must be treated 'as if' it is identical to the idealized entity that defines the category. Anything that is not in the category is un-similar in all respects to the category, and must be treated as totally different. As long as this doesn't cause a problem, then all is fine. But this is not always the case. For when referring to any 'thing' that is being measured, or is being categorized in any other way, it is not just the particular category that is being actuated, but every aspect of that thing including all its severed structural couplings. Who knows what the consequences will be?

It is possible for an entity to be simultaneously part of two different categories. For example, someone asked to 'toe the company line' (one category) could feel contradictory political, religious, moral and family pressures: so-called lateral loyalties. That creates a serious problem for any observer who identifies any attribute to be simultaneously part of different categories. The observer then has to make a context-sensitive value judgement about the relative merits of each category. Hence, we must recognize that the logic of category is just idiosyncrasy. In analyzing societal problems, mathematics, statistics and the like have become mere

self-indulgent over-sophistication. Mathematics is not universally appropriate. Was it ever? Could it be that some people find mathematics difficult to grasp simply because their personal delusions refuse to indulge this unnatural/artificial linear idiosyncrasy?

What about statistics? Mark Twain was being deluged by a torrent of statistical data, culminating with the rebuff ‘the figures don’t lie’. His devastating retort was: ‘it’s not the figures lying that worry me, it’s the liars figuring’. It’s what all managers do come budget time. But maybe Twain should have been worried by the figures. For perhaps numbers do lie. Well not exactly lie. Nietzsche claimed that numbers are grounded in error, in absurdity, or more specifically they are ‘instrumental fictions’: sometimes useful, but fictions nonetheless.

When it comes to winning an argument, rhetoric is far more powerful than numerical logic. We don’t need numbers to prove that we have won a particular argument. Champions of numbers get very annoyed when they can prove themselves right with their numbers, and yet somehow they still lose the day. After all, the use of numbers for measurement is itself dependent on an intellectual trick that we play on ourselves. That trick, the concept of spurious comparison that pervades all pseudo-scientific thinking, is fundamentally flawed. It is all too easy to forget that numbers are not objective; they are linear and unnatural. They are ‘instrumental fictions’. Numbers are like people; torture them enough and they’ll tell you anything.

Even the so-called experts have come to doubt the validity of statistical methods for predicting the behaviour of complex systems. For example, as little as thirty years ago these experts were claiming that the mean time between failures of nuclear power stations was in the order of tens if not hundreds of thousands of years. The meltdown at Chernobyl in April 1986, which was just the worst in a series of over 150 serious nuclear mishaps occurring over a ten-year period,³ had clearly shown that position to be fallacious.

Rationalism in the Post-modern Era

Unfortunately the numerical methods of science spouted by a management culture dominate all governance, both organizational and national. These methods seem so attractive, yet they are not going to help. Methods and methodologies are mere rituals that evolved to be optimal in the modern age; but will they help us cope in the post-modern? No! It is now quite

clear that our over-use of measurement is merely misplaced ritual, as is computerization, as are command and control systems, as is auditing: output measurement that can be easily outmanoeuvred, as in the off-balance sheet risks that finally brought down Enron, or the mathematically based financial instruments that played such a major part in the sub-prime mortgage debacle and the Credit Crunch. All are rain-dances, self-pretences that we understand our world, and are in control of it.

Many professionals themselves have sensed the inadequacy in much of ritual measurement. Yet still from all sides there are loud calls for rational solutions to the problems facing us, as if there is a single unifying rationality. Everywhere we see the quest for quantified efficiency, where any form of redundancy in the data is viewed as inefficiency that is to be eliminated. Rationalists believe that efficiency is necessary for a well-run organization, and they forget that efficiency is measured in terms of yesterday walking into tomorrow.

This perverse and decadent view of efficiency was anticipated by Northcote Parkinson, when he warned that 'perfection in planning is a symptom of decay' (Parkinson, 1968). Efficiency is bad for business. In Darwinian terms, efficiency optimizes a species to a niche, and when that niche changes, as it must, the species becomes extinct. For redundancy is not waste. It has its uses: helping reinforce or reject values; allowing for human forgetfulness and for social checks and balances; enabling for error tolerance; and giving time to reflect and reconsider. Redundancy creates flexibility/variety needed by the organization to cope with whatever the business environment throws its way. Unfortunately the prevalent distortion of Taylor's scientific management, all too readily pointed at society by its political and commercial leaders, portrays all of these reasons as human faults, to be corrected in the world of virtuous technology. Their *Brave New World* will not be one of ordered, constrained and controlled lives, but a rule-based bureaucratic shambles. The unknown, uncertainty and *Chaos* require that we take a strategic view, one not based on some mythical pro-active mechanistic rule book.

Rationalists want a return to an orthodoxy grounded in engineering principles and the factory metaphor, and to treat society and the economy as if they are machines on a production line. They want to confront what they consider to be the post-modern hysteria brought on by a loss of faith both in the instrumental efficacy of science and technology and in the high priesthood of experts who proselytize that faith. The authors hope to show that this loss of faith in experts is not without merit. Indeed, they very

much agree with Surowiecki and his promotion of the *Wisdom of Crowds* in that in social situations the sensibly aggregated uninfluenced insights of the many usually better expert opinion (Surowiecki, 2004).

Rationalists want society to regain the faith in scientific expertise, and then everything will be back on track. They want our world to be tidy, and to try and banish all the evil spirits by forcing tidiness on it with the magic wand of systematic, yet arbitrary, use of measurement. Rationalists call for such best practice, when best it certainly isn't, as so vividly exposed by the 2008 Credit Crunch.

Best practice would be a mistake, for it is becoming increasingly apparent that the ritual use of conventional methods simply doesn't work in the broader social arena where professionals have to operate. Measurement may make sense for the development of technology and of physical artefacts, but to use it as a tool for social engineering is absurd.

It is crazy to think that the complexity of our world can be captured as a mere collection of numerical data: representations and instances of so-called absolute facts. Each fact really does depend on the context. Yet everywhere there is the folly of forecasting techniques that are merely an assignment of numbers to the future. Such forecasts are a belief that numbers are meaningful in relation to the future, and controlling that future becomes a matter of labelling it with numbers. Wrong! The future is not some smooth trajectory of the past; the discontinuities implicit in change are forever pulling the future away from past trends. Discontinuities mean that the ride of life just isn't that smooth.

Searching for the right numerical label to represent the future is no different to mysticism: it is the modern-day equivalent of reading the runes. As now-sceptical ex-scientists, both authors can still individually recall his disorientation when he first realized that certain, nay most important things couldn't be measured, and that what was being measured could be totally irrelevant. Often, the only reason that something was being measured at all was because it could be measured, and only ritual made that important.

The mere availability of ample data, in both the physical and the social worlds, is enough to generate the rituals themselves; and this sets in train the vicious circle of measurement, production of results and re-measurement.

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CHAPTER SIX

Tidy Minds, Technology and the Myth of Control

With this present chapter the authors reach a catharsis. By contrasting their ideas with the popular and prevalent attitudes towards science and technology, they will be in a position to deconstruct fully the notion of delusion that underpins much of their thinking, and justify their assertion concerning *Science's First Mistake*. In previous chapters they outlined the complexity and paradox behind so-called rationality, and showed how this has given rise to the myth of control, which permeates much of contemporary thinking and practice. They contend that much of the appliance of science to society and business is quite absurd, only most people don't see it that way. Just like the young boy in Hans Christian Andersen's fairy tale, the authors know the emperor has no clothes. Here they justify that claim.

Humanity has always tried to exercise control over its surroundings. However, until the rise of science we always assumed our fate was in the lap of the gods; and our role was merely to placate them. Modernity removed the gods from the equation, and imperially we clothed ourselves in rational methods and the scientific approach, strutting our control for all to see. That this control is grounded in 'instrumental fictions' was rarely considered. Now that our scientific and social systems have acquired a high degree of complexity, the cracks are appearing, and we are beginning to see through the delusions to the paradoxical consequences beneath.

In this chapter we will discuss the shared-delusions of the present day, many involving the perfecting of technological systems, particularly computers. Computer applications certainly have a utility, but one that often deceives its users into believing that they are in control of a benevolent technology. The fallacy of personal validation takes over; we see only the limited successes, and overlook the failures. Our inability to see the absurdity in our attitudes towards technology has created a society in denial.

Only after the authors have highlighted the many problems with computerization, and the reader is convinced of the validity of their position on delusions, can they entice her to dig deeper into the relationship between cognition and observation. To do that she must step outside the self-referential certainties of a society in thrall of technology and join in the deconstruction of *Science's First Mistake*.

An Obsessive Compulsive Neurosis?

The unquestioned acceptance of computerization by our societies and the sheer scale of modern applications are having a huge impact on social, political, scientific as well as economic life. Consequently, a great deal of social endeavour has come to rely totally on the functioning of the technology. Increasingly societal structures develop primarily on the basis of this reliance. This precondition of what has become a dependence on technology has reached such a degree that it has lost touch with reality.

For far too long technology was seen as an automated replacement for manual processes. That distinction between manual and automated processes has become almost universally accepted, although it is as artificial and paradoxical as any other distinction. With computerization penetrating so deeply into contemporary life, the structure of all modern institutions has changed to such a degree that the distinction between manual/automated processes is no longer even considered. Computerization has so deeply penetrated contemporary life that it now constitutes a justification in itself for the development of further computerized processes, and the distinction between manual/automated processes quite often becomes utterly meaningless.

These processes are a symptom of mass automation, and already presuppose a belief in technological instrumentalism; a belief that remains strongly held despite so much contradiction. This belief, relatively benign in individuals, possibly even useful, becomes hugely problematic when it is organized and promoted within larger social groupings. Witness the ever-expanding multi-billion pound spending of the UK government on databases for everything from health records, to children at risk, to criminal records, to identity data; all set against a history of failure, and budgets spiralling out of control. 'Madness is something rare in individuals – but in groups, parties, peoples, ages it is the rule' (Nietzsche, 1990). The madness of our particular age is an absurdity we rarely question: that our world can be controlled using the excessively tidy methods of science and technology. It is a madness that believes, particularly nowadays through computerization, that the world will become the way it ought to be. French President Pompidou¹ may have been right: 'There are three roads to ruin: gambling, women and technology. Gambling is the quickest, women the most pleasurable, but technology is the most certain.' Computer technology fails, not necessarily because of human error, but inevitably because of the paradoxes implicit in the notion of data.

This book calls for a rejection of any belief that ‘truth’ (and subsequent ‘understanding’ leading to control) may somehow be pursued scientifically. The construction and evolution of such a pursuit have always involved some form of technology or another. In the particular case of modern society, the computer has been promoted to the means of achieving anything from improving organizational efficiency to even constructing science itself. The results of a computer’s operations are then elevated to a supposed simulation of socio-economic reality, but this is precisely the problem: the fallacious belief that the simulation of reality by computerized methods can provide an accurate enough picture for the manipulation of that reality. This tendency of constantly tidying up the world through the help of automation is reminiscent of obsessive compulsive neurosis, in that people are compelled to act according to rigidly applied rules in order to achieve tidiness and control over what they designate to be problematic. Some go out of their way looking for it. A place for everything, and everything in its place. Increasingly this madness is appearing as a corporate disposition, particularly in the lunacy of trying to *manage change* or *engineer knowledge* with the tidy methods of science, or rather a pseudo-science.

The literature is full of cure-alls that sell tidiness to the gullible in the form of ritual application of computerized methods. Consultants then charge onto the scene, promising a world neatly described in networks of boxes, triangles, hexagons, circles and arrows; a world controlled by bubbleware. With their methodologies, with their computerized information systems, with their organizational charts and mission statements, with their battle cries of synergy, management of change, competitive advantage, business process re-engineering, total quality management, data warehousing and data mining, knowledge management, customer resource management, with their tidy minds, they sally forth turning organizations into neurotics. It is well to remember that ‘when a lot of different remedies are proposed for a disease, that means the disease can’t be cured’ (Chekhov, 1991). Most so-called methods have a half-life of about five years, and probably less.

The Folly of Forecasting

Despite the obvious and persistent failure of these methods when applying supposedly scientific solutions to complex problems, the belief in their utility remains undiminished. Even worse, it is believed that the accumulation of past information about whatever is being modelled, somehow with the

help of technology, will assist in a direct manipulation of that information. Predictions about future behaviour then assume the mantle of scientific validity. Indeed, the first reaction of decision takers is to run to modern pseudo-scientific methods. When faced with profound uncertainty the standard approach is to impose tidiness on the complexity of this world, and to automate the tidiness with the support of information technology. However, a good technology platform, although useful in organizing and structuring part of the complexity and assisting in information exchange and communication, is not sufficient for success. In the search for success, what makes the real strategic difference is the quality and integrity of the people involved and their network of contacts. Both success and failure will be determined by unique social, political, organizational, and particularly personal factors.

An unquestioned belief in automation only demonstrates another misguided belief in managing uncertainty. For uncertainty is a foreboding, where the surprise of imminent change is outside of our control, and it certainly does not conform to a neat computational logic. Deep down, surely we must all know that profound uncertainty contradicts the smug certainty of formal methods? Yet still neurotics want their world to be well behaved, and they believe it is virtuous to collect numerical data: representations of so-called absolute facts. This situation is reflected in the large number of methods through which computerized tidiness is being forced on society, all underpinned by the arbitrary use of measurement: with systems analysis, opinion polls, market research, socio-economic classifications, performance measures, efficiency audits, cost–benefit analyses. Everywhere, in the folly of forecasting, which the authors insist is merely the arbitrary assignment of numbers to the future, the neurotics believe that such numbers are meaningful in their urge to control. Neurotics insist that control comes by labelling uncertainty with numbers, rather than by continually re-evaluating each uncertain situation.

The approach of searching for the right numerical label to represent the future, whatever its scientific credentials, points to a lust for numerical solutions and other theoretical abstractions that is spreading. But numbers can only show an average of what is not a homogeneous sample. Numbers always hide some act of choice, some hidden agenda, a prejudged priority, some preconceived notion of category and of what the number means. ‘Not men but measures: a sort of charm by which many people get loose from every honourable engagement’ (Burke, 1975).

Computerizing the Neurosis

The perversity of number-driven decisions is obvious to those who view categorization as an including/excluding act of distinction. In this act of distinction, categorization constructs an abstraction that represents all that a category is, but only that. And yet this approach is being used indiscriminately in both public and private sectors to computerize each and every decision process. With the minimalist insight of true genius, Pablo Picasso identified our particular predicament: 'computers are useless, they can only give you answers'. More often than not, the answers they give are irrelevant, or just plain wrong, or they solve the wrong problem, and in the process they create new problems.

And yet (pseudo-)scientists project the world as a deterministic black box; as if linking pre-ordained input parameters with real-world variables leads to an output that predicts behaviour in that world. Neurotic governments and companies attract these tidy minds, which only goes to reinforce the institutional neuroses. But they will eventually find that ambiguity cannot be resolved into some tidy pattern, and that jumping onto a bandwagon of methodologies is merely impulsive stress-relief. The result is an insecure world where everyone feels that the remedies are successful for everybody else, but not for them.

Computerizing the tidiness only goes to amplify the error/absurdity. Computers can deal with well-structured problems with amazing speed, they handle detail, but they cannot cope with the subtlety, ambiguity and complexity that permeate much of contemporary problems. Part of the reason can be found in the fundamental problem of integrating computerized information systems with human activity systems: two radically different modes of operation. Computers do not work in physical space or within a biological existence, but in a mathematical dimension; a subtlety too easily forgotten until it is too late.

This difference between computerized information systems and human activity systems is clearly visible in complex socio-economic environments where the integration of technologies is rendered problematic, but it can also appear in traditionally scientific applications, such as aircraft navigation. In August 1987 there was a collision between two RAF Tornado fighters on separate low-flying night exercises over Cumbria. Based in different airfields, the planes were using the same program on their onboard computers. A cassette, given to each navigator before take-off, flies the plane automatically to avoid obstacles like hills and electricity pylons. Although

coming from different directions, the planes arrived at exactly the same spot simultaneously, hence the crash. What no one had realized was that the computer program (the delusional frame) had reduced the flying space of three dimensions into a single linear path, where the planes could not avoid one another. Even though this is not a systemic error of integrated technologies, and it can be corrected (as indeed it was in the next version of the computer program), it does demonstrate how the mundane so often escapes the attention of architects of automation. Such examples abound.

The checks and balances fundamental to error tolerance and correction in any human activity system can become invalid in the rule-based world of computerized information systems. We simply cannot act fast enough to keep up with machines, and so instead we often surrender responsibility. But because it is only in hindsight that we can analyse the subtle differences between the dimensions of man and computer, there is an enormous potential for misunderstanding. The sheer speed of feedback from computers means they are just not in tune with the human mode of error correction. By our failure to deal with this different time scale, errors are amplified, and this feeds back into chaotic situations. A trader once typed 1,150 instead of 1,250, followed by 'At Best', when trading in Vodafone AirTouch stock, triggering a drop of two pounds a share and wiping £13 billion off share prices.

The Butterfly Effect

Of course, such errors are to a certain extent avoidable; but the issue here is different. Tidy minds fail to grasp that all facts are context sensitive and do not recognize a 'capricious division and fragmentation' (Nietzsche, 2006) in the flux of events. Nuances of detail, as well as deliberate, accidental and arbitrary actions feed back and continuously modify and amplify the elements, processes and sub-systems. In most cases this feedback has minimal effect on the processes that stabilize the system (so-called negative feedback); it simply reinforces them. But every so often positive feedback,² with its seeds in *Chaos*, explodes the stability. The devil is in the detail, or rather the complexity.

An initially marginal event can, through positive feedback, trigger the long-term dramatic events of the Lorenz Butterfly Effect.³ Apparently, a butterfly flapping its wings in the Amazon can 'cause' a typhoon in Hong Kong. There are innumerable marginal events (butterflies) out there, but very few precipitate the butterfly effect; and those can only be identified in hindsight, and then only hypothetically. They cannot be identified in

advance. However, just because the typhoon may not have happened without this mythological butterfly, that doesn't make that butterfly the 'cause'. It was merely one of a series of influences, all of which culminated in the effect; not forgetting everything that could have previously stopped the butterfly, but didn't. Much of the insights claimed for this effect derive from the mathematics of the Theory of Chaos, and its demonstration of a causal path between the butterfly and the typhoon: whence a single butterfly takes the blame for the chaos. However, *Chaos* as we mean it cannot be caused. It is always and already there; it is pre-order, the natural non-linear backdrop out of which all artificial and unnatural linear 'order' is constructed by human cognition.

The importance of this insight of the butterfly effect is not that a single butterfly can in popular parlance cause chaos, rather that minor events can interact, and through feedback build up into a significant force. As noted above, by the same reasoning, the constraining of our untidy world into a straitjacket of categories is forcing square pegs into round holes. This sheds a debris of detail that conspires with the context to form a critical mass, and a subsequent explosion of confusion of inexplicable observations.

The prevalent form of linear thinking disregards most processes that are responsible for the creation of positive feedback, thus creating systemic instability. Such thinking reckons that any instability can be rectified by the discovery of cause-and-effect processes that counteract any form of positive feedback. Also, it totally rejects the idea that the act of imposing tidiness onto a world that cannot be accurately simulated because of its complexity can itself lead to a chain reaction of chaotic positive feedback, which generates hazards that refute any prior analysis. We may know the general form of a hazard, but we may not recognize a particular occurrence until we are wise after the event.

Today's technology is awash with such hazards, and these often go unnoticed. Our touching faith in a benign technology has uncanny parallels with the preposterous claims made in the early days of every technology. X-rays were once considered harmless novelty, used unguarded to check on foot size in shoe shops; and to make a photographic souvenir for newlyweds, bride and groom clasping skeletal hands showing brand new wedding rings. In its pioneering days, electricity was promoted as a cure for everything: consumption, dysentery, cancer, blindness, worms and impotence. Of course, one hazard of technology that has at last been recognized as a direct consequence of industrialization is global warming.

Nowadays, automation through computerized information systems is also promoted as a cure for everything; as the metaphorical silver bullet. There is no denying that the dominant ideology of our times actually promotes computerization as a virility symbol. No expert can appear on television without the ubiquitous microcomputer peeping over his shoulder. Every business programme on CNN and BBC displays wall-to-wall knowledgeable computerized charts; meanwhile the categories that have been constructed to make use of these particular applications remain hidden. The pleasant visual aesthetics of something that is computationally supported is apparently enough to hold unwelcome thoughts at bay. We really *do* believe that computers increase business potency.

Climbing the Nearest Tree

The history of human problem solving is littered with examples of this *first step fallacy*: 'they think they are reaching for the moon, but all they've done is climb the nearest tree' (Dreyfus and Dreyfus, 1986). It is only after the nonsense stops that a technology can be used propitiously to its optimum potential. But the nonsense goes on.

The market's response to this onslaught is to 'follow any lead one can get' (a television advertisement for computer manufacturer Compaq). By following these leads, the belief in a potent technology is insinuated as part of the deal. Governments and businesses worldwide have rushed headlong into what can only be called a technology binge, in the confident belief that lavish spending on Information and Communication Technology (ICT) will ensure success and progress. Developing countries in particular have been urged to fall into this trap and are induced into spending big on technology, even when their basic infrastructures are underdeveloped or non-existent. In light of our dominant scientific mind-set, it was inevitable that computerized information systems would be thrust upon organizations, all with the highest motives. But ICT is just the latest technological adventure whereby man feels he can subjugate nature by mere will. How easily we forget Alan M. Eddison's warning, that 'modern technology, owes ecology, an apology'.

A history of technological achievements, including the development of the computer itself, sustains a scientific optimism that is apparent in the huge sums being thrown into the bottomless money-pit of computing. Despite the waste, the sheer power of optimistic rationality dominates. A belief in progress; being in control of a better world, achievable through rational thinking: rational thinking expressed as science and technology.

Tidy thoughts implemented by tidy minds on that icon of tidiness, the computer.

Far too often, ICT is considered culturally neutral, when in reality it is value-ridden, and hides a powerful intellectual imperialism. This predicament is nothing new; it is the culmination of the trend, the unquestioned application of scientific method, which was recognized over 200 years ago by Edmund Burke. He stated: 'But the Age of Chivalry is gone. That of economists, sophisters and calculators has succeeded; and the glory of Europe is extinguished for ever' (Burke, 1999). For behind much application of information technology is the malignant belief that human thought is mere calculation; we are no more than biological analogue computers. There is a sinister hidden agenda stemming from the dominance of two degenerate attitudes: that a number can be a meaningful representation of human experience; and that arithmetic operations on such representations, implemented on a computer, can produce so-called rational decisions about the human condition.

Information Audits

Computer simulations maintain the pretence that they represent reality within their limited models. Unquestioning acceptance of simulations of open-ended human experience is sheer folly. Models can only ever be a pale shadow of what actually happens, and can never emulate the subtle, and not so subtle, checks and balances and the feedback of unknown and unknowable interactions. They really cannot hope to emulate the infinity of parameters implicit in 'being there'. The application of ICT obscures the difference between correlation and causation, confuses superficial process with substance, and principles fly out the window. One horrific example is presented by the neurosis for targets in the British National Health Service. Over a fifteen-month period thousands of seriously ill patients had to wait for hours aboard ambulances parked in 'holding patterns' outside overstretched hospital Accident and Emergency units in order to meet a UK government pledge that all patients would be treated within four hours of admission.⁴ Apart from the danger posed to the health of patients by this 'patient stacking', detaining the ambulances meant they and their trained crews were not available to answer new emergency calls.

The reader should think about Goodhart's Law. Charles Goodhart, a distinguished Professor of Economics at the authors' university, made this celebrated reflection: 'any observed statistical regularity will tend to

collapse once pressure is placed on it for control purposes' (Goodhart, 1983). What Goodhart is saying is that cause and effect must not be mixed. Any observed regularity in society is an effect, but the moment it is measured, and that measure is used as the basis of control, then a false assumption is being made that the regularity is the cause of the observation. The problem is made worse because of the highly subjective nature of observation itself, which as we shall see from Chapters 8 onwards opens up a can of worms.

Everywhere people are using the term *system*, when all they actually mean is *installation*. For a system is what that installation becomes, what it will become, and not what it was intended to be, as we shall see in Chapter 7. The belief that any system can be designed to optimize and organize the context within which it is placed is, however, a fallacy. The system can only temporarily optimize itself, but all the while it creates completely unexpected phenomena that influence/change both the system and its context.

Systems Misbehave

Systems misbehave! And technological systems are no different. Technology is a prisoner of societal consequences, which cannot be controlled, no matter what the management regime. Theoretically valid ideas can result in failure, while blatantly incorrect facts can induce success. When using the tools of technology to solve a particular problem, we may or may not succeed, but what is certain is that completely unexpected phenomena will happen. This is John Gall's First Law of Systemantics: 'All Systems have Antics' (Gall, 1988). Sometimes the antics lead to a system's inversion, where the exact opposite occurs to what was intended. Grand schemes may solve the problem as intended, only to create worse or different problems. Worried that adverse weather conditions at Cape Canaveral would delay the Apollo project, NASA constructed a giant awning over the launching pad. It was so large that a micro-climate formed beneath it: even though the sun was shining on Florida, it was raining on the rocket.

Most software supports, administers and/or refers to other software. How many applications of technology solve the wrong problem? Problems are solved because we know how to solve them, rather than because we want or need them solved. And more often than not, even more technology is needed to shore up that non-solution.

No technological solution is applied in a vacuum: we have to perceive the problem; there has to be proper management and housekeeping in order for technology to achieve its intended functional aims. At the same

time we must deal with any implications of its use, avoiding any emergent hazards, all the while profiting from any unexpected opportunities that may arise. These new risks, both hazards and opportunities, must be sensed as problems and subsequently solved. Lo and behold, we are back at the beginning. The feedback loop, which holds the potential of opportunity and risk, is closed. Some feedback will oscillate and amplify the loop processes, eventually totally destabilizing the system. Problems increase exponentially, as do the technological solutions. We are one step away from chaos. Anyone who runs a computer system will recognize this scenario.

Some loops will imply risk, and these must be intercepted and curtailed. Even the feedback loops that enable commercial opportunities must be monitored, so that they don't oscillate out of control. We must control the feedback loop, not just tinker with the tools. We must all face up to the problem of keeping the commercial and social feedback from information technology under some semblance of control.

The Law of Diminishing Returns

Prevailing over both the functionality of the technology and the phenomena of complex systems that spontaneously emerge around it is the dominant requirement of intelligent human response: to sense a problem and to identify what is appropriate and inappropriate action.

The role of technology in the construction of a *problem* and its subsequent *solution* therefore becomes central. Only on the basis of personal criteria can an individual balance the advice from those around him, and decide which method is most appropriate. But more often than not, that doesn't happen. The authority of our scientific society forces the individual to formulate every new solution in terms of technology. We even sense the situation as being a problem, specifically because of the potential offered by technology. Give a boy a hammer, and he will look for nails.

The self-serving logic of methodically applying technology takes on a significance far greater than the original problem. The use of technology has become *compulsive*. Because of an initial success, managers *obsessive*-ly introduce yet more and more layers of technology. To justify the extra effort and expense, they will look around for partners in search of synergy, that mystical pot of gold they learned about in MBA courses. The implications of each new layer of technology always feed back in the form of new questions about the appropriateness of solutions, and of new problems: *neurosis*. Any tidy demarcation will always collapse in a confusion of multiple overlapping

systems. For example, the vast majority of software simply deals with other software, and not the management problems at hand. Eventually complexity increases to a point where utility turns into reliance, reliance becomes dependence, and the law of diminishing returns precipitates a galloping descent into nightmare.

It is common for managers to think that by creating a database, it will somehow throw out facts to help them in their crusade for tidiness. But classification is notoriously difficult. A Canadian electricity company decided to produce an Executive Information System that would tell the management about the state of the organization, and would help them deal with the competition and with local political factors (Marche, 1991). They started by cataloguing their 'buildings', but then the whole process fell apart.

One structure was built in two separate stages. To the company it was two buildings, but the local authority claimed there was just one. Then there were portable cabins. In winter these have sleds fitted; for most of the year they run on wheels, and if unused they are stacked as containers. Were they to be taxed as buildings, vehicles or containers? There was the problem of manholes. It took a very expensive Royal Commission to decide that a manhole containing a seat was a building, otherwise it was just a hole in the road. Feedback had reduced the whole situation to farce. Would the company have been any worse off if it had left well alone? It would have saved a great deal of money. The management finally learned an important if somewhat expensive lesson: the tidy collection of data is not necessarily virtuous or beneficial.

An Information Ideology

Ultimately, because of a growing tsunami of technological complexity, both the sensing of problems and the managing of solutions become impossible, and the whole edifice falls apart. The basic problem is that the pseudo-scientific ideology of sameness has mixed up cause and effect. The dominant belief is that with proper control procedures we can impose order. This is a complete misunderstanding of the human condition. Control doesn't create order, quite the contrary. Order is systemic and may have come about in the complexity of human actions (rather in the feedback of interactions with the environments), but not necessarily from human intent. Order must emerge there first, and this order tolerates control. Only by the concession of that order, does the consequent control impose structure and stability. Don't confuse order with structure and stability; don't confuse cause with effect.

All order is transitory regularity; order allows controls to work, and then order fails; consequently the certainty of control and structure collapses. Uncertainty precedes the birth of a new order, followed by new controls. Innovators act as midwives at this birth. They stand out against the tidy minds that spread the deadness of stability, and instead create the turmoil of yet more transitory but temporarily useful orders.

It is typical of countries with an excess of government control, such as the former Soviet Union, North Korea or Castro's Cuba, to misunderstand totally this property of order and control. These governments had socialized their economies through rigid controls and by the setting of arcane planning targets. It was only a short step from these unrealistic targets, to false accounting, and ultimately to economic collapse. Mao Zedong's Great Leap Forward in China claimed that revolutionary zeal would deliver national self-sufficiency. The result was the Cultural Revolution, and 28 million deaths from starvation. All the while the Chinese government was keeping up the pretence of targets. Things there have changed substantially for the better since the death of Mao.

The very act of naming the target figure guarantees a phoney success. The government controls the data collection, and so it can re-label any old data to fit the categories being measured, and then bluffs its way through, ignoring that quantity is not a measure of quality. Announcing that it is about to spend large sums of money is another good trick. The message: the more money it spends, the more successful it will be. Such are the shared-delusions designed to deflect criticism, because no one sees the big lie. Even when its figures are transparently false, what does the government do? Fire a few scapegoats, before creating a fanfare around yet more targets. 'Lies, damn lies, and statistics'⁵? The sleight of hand can become very sophisticated, like the agricultural targets and claims of full employment that continued well beyond the point that the former Soviet Union was bankrupt and Mao's China was starving. Ultimately, however, the accumulation of inevitable failure becomes undeniable.

These governments were rain-dancing with pseudo-science. It is ludicrous to think that they can control uncertainty. Forget the promises of science and logic. Ultimately, the sorcery of a new rhetoric will always emerge to sweep away the old, although that too will eventually degenerate. 'Every revolution evaporates and leaves behind only the slime of a new bureaucracy' (Kafka, 1995). We must live with that uncertainty and love it. Enjoy the sheer wonder of it. So when anyone tells us that information is good, more information

is better and computerized information is best, reach for the straitjacket. When a man has a watch he knows the time. When he has two watches, digital or otherwise, he isn't so sure.

This then is the human condition, and the place of technological systems within it. The only property all systems have in common is that they *all* fail. The only question is when. Control is a myth. Confidence in control systems is a precursor to hubris. With a restatement of Nietzsche's observation that theory is 'refined ignorance', this book has completed its first circuit. The authors have returned to their starting point with a description of the problems that beset their own topic of Information Systems, only for them to suffer from an even bigger headache with the notion of *theory* in general. Their sceptical message is that all theoretical descriptions are based on frames that are both underpinned by delusions and from which delusions emerge, which in turn trigger paradoxes. This is all tied up with the structural coupling of observation and cognition, all made possible with acts of choice by the singular observer.

The authors could have ended the book here, but that would have been disingenuous. For readers must look at these issues at a deeper level. Granted the authors have confronted their initial concerns with their self-referential analysis, although they deem it necessary to set off on yet another self-reference. In the remainder of the book they will peel away the various theoretical layers underpinning what they meant by the structural coupling of observation/cognition.

However, before they expand on any esoteric theory, the authors believe it is important for the reader to place these notions among her commonplace everyday experiences. The discussion of observation that follows is not meant solely for the rarefied world of theory. It has relevance even to the world of the mundane, to the world of technological folly we have described in the present chapter. It has particular relevance for pragmatists who want to cut through the self-referential absurdities of the modern word. To do this we need to consider where these absurdities come from, and how they are ignored. This requires that we consider further the notion of higher orders of observation, which is at the core of the upcoming analysis. Before the reader writes off such concepts as mere pseudo-intellectual indulgence on the part of the authors, we take a short detour with a more down-to-earth example of how objectivity, by failing to take orders of observation into account, can lead to misplaced confidence in logical/scientific reasoning, particularly when other people are involved. However, those readers who

are comfortable with these notions can skip the next section, and jump directly to Chapter 7.

Considering Orders of Observation with a Brainteaser

Some years ago the Sunday Times, a leading British Sunday newspaper, ran a recruitment advertisement for a major IT Management Consultancy Company. It contained the following variant of a well-known brainteaser; the wording of the original advert has been adjusted for illustrative purposes:

A prison warden decides to release the *cleverest* of his three prisoners (let's call them A_1 , A_2 and A_3). In the prison yard he shows the prisoners three black disks and two white ones, and tells them that he will pin a single disk on the back of each prisoner, and then pocket the remaining two disks. The warden announces that he will release the *first* prisoner who can *name* the colour of the disk on his own back, and give valid *reasons* for the choice. In fact he intends to pin a black disk on each prisoner, and pocket the two white ones without allowing anyone to see which disks are unused. Each prisoner will see the black disk on each of his two companions' backs, but not the one on his own. The warden then planned to walk to the far side of the yard and await the first prisoner to come forward with the *correct* answer plus valid reasons.

The advertisement went on to imply that anyone who could put themselves in the role of one of the prisoners, and solve this problem, would be well-suited to a career in consultancy and should apply for the advertised post.

This brainteaser is typical of a simplistic logical/rational view of the world that this book is questioning, and it is well worth considering this rigid type of thinking from the relativity perspective of first-, second-, third- and even higher-order observations. This involves recognizing that each observation carries with it the assumptions/delusions made at its own level, and also different assumptions at all the lower orders.

Five words are italicized in the statement of the problem. This is to help illustrate that the expected so-called mathematical logic needed to solve the problem requires a very restricted interpretation of those five words, and depends totally on other very important and yet unstated underlying assumptions/delusions. Of course, there is yet another layer of observation, namely the reader of the advert, who has the extra information about A_1 ,

A_2 and A_3 , and who uses it while watching/imagining the warden watching A_1 , who is watching A_2 , who is watching A_3 ; not forgetting all the many other permutations of higher-order observations. By introducing various interpretation/assumptions among the various levels, the authors, who are also observers of the scene, intend to lead the reader towards some very different inferences.

According to assumptions made in the authors' higher-order observations of events, the 'solution' that the consultancy expected, and by implication by the imagined warden, is something similar to the following *reductio ad absurdum* falsification argument. The authors, for their own particular purposes, have packed it with bracketed comments about orders of observation.

Consider prisoner A_1 . {From his first-order observation,} he sees two black disks on the backs of his two companions (A_2 and A_3), and concludes that there can be at most one white in play; and if so, that would be on his back. Prisoner A_1 starts by assuming that there is a white disk there. He would then conclude {from his own second-order observation of A_2 (who is watching both himself A_1 , and A_3 , in what to A_2 is a first-order observation)} that A_2 (seeing the white on A_1 's back) would deduce that there is only one white in play (on A_1 's back) for otherwise A_3 would see two whites {in his first-order observation (second-order by A_2 watching A_3 , and third-order by A_1 watching A_2 watching A_3)}. However A_3 doesn't move, and so A_2 would conclude his disk is black. However, A_2 doesn't move, so A_1 's initial assumption has been falsified, and therefore A_1 decides that he must have a black disk on his back, not white.

The same logic should also hold for both A_2 and A_3 (and their respective higher-order observations of the other two prisoners). Hence the first prisoner to move is the cleverest, being the first to work it out. Of course, fundamental to this pure logic is the assumption that all three prisoners share a common objective logic, and that the various orders of their observations don't matter. This is the warden's interpretation (the brainteaser's assumption), but not necessarily any of the prisoners'. For suppose A_1 , A_2 and A_3 do not share the warden's ability in logic. Then the warden's assumption (the assumption is actually being made by the person who is solving the problem according to this logic), about the rational objective behaviour of the prisoners in his analysis, is invalid. In this situation, A_2 's first-order observation of A_3 would be different from A_1 's second-order watching A_2 watching A_3 , and the same is true for all the other possible permutations of who is watching whom.

Of course, if A_2 did actually share the same mathematical logic as A_1 , but was cleverer, he would come to the same conclusion as A_1 , but sooner, and so would approach the warden. However, because A_2 had moved, A_1 would gain the instantaneous impression that his initial assumption was correct, and that he does have a white disk on his back. A_1 would react immediately to A_2 's move, and if a faster runner, he would reach the warden first, but with the wrong answer. So the various orders of observation, and the sequence in which they are processed by the logic, do make a very real difference. What sort of logic needs each solution to be universally free of contradiction for it to be valid? Answer: a logic steeped in, but in denial of, paradox.

Note also how the problem, as stated by the warden, implicitly equates *cleverness* with thinking in this rigid, paradoxical and formal mathematical (and the only *correct*?) way of thinking. This presumption is far from being universally valid, and as we have seen can place mathematical thinkers at a real disadvantage when they are cast adrift in the real-world turmoil of human observation and assumptions.

The very existence of alternative logics, such as those given below, will further deny the predictability of the behaviour of the three prisoners needed in the above argument, and in doing so will invalidate the mathematical logic, showing that the various orders of the observation cannot be dismissed with impunity. These substitute logics have the extra advantage of not requiring any assumptions about the abilities of the other prisoners; they are pure intellectual abstractions, and so can be said to be order-less observations for all A_1 , A_2 and A_3 . Delusions in the making, maybe?

Suppose, for the sake of argument, that the three prisoners are a gambler (A_1), a disbarred lawyer (A_2) and a psychologist (A_3), with behaviours imposed in the first-order observation of the authors. The consequent radically different world views of each individual prisoner mean that a mathematical solution to the problem (as perceived/observed by the warden: the only objective thinker present) cannot be isolated from the contrariness of human context and experience, or from a recognition of 'who is watching whom, watching whom'.

Note that the warden too is an observer. While he is pinning the disks to their backs, and watching proceedings with fixed expectations of the prisoners, he may have ignored A_1 tossing a coin, and A_2 sneering at him, or that A_3 is already moving towards him. That's the problem with observation; it involves choice and focus, it uses distinctions, and hence it entails not seeing, as well as seeing.

A_1 , the gambler, takes a probabilistic perspective, and could reason in the following perfectly rational way. 'Only one prisoner will be released, so unless I am *first* with the answer, even though I am *correct*, I will not get my freedom. The *a-priori* probability of my being correct and being first with the solution is one in three. I *reason* that if I toss a coin, my chance of correctly *naming* the colour of my disk is one in two (evens): much better odds. So I will toss the coin and be first! Of course with three black disks and two white disks, the odds are not evens: the *a-priori* probabilities are black (three in five) and white (two in five).

Will I act on this, or will I take a little time to look (a first-order observation by gambler A_1) at my companions' disks (both of which happen to be black), and calculate the *a-posteriori* probabilities: black is now one in three, and white two in three. Any one of these approaches is as good as, if not better than, the odds of straight competition between my fellow prisoners and me: one in three.' So the sensible choice for A_1 is not to waste precious time observing his fellow prisoners, but to toss his coin and act. However, then the assumptions made by the warden that all the prisoners (including A_1) are watching and logically analysing their companions' behaviours will be invalid. And it gets worse for the logic required by the advertisement.

Even this simple logic takes far too much time. Consider A_2 , the lawyer, who will have taken the warden's words literally, and who has a totally different, but again a rational and consistent logic. 'The warden did not say that only one solution could be given by any prisoner. So I will say "My disk is black; my disk is white". Since I have exhausted all possible solutions, then one of my statements must be *correct*, and within the letter of the law I will have both *identified* the colour of my disk and given my *reasons*. Therefore I must be released!'

When we come to A_3 , we meet the shrewdest of all the prisoners (according to the authors), a student of human nature. His logic is the most cynical, and the most profound. He rejects the mathematical logic out of hand. He is turning the tables, and is observing the warden: 'I know these brainteaser people, like the warden. They think they are so *clever!* In fact, so clever that they are totally predictable. So as not to give any one of us an (unfair) advantage, any problem they set will disclose exactly the same symmetrical information to all three of us. Since it is impossible for each one of us to see a total of two whites (implying three white disks in all), or a black and a white (which is combinatorially impossible with three people), I *reason*

that the warden will put a black disk on each of our backs.' So A_3 has the answer before the warden has even started to pin on the disks.

The individual experience of these three prisoners has created, for each, his own unique view of reality and his own coherent and consistent, but totally subjective, logic. So none of the prisoners are making the assumptions required for the logical analysis to work, and it has been shown that the mathematical approach is itself subjective in assuming a world of mathematically astute individuals. The prisoners' first- and second-order observations are in fact the warden's first-, second- and third-order (that he misinterprets), and the reader's first-, second-, third- and fourth-order observing the scene through both the warden's and the prisoners' eyes. This all has to be condensed down into a single first-order objective mathematically rational (and incorrect) view. An objective world, constrained by a linear logic, where the various orders of observation play no part in any analysis, is not the world inhabited by us humans.

Even in this most trivial and contrived of examples, the rigid mind-set of mathematical logic is seen to be not only inappropriate but also actually invalid. What is more, the assumption that the warden knows what he is doing is questionable. He could be mathematically unsound, and is merely copying a game that he has seen elsewhere. Since he may not have the slightest idea of what is going on, who knows what colour disks he has placed on the prisoners' backs? The prisoners, even if they are all mathematically adept, will then be unable to operate the requisite analysis in what is now an arbitrary situation.

But why stop there? It would be interesting to consider the attitudes of other prisoners to the problem. Some old lags don't want freedom; that would confuse the issue even more. Therefore, the belief that mathematicians (or other groups that share a similar logic, such as chess players) make the best strategists, solely because of their reductive and mathematical deductive skills, is self-evident folly. Even the above imaginary gambler knows that in a two-person game of perfect information there is no optimum strategy, because moves in such a game become predictable.

Then there is the harsh reality that this game is a contrivance, designed (that is, based on a set of assumptions/distinctions) to identify people who share a particular set of assumptions: so-called scientific truths. However, the world of hard knocks is not a board game with well-defined rules, but a subjective jungle of uncertainty; at least this is what the authors observe. People cheat! We humans must face up to the reality of asymmetric communication, incomplete information and of risk.

What we have here is yet another example of *Science's First Mistake*: namely a belief in an objective world, independent of observers. Thus the Sunday Times advertisement was proselytizing a flawed mathematical perfection. Holding up logic as a virtue is promoting a formula for an incestuous reinforcement of a narrow, restricted, restrictive and un-human approach. Sceptics, such as the authors, insist that consistency and predictability must lead to false assumptions, although they do admit that in certain circumstances, such assumptions may lead nevertheless to a utility. However, we must never forget that people are irrational. As an *aide memoire* we would do well to remember John Maynard Keynes warning about solvency and markets.⁶

It is now time to leave this brainteaser far behind, and with *Science's First Mistake* in mind set off on a deeper analysis of observation.

CHAPTER SEVEN

Systems Theory

Having arbitrarily introduced the notion of systems in the previous chapter and alluded to various systemic notions on many occasions thus far in the book, it is now appropriate that we step back and consider where this type of thinking leads. This necessitates us first describing some core concepts from Systems Theory, and in particular the notion of self-reference. Then we will be in a position to consider the structural coupling of observation and cognition, before moving on to uncover the paradoxical nature of scientific method that culminates in *Science's First Mistake*.

Systems Theory has developed over many decades and describes different types of systems: physical, biological, economic, political, legal, scientific, technological, social (Arbib and Cornelis, 1981; Bausch, 2002; Germana, 2001; Geyer, 2001; Lin, 1988; Saviotti, 1986; Trist and Emery, 1965). Such broad-ranging usage demonstrates that the Theory has reached a level of abstraction suitable enough for it to be applicable in a large number of areas (Avgerou, 2000; Kallinikos, 2006a,b), and abstract enough to facilitate the emergence of this diversity of applicability (Xu, 2000). Granted there are specific concepts that are used contextually within different individual problem areas, however, the underlying structure of the theoretical framework is common to all, and exhibits a rather remarkable simplicity.

Systems Theory, then, is suitable for communicating a number of ideas across different disciplines, and so lends itself as the natural candidate for the theoretical framework of this book. In this chapter we introduce some key aspects in order to provide a description of the evolutionary processes of science, and to reflect on key scientific ideas, as well as on their interplay with technology. In particular we focus on self-reference, a unique concept within the tradition of second-order cybernetics that has influenced the latest steps in the evolution of Systems Theory. We will then use this concept to describe the processes that orchestrate the development of scientific theories, as well as to highlight the inevitable emergence of paradoxes whatever the system identified by an observer.

System/Environment

We should start by asking: just what is a system? A simple way to proceed when considering relevant notions is initially to compare a system with a

biological cell. A cell contains ribosomes, cytoplasm, mitochondria etc. Each of these could have been chosen to be a system in itself, or alternatively they could be viewed as sub-systems within the system of the cell. The cell itself and its components are seen to be coherent by an observer, and their properties and mutual behaviours factor into the choices that turn this complex thing into a perceived unity: a system.

No matter how we choose to define our system, the choice implies the designation of a specific perspective for a particular purpose. Each perspective can change, depending on the purpose of the observer designating the system and operating within his own particular choices. The metaphor of choosing our system to be similar to a cell shouldn't be imposed too rigidly, and it should be jettisoned as soon as possible, as we will need to generalize our ideas beyond the specifics of that simple organism, and move beyond the analogy of biological systems. But it is a useful springboard to more complex ideas.

For a system can be a human body, a financial institution, an organizational structure, a celestial body, a legal framework, a societal structure, or indeed, a scientific theory. In principle, a system can be anything an observer defines it to be, and as such any particular system will be observer-relative. The very act of defining a system involves an unavoidable restriction that essentially highlights the issue that a system is an artificial construction, which reduces the complexity of 'everything' being observed so that 'something', some particular thing, can be separated out from the *chaos* and complexity, made coherent, and thus identified for further exploration and study. Hence, the act of choosing a system is the first and fundamental step taken by an observer to reduce the complexity that surrounds him. A consequence of any such choice by the observer implies that no matter what system is actually chosen, it is isolated from the complexity of other systems and is artificially singled out for study by the very operation of observation. Such simplification of the complexity of the 'whole' means that the choice itself must be partial: the system can never capture the whole. This is a necessary compromise without which observation would have been impossible.

For this reason, no system can be fully described; the issue is always whether the description chosen is appropriate for the task at hand. Indeed every individual system is brought into existence with such a choice and for some purpose.

Definitions of the concept of system abound, but as far as this book is concerned a system can be decomposed in two distinct ways, although it

must be noted that both views are somewhat restrictive. One is to consider a system as an assembly of sub-systems, and then to consider these sub-systems as assemblies of sub-sub-systems, *ad infinitum*. The other is to consider a system as an assembly of elements, together with the relationships between these elements. The first option gives a basic function for dissecting systems hierarchically, but it is a rather structural perspective of the decomposition of the concept of system. The second is to some extent better in pinpointing that there are important interrelationships between the elements of a system. However, it does not account for the role of communication between those elements, a role that is crucial for conceptualizing the complexity of the system and its individual elements. Thinking about our metaphor of a cell and its components from these two perspectives is a good starting point for grasping these subtleties.

If we consider communication between systems then an important aspect surfaces. As Luhmann remarks:

This concept of communication can be built into a theory of complex systems only if one gives up the long-established idea that systems exist as elements *and* relations among these elements. It is replaced by the thesis that, because of complexity, carrying out the process of relating elements requires selections, and thus relationship cannot be simply added onto the elements. With those selections, the process of relating qualifies elements by cutting off some of their possibilities. In other words, the system contains, as complexity, a surplus of possibilities, which it self-selectively reduces. This reduction is carried out through communicative processes, and therefore the system needs a 'mutualistic' basic organization – that is, attribution of its elements to complexes that are capable of communication (Luhmann, 1995).

No matter which of the two viewpoints is chosen for the decomposition of a system, both views presuppose that the system has been identified by a *human observer* as being of special interest. Later on we shall see that broadly speaking *observation* of another type is possible, that of observation by computer albeit with severe restrictions. The designation of any particular system is therefore an observer-relative act. Thus any system can be designated otherwise by a different observer, even by the same observer but in a different frame of mind or with a different purpose. The behaviour of each element of an identified system has an effect on the behaviour of the

system as a whole. The elements may form sub-systems, each a system in itself. Each element and sub-system will affect the behaviour of the whole, and all are interdependent. They are affected by being in the system, and are changed if they leave it¹; as the system itself is changed with the loss of a sub-system.

A system is perceived to have a *boundary*, which separates the system from its *environment*. This differentiation between system/environment has repeatedly been remarked upon previously in this book. We note that the environment should not be considered as some type of residual category, but as constitutive of the system's existence. By examining the relationship between a system and its environment, that system is often classified by others as either closed or open, depending on how the system regulates its boundary for receiving information from its environment. However, the classification of closed or open is problematic, being made on the basis of the environmental influences (quite possibly unknown elements from the environment) that affect the system. How this degree of openness or closedness is orchestrated by the system itself is even more vague, since that too is dependent upon the definition of a system: an act that is observer-relative.

This notion of open versus closed systems is now considered outmoded, and has been replaced by the concept of *self-referential systems*, something that will be described later. However, even with something as simple as a cell, it is never totally clear and unambiguous as to where the *inside* ends and the *outside* (namely the environment) begins, all exacerbated by the structural coupling between the two; not to mention the issue of residual category: 'relationship to the environment is *constitutive* in system formation' (Luhmann, 1995).

With more complex systems the ambiguity is yet more apparent: is the air in the lungs, or gastro-intestinal bacteria, inside or outside the system of the human body? The boundary is chosen according to the human observer's particular purpose and priorities, since it is the observer that identifies the system to begin with, and hence who designates how the boundary is to be perceived for any particular chosen system. However, when the system is artificially separated from its environment, and subsequently the environment is considered to be a mere residual category, all the ensuing paradoxes and the severed structural couplings will be conveniently swept up into this mythical boundary, where they are ignored to simplify further consideration. For example, even with the million and one questions we

humans could ask about where the body ends and the environment begins, we still believe we know what a human body is.

Whatever the purpose or priority, the choice of boundary will encompass some concept of a dynamic yet coherent *reference state*, which in turn will identify a generalized version of the system itself to the observer.

Feedback

The interaction between a system and its environment is what is known as *feedback*. Evidently, the environment must not be considered as some sort of inert background, rather as a complex system in itself: a bubbling soup of interacting systems, both similar and different, all continuously changing and affecting one another. Furthermore, the exchange of feedback between a system and its environment should not be viewed as a mere set of input/output processes. As the environment is constitutive to the system's existence, it becomes structurally coupled to the system; hence all interactions between system/environment do not simply originate in one or the other. These interactions coexist in both system and environment. In this sense the concept of feedback is artificial. Feedback is what occurs between system and environment when we isolate a system for study, selectively cutting it off from the complex and multiple interactions of its natural habitat. Not that we would ever know what that original habitat was; by observing, we lose that information by necessity. In this respect, a system's environment is also the result of identifying the system. It is a result of observing.

This constant negotiation between the system and its environment, which we capture in the concept of feedback, is mediated by the elusive concept of the boundary that separates the system from its environment. The system affects its environment, and is affected by it. Through a series of actions, to which the system's elements and relations are subjected, the system triggers changes in its environment, and vice versa.

Such feedback is termed *negative feedback* when it counteracts any disruptive processes, and reinforces the relative stability of the system. For example, breathing in and out causes the outline (the boundary?) of a living body to change, but it is still recognizable as a body. Stop breathing altogether, and the body displays less variation from the reference state (at least in the short term), although it soon enters *positive feedback* in that it is dead, and will begin to decompose into other systemic components. Positive feedback amplifies the processes that carry the actual state of the system away from what the observer recognizes as the reference state, in this case a living body.

It is important to realize that no system is passive. Even the simple cell is no solid inert lump, rather it is in a state of constant flux about what the observer perceives to be an idealized reference state, albeit fictitious, that represents cell-ness to him. That state of flux is also relative, since even when a system is apparently doing nothing (according to the observer), the structural coupling means the system's relationship to the environment is constantly changing and this outside world is itself in a constant state of flux. Structural coupling then refers to the relationships that exist between system and environment, relationships that are prone to further differentiations by other observers and relationships that are ultimately constitutive of the system's existence and that cannot be fully described because of the complexity present in any system's environment.

The observer, whose choices initiate a particular system, will view it as doing something (even if that something is nothing), which will involve the system sampling its environment as part of a feedback process. That is to say, each system is itself a first-order observer, in that it will include some means for such sampling, although this observation does not necessarily involve cognition (a fairly obvious conclusion if the chosen system is a tree). Thus the choosing of a system by the original observer must necessarily involve a second-order observation (the chooser observing the system observing/interacting with its environment), and in doing so that system tends to be perceived by him as being autonomous in its actions. This is why the idea that a system is the result of an observer's choice, rather than a specific and self-evident thing in the world, may seem so odd to those uninitiated in Systems Theory. We are back with Bishop Berkeley, and his tree.

The apparently now-autonomous system must be adaptive to the continual changes in the environment, both predictable changes to the extent that the system can anticipate environmental feedback and the unpredictable. It must survive, reproduce, possibly be purposeful and teleological (where developments both in itself and in the environment are due to the purpose and design of the system), grow, colonize and cooperate. The system must achieve the same results in different ways and from different initial conditions (so-called *equifinality*), and do any of the things that physical, biological or social systems do.

However, positive feedback will tend to distort the system, possibly to a point where it is no longer recognizable when compared with the original reference state; not necessarily to the point of death, but transformed into a different system, such as from a caterpillar into a butterfly. Therefore, if

the chosen system is to be recognized (the caterpillar, and not the butterfly) that system must for the time being somehow maintain the relatively stable form of its reference state. However, we must accept, in a deliberately vague way, that a system will not remain in an unchanging initial state, and that the very concept of state is problematic since it freezes a system in time, and time itself constitutes the most mysterious and mind-boggling of all entities, even for physicists. A system is therefore what it has become, what it will become through feedback, which is why no description of the system will ever capture totally the whole that it is. By implication, no system can accurately describe itself.

By the very nature of a consensus demarcation that is its boundary, any system will have an identity, which must be maintained in a dynamic yet stable and recognizable reference state: a self-organizing property named *homeostasis*. In order to be homeostatic, a system must receive energy/material/information from outside its boundary. At least in the short term it must be *negentropic*; negative entropy (negentropy) is perceived as contrary to entropy. Entropy is the thermodynamic principle that systems run down to ultimate disorder or to death, which is the state of maximum entropy.

Emergence

Any system exhibits an internal complexity; such a complexity (as ‘a surplus of possibilities’) is partly required to deal with the changes in the system’s environment, and is partly the result of the system’s co-evolution with its environment. An important side-effect of this process is that there is no causal control over the qualities that a system’s elements tend to exhibit. Elements at each macro-level are identified by *emergent properties* that do not exist at lower micro-levels; this systemic property is characteristic of any chosen system.

On their own the complexity of components at micro-levels cannot ‘explain’ the emergent properties of macro-levels. For example, the micro-level behaviour of individual brain cells cannot explain the emergent macro-laws of the cognitive functions of the brain. Even more profoundly, the laws of physics and chemistry, considered at the micro-level, cannot explain biology at the macro-level, let alone the emergence of life. In turn, biology at the micro-level cannot explain the macro-level behaviour of individual animals, including humans. Similarly, the aggregation of individual behaviour does not explain emergent societal behaviour or differing cultures.

This issue, that unexpected structures/functions emerge within systems, is crucial. Consider the question 'can a single cell think?' The answer is obviously (probably) no! But the approximately 100 billion cells in the human brain certainly can. Cognition surfaces as an emergent quality from the entire functioning system, although this cannot be attributed to the single elements that are perceived to constitute the system.

There comes a point in a complex coming together of 'things' that a change occurs, which is not solely quantitative, but one involving a considerable qualitative shift. 'The whole is more than the sum of its parts' (Aristotle).² This renders reductionism (i.e. the process of breaking up an identified problem into its parts and examining the parts instead) irrelevant when describing higher-level systemic formation in any complex system (like the brain). Decomposition of a system into its parts will fail to describe the new laws that are a property of the system itself. These new laws cannot be attributed to the parts of the system alone; they govern the new macro-levels and result from the complex interactions of the systems' parts; such new levels experience what are utterly emergent phenomena and are dependent upon connections that are created amongst different elements within the system (such as synapses in the brain, or memories).

An ever more crucial question, and one that merits considerable pondering (even though we can hardly provide any conclusive comments), concerns the threshold at which this change from quantitative to qualitative occurs. How many brain cells does it take for the collection to start thinking? Is there any property within the evolving system of the brain that could potentially determine this? Or is thought simply an unknowable emergent property?

Standing in direct contrast to reductionism is the notion of holism,³ namely that parts cannot exist independently of the whole; the emergent properties exhibited by complex systems cannot be reduced to individual parts. Holism stresses that parts cannot be 'understood' without reference to the whole. Of course, this book claims that reference to/understanding of the whole is also impossible; both reductionism and holism may have a utility but at the cost of introducing paradoxes.

Pondering such difficult questions should be left aside as what determines the emergent behaviour in any system is heavily dependent on the system itself, and by implication on the observer who chooses the system, thereby observing some particular emergent properties while at the same time ignoring others. By its very definition, emergence cannot be reduced to something else. However, far more important to the thrust of this book is the

recognition that there are indeed emergent phenomena: a set of properties that are based on, and at the same time emerging from, the system's components and their interrelations. Such emergent phenomena cannot be fully accounted for in advance; they are heavily dependent on the internal complexity of the system, on the processes that guide the interaction between system and environment, and their state at the moment of formation.

Communication

As previously remarked, communication between elements of a system leads to a compromise in the elements' connective capacity. There needs to be a reduction in the complexity of individual elements so that they can interconnect with other elements. The internal complexity of a system, perceived to be a surplus of possibilities for the system's own restructuring, is needed in order for the system to regulate itself, and to control its actions and reactions, to maintain its identity, and to renew or repair itself while interacting with its environment. Control here is not to be taken as a causal mechanism within the system. Because of the complexity, intrinsic both in the system itself and in the environment to which the system is structurally coupled, the system can anticipate environmental and internal influences, but cannot manipulate them with any degree of certainty.

The environment itself is a thriving bubbling mass of systems. As the environment of any system is perceived to be substantially more complex than the system itself, the system becomes dependent on the constant restructuring of the complexity of its environment. As a response, the system restructures itself according to its own internal complexity, namely its surplus of possibilities for re-interconnecting its elements. The system moderates the exchange of feedback with its environment in a process of continuous adaptation. This adaptation does not always serve the system well. Systems may become extinct, and do so frequently, depending on their capacity (rather incapacity) to survive the changes in their environment.

Hence, from the development of new systems and the breakdown of old systems that result from interactions within the environment, we can infer that there can be no permanent control over a system that is continuously evolving. There is only a limited form of control in the sense of purposefully directing a system's procedures as they exist in their present states. These control procedures will have evolved along with the system, but they are as much a consequence of relative stability of the environment, namely the order sensed by the observer in the environment, as of the system itself.

Self-reference

All of the processes described above are very important in how any system functions and how an observer perceives it. A system is differentiated by its environment; in doing so, it is established as a unique entity that is co-dependent with its environment, and at the same time must survive the positive feedback that may destabilize it. In order for the system to survive the changing environment and processes of positive feedback, it attempts to regulate the exchange of feedback through its boundary. To be effective in sustaining itself it has to utilize the surplus of possibilities of its re-constitution that exist in the form of an *internal complexity*: the mechanism for dealing with environmental complexity. That having been said, the authors must comment on the phrasing of these latter sentences. The reader must still remember that every system is brought into existence by the act of choice of an observer. And yet somehow, as is quite normal when discussing systems, we are suddenly talking about that system as if it is blessed with self-action and the originating observer has been abstracted away. We are back in the territory of orders of observation, just like with the prisoner brainteaser in the previous chapter; and this is why much of the remainder of this book will be considering the implications of such orders of observation.

Reading the above paragraph carefully we will notice that with every single systemic function described, the apparently self-active system has to refer to itself in order either to carry out a particular function or to deal with the complexity of its environment. Broadly speaking, this is the basic idea behind the concept of *self-reference*. As Luhmann notes:

Our thesis, namely, that there are systems, can now be narrowed down to: there are self-referential systems ... there are systems that have the ability to establish relations with themselves and to differentiate these relations from relations with their environment ... one can call a system self-referential if it itself constitutes the elements that compose it as functional unities and runs reference to this self-constitution through all the relations among these elements, continuously reproducing its self-constitution in this way (Luhmann, 1995).

The primary distinction used in this regard is that between system and environment. All of the foundations of Systems Theory are based essentially on this distinction. To be capable of identification by an observer, the system must be differentiable from its environment, but the same distinctions

between system/environment can apply reflexively within the system itself (i.e. internally). This is rather characteristic of a system's self-referential nature.

That self-reference has a key role to play in theoretical descriptions becomes evident in the use of the concept in major philosophical and scientific works. In an insightful comparison of the works of Michel Foucault, Friedrich Nietzsche and Niklas Luhmann, Stephen Rossbach describes how Foucault came close to the concept, Nietzsche even closer, but it was Luhmann who, many years later, made self-reference the centrepiece of his work by providing a theory for social systems, and at the same time consolidating Systems Theory (Rossbach, 1993).

Luhmann himself was greatly influenced by cybernetics, and in particular second-order cybernetics, which already included concepts of control and communication, learning and adaptation, (co-)evolution, and most relevant, self-organization. With the theory's use in biology, and in particular via the concept of *autopoiesis* by Maturana and Varela, systems were seen to have another very important property (Maturana and Varela, 1998). The word autopoiesis comes from the combination of two Greek words, namely those of *αυτο* (auto: meaning 'self') and *ποιώ* (poiesis: meaning 'to make'). Autopoiesis refers to systems that have the capacity to 'make themselves', insofar as this refers to the systems' capacity to refer to themselves and thereby to re-constitute their functioning parts.

One of the first accounts of the concept of self-reference comes from Korzybski in describing language as a 'uniquely circular structure, where an "effect" becomes a causative factor for future effects, influencing them in a manner particularly subtle, variable, flexible, and of an endless number of possibilities' (Korzybski, 1948). This idea of a structure, a bizarre form of re-entry, a form that enters itself and hence can be characterized as self-referential, has intrigued many researchers over the years.

The relationship between complexity and self-reference is also crucial. For if any type of system confronts an increase in environmental complexity, such an increase can only be 'controlled' (this is not really control, merely an attempt to cope) via a series of systemic self-referential processes that have the potential of increasing both the system's internal complexity and hence the pattern of selections within the system. These in their turn can allow for a greater degree of flexibility in the responses from the system; but such a process cannot be characterized by mere causalities. In this manner, self-reference can also be recognized as the crucial mechanism

with which the system uses its own internal information system in attempts to reduce the complexity of the information that is its interpretation of its environment, so that it can survive both that complexity and the changes of its environment.

There are three predominant meanings that can be distinguished when referring to the concept of self-reference. According to Felix Geyer these are: a *neutral meaning*, whereby any changes that occur in the system's state are dependent upon the state of that system at a previous moment; a *biological meaning* whereby the system contains information and knowledge about itself; and the stronger *second-order cybernetics meaning*, whereby a system collects information about its own functioning, which in turn can further contribute to a change of its functioning (Geyer, 2002).

Clearly, self-reference means much more than merely what the two words alone imply, namely a reference of the system to itself. For that would simply end in a tautological form that would be of little or no use, and one completely de-contextualized from the broader systems-theoretical context. Self-reference must instead be seen as a concept central to systems. In order to resolve the issue of de-contextualization, the following key aspects need to be considered:

- i) Self-reference is fundamental to the formation and survival of a system. The system not only refers to itself and its constitutive elements, but also maintains that (self)-reference for sustaining its functions. In this way, the system is autopoietic, for otherwise, if self-reference is not maintained, the system collapses.
- ii) Self-reference is fundamental to reducing environmental complexity: the system refers to itself and to the relations that support it, so that it can exploit its pattern of selections. By exploiting this pattern through self-reference, the system is better able to increase its internal complexity and contingency in order to cope with environmental changes.
- iii) Self-reference is fundamental for information processing, whereby the system refers to itself by interrogating those elements that are supported by its information system, which is a necessary sub-system of every system.

However, in all this talk about systems we must make it quite clear that systems do not exist as 'things' in themselves operating in what is the unknowable non-linear complexity of the 'real world' around us. Systems

are products of the mind of an observer who decides what to observe, what distinctions to create, thereby designating those systems. The hypothesis of this book is that systems emerge from the structural coupling of observers' cognition and observation. They are the means through which we develop the concept of *structure* in social, economic, political, scientific and other contexts, as well as the means through which we impose ourselves on the *Chaos* all around, and thereby pull usable and useful information out of it. In effect, the identification of systems is dependent on observation.

The creation of any particular system can be portrayed as a bottom-to-top process by an individual, which functionally differentiates that system. However, as Luhmann remarks, that creation occurs within a society; for example the invention of coinage leading to the differentiation of an economic system (Luhmann, 1995). Nevertheless it is still the structural coupling between cognition and observation in the minds of various individual observers that allows the system to develop. By interfering with each system's processes, each observer is both participating and guiding the system in its development. However, a surplus of observers, leading to a surplus of differentiations, implies that the system experiences an imposed complexity, far beyond its intrinsic complexity. Hence, the self-referential development of a system can never be causally determined.

To the authors, the ability to create systems is the self-referential stuff, the way and the means, of both observation and cognition. What this thinking implies for the human condition in general and for the scientific approach in particular is now analysed in the chapters that follow.

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CHAPTER EIGHT

On the Premises of Observation

The Delusion of Objectivity

The first part of this book was a mere foray into *delusion*. Now we must look in more detail into how delusions come about, recognizing them as the systemic encapsulation and extension of frames. We can never communicate such very personalized and private non-linear delusions to others, only the linear frames that cognition pulls out of them. The frames themselves are not singular entities, but compound constructions. They are a fusing of not only an individual's self-reference to things observed in the world via delusions, but also the highly complex and sophisticated frames assembled by others from their observations and then communicated: what we can call theories for lack of a better word.

The authors claim that these linear frames, and their precedent and consequent systemic delusions, are the basis by which we humans infer meaning; in other words, delusion is both a prerequisite and a consequence of cognition. Thus cognition is not understanding, merely a consistency underpinning useful descriptions, which then factors in to build yet more frames and delusions; and out pops the amazing fact that thought can trigger thought. Hopefully, the descriptions written down in this book will trigger the cognition of each reader to form appropriate personal descriptions, and thereby to appreciate the notion of delusion, although with the proviso that being non-linear, each delusion may be labelled as a delusion, but it will never, it can never, be fully understood. For delusions are the unknowable way we think about the world, the basis of understanding; however, a tool used for describing can never totally describe itself. All that is possible is a useful refinement of ignorance. In that refinement, the intrinsic linearity makes frames more approachable and communicable, but never knowable.

Cognition itself is presented here as just one of many recursive and ultimately self-referential systems of chicken and egg¹ delusions and processes that inhabit the systemic appreciation of the world endorsed in this book; a world that is observed as a system of delusions.

One such delusion already addressed in Chapter 3 is causality. Causality is not in the 'real world' of phenomena, but is a personal delusion for imposing meaning on relationships between events necessarily happening in that world. Thus meaning doesn't uncover any causes there, no matter what the

intellect tells us. Causality is a prescribed fundamental component of the way we think about reality; a prerequisite, a building block of meaning/logic, not a truth uncovered by thought. There is no *why* in the way the world works; 'why' is solely in the head of an observer, and its function is to stimulate further distinctions that acquire new descriptions. It is the first step of any delusion-based cognitive system that is able to question itself about the validity of its own validity. Although even that is a misunderstanding. The descriptions that are the by-product of cognition cannot be elevated to an explanation that surpasses the limits of cognition itself. Any answer to the question 'why?' must be a delusion. When we think we are explaining 'why?' we are merely communicating a description that answers 'how?'. One that is formulated as a sequence of events within the self-referential delusions of causality. We can describe 'how' an apple falls by using the scientific concept of gravity, but 'why' it should do so stays as elusive as ever.

On a more mundane level, but by the same principle, one of the authors was called in to his local high street bank to find out why its computer system had him entered as a fourteen-year-old girl. He and a bank employee managed to work out 'how' and in what way the database entry had been changed, but 'why' it had come to be altered remained hidden in a conspiracy of paradoxes. Of course, what we are 'explaining' here is a cosmic joke: why there can be no 'why?', itself a paradox. A paradox that strikes at the very heart of causality: every answering of 'why?' will inevitably contain other unanswered 'why?'s: the chicken and egg dilemma again. We are back with the child's incessant asking 'why? why? why?', and its exasperated parent's terminating response of 'that's why', forcing the child back onto constructions made up of accepted and acceptable shared-delusions.

What is necessarily so in the world just happens to enable a consistency between each delusion and the world it describes, which in turn permits us to answer questions like 'how?' by modelling the world via delusional frames. However, that consistency too doesn't need to be in the world; all that is required is for our cognition to be taken in by the smoke and mirrors of delusion, and then for us to ignore any inconsistencies and paradoxes.

From this sceptical axiomatic position, the authors cut through the perpetually recursive self-reference in cognition. Naturally they too must resort to theory, although they always view theory as an imposition of choice from among their personal collection of shared frames, not as some truth implicit in the world. Thus they chose to introduce the notion of system to describe various processes within the world observed via cognition. System

is the cornerstone of the analysis that the authors are undertaking in this book. This justifies their treatment of cognition itself as a self-referential and ever-expanding system of taken-for-granted delusions. And indeed, delusions too appear systemic in their dynamic behaviour.

However, all of these concepts involve a sleight of hand on the authors' part. For convenience, thus far they have skated over the detail that with every delusion, being systemic, someone, some person, still needs to be deluded. Cognition occurs in the head of a distinct and unique individual, and that individual first needs to sense/observe the world in order to act in it. In each particular instance of an observation, the observer, the person doing the observing of the world through processing data from his senses, needs to observe and collect data, to choose to distinguish between that data from that world, before the necessary delusion (and hence before cognition of that situation) can even begin.

In this regard, the specificity of the *thing* being observed remains ambiguous, as it is rarely one thing alone that can be considered by any one observer. Any thing being observed has an environment from which it is cut off in order to be observed. Cognition is the mechanism through which this artificial separation occurs; it is the mechanism through which *a thing being observed* becomes the *system* that is observed, and the mechanism through which the system is distinguished from an environment. However, as the definition of any system is an observer-relative act, there is always the possibility that the thing being observed constitutes an agglomeration of individual elements that is viewed, whether constructed in an instant or over an extended period of time. For analytic simplification, and without jeopardizing the generalization of their observations as authors, the characteristics of observation are analysed in the sections that follow. At the same time, it is useful for the reader to remember that while definitions can be drawn differently, which is a problem that is prone to endless debate, the definitions in themselves are less important than the relations that are developed between the elements.

Added to this we also finally confront head-on Luhmann's enigmatic assertion that 'the world is observable because it is unobservable'. Working on the reasonable presumption that observation is possible, in the next few chapters we produce a *reductio ad absurdum* argument to show that 'real observation' would lead to the condition that Luhmann calls hyper-complexity: the impotence of layer upon layer upon layer of orders of observation. We will see that cognition somehow manages to deny this absurdity, and collapses it all down into a false objectivity, the result of

which we will label 'self-stochastic observation' (of which, more later). Thus we delude ourselves into believing that what we do observe is an accurate representation of the world itself, and this we use to advantage.

The Impossible Dream

To help clarify the situation, an overview of some of the material in this and the following chapters is now presented to assist the reader with a partial roadmap. Consider A observing a *scene* B, which can be a component of a larger scene, or can itself contain other scenes. B is a complex agglomeration of things that it is indicated to be a single thing, one entity (that is labelled as B) as a way of reducing the complexity that is already present in that scene. What the authors mean by *scene*, just as with delusion, is left deliberately vague. It covers anything from a highly complex and unstable social situation to more consistent scientific experiments, such as studying the humble hydrogen atom (see below).

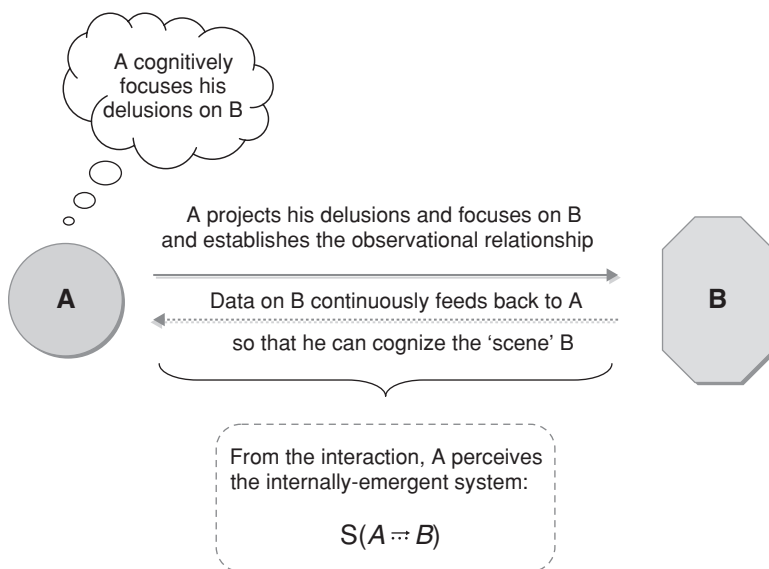
For the time being the authors ask the reader to consider the scene using vision as a metaphor for observation, and to worry about the details later: see the postscript following Chapter 9. Just think of the *scene* itself as being complex, and what A is observing therein is internalized according to his cognition, as a delusional system that emerges dynamically from the observational interaction that he has with B. The overall process is encapsulated in the symbolic representation $S(A \rightarrow B)$. Deconstructing this representation, $A \rightarrow B$ denotes the unity of the observation; it is meant to indicate that the observation is a consequence of an interaction between A and B. The system S emerges from the observation and is the way A perceives the unity of himself observing B. The small unidirectional arrow from A to B implies that an observational relationship is being established, but that this relationship is observationally initiated by A, which is why A appears before (to the left of) B. The dots below the solid arrow lead back from B to A and imply that there is feedback from B to A, which aids A to continue his observation of B, from which there is more feedback, and on and on. This feedback is necessarily established with the initiation of the relationship between A and B, and is fundamental to A's dynamic construction of S as an emergent system. Obviously, without such feedback, S could not exist as a dynamic system. Once the system has emerged from A's observation, then it is subsumed into A's memory and added as another of his systemic delusions.

Of course, B itself will have components, and also be a component of larger *scenes*, and in building up the system S, at any moment A can shift his focus between B and its components, or the larger *scenes*. Each change

will involve new distinctions; and new residual categories, new paradoxes, all the implications of which are ignored in the self-referential fine-tuning of the system's definition within A's cognition. In effect, each change will involve new systems and sub-systems, or even supersystems that contain S as a sub-system. Thus the term '*scene* B' stands for a cognized aggregation of systemic concepts that will be further differentiated, thus providing A with a range of different possibilities for what may actually comprise B. The authors appreciate that there are a number of epistemological and ontological issues that need to be resolved here. These are discussed later. What remains of importance for the moment is to clarify conceptually some of the mechanisms under which observation can be established.

Consider Figure 8.1, with A observing B. Observer A chooses a perspective in which he projects his delusions onto B, and thereby, via feedback, dynamically observes B. As A initiates the observation and establishes the observational relationship, a system emerges from the interaction within A's cognition, and this is absorbed into A's memory and delusions. This emergent system we call $S(A \rightleftharpoons B)$, that is, the system S that emerges in A's perception after the observer A repeatedly projects his delusions, receives feedback from B and recognizes within his observation that he observes something, a *scene*, which for the moment we call B.

Figure 8.1 A schema for observation



In projecting his delusions, which guide his observation of B, A is actually choosing what he is describing as B. For even the target scene B is itself the result of an act of choice by A. Each component of the scene is also uniquely chosen by the projections of the observer; it is sampled using past experience, for otherwise the totality of detail in the scene would swamp the observer. Thus no two observers can access exactly the same scene, because no two purposes, no two delusions, no two projections are identical, and hence no two observer choices are identical.

Despite observation being isolated within individuals, communities have nevertheless developed the shared-delusion (the authors call it the impossible dream) that members can communicate perceptions (in that they can convey the system S for each observation to others in the form of a frame), and thereby each member can observe the *same scene*, and subsequently share information about it. In the world of science we shall see that in the main this delusion is not too problematic; however, in societal situations this is quite another matter. In all cases there is always the problem that any other observer C, when considering the same scene B, will actually be observing a personalized and slightly different one, which we can call B', and will be interpreting this similar B' as a system $S(C \rightarrow B')$, and so C's perception will be something subtly but quite different.

In chasing the impossible dream, A wishes to communicate a widely understood objective description of what he has observed/perceived to others in his community of choice. He must first encapsulate the essence of the observation $S(A \rightarrow B)$ by simplifying it (forcing it into a linear form), and represent that simplification using one (or more) of the shared notations available to him and his community: for example using mathematics, language, painting and photography. By *objective* here, we mean another observer C would believe he was considering exactly the same B (namely that B and B' are identical), that he was perceiving the same system as A, namely that $S(C \rightarrow B')$ is identical to $S(A \rightarrow B)$, and that when communicating it himself, C was transmitting exactly the same description as would A.

In the event that A is attempting his transmission of his perception of the unity of his observation of B, namely the system $S(A \rightarrow B)$, A has to step outside that perception/unity to create from among his many delusions and memory an instance, a frame $F_{A \rightarrow B}$ or series of frames: for example this could be an expression of a theory, a single book, all the books on science, a mathematical formula, a poem, a realist or surrealist painting, a photograph, a movie, just a word or even a hand gesture. By frame $F_{A \rightarrow B}$ we refer to a

particular depiction of regularities within the coupling of A's delusions with $S(A \rightarrow B)$. With the expression of the frame using some common notation, all of those involved believe that the regularities have been successfully externalized. Depending on the complexity of the system, a frame can vary from a highly involved set of communications like a book (indeed this book, because here the present authors are describing the process that they are undertaking) to something as simple as a formula, or even a single word, or sound, or a gesture. Each frame will exist in conjunction with a whole set of other frames, so that the observer can construct more and more complex configurations.

Before a community accepts a frame, it must first prove itself appropriate and reasonable by undergoing various tests, and by being accepted by the reasoning of others. Alternatively, it could be rejected or ignored. Alongside various empirical examinations, the frame will also be confronted by a liberal mix of popular sentiment, political power and social biases, as well as each individual's vague feelings about validity. Each culture can be seen as an agglomeration of frames, both explicit and implicit that has come to be accepted over time: a community of shared-delusions that has stood the test of time. Education within a culture is then a rite of passage, where novices continually re-member themselves to the community by accepting such a socially agreed collection of frames and instances of common notations.

The scientific community is no different, although it is somewhat more formal in its procedures for accepting frames, although it too is awash with political power games. Science insists that each frame must be formulated in such a way as to be empirically falsifiable. Each candidate frame will remain a mere hypothesis, which will be rejected whenever a legitimated test contradicts it. If a particular frame undergoes a sufficient number of instances of tests and survives, the frame will finally gain acceptance in the community, although what is meant by sufficient will always be a moveable feast.

For such sharing and testing to take place the observer has to externalize regularities in his observation; and, using a notation, fix them in a frame that he believes will stay unchanged, exactly as he made it, and where it denies the surrounding paradoxes and reinforces his interpretation of the observation. Thus the frame forms a pragmatic sink for the noise surrounding the observer's senses, delivering a springboard for opportunistic action. Order coalesces around this frame, thereby making his interpretation convincing both to the observer himself and to others.

Thus a frame has an added bonus of reflection, in that it can help the cognitive observer A to concentrate on B, and thereby focus on what it is about B that will be observed. What is being observed in B feeds back and helps A both to identify further frames, suitable for observing either B or other entities in the scene, and dynamically to re-construct the meaning supposedly held in the frames themselves. Because each frame is expressed in a common notation,² another observer C assumes he can both observe that 'same' scene and 'understand' what A is observing in that scene from a so-called second-order observation (C observing A observing B). This C builds from memories of his own previous observations, and which he further assumes are based on the same distinctions that he (C) would have made in the situation of a first-order observation.

That C can put himself in A's shoes is quite a delusion. However, the best C can actually do is to re-construct from $F_{A \rightarrow B}$ a vague and necessarily distorted shadow of A's observation, and absorb this into his memory and delusions. This will alter C's present perception of the scene B', leading to a new choice of scene B'' and a new first-order observation (we are being somewhat disingenuous here, because for each observer the perception of any scene will be in a perpetual state of flux). The ultimate objective dream for the community is for B, B' and B'' and all the other dashed Bs to be identical, and with the systemic descriptions independent of the observer. In such a scenario, the dream of objectivity projects a collapsing of all the emergent systems from these interactions. Hence systems $S(A \rightarrow B)$, $S(C \rightarrow B')$, $S(C \rightarrow B'')$ all collapse into a seemingly objective entity S_B , with the observer being suddenly abstracted away: the delusion that everyone observes the world exactly as it is, whereas all they have is an agglomeration of frames synthesized from the frames of others and their own 'self-stochastic observations' (see later). However, even A's observation is not uniquely preconfigured. A's mood will impact on his internal choices of delusion, of his personal frames, and the frames of others, thereby affecting his choices in observing B, and subsequently the construction both of any new delusions and of frames used to communicate any other observation.

However, no delusion can be expressed completely as frames, hovering as it does deep in the subconscious. Nevertheless, those delusions that we believe are accessible and communicable as frames will coalesce into the toolkit of appropriate frames, enabling the delusion that every member C of the community observes B', not as his own unique system $S(C \rightarrow B')$, but as the same shared observer-independent system S_B .

It is this shared-delusion that enables us to make our way in a social world. From this perspective, the social world of a scientific theory is then a particular restricted collection of shared-delusions/systems and frames. The frames are themselves of various degrees of sophistication. Consider the frame that could be used to capture the delusion of gravity. That frame could be simple text commenting on the *fact* that things tend to fall, or it could involve Newton's Laws, or even Einstein's insights. It could be argued that all three are stages of an evolution of a shared frame that describes a particular empirical observation, and with each level of sophistication a new raft of utilities opens up: for example Newton's laws enabled the science of gunnery.

However, whatever its level of sophistication, gravity remains an entity that can be framed in different ways. And through frames, all we see are shadows on the wall of Plato's cave, the cave of our senses. We delude ourselves into believing that they are an exact emulation of what is happening outside in the sunlight, but there can be no going out into the light. For better or worse, we are trapped inside with these shadows that are mere frames bouncing self-referentially around the wall in the cave of our consciousness and cognition.

The metaphor of Plato's cave is readily apparent in the case of gravity. By taking a so-called objective perspective in attempting to deconstruct the property of gravity itself, a number of frame representations are possible, not only Newton's Law, or Einstein's as noted above, but also from among a number of other new and radical descriptions. A most recent theoretical development is the concept of unparticles (Georgi, 2007), which leads on to an entirely different kind of matter: one that exudes an ungravity force. Regardless of how many different ways that gravity may be framed, the fact that more than one is possible means that an important issue circumscribes the attempt to define gravity itself. The simultaneous existence of different frames that may represent the same property (gravity in this example) introduces an important complication. The very existence of these different frames must deny any notion of an objective perspective; but objectivity is supposed causally to deliver a single-truth-encapsulating frame.

Ontologically, this creates a problem that has severe epistemological consequences: what sort of reality exists that allows for the concurrent production of similar yet different frames to represent gravity? Surely the very possibility of drawing different distinctions for the so-called concept of gravity negates the intrinsic objectivity that the frames are supposed to

encapsulate. So how then are we to make sense of all these differences? How is this paradox, which is created by differentiations, to be resolved? How is ungravity through unparticles even possible?

By simplification through denial, of course. For unless these paradoxes are suppressed, a consensus on what we may refer to as gravity cannot be achieved, and consequently practical implications on the objective property of gravity cannot be examined. What the authors find genuinely bizarre is that even in the most *natural* of all scientific disciplines, namely physics, totally artificial and thus unnatural linear expectations become incorporated into the discipline itself without raising a single quizzical eyebrow, just so that the paradoxes in theories may be suppressed. However, these paradoxes remain, and go on to influence the way the theory and the discipline evolve. For example, multiple universes (in quantum theory; indeed the notion of quantum theory itself) and the ununiverse (in unparticle physics) constitute two such examples where the physics stretches far beyond any normal expectations. The discipline then contrives theoretical descriptions from some very strange circumstances, at the very least alien to normal everyday experience, and feeds them back into itself as a discipline, in order that empirical data can acquire an apparently theoretical explanation.

Simply by questioning this process, as recommended by Feyerabend, for example by insisting that 'the emperor has no clothes', the unavoidable paradoxes rise to the surface and the communal amnesia is uncovered. Yet if we were to ask the scientific community empirical questions such as: 'how can you prove that multiple universes exist?' or 'can you show us an ununiverse?' then these questions would be met with disdain. This is unsurprising since the disdainful community is utilizing, as axioms, the presuppositions embedded in the questions, thereby accepting them without question as the foundation for attributing the status of being objectively true to any findings they derive from the original artificial, *unnatural*, and linear assumptions. To what extent reality is objectively captured in this process, or is re-constructed by the interplay of unnatural/natural (linear/non-linear) assumptions, remains equally problematic.

Observation and Cognition

In a so-called first-order observation, cognition is always and already active; and supported by memory it may even be the compulsion concentrating the observation. This is yet another chicken and egg situation: but which came first, the chicken or the egg¹? Observation or cognition? The answer

is neither, and both: because for the thinking observer, the processes of observation are structurally coupled to those of cognition. Observation and cognition for an individual will have co-evolved since and possibly before birth (Kandel, 2006), thereby assisting in the continuous expansion of memory and delusions. Every occurrence, for which participatory action is required of the observer, is dependent on all the observations, cognitive interpretations and memories that have gone before for that individual, all building and being built on delusion. Of course, that potential for and the natures of observation, cognition, memory and delusion will have also co-evolved in that individual's progenitors, and have been passed on as both genetic and social inheritance.

For within this perpetual feedback, societies become possible as systems of conglomerates of different observers, each with the apparent capacities both to observe as a group and to communicate within that group. However, these possibilities are realized only when each individual within the group is self-deluded, in that he/she shares with others the common systems that result from observation and cognition: this delusion is fed by the reality of shared notations. This potential co-evolves along with systems of communication between individuals. That is just as well, for how else could the reader take in the authors' delusions being expressed in this book?

The authors did allude to this situation in Chapter 7 on system, where they made it clear that notions such as system and boundary were not actually in the world, but in the head of an observer who is imposing the system in the first place. However, in all their descriptions, that observer was quietly abstracted away, being simultaneously there, but not there; the situation collapsed to a state where the observer was excluded; where thinking about something, even thinking about observation, is excluded from descriptions; and yet it is all in the mind of someone. This constitutes an order-less observation (a place where objectivity emerges from reflection) that may act as a simulation of different observational orders, and in a pretence of objectivity, the observer becomes removed from involvement, so that it appears that no observation is actually involved.

This raises a very intriguing possibility. What if thought is itself a self-referential by-product of observation, collapsed down to an order-less observation, a result of the evolution of the structural coupling of observation and cognition? What if cognition came into existence initially as a mechanism coupled with primordial observation to handle the complexity, overload and noise of the multiple levels of such observation? Only later did it become

conflated with thought, when the coupling evolved and emerged to become sophisticated enough to reflect on order-less observations.

The Individual Matters

Of course, the observer can never be completely abstracted away. The observer matters, because all inference starts with memory and a set of pre-constructed cognitive experiences in the mind of an observer. That observer is a singular individual, although he does imagine himself observing other observers: second-order observation; not forgetting even higher-order observation, of observers observing observers, *ad infinitum*. This inevitably ends in a cacophony of different and multiple orders of observation: a complex system of observations. However, ultimately everything must be reduced to a very singular observer: the 'I' that is you, whether in this specific case as the reader of this book or in general as the thinker considering a particular situation.

Indeed, the 'I', the reader, is making a first-order observation while reading the book. But in imagining the ideas written down by the authors (the delusion of sharing the authors' delusions), the 'I' is observing a description of the observations (a frame) made and communicated by the authors: namely that 'I' is making a second-order observation of the first-order observations of the authors. But are they really first-order observations of the authors, because these observations too may be descriptions from among their experiences, including references to other authors? Furthermore, those others referred to have had their own experiences, and they also have referred to the experiences of yet more others. What started out as a simple first-order observation has resulted in an explosion of different levels of observation that, left unchecked, would lead to impotence. Cognition, for ease of reckoning, must ultimately ignore the various orders; a necessity imposed by the structural coupling of cognition and observation. Needing to act, the 'I' collapses them down into the delusion of either an order-less, or rather a self-unconscious first-order observation that masquerades as objectivity, and in doing so imagines a 'real world' into existence. Thus every observer is forced to collapse all the different possibilities into an ultimate first-order observation precariously perched upon the objectivity of thought-induced order-less observation; this, in effect, is the function of any observer.

The 'I' operates in this complex world by inventing such objective (!) perspectives within cognition. With each perspective, the 'I' fabricates two different observers into existence: the perspective itself, an imaginary

disembodied objective observer of the world, and the self-realization of 'I' observing the scene of the perspective, although this is achieved as a reflection, and not a first-order observation. However, in doing so, the 'I' is inventing two different worlds of meaning, all adding to the complexity of orders of observation, but which, within cognition, again collapses, for ease and convenience of reckoning. Indeed without the delusion of objectivity, observation/cognition would be impossible, with the would-be observer drowning in a maelstrom of an overload of sense data.

All attempts at constructing meaning require the trigger of an initial observation, and so it is impossible to abstract the observer away. But this is also exactly what theory is attempting. The various orders of observation are collapsed: sometimes into imaginary order-less observations, which are claimed to see all, but which this book will show to be paradoxical; sometimes into the nothingness of the absolute and the objective, the so-called real world where there is no observer, no observation, but where there is still cognition of the situation; another paradox. Does this really matter? Very much so!

The False Objectivity of Theory

Every time a theory is imposed on the result of observations, in a necessary attempt to cut through the complexity with simplifying assumptions that masquerade as objectivity, that theory, indeed every theory, must collapse the multitude of orders of observation down to the order-less nothingness of a false objectivity, so that the thinker can decide, and act sensibly by imposing linearity on what is a non-linear natural situation. All theory is artificial, is unnatural, is error; all truth refined ignorance and absurdity, contrived to have this utility. However, re-establish the many levels of observation, and the tidiness and certainty that theory brings will soon disappear along with the simplicity, in a downpour of confusion, but a confusion that is a representation closer to what is actually going on.

This complexity, error and absurdity can be illustrated with a classic example from the rarefied world of high finance. Aided and abetted by computer technology, this delusion of the objectivity of theory has turned the world's financial markets into a huge global casino. It started with 'the chartists' who claimed to predict stock movements by pattern matching, as if the market was some recurring dendrochronology. Then the 'Masters of the Universe' arrived, brandishing their much more sophisticated mathematical models. Developed by the likes of Nobel Laureates Robert Merton and Myron

Scholes, these methods were then exploited to beat the markets. Accordingly, hedge funds leveraged already huge amounts of money into astronomical sums, which were then placed as bets. Failing to recognize the irony, both Wall Street and the City of London believed in a mathematical guarantee of 'riskless risk' that would profit from all market movement, whether prices went up or down. From their perspective, the market they were observing was an application of Game Theory. In that theory, the high rollers who laid huge 'buys' and/or 'sells' could distort the odds in their favour, so they could fleece the small-timers without being exposed to hazard. John Maynard Keynes's warning that 'markets can remain irrational longer than you can remain solvent' fell on deaf ears.

With the vast sums involved, even very small percentage gains turned into a tidy profit. Indeed the modellers did win big in the 1980s and 1990s, which is why the banks were happy to lend them ever-increasing sums of money. Then in the summer of 1998 Long Term Capital Management (LTCM), which had leveraged its \$4.5 billion into a \$1.25 trillion bet, suddenly lost 44% of its capital, and bank's exposure to the leveraging created huge instabilities. Only swift action by the US Federal Reserve Bank avoided global financial Armageddon (Dunbar, 2000).

What happened? Those who were originally incurring losses with LTCM did not have the luxury of a false objectivity; they were in the game not as speculators, but for life-and-death commercial reasons. Meanwhile, the paradoxes and conflicting orders of observation were conspiring. Inadvertently, LTCM had thereby turned Game Theory into a singularity; a denial of any variety in the system that is the market. Even Game Theory itself warns there is no guaranteed strategy. In August 1998 Russia defaulted on its bonds: an example of the systemic reality that variety cannot be denied indefinitely. Risk is never riskless; it can never be riskless. And Game Theory, at least in its systemic description, is merely a system of contradictory forces. More problematically, Game Theory has a major flaw, in that it assumes an objective game with rules; it presumes linearity despite ample historical evidence showing human gaming to be non-linear; one of cheating and of breaking the rules, not paying up, operating outside the game, and of playing a different game ... which is what happened in this case.

It seems that neither the chartists nor the 'Masters of the Universe' had ever heard of Goodhart's Law: 'any observed statistical regularity will tend to collapse once pressure is placed on it for control purposes', and they certainly failed to recognize the problematic nature of observation. Underlying all

the self-assured mathematics of hedge funds is a manipulation of observed regularities. But once the sums involved had become so massive, the gamblers had changed a bet into an attempt to control the system. However, there can be no permanent control. Collapse was inevitable.

The same was true of collateralized loan obligations, the instruments at the bottom of the sub-prime mortgage shambles of 2007/8, and it will be true for all the other financial instruments based on the rocket science of mathematical over-sophistication. The subsequent Credit Crunch and meltdown of Fannie Mae, banks like Lehman Brothers, and eventually the markets themselves can all be foreseen as Goodhart's Law in operation.

With these two examples from the world of high finance this book has reached that point where the authors can no longer ignore their initial sleight of hand mentioned at the start of this chapter. The time has come at last to confront, in detail, the notion of observation (and cognition), in particular when the results of observation are communicated to others.

Observation

And so back again to observation itself. To observe something in a scene (and subsequently to perceive the unity of that observation as a system and absorb it into the observer's delusions), that thing must be distinguished, separated from its surroundings, excluded from everything but itself, so that it may be reflected upon and incorporated by cognition into the system that represents the overall scene. This unavoidable and artificial distinction created by the observer has two important consequences. Firstly, in performing the operations needed for a distinction, by necessity the totality of everything else is not observed; the complement of the thing to be observed is left unobserved. It cannot be observed. However, once the distinction has been made, the totality of that complement constitutes a residual category, which is assumed/presumed to be there, but invisible, and the implied paradoxes from the truncated structural couplings are ignored.

Secondly, by identifying what thing is to be observed (the scene, or a component of the scene), that thing may constitute a complex entity in itself and therefore the very process of observing that thing involves observing part of its underlying complexity and the sub-things that constitute it. The very implications for observation in the latter case imply that the observer has, in observing, to oscillate between the thing identified for observation and both its constituent elements and the context in which it is sitting. This oscillation is based upon internal differences that succumb to the same principle: that

the moment something is observed, something else is left unobserved. Because of this foundational principle in observation, it becomes evident that the observer is struggling to manage all the distinctions and consequent paradoxes created by the necessity of observing. Connections within that entity are severed by the very act of the observer interfering. How it becomes possible to observe a complex entity, and to cope with all these distinctions created between the constituent elements, when each of these leaves the others unobserved as a precondition for observation, itself remains a paradox. That this complex idea is vague and difficult to grasp is perfectly sensible; because in the above description we are jumping to-and-fro across the interface between distinguished individual entities (and their concomitant paradoxes), and all the other distinguished entities (and their paradoxes) that go to build up a systemic description of a scene. It is only to be expected that such a description will come in and out of focus and that delusions must by necessity remain vague and unapproachable by cognition.

Once the initial observation of a scene has been made, the observer has artificially isolated the observed system from its environment, but with which the system is structurally coupled. The circumstances under which the observer isolates the observed system from its environment create interconnected observational restrictions: the observed system may also act as an observing system itself, thereby observing predetermined aspects of its environment, and with which it too has become structurally coupled, while at the same time leaving other elements within that environment unobservable, as a necessity for cutting down on the complexity of its own constitution.

And here lies the dilemma. In order to observe the whole, everything invisible must be made visible, but then nothing is distinguished from anything else, from everything else; nothing is different, and everything is different.

As Luhmann puts it:

But in order to observe, an observer needs to 'perform' operations. Distinctions need to be drawn – and by drawing them, respective other sides are excluded, these exclusions being not reflected upon during observing. To put it shortly: we are dealing with a permanent production of blind spots. In order to see that which a first-order observer does not see, a second-order observer is needed who may observe how the first-order observer constructs his reality, but who, by doing so, produces blind spots just the same way – and so forth (Luhmann, 2002b).

Thus, the observer cannot observe his act of observation (as the eye cannot see itself seeing, or any other sense, sense itself operating). The observer 'knows' that he can observe, but ultimately 'observing' and 'observing that observation' are quite different. In the former, a distinction is being made; in the latter both that distinction and what it is distinguished from must be subsumed into a new distinction. However, in the latter case what that observer must do is to infer/observe another observer, a perspective, a proxy caught in the act of observing. Such a cognitive inference is a second-order observation, building on memories and assuming the same distinctions as the first-order observer would have made.

Here we must highlight this phenomenon of cognitive inference and the notion of order, and not just slide them into the discussion without comment. To the authors these concepts are central to the workings of human cognition, and yet they introduce all sorts of problems. For, as will be discussed later, there is a weakness in using the word *order* when analysing observation. As we shall see, higher-order observations introduce all sorts of non-linear complexity into observation, and so we must assume that objectivity is the epitome of a denial of such orders: a situation where the implied non-linear complexity of observations collapses into linearity. What is being discovered from an observation (the perceived epistemic certainty of objectivity) has to be detached from the multiplicity of all other orders of observations that came together in that discovery.

What Luhmann is saying is that observation is not, cannot be, what we think it is. He has uncovered the fallacy in all linear interpretation, by pointing at the non-linear nature of 'real observation'. Instead, human observation is conditional, but those conditions are necessarily unobservable, unappreciable, hidden in paradox, beyond observation, beyond cognition, beyond logic; these conditions are actually necessary preconditions of observation, cognition, memory and logic, but they must be denied for observation to operate.

If one tries to observe both sides of the distinction one uses at the same time, one sees a paradox – that is to say, an entity without connective value. The different is the same, the same is different. So what? First of all, this means that all knowledge and all action have to be founded on paradoxes and not on principles; on the self-referential unity of the positive and the negative – that is, on an ontologically unqualifiable world. And if one splits the world into two parts, marked and unmarked,

to be able to observe something, the unity becomes unobservable. The paradox is the visible indicator of invisibility. And since it represents the unity of the distinction required for the operation called observation, the operation itself remains invisible (Luhmann, 2002b).

Here Luhmann uncovers a most powerful ontological delusion, a drive to qualify the 'ontologically unqualifiable world': the notion of the system and its complement, the thing being observed separated from everything else. Observation requires that we, as observing/cognitive beings, must distinguish and categorize the distinctions informed by memory; we indulge in the fallacy that we can separate each thing from its 'everything else', and treat that complement as a residual category. It is with this separation and categorization that we build up the memories that feed back into observation and cognition. So observation is, by its very nature, non-holistic, artificial, unnatural. 'The world is observable because it is unobservable.' 'The condition of its possibility is its impossibility.'

Cognition requires both the observation of each categorical thing and at the same time the non-observation of the unbroken links that remain between it and its residual category. Meaning is based on the error/absurdity of compounding separation upon separation, a mountain of things categorized and distinguished from their residual categories and stored in memory. In the observed world, each thing and its complement can only exist as complements; they are otherwise non-referential. All reference between them is cut, as the distinctions needed by observation (cognition and memory) must separate utterly, with all connections severed.

They are cut because a connection would require a simultaneous observation of a separate everything else, which in itself necessitates further observation. This would discharge the original observation, thereby renouncing the choices made from it, other than leaving them in memory. In one fell swoop, Luhmann's uncovering of the linear nature of observation/cognition, in what is a non-linear world, has supplied the authors with what proves to be the theoretical justification for their rejection of any unified Theory of Everything.

However, observation is something we humans engage in, whether we want to or not. Wherever there is life and cognition, observation becomes a constitutive element and specifically in the case of humanity, that is of paramount interest to this book. Thereby, observation is intrinsically related to each human life form's very existence and survival. Non-observation for

humanity would mean that there would be no mechanism for filtering the data on changes in our environment. Consequently, the human cognitive system would either behave arbitrarily or remain static, and blindly face untold dangers, not being able to conceive of its own cognition conceiving itself acting in the world.

Therefore, a necessary precondition for each individual human system's survival is the ability to profile its environment, and to position itself within that environment in order to create beneficial connections for itself. An examination of the premises of observation is therefore crucial because being able to observe is critical, not only for sustaining human life (and our individual survival within each of our respective environments), but also (and of particular interest to the authors as students of Information Systems) for the development of artificial constructs (non-human actors) like computerized algorithms that become equipped with an observational capacity infused by the will of humans.

Can Machines Think?

Almost immediately, this assertion raises the question of whether machines can observe; and by implication of the above theory, can machines think? The authors' answer is dependent on the difference between how we treat observation within the human realm and how we treat observation within the realm of machines. Inasmuch as observation is reflexively related to cognition, then machines can never observe, for they have neither the cognition nor the intelligence that comes with it. Intelligence in this regard is not logical, but biological. The evolution of such intelligence may very well be a product of both logical and biological operations, but never a purely logical one. It is the spontaneity in the generation of distinctions that ultimately directs observation, and becomes the guiding factor in an emergent cognition (such as that of humanity) over its evolution, and which differentiates thinking from a purely reductionist approach to constructing a 'cognition'. Since machines are restricted to carrying out simulations of logical operations, their operations are totally describable and can in no way be called delusional, then how can they possibly observe; and why should we treat their so-called observation as anything more than mere data collection linked to a set of pre-programmed actions?

Nevertheless, there is one particular reason for assuming that algorithms do have some observational capacities, but only in the world of computation. This is because that world is one of excessive scale, information overload

and induced complexity that cannot be observed by humanity, only by machine; and that machine has been constructed as a proxy observer specifically to deal with situations in which humans cannot cope. However, such observation by algorithms is devoid of all spontaneity and cognition (and system generation) and so is not in any way what this book would call observation.

The difference in how the term observation comes to mean different things within the two distinct domains of man and machine can now be better articulated and considered. While humans possess a spontaneity in the generating of distinctions (though limited by sense-making restrictions and cultural biases), machines cannot spontaneously generate distinctions without a computational and engineered platform that will guide the process. Computers may, of course, adjust, distort and manipulate the distinctions, but the rules for such adjusting, distorting and manipulating (ultimately for data collection, and for a pre-defined purpose) are pre-engineered constructs.

Ultimately machines cannot think purposefully because theirs is a world of detail, a detail that cannot be made invisible; and the ability to make detail invisible is a basic necessity for thought. Their non-cognition implies an artificial un-intelligence, and this is precisely the machines' strength. Without non-cognition and un-intelligence, the machine operations that this book now characterizes as (hyper-)linear and automated would have been impossible. This is not to be taken as a patronizing assertion, or indeed as a celebration of the superiority of human-kind. Humans view machines to be intelligent because machines are un-intelligent. Machines thrive on linearity, automation and scale in ways humanity, because of the way we observe and cognize, could never do. Machines streamline the logical predetermined paths that are pre-programmed to perform certain functions or operations. The inability of humans to perform large-scale automated operations extremely quickly (say trillions of calculations per second) profoundly distorts our concept of intelligence, so that we are prone to believe that machines can be eventually infused with a self-determined purpose. Consequently the mundane automation of tasks is elevated to something beyond mere processing.

The authors can accept that, at the level of the interaction between man and machine, observations by both humans and machines together create scientific constructs that stand as important steps for the creation of more scientific constructs, and consequently more and different observations. However, this book will mostly use the term observation in the context

whereby humans generate distinctions, some of which may indeed be encapsulated within a technological form.

Self-stokhastik

That observation is taken to be the built-in (born-with) mechanism with which any cognitive life form expands its own cognition means that this book is describing the process whereby a self-referential³ cognitive system generates cognition out of cognition (and observation). Following on from the previous description of self-reference, and applying it to cognitive systems, this means that each such system will refer to both itself and its cognition as a requirement for both sustaining that cognition and progressing the outcomes (learning processes). Such a process will be referred to here as 'self-stokhastik'. The word 'stokhastik' derives from the Greek word Στοχαστικός, which means 'to ponder and aim at'. This peculiar variant of spelling the word is used deliberately, rather than its more usual anglicized form 'stochastic', because the authors stress that their usage has nothing to do with stochastic probabilistic models in statistics, where the adjective refers to entities that may be analysed statistically, but whose individual behaviours may not be predicted accurately. To the authors, a self-stokhastik process is one that is self-aware, self-contemplating and aimed at delivering meaning; in other words, it is a process of divination, exactly as introduced way back in Chapter 2.

Every self-stokhastik process operates both to enhance the cognitive functions of the life form itself in a self-referential manner (and always through observation) and to sustain the cognitive processes that continuously form and reform its identity. As the authors have already established in Chapter 3, from their fundamental epistemological basis of delusion, and for which they gave a series of arguments, it swiftly becomes evident that any self-stokhastik process employed by a cognitive life form will conform to the premises/principles of observation, which are in turn informed by delusions and memory. By premises/principles the authors mean here the foundations of observation, the set of rules upon which observation is based, like the creation of a distinction. Delusions in this regard sustain an encapsulation of the paradoxes that are unavoidable in any observing system; they create a black-box that allows for an observation to occur, all the while confining its consequential paradoxes, and submitting them to an invisibility without which the observation would have been impossible to begin with.

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CHAPTER NINE

The Frame of Observation and the Functional Differentiation of Science

With the recognition of the significance of observation, the authors could have concluded the book there, having closed the loop on delusion. Instead, in a drive to refine the description of self-reference, this book now takes a closer look at the underlying intricacies that are involved when observation is taking place, and expands on the notions laid out in Chapter 8. To highlight these details and their relevance, the next few chapters will focus on these implications, particularly on the objective world of science, arguably the very pinnacle of rational human thought. These chapters also justify this book's somewhat conceited title: *Science's First Mistake*.

Each observation involves a distinction, which stores up paradoxes. Observation after observation creates a mountain of paradoxes that haunt cognition alongside its memories. In all this complexity, negative feedback dissipates any difficulties, but ultimately positive feedback must confuse any comfortable set of delusions. Thankfully we operate in a physical world that is not arbitrary; there, objects tend to remain fairly consistent, or follow reasonably consistent trajectories, so that paradoxes created in observing them are aligned, and tend not to interfere with one another overmuch. That is until they do, when they cascade in as a torrent of positive feedback. Furthermore, linear descriptions tend to work quite well. In general, perception isn't overly disrupted over time. Hence, theories (expressed as linear frames) of that world (such as those represented by a large number of scientific fields), although unnatural and in error, and thus absurd, can remain stable; stable, and with a utility; but not true. We will now consider how the overlapping of such paradoxes, multiple orders of observation and imaginary observations interfere with any possibility of objectivity.

The Act of Observation (and Not Observing)

First and foremost, and something well worth repeating, the authors fully subscribe to Luhmann's viewpoint that any observation is about creating a distinction: a difference between what is observed and what is not. The function of creating such distinctions is to stop the totality of the world invading the senses, for otherwise everything would be swamped in white

noise. Distinctions are necessary evils for the reduction of complexity, and necessary prerequisites for observation itself.

From the fundamental premise of the creation of a difference that is implied by observation (a difference that must be imposed, so that each observer can differentiate between what is observed and what is not), this book now considers a difference that is constitutive of observation itself: the difference between the observer and the observed. This difference implies that the observer's active participation is critical in the whole act of observation, and it unavoidably presupposes the existence of an observed part. The word observation itself implies some kind of interaction between the observer and the observed.

The authors must make it clear here that observation is far more than just seeing. It is the act of using all the senses, coupled with cognition. It is informed by delusional inferences, the selective recalling of memory and reflection. This recalling feeds forward to the structural coupling of observation and cognition, and in effect constitutes the process by which memory shapes itself in a self-referential fashion. It is the total input of sense data that makes the world seem real to the observer. When that world is the world of science, then observation primarily culminates in measurement.

From this book's standpoint, the observer, a singular and distinct individual, matters. He matters because all meaning comes from that individual's cognitive application of sense data. Groups do not communicate with other groups; to say a group communicates is to use the metaphor of the group as an individual. A group in itself cannot be an observer. It is not a cognitive entity; it is not self-stochastic; it does not think; therefore it does not communicate in the strictest sense of the word. Individuals within a group communicate to share individual interpretations via shared-delusions expressed in common notations. Indeed, it is the totality of the sharing of individual communications itself that actually defines the group, along with the mechanisms that individuals establish (underpinned by a co-alignment of individual projections of how the group should function), which further allow the group to communicate with its environment.

Groups as organizational structures that themselves constitute systems are open to information about variations in the environment. Such variations, however, are then internalized within the organization, that is within the group. By being internalized, interpretation of information is required, but no interpretation can take place devoid of an individual observer with the capacity to cognize, observe and communicate. Without the individual,

nothing would be communicated to others, and complex social constructions like theory would be impossible. At the very least the ghosts of the original observers who created the frames of social norms hover all around. Hence the observer cannot be abstracted away; but that is exactly what is claimed to happen in theories informed by an objective epistemology. By inventing so-called different and independent perspectives, particularly with scientific measurement, we are actually bringing into existence separate proxy observers, and hence different worlds of meaning, which theory then collapses into one imagined and imaginary observer for convenience and ease of calculation.

Here we reach another realization, and ultimately another distinction or difference. In order for something to be recognized and perceived as an observation, which may then contribute to a self-stochastic operation, the observer who imposes the initial act of observation must be a cognitive life form; in our case, a human being. Artificial robotic life forms, so beloved of science fiction, can only observe via a designer's non-spontaneous imposition of proxy observations: the necessity of delusion is missing. In discussing the difference between observation within the human realm and within artificial robotic forms, this asymmetry becomes immediately apparent.

The observer has to be a cognitive life form, otherwise observation cannot take place as a self-stochastic operation. However, the observed object of study need not necessarily be cognitive. Actually three distinct roles can be assumed by what may be classified as an object of study:

- (a) as another cognitive life form, which itself has the capacity to employ the operation of observation as a self-stochastic process. In this case, our initial observer is observing another observer, and this constitutes a case of second-order observation. Put differently, the observed object of study is 'an observed observer'.
- (b) as a physical object, within a presumed physical 'reality'. Natural sciences (seen by the authors as artificial, linear and quite unnatural), for example, contain entities that fall within this category, whereby the observer (a scientist) observes the world as a physical reality. The scientific objective (representing of the world through various mathematical, or other notations) emerges from the interaction of the observer with the object of study (physical reality, or rather a subset of that reality). The means whereby abstract descriptions of previous observations are externalized, namely theories, notations and particularly frames, also fall into this category. Each frame is a synthesis of the first-order

observation being made by a particular observer of a scene, and is used to expand that observer's memory and set of delusions, and to facilitate the communication of his observation with others. The scene itself may reference further frames that describe observations made previously by that observer or others. Those frames may reference yet more frames, that reference yet more frames, and so on; and in such a way higher-order observations are constructed.

- (c) as an algorithmic form, which operates as an observing system in its own right, and whose acts of observation are dependent upon rules of observation that have been engineered into existence. We can make the assumption here that an algorithmic form cannot simply initiate an observation in itself by imposing its own rules for that observation.

Irrespective of the above three roles for which combinations may be attempted, we can still talk about an act of observation as a unity, which includes both the observer A and the observed scene B. This does, however, raise some thorny questions for and of the reader who is observing/interpreting the authors' observations on observation. The authors hope they have clarified this point in the text that follows.

What is Observation?

As already mentioned *ad nauseam*, observation presupposes both an observer and an observed. The distinction between observer and observed may then be subsequently subsumed within a unity; such a unity can be defined as the act/operation of observation. However, that unity creates a problem because the moment the unity of the distinction between the observer and the observed is realized, then the question arises as to who/what realizes that unity.

In order to define the term 'observation', we start more specifically with first-order observation/the act of observing: cognitive being A (the observer) observes scene B (the observed, acting out one of the three roles mentioned above, or combinations thereof) in the 'real world'. In other words, in observing B, observer A via an emergent system $S(A \rightarrow B)$ perceives B internalized within A's perspective, which initiated the observation.

All observation starts with a cognitive act of delusion. Observer A projects filters (delusions, possibly utilizing the focusing lens of frames, although not necessarily as conscious projections) to his senses, which introduce separations/differences that distinguish B, and B's behaviour (to A's senses),

from the noise/complexity all around; or more specifically differences that identify those aspects of B that are of interest to A. Data on B is returned to A via A's senses, and this is cognitively processed via A's delusions, memory and frames to give that data meaning, and all this reflexively adjusts both A's memory and his delusions, and incidentally A's subsequent ongoing observation of B, and his perception of B as an emergent system $S(A \rightarrow B)$.

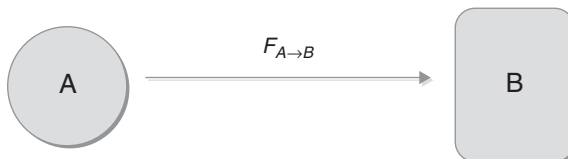
The Act of Observation

The authors do not allow $A=B$, the case where A is observing/considering himself (self-observation): self-observation can never be a first-order observation. The eye cannot see itself except as a reflection. No sense can sense itself, or any other sense for that matter, and no observer can observe himself observing. The act of observation itself is unobservable to the observer other than within the delusion of cognitive reflection.

Leaving aside implications of the quite particular and peculiar circumstance of self-observation, we now examine the general scenario whereby A observes B, as represented in Figure 9.1. It is appropriate to ask at this stage whether the utterance *A observes B* actually makes any sense, because a crucial and fundamental issue is being posed here, and which deserves further attention. The moment the distinction between observer and observed is treated as a unity, that is the moment we make the utterance *A observes B*, another second-order observer is automatically being introduced into the process, namely the entity that has noted A is observing B. For example, this new observer could be the reader of this book, let's call her R, who is looking at Figure 9.1, and is able to distinguish between *A observing B* and *herself observing A observing B*; and thereby in the latter case recognizing the operation *A observing B* as a unity that encloses the distinction between observer and observed.

However, the utterance of *A observing B* does not equate to *what A is observing in B*, as for the latter case this is perceived by A via a system $S(A \rightarrow B)$. Communication is achieved through a frame of some sort,

Figure 9.1 Observation via a frame



$F_{A \rightarrow B}$, in an attempt to open up the information in A's observation to other observers and observations. What form the frame would take is essentially dependent upon A's choice of distinctions, and it is precisely this sequence of distinctions that guides the process of constructing the frame. Hence, that frame will point towards some representable regularity in what has been observed in B, thereby masking what has been left unobserved. This masking of what has been left unobserved is not something that can be amended; it is the prerequisite both so that something can be observed in B in the first place, and for any communication to take place. These aforementioned aspects not only constitute restrictions intrinsic in observation, but also lead to complexity in observation (and to 'hyper-complexity': see Chapter 10). Every observation creates a distinction, for which there is an unobservable part, and which creates a paradox. Subsequent observations of the same scene create further distinctions that merely intensify the paradoxes on the basis of what is further left unobserved.

This agglomeration of unobservable paradoxes is impenetrable. Even if another observing system attempts to deconstruct these paradoxes by observing the unobserved side of each distinction (by means of an inversion of the observation), a series of distinctions will still have to be further appropriated. These new distinctions will introduce inconsistencies and new paradoxes into what is being observed, and thus even a temporary recognition of a paradox will create a distinction that constructs another paradox within the paradox. A distinction generates the dichotomy between observable and unobservable, hence observation upon observation leads towards paradox upon paradox.

The foundational difference between *A observing B* and *what A is observing in B* is what makes it possible to define the act of an observation in the first place. However this difference is also what collapses every higher observational order into what, without careful thought, appears to be a first-order observation, itself dependent on a seamless and objective background that permeates memory and cognition as order-less observations. This necessity is imposed by the fact that for observation *per se* to take place, higher-order observations can only be defined within the scope of another first-order observation. Luhmann gives this issue the utmost importance, when he writes: 'Observation has to operate unobserved in order to be able to cut up the world.' When A observes B, A cannot distinguish his act of observation, since that would require another operation, which can only be attained by the act of introducing another observer into the process.

This creates a paradox within observation that cannot be easily resolved,¹ even if we take into account the introduction of subsequent observers, or we dispute the very meaning of the phrase ‘order of observations’ (a point that will be further elaborated in Chapter 10). Does the utterance *A observes B* even make sense? The moment we accept that *A observes B*, then A also ceases to be the only one to observe B, or indeed the only one with access to the information that B is being observed.

The reader R is now part of such an observation, with access to not only B being observed, but also that B is being observed by A. But is that a second-order observation (R observing A observing B)? What about the first-order observation of R observing A, but without her noting that A is observing B? What about both possibilities taking place simultaneously; and where is the order in that? How much of what A observes in B is transferred to R? What is lost? Does R add something extra about B? What about this book’s authors, who ontologically presuppose an R, and who collapse their own third-order observation (namely themselves observing a proxy R observing A observing B) to a descriptive form, which includes only A and B (and then an invisible R as another hypothetical observing system that has managed to read this book up to this point, and seeing herself referred to as R)? There is a paradox, therefore, even in the problem of recognizing an order of observation.

The point is laboured here because, although this differentiation into separate levels of observation may seem like pedantry at this stage, it will be shown that this separation, particularly the different nature of first-order observations from the higher-orders, will have profound implications in the analysis that follows.

It quickly becomes evident that the concepts of linearity and order are ill-equipped for the subtleties that we require in a description of observation; subsequent sections will elaborate on this issue. The primacy given by the authors to the handling of the concept of observation has tremendous implications, and it is something that we will encounter later on in the description of science, by using an example from physics.

Acting upon Observation

In building cognitive inferences from an observation, the individual observer utilizes the raft of vague indefinable personal delusions as well as equally vague memories that have built up self-referentially within that individual throughout a lifetime of not only empirical experience but also

social intercourse. Although the individual knows his insights to be valid, their very vagueness means there is no clear way of acting upon them, and that includes communicating those insights to others.

As Luhmann remarks, 'Communication actually arises only under the precondition of a mutual lack of transparency, which includes the lack of transparency of systems in themselves...' In order to fulfil the need to communicate, human cognition has another trick up its sleeve, that of 'notation'. Evolution has delivered the delusion that human cognition can somehow tidy up this vagueness, this lack of transparency, so that the essence of a personal insight from an observation can first be condensed into symbolic linear forms/frames, and then communicated to others. The various notations include not only phonemes, alphabets, mathematical signs and symbols, but also the media of music, painting or photography, even facial expressions; and these are then prescribed with the delusion of certainty that the world is accurately captured and can be endlessly communicated.

Notations exist for a reason: to give the self-stochastic system A tools for encapsulating a mere shadow of each particular observation of B, which is perceived as a whole² – system $S(A \rightarrow B)$ – and derived from the more vague, elusive and unapproachable personal delusions. The essence of the original observation is then externalized as a frame $F_{A \rightarrow B}$ by the self-stochastic system in the form of sounds, images, text, numbers, formulae etc. (see Figure 8.1). When shared and accepted by the community, members of that community have thereby also shared the delusion that both system and frame have become the observer-independent S_B and F_B respectively. The process concludes with even the scene itself being considered as F_B rather than as B, and all the vagueness implicit in what B is, and all the observer-relative choices made about B, all simply disappear in a communal agreement grounded in a shared notation.

Of course 'the knowing about' some particular observed phenomenon is never totally captured by the frame, but there is sufficient in the combinations of such symbols for them to be the basis of both objective self-instruction and a guide to formulate action including the communication of meaning to others. Those others will then interpret the frame of processed observation with the intent of re-constructing the original meaning. But it is never that simple. The meaning tied up in the frame is subsumed into each individual's personal meanings, to give the data taken from the frame a uniquely private meaning, similar but never the same as the original. Everyone's experience of a frame is similar, but different.

Music as an Example

These somewhat esoteric ideas can be clarified with a practical example, say observing something as vague as human emotion. So that emotion can be communicated in the first place, it needs to be encapsulated and codified within a notation. Music gives a clear example. By music we could mean the representation of various compositions, each written down in a frame constructed from a notation of staves, notes etc. However, according to Charles Ives 'the music is not in the notes', not in the notation. The music is not only in the musicians playing the piece, but also in the feelings/emotions of the individuals in the audience after they each uniquely experience a performance via their own personal delusions/impressions. Nevertheless, those emotions could not have been re-constructed to such intensity without the existence of the frame of a musical score (Goodman, 1976).

Once a single observer of the human condition, particularly a genius such as Beethoven, composes a piece of music to express his feelings towards for example Nature (say in the *Pastoral Symphony*), then the very act of writing down his observations using a notation, in this case musical notation, creates a specific frame of the musical score of the Sixth Symphony. That music, however, is only a pale shadow of the total music in the head of the composer. The frame can then be communicated to other observers, say a conductor and an orchestra, so they may attempt to replicate Beethoven's observation, albeit restricted by the original notation, by the interpretation of those playing it, and by the way it is received by yet more observers, namely the audience in the concert hall, with all its acoustic ramifications.

This specific frame, the music score of the Sixth Symphony, elevates Beethoven's initial and solitary observation to something that is communicable to many, and surpasses his initial isolated purpose. The audience of a performance will also have read the programme notes, another frame in itself; the notes themselves are an observation of a Beethoven expert expressed in the notation for language (namely text). They will also have seen photographs of paintings (a frame including a frame) of an increasingly tortured Beethoven. Each member of the audience can then listen to and personally interpret the orchestra's group interpretation of the music in combination with the narrative to heighten their individual experience of the original observation. Of course, the vagueness and variability in the personal delusions of everyone involved mean that different emotions are brought out with each new performance, despite the unchanging frame of the musical score.

Another audience could have instead chosen to attend a performance of Stravinsky's *Rite of Spring* in the form of a ballet, with the dancers using Nijinsky's choreography, captured for posterity in a frame expressed in for example Benesh Movement Notation. A world full of frames beckons: frames within frames within frames *ad infinitum*.

Each of us is born into that world as a blank page, but with senses supported by a self-referential will both to categorize and to construct. Whether subsequent constructions and categorizations are genetically predisposed (or not) is irrelevant to the observations that are underpinned by them. Whatever path the self-referential process of categorization and construction may take, it will involve observation; it will involve the unavoidability of both generating distinctions and suppressing the paradoxes that come with those observations. The cacophony of such paradoxes, together with an explosion of frames that are often inconsistent and contradictory, is what effectively necessitates the dynamic re-construction of both individual and shared-delusions.

Every society socializes its members by exposing them to acceptable notations and frames that have been set down by bell-weatherers from the past and innovators of the present. Thus, as was noted earlier, the individual lives a life of self-referentially re-membering himself to his community by acceptance of these notations and frames. Education is a society's way of socializing individuals, by presenting them with socially acceptable data that must be accepted as truth. However, adrift in an ocean of paradoxes, each individual will find personal inconsistencies in this learning, and will only resolve them by a reflexive construction of a personal sense of appropriateness as he makes his way through the context of all around him. When appropriateness, both social and individual, is aligned, then the individual is comfortable in his society and will follow its lead; out of alignment, the individual must observe and choose for himself.

Science is one particular community that has developed a tactic to reinforce this alignment: that tactic being described through the concept of falsification. There are a number of issues in respect of falsification, which will be dealt with the example of hydrogen given below.

Theory as a Frame

Using his personal delusions, the observer A carries out his observation on the observed object B. Previously constructed frames, both from A himself

and from others, may be used as a lens to guide A's observation. Then, as a result of the observation, any particular frame may be adjusted or (re)-constructed when a self-referential process feeds back to A in order for him to fine-tune (deludedly some would say clarify) his personal delusions. In particular, this is what happens in the cases both of the development of scientific theory itself and of an individual's appreciation of that theory. It is appropriate to repeat Einstein's quotation here: 'Whether you see a thing or not depends on the theory which you use. It is theory which decides what can be observed.' Whatever processes take place in order for $F_{A \rightarrow B}$ to be constructed, the important thing is that A requires a frame as part of his observation of B if that observation is to be communicated.

In an attempt to simplify both the cognitive processes that were depicted in the previous sections and the notion of the communication of a frame, we provide the following simplified scenario so that we can begin to unravel the implications of the frame, which are further exposed with the example of the hydrogen atom below.

We might ask here whether it is possible for A to observe B without using a frame. The answer is yes. But in that event, we cannot anymore talk about observation as a self-stokhastik process. With our music example, we can listen in rapture to the sheer beauty of the symphony, it can enter our memory, but for it to be the basis for action, even self-development, it must be represented in a notation, although not necessarily a musical one. For if only personal delusions are used for observation, but no frame is used to capture and describe that observation and further observe that thing or something similar, then such observation collapses into an emotional though meaningless blank gazing at the world of physical reality. There would be no purpose whatsoever to categorize, classify, interpret or (of particular relevance to this book) construct, reflect on and communicate theories about reality.

The authors find it inevitable that while an attempt is being made to model, categorize, explain or describe physical (or even social) reality, a frame for the observation that aims at such modelling, categorization, explanation or description must be generated, and subsequently and continuously used or modified. The purpose of that frame $F_{A \rightarrow B}$ of a particular observation is to codify linear regularities in the relationship between the observer and the observed (see Figure 9.1), and to depict them using some notation so that supposedly they can be communicated, and considered by others or by oneself.

The necessity of using a linear frame for observation while describing self-stokhastik systems opens up ever more important and interesting questions.

These questions need to be pondered further before other observers can be introduced into the picture, and observational complexity is considered in more detail.

The frame of observation is vital as it participates in the construction of theory, and at the same time it constitutes part of that theory. The authors have already asserted that the purpose of the frame $F_{A \rightarrow B}$ is to codify the interaction between the observer and the observed in some notation, i.e. mathematics, language, musical notation, painting, dance, photography. Although from now on this book will mostly refer to the natural sciences, and not the social sciences or the arts, the authors claim that the premises of observation are equally valid for them all. The fundamental differences of these various domains lie elsewhere.

In any event, it is important to state more clearly why the primary function of the frame of observation is considered to be the codification of the interaction between observer and observed. In order to achieve such a codification, a basic prerequisite is the depiction of the codification that uses a notation. While there are a variety of notations for the purpose of codification as noted above, individually or in combinations they are utilized for depicting underlying frames that can then be cognitively clarified to oneself with the linear regularities standing out, and communicated with others; but as we have noted the delusion of 'truth' behind clarification is merely refined ignorance.

The observer, as a self-stokhastik system himself, requires the creation of frames from observation, without which no considered action, no communication of any theoretical construct would be possible; no potential 'improvement' could ever be attempted; and hence there would be no self-referential mechanism to sustain and evolve the self-stokhastik system itself.

Furthermore, the ability to create frames immediately raises the exciting self-referential possibility of *cognition out of cognition*. Sustaining the self-stokhastik system itself implies that stokhasticity, the function of all self-stokhastik systems, is preserved. Indeed, the production of cognition out of cognition is therefore a characteristic of all self-stokhastik systems. In 'physical reality' the function of cognition out of cognition has found the ideal environment with which such self-stokhastik systems could become structurally coupled, and 'all that they could ever hope for': namely an application domain and an environment in which they can survive and prosper. With the structural coupling between each self-stokhastik system

and its environment, it is apparent that cognition out of cognition exploits the environment to which it is structurally coupled, and to which it can be applied. This gives rise to *theory out of theory* as the self-stochastic system keeps carrying out a series of self-referential interpretations of observations.

The product of such self-reference, which is fuelled by the system having access to its environment, conjures up other important esoteric delusions: *objectivity* and *truth*. The restrictions on observation, the structural coupling and the utilization of self-reference quickly become absorbed into the background of cognition where they are ignored. For this background swiftly limits each self-stochastic system to within its own mode of self-reference, and for which it has developed a series of utilities and frames for observing those aspects of its environment that are deemed to be of interest and benefit.

Using the Model of a Hydrogen Atom as a Metaphor

Having established the importance of the frame of observation, this book has reached a critical point in its development. All the pieces are now in place for a description of how the notion of the frame of observation is utilized in the process of discovery, and the communication of a discovery across a community: any discovery, and not just scientific discovery. The key lies in how self-stochastic systems such as human beings utilize frames in the preservation of their self-stochasticism by expanding the linear schematic basis of their delusions of truth, and in doing so continuously and self-referentially produce new frames of observation, and modify existing ones by carrying out yet more and new observations.

The process will be illustrated here with the use of a metaphor for the way science is abstracted out of observation, the simple example of the hydrogen atom: the atom of the most abundant element in the universe, overlooking the fact that the existence of a universe is problematic in itself. Although it should be added that the process we describe is typical of all socially sponsored understanding. The metaphor points at the basis of both how self-referential delusions operate and ultimately why science itself, and indeed any claim to capture meaning, is a delusion.

Science identifies the hydrogen atom as the simplest atom: the starting point of the Periodic Table of Elements. The hydrogen atom consists of an electron spinning around a proton: the orbital model attributed to Niels Bohr. An electron is a particle that carries a negative electric charge,

whereas a proton, the nucleus of the atom, is positively charged. Of course, many questions arise at this point, not least of which are where did the concepts, categories and frames used in this model (atom, charge, nucleus, proton etc.) come from, how were they captured in a mixture of narrative and mathematics and indeed the validity of the notion of model itself. This book's answer as always is that they all came about self-referentially, step by step, over many lifetimes of shared-delusions; no theory starts with a blank sheet. The example of the hydrogen atom will illustrate just one step in this never-ending story.³

There are many detailed and specific questions about this model. For example, is an electron a particle? The current answer to that particular conundrum is both yes and no. According to quantum physics, all matter is both waves and particles. We will see more of this duality in Chapter 12. But if the electron is both a wave and a particle, then the concept of *orbit* will have lost its meaning, and is subsequently replaced with that of a *cloud*.

Whatever their model, physicists have reached a temporary consensus where electrons are described (in frames) with *energy levels*, in order to denote how much energy is required for the electron cloud to be detached from the nucleus. The term level is used because the electron can be excited to move to other orbits/clouds/states further away from the nucleus. At the ground state 1, where the electron is closest to the nucleus, and only in the case of hydrogen, the energy required to detach the electron from the nucleus has been determined to be 13.6 eV (electron volts). By writing it down as a frame expressed as a number and a unit of measurement it may be both remembered and communicated with others.

Scientists around the world have measured that energy, and in doing so have found the same numerical value. After similar measurements were carried out for other states of the electron, Bohr's model to describe the energy of the electron in any given state n for hydrogen⁴ eventually took on the form

$$E = -\frac{13.6}{n^2} eV$$

This equation is another classic example of what this book terms a frame. According to our previous definition, this frame of observation serves the function of codifying the act of observation between the observer, namely the scientist, and the observed object/scene of study, the hydrogen atom, with a depiction of the result expressed in a notation. In this case the codification takes place in mathematical notation, typical for the natural sciences.

Even more importantly, without such a possibility for codification there would be no self-reflection of the observation, no means of comparison with other observations, no mechanism for any next step, including communicating the findings from such an act of observation to other scientists. Far worse, the scientist would have to resort to carrying out experiments with hydrogen over and over again in order to determine the energy that would be required to detach the electron, always assuming that the frame, the textual expression of Bohr's theory, is widely accepted, or otherwise that frame itself would have to be perpetually re-invented.⁵

Thus from a series of interactions between observer and observed, a frame is created in the form of an equation that may be communicated to others, and may also be pondered upon by the observer himself. In the first instance these other scientists (let's call them A_i , where $i = 1 \dots \text{many}$) receive the frame as a hypothesis $F_{A \rightarrow B}$, which each observer can test by undertaking a series of corresponding observations comparing his own observations against the hypothetical frame, each having first understood and accepted the theoretical assumptions made by A (let's call him A_0 now) by observing A_0 and perceived as a system $S(A_0 \rightarrow B)$. Of course all the A_i must assume that they are each investigating the 'same' B. How this comes about is problematic in itself, although the frame has a part to play here. Only when a substantial community confirms the validity of the frame communicated by A_0 is it accepted as scientific fact, no longer requiring testing.

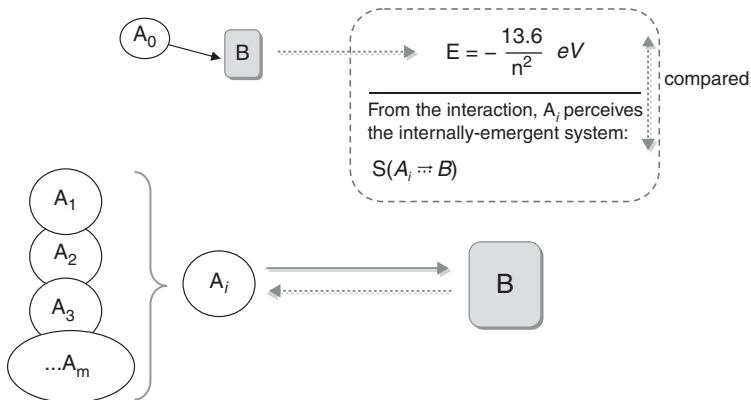
This testing will consist of numerous attempts to falsify the communicated frame, during which the frame itself will be used as a means to facilitate a comparison between two concurrent first-order observations. The frame itself encapsulates one such first-order observation, namely when it was created as a result of A_0 observing hydrogen. Other first-order observations are generated by the sequence of observers A_i , who pursue measurements of hydrogen's energy levels for juxtaposition with the frame. In attempting falsification of the frame, the observers engage in a peculiar form of observation, which cannot be classified in the normal straightforward manner. This is because for each observer within the sequence of observers A_i , a potential classification would have to take into account both their own first-order observation of hydrogen and recognition that another underlying first-order observation remains hidden as the output of A_0 's previous first-order observation. This is viewed by each individual A_i observer as a second-order observation, since through the frame each observes A_0 's observation of hydrogen, while concurrently observing the same element, albeit a

different instance of that element. Despite this difficulty in classifying such observational complexity as first- or second-order or both at the same time, it cannot be denied that this sequence takes place when the observers A_i engage in attempts to falsify the frame, as portrayed in Figure 9.2.

Here we encounter something fundamentally important, which connects observation, the frame and the concept of falsification. Karl Popper introduced falsifiability to denote that a ‘something’ can be refuted, either by an observation or by some other means that tests the validity of that ‘something’ (Popper, 2002). However, in order for the falsification principle to be applicable, that something must preserve the possibility of being falsified to begin with. In our example, the frame that captures information about an observation of hydrogen holds this possibility. We can accept that the frame contains the possibility of falsification; the frame can be falsified if someone observes hydrogen and finds a state n where the frame does not correspond to regularities in what is observed. But more importantly, this possibility of falsifying the frame can be actualized only via other observations.

When a new frame, or any theory, is proposed, members A_i are expected to test repeatedly the hypothesis that the frame is valid, looking to find just one particular observation where it is an incorrect representation. Comparison is of course possible because each observer A_i in the first instance creates for himself a system $S(A_i \rightsquigarrow B)$ and also a personal variation on the frame: $F_{A_i \rightarrow B}$. He will then test whether the communicated frame $F_{A \rightarrow B}$ makes sense. This is possible since all frames are expressed in common and accessible notations such as mathematics. Only after the frame has survived substantial

Figure 9.2 Falsification of a communicated frame



numbers of such tests, instigated by large numbers of different observers and observations, will it be accepted as an observer-independent frame F_B , and transmitted across the community.

Falsification can potentially go on indefinitely; however, then the frame would have no utility. At no time can a frame be proved true, and so at some arbitrary point the community must decide enough is enough and accept the frame as valid, whereby subsequent observations will suppress the distinction between the validity/invalidity of the frame. Hence, unless a test can be found that invalidates the assertions of the frame itself, the frame will continue to be accepted as true, and the likelihood of falsification in future will be diminished.

Let's suppose that all the subsequent observers fail to falsify the frame. No matter how many times they observe hydrogen, or anything else for that matter, their observations seem to be entirely consistent with the frame: we have already seen this with the universal acceptance of the Inverse Square Law before Einstein's intervention. It is then reasonable to believe for the time being that 'reality' is sufficiently represented within the particular frame, and that all other observers should stop bothering with similar observations. Subsequently others try to expand the frame into other forms, say other atoms besides hydrogen, or reach a generalized formula for energy levels for all atoms.

Something surpassingly more interesting has occurred within the scientific enterprise. B, the observed object of study, hydrogen, can now be completely removed from the act of observation, and all hydrogen atoms in a scene may be replaced with the frame that represents the outcome of the initial observation of B by A. This is indicated in Figure 9.3.

This interesting substitution, originating because to date the frame has not been falsified as yet, if at all, means there is no need to return to the actual hydrogen atom. The part of the 'real world' that is the hydrogen atom

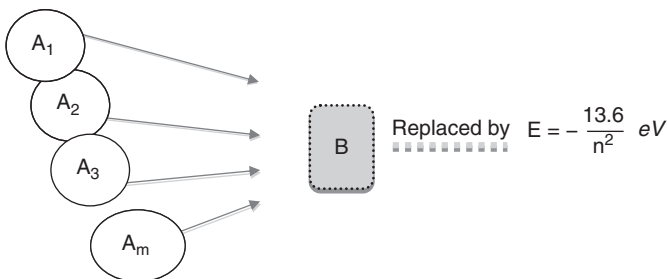


Figure 9.3 Notational hyperlinks and the differentiation of science

has been subsumed into each observer's set of delusions, paradoxically convincing each observer of an abstract internal world of an unfalsifiable truth. The description of the observed object of study subsequently becomes familiar and taken-for-granted, built into the frames of all shared scientific delusions. The newly established object of study has essentially become a notational hyperlink to the unity of observation it embodies. Now, for any other observer who has the possibility of interacting with that notational hyperlink, further differentiation regarding the object of study is unnecessary; for that new observer, the notational hyperlink remains just an object of study.

B, therefore, remains the observed scene/object of study, but now we are faced with a further problem since the substitution of the actual hydrogen atom by the frame has occurred; and consequently there is nothing to study. Observing such a frame, say an equation, in itself does not lead very far, and the concept of observation becomes problematic in itself. However, now that it has been absorbed into the memory and delusions, the frame does give rise, upon reflection, to the possibility of generating further frames that may constitute a testable hypothesis, like an expanded form of the frame/equation for another atom, say uranium. Furthermore, this possibility of giving rise to a testable hypothesis of another frame has no direct reference to the original frame, that of hydrogen. The new frame, for example describing uranium, merely constitutes an inspired logical inference on the basis of commonly inferred characteristics between the two frames. However, the important aspect that must be stressed remains the replacement of the object of study B by the frame itself, a process that diminishes the requirement to go back to the original object of study.⁶ This is illustrated in Figure 9.3.

That there is nothing to study does not mean that there is nothing to apply. It is precisely this functional difference that makes it possible for scientific systems to differentiate structurally between theoretical and experimental forms of science as co-evolutionary and self-referential steps. More so, such theoretical and experimental steps become structurally coupled in the form of a co-evolution, precisely on the basis of such fundamental frames, whether the result of direct observations, or new theoretical constructs. Thus we see that observation is the means to not only the falsification of a hypothesis, but also the creation of new frames, and the expansion of previous ones.

According to what has been described thus far, we are now in a position to articulate better the nature of scientific progress within observation. The

way such a progress occurs is by differentiation among further observations. With the principle of falsification, the self-referential system of science is equipped with the criterion with which it differentiates amongst a variety of possibilities and frames. If a frame resists falsification after a series of observations/experiments, then the self-referential system of science can internalize the frame and treat it as an element of the system. This implies that the original observation, which attempted to observe part of reality and further encapsulated it in a frame, is reflected in the frame itself. Once a substantial number of such frames have become difficult to falsify, then the system of science allows for subsequent observers to explore the increasing number of combinations of these internalized elements, resulting in the system achieving a greater degree of complexity. All the while an increasing number of observers come to realize the applicability of pre-existing frames, and set out to expand them into newer forms of representation.

The purpose of scientific observation at its initial stages, and insofar as it refers to physical reality, is to carry out a multiplicity of differentiations with the physical world and to create unities of distinction that can be codified into frames that are expressed mathematically and can be communicated, exchanged and considered for further applications. These communicated elements can be incorporated within the system of science, and used as needed, with new elements generated by new observations and/or by new testable hypotheses created with the help of previous elements from within the scientific system.

Postscript

The astute reader will have realized by now that the word *scene*, written originally italicized, which was introduced at the beginning of Chapter 8, was itself being used as a frame $F_{\text{authors} \rightarrow \text{vagueness}}$ by the authors to cover up the vagueness/complexity in their description of what is being observed. The implied vagueness was noted with the word's introduction, but as the chapter progressed the italics gradually disappeared. Through repetition and familiarity, by remembering the word's meaning in the vision metaphor, and the lack of any contradiction, namely no falsification, the reader took it for granted and simply forgot the vagueness noted by the authors. She instead accepted the delusion that the word was meaningful: the vagueness was replaced first by the frame independent of the authors $F_{\text{vagueness}}$, and then finally by something more concrete and *objective*: the now-meaningful word *scene*.

By the same token, the authors hope that the reader has stopped worrying about the equally vague term 'delusion' that they slipped into the discussion early on in this book, and which by now through possibly excessive repetition and familiarity she has also *come to understand*.

Nevertheless, the authors are also insistent that the reader never gets too comfortable, too certain, about any scene she is observing. Certainty and clarity of thought are delusions, self-referentially instigated by the linearities absorbed into cognition. Clarity of thought is when all feedback in the structural coupling of cognition and observation is synchronized with, and thus supportive of the observer's system of self-reference.

An observation must never be considered as a series of instantaneous snapshots of a particular physical thing. This present book, for example, was the result of a collaboration of two observers, and developed over a period of six years, that is if they include their initial skirmishes with the book. Although it could be argued it has taken their two adult lifetimes to date, as the text describes their reflections of their intermittent experience of thinking about 'thinking about theory'. The book itself is a frame that communicates their description of a *scene* that is as vague and wide ranging as science, the human condition and the development of theory.

The various versions of the book that passed back and forth between them for editing show that a frame can be a work in progress, and also a means of focusing observation, possibly by more than one individual. But that frame is far more than a mere description and an aid to focusing. This book/frame was itself absorbed into the dynamic scene being observed/studied by the authors. Self-reference in action!

The version now before the reader is simply the frame as it existed at the point when the authors were not too embarrassed to communicate their considered observations to others. Subsequently, they each will be scribbling notes in the margins of their own copies, and using the ideas on other projects/observations.

CHAPTER TEN

Higher-order Observations

It should be clear by now that before reflecting upon the complexity of any particular problem domain, be it physics or any other for that matter, it is essential that the researcher gets to grips with an expanded description of the nature of observation. We started that journey in the previous chapter; however, we still have to consider the subject matter of higher-order observations, and in far more detail. For we shall see that such observations, or rather the denial of their higher order and their collapse in something order-less, have considerable implications for the construction of theories.

Normally, of course, most human observers are quite unaware of the existence of these various orders of observation ... they don't need to be. For observation is second nature, in which all higher orders have unconsciously collapsed into the apparent objectivity of a mundane first-order observation of things in the world. We tend to take for granted that a better description of the assumed-objective world may be achieved by the simple expedient of repeated first-order observation, although perceiving this as order-less observation. This belief, reinforced by any subsequent utility of such mundane observation, generally ignores any problems that arise with the distinctions necessary for observation; it overlooks the subsequent paradoxes, or indeed the paradox of observation itself. For without the discarding of paradoxes with the use of delusions (see Chapter 3) observation would not be possible; and we are back with Luhmann's insight that 'the world is observable because it is unobservable'. For all knowledge is founded in the absurdity, the 'refined ignorance' that is implicit in all observation. Every process of knowing creates the distinction between what it is to know/not-know, namely a distinction that is itself constructed from what has been observed, and what has been left unobserved.

This is particularly the case for the more sophisticated observation undertaken by developers of theory. Their theories too are grounded in the same linear causality that supports the apparent validity of mundane observation. In their theories, problems that must inevitably arise from time to time out of the paradoxes of observation are taken to be anomalies, and are dismissed; that is they just disappear within a collapsed order-less 'objectivity'. Most of the time, the theories correlate with the regularities that are perceived within such collapsed orders of observation, and this only

serves to reinforce confidence in the objectivity of linear apparently orderless observation. However, and as we shall see, there are implications from ignoring these higher orders.

The present authors too must admit to falling into the same trap. In introducing ever-increasing sets of orders their descriptions enter into ever-decreasing circles. The time will inevitably come when they too must collapse this potentially infinite expansion into the linearity of a finite set of orders, and deny the paradoxes they have introduced. This present chapter is, to a certain extent, an analysis of the authors' own refined ignorance; and indeed they eventually admit that the concept of order of observation is itself paradoxical, although it does deliver some useful insights.

Self-evident Distinctions

Ultimately, even the field of epistemology, the study of *how we know what we know*, thereby constructing a meta-description of the distinctions of knowledge, must itself be prone to distinctions. In other words epistemology, the study of how knowledge is constructed, utilizes rules for such a study; and so imposes further distinctions. These distinctions imply that the process of delineating 'how we know what we know' is incomplete by default. It implies that the enterprise that is widely labelled epistemology, by its necessary use of distinctions to undertake that study, must create an observable/unobservable distinction within epistemology itself.

The study of how we know what we know projects a fallacy, namely that a method is possible for validating knowledge itself, and that the knowledge thus constructed is devoid of paradoxes. This fallacy ignores the distinction between knowing/not-knowing; it ignores the very fundamental concept of distinction, and in doing so legitimizes an absolute belief in attaining a truth for which no distinction is necessary. Such is the arrogance underlying science, which permeates much of modernity. Science insists, to its peril, that such not-knowing can eventually be suppressed by undertaking enough further observations. The belief is that after sufficient traversal around the loop of consequential experimentation, namely theorizing and yet more observing, the issue of distinction eventually ceases to matter, and science is left with an *understanding*, and in control of the world. But it is a vain hope.

Theoreticians search for the point in the development of a theory where all observations guided by that theory deliver self-evident distinctions. To all intents and purposes the world has become an objective place, so that all

observations, whatever their order, ultimately boil down to the same unique set of distinctions, reduced to identifiable and communicable universal categories. There can be no debate allowed, no difference of opinion. The world is as it is, as it appears to be, the same for everyone. Then the findings of science are taken as obvious, self-evident, just as we accept as *fact* that everything we observe in the world is as it is for everyone. This is after all how we humans consider our physical world of colour and sound to be; of objects like trees, clouds, animals and stones to be. We believe that we all see/feel/hear/smell/taste/reflect on the same things, exactly as they are. Higher orders of observation appear to have no consequence; all is order-less objective observation. Theory too operates in this same objective world.

The authors of this book, however, take a different stance; albeit admitting that at some point they too must collapse their observations. Based on the premises of observation examined thus far, they claim that observations of an order higher than first need to be examined in much greater detail. Unpicking this particular knot of complexity within observation is no easy task. Indeed, this present chapter seeks to show that further complications come into play in these higher orders of observation, noting that too often these go unnoticed.

The Reader as Observer

It is useful to start our examination by distinguishing between the terms *observing* and *observation*. In the previous chapter observing was taken to be a physical act, where an observer merely observes. However, when both the observing and the observed parties, namely the observer and the scene and referred to there as A and B respectively, are subsumed into the unity of the distinction, then the question immediately arises of who is observing that unity. For ontologically, another observer is being created, brought into existence in someone's mind, operating at one order of observation higher; an observer who realizes that A is observing B. Who that observer is has little consequence. What matters is that A, not being able to self-observe himself, will know he is observing B, but will be unable to include himself in the unity of the distinction between observer and observed.

For the time being, let us consider another observer who is capable of realizing that A is observing B, namely the reader of this book, and designate her with the letter R. This apparently creates a second-order observation, since R is observing A observing B. But this designation of another order of observation exposes yet another issue. If we ask who it is that creates the

sequence of R observing A observing B, then one possible reply would be the authors, who are thus acting as third-order observers. In writing this text they have observed/imagined R observing A observing B, and constructed their analysis apparently to exclude for the moment this third-order observation, forcing the reader into accepting the second-order observation as R observing A observing B. However, having been made aware of this situation, R may now construct a fourth-order observation that would unavoidably include herself, observing how the authors are imagining/observing her (R) observing A observing B. The re-entry of an observing system, R in this case, into the order sequence of observations itself has interesting implications, which will be dealt with later. This introduction of new observing systems can go on *ad infinitum*. 'I know that you know, that I know that you know, that I know that you know ...'

For the moment, it will suffice to recognize that observational complexity is being created in a number of ways. If we go back to our example of a second-order observation, that of R observing A observing B, then we can additionally designate *A observing B* as a distinction, the unity of which we may label as U. In this case, R would be observing U. In light of this encapsulation of *A observing B* into U, is R conducting a second-order observation of B? Or a first-order observation of U, or of A? Or all? Or none? As a way of avoiding this conundrum, it will be useful to accept for the time being the difference between the terms *observing* and *observation*. Observing implies a direct first-order observation of something that may in turn incorporate further observations. In this regard, simply observing would classify as a first-order observation; observing someone observing would be a second-order observation, and so on.

The Absurdity of Infinity and the Twin Paradox

However, the very concept of order creates paradoxes, some of which are already apparent with the simultaneity of orders of observation: a second-order observation can also be a first-order observation of an implied unity, or both a first and a second. Higher-order observations, therefore, come with an inevitable confusion that is not easy, nay impossible to resolve. To this confusion, we may add observers that are imagined in the head of other observers. Therefore another distinction can be attempted: that between real orders of observation and imagined orders, and indeed imagined observers that have no possible counterpart in the real world, based as they are on the memory and the cognition of *a particular someone*.

With imagined orders of observation, the introduction of thought-experiments becomes possible; experiments that often involve observers with impossible superhuman powers, operating in artificial unnatural situations. We contemplate integers into existence that are greater than the total number of atoms/particles/things in the universe, not that we could ever count them, without the slightest concern for that absurdity. For something very odd has happened. Arithmetic started quite reasonably by adding up a number of things, but somewhere in the development of this abstraction a qualitative change takes place; the instrumental fictions have taken us beyond the total number of things that can be counted. Infinity is bigger than the total number of all atoms in the universe, bigger than all the fundamental particles there. Mathematics has moved from the rational/natural/non-linear real world to the irrational/unnatural/linear and artificial without us realizing it. How can we maintain that arithmetic is still of that real world? Why, simply by insisting that all descriptions of that world are self-referential, in which the absurdity of infinity is never confronted. In general the concept of infinity absorbs all the paradoxes and delivers a utility; but eventually singularities in the natural world will conspire to mess up all this unnatural tidiness.

Then there's the thought-experiment where one of a pair of twins travels in a hyper high-speed rocket, and returns to earth only to find his/her twin much older. Paradoxically, as a consequence of the Special Theory of Relativity, the twin left behind experiences the same effect, so that each twin is simultaneously both younger and older than the other.

This inconsistency does not matter, because such a situation can never occur, since that experiment can never happen in practice. A series of compromises have been made: a rocket travelling close to the speed of light does not exist; human physiology could not withstand the implied pressures. Even more important than these restrictions is their complete suppression and the neglect of their implications to the experiment. We humans operate as if the restrictions do not matter, do not exist, and then move on to ponder without a moment's thought the consequences and implications of realizing the thought-experiment. Absurd!

We even wonder why it leads to a paradox, the so-called *twin paradox*; and consider possible modifications to the theory that led to the paradox, so that the paradox may be resolved. Whenever we are fortunate enough to find a resolution we stand tall, and heavily, upon the thin ice of our intellectual constructs, and gaze proudly at the marvel. But any such resolution of a

paradox is a delusion in itself: the paradox of paradox. It is the situation whereby the paradox is rendered invisible by creating an alternative distinction so that reality can be observed and described differently. For, no matter what the facts tell us, these so-called facts remain the outcome of a distinction made by an observing system; and those distinctions are contingent, they can be drawn differently, and always spawn yet more paradoxes.

As responsible for the generation of distinctions, observing systems are therefore of vital importance. Observing systems have the capacity to generate observations by stipulating guiding differentiations, instead of simply being observed: the physical world of phenomena being an example of the latter.

The Reader Complicating Matters

The reader should remember at this point that a number of issues were discussed in the previous chapters regarding *A observing B*, including the delusions that A may be using to sample the observation, the feedback from B to A, as well as the frames that were utilized by A in order both to communicate his observation of B and to reflect on B. All these issues are still valid, but are omitted in the diagrams below in order to simplify matters by enabling the reader to focus on the main subject matter of this chapter, namely observations of an order higher than first.

In Figure 10.1, we depict the scenario where A is observing B. However, if we depict the scenario where another observing system is introduced, then we would have to increase the order of observation by adding an additional observing system to produce Figure 10.2: an observing system that we shall label as C.

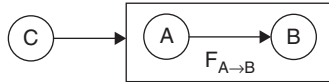
Figure 10.1 A first-order observation?



At the same time, the reader R (the one actually reading the book, not the one imagined into existence by the authors, and who hence cannot appear in the figure), in realizing that she could herself assume the place of another observer who is observing C, who is observing A observing B, is faced with the possibility of elevating her own observation of this phenomenon up another level to an observation of the third order. Already, a number

of observing systems have been introduced. This implies that a number of distinctions have already been made and a number of possibilities are raised for analysing this complexity behind multiple observers. Let us briefly examine one such possibility.

Figure 10.2 A second-order observation?



Deconstruction

In Figure 10.2, as an observing system, *C* is developing his own choice of frame in the process of observing *A* observing *B*. However, that choice of frame is influenced by the agglomeration of personal delusions that instantaneously collapse in the face of utility. Ultimately the choice of frame is influenced by what the observer perceives to be the appropriateness of the frame in a particular context of personal purposes. The frame is denoted in the diagram above by $F_{C \rightarrow (A \rightarrow B)}$. Again a simplified notation is used for the purposes of this present chapter. This diagrammatic form does not reduce the complexity highlighted in Chapter 9, but it will suffice for the material being discussed in the present chapter. Why are we stressing this point about higher orders? Because it is through higher orders that observers make assumptions about what others are observing, something crucial when considering the construction of theories. We must recognize that *C*, in using his own choice of frame while carrying out the observation, has opened up the possibility of treating his second-order observing as a process of deconstruction of, that is inferring meaning to and from, the original observation of ‘*A* observing *B*’.

According to Luhmann:

Deconstruction draws attention to the fact that differences are only distinctions and change their use value when we use them at different times and in different contexts. The difference between heterosexuals and homosexuals is not always the same; it is subject to *différance [sic]* ... Then immediately a variety of observing systems appear: the political system, the interaction of a session of the US Senate, the army, etc. The illusion to be deconstructed is the assumption that all these systems designate the same object when they use the distinction heterosexuals/homosexuals. *The stereotypicality of the distinction leads to the*

assumption that all these systems observe the same thing, whereas observing these observers shows that this is not the case (Luhmann, 2002a) – emphasis added.

From this example, and generalizing between the orders of observation, we may infer that first-order observations may be deconstructed by a second-order act of observing, a second-order observation will be deconstructed by a third-order observing, *ad infinitum*. We are back with the prisoner brainteaser of Chapter 6. The introduction of more and more observers creates more distinctions, and more possibilities, as well as additional constraints and uncertainty.

Therefore, in order to deconstruct and observe further in what context-sensitive capacity A is observing B, and to reflect on some of the consequences of such an observation, a second-order observation needs to take place; an observation for which the observing system that we designated to be C becomes necessary.

As we saw with the prisoners brainteaser, C can never properly deconstruct what A is thinking when observing B, because C and A have different personal delusions, and thus operate with different cognitive processes, and therefore observe different things in B. Hence the authors' insistence on separating the orders of observation. However, in certain restricted environments, it is possible to deconstruct the frames that are externalized in the process of observation. This is after all what theory, what science, is all about. Then what A is observing in B, as represented in a linear frame, itself constructed in a shared notation, is communicated to C. Then C, if he accepts the theoretical propositions in that frame, will presume that he observes exactly the same in B as does A. Objectivity is simply an acceptance that vague non-linear personal delusions are irrelevant, and that anything of any consequence will be uniquely represented in a linear frame, to be shared with others as a true and total description of B.

Mutual Interference

Needless to say, the addition of further observing systems creates a complexity that is attributable to the mutual interference between these observing systems, the frames they use, the delusions and perspectives that influence their observation to begin with, etc. Hence, the introduction of new observing systems interferes with any pre-established observational setting.

But where are the paradoxes behind the introduction of new observing systems and the concept of higher-order observations to be found? Ironically enough, within observation itself. That is, the only way that cognition can distinguish between the various orders of observation is through observing. In other words, observation is itself the means through which higher-order observations are granted their status of being of a higher order. However, in doing so, another paradox is constructed; orders of observation can be determined by observation that, in itself, may have an order, either first- or second- etc., but at least one order greater than the orders of observation examined.

In other words, if an observer attempts to classify the order of an observation, he has to do so while he himself is engaged in observing, and more explicitly, in observing at a particular order. At the same time this must be a first-order observation, since the observer always observes, as well as all the other observational orders up to a point one less than that particular order. But this level can only be recognized by that observer with the introduction of yet another observation one order higher again, and that recognition needs yet another level.

Hyper-complexity

This paradoxical implication, whereby orders of observation require observation with an associated order to be implied, creates a hyper-complexity as a result of the interplay of paradoxes underpinning observation itself. Here, we are using the concept of hyper-complexity from Luhmann, who has used it in a slightly different context, but with the same implications for observation. In discussing this meta-complexity as hyper-complexity, Luhmann remarks:

What has become visible after some centuries of impact of the printing press and after a hundred and more years of mass media is a much more complicated, some say *hyper-complex*, description of complexity; hyper-complex in the sense that within the complex system of society there are many competing descriptions of this complexity. The unity of the complexity becomes unobservable. Intellectuals occupy themselves and others with describing description, philosophers become experts on philosophical texts – and literary criticism takes over, nicknaming ‘theory’ something that we suppose has been done elsewhere (Luhmann, 2002a).

This, we argue, is the case for any system that is dependent on observation for constructing knowledge. The system of science is not, cannot be, an exception to this rule. It too depends on observation, on the generation of distinctions and on the paradoxes that these imply. One typical way this hyper-complexity becomes expressed in science is the increasing number of disciplines. Because the 'unity of the complexity becomes unobservable', then scientific knowledge, like all knowledge, must have a number of meta-descriptions of itself. As testified by the existence of a growing number of scientific disciplines, the multiplicity of approaches in epistemology and the fragmentation within physics itself and other disciplines; something that is apparent in the expanding and various descriptions of the system of science. How perversely paradoxical that, according to our analysis, the drive to unify physics will culminate in the exact opposite effect? Actually every branch of science, as it develops, far from becoming unified must continually fragment into sub-disciplines, which are supposedly recombined in what has become known within modernity as multi-disciplinary research, which in itself will lead to yet more fragmentation.

Even though the consequences of the above assertions will be expanded upon in Chapter 13, the concluding chapter, what needs to be made clear here is that any discipline that attempts to end up with some form of a Grand Unified Theory is in effect simultaneously moving in an opposite direction. The system of science is not immune to this schizophrenia.

The State of Complexity in Orders of Observation

Amongst this sequence of interplaying paradoxes it turns out that higher-order observations become, to a large extent, unsupportable. The sequential linearity projected by the use of the concept of order is seen to be highly problematic. The designation of higher-order observations actually entails in itself the assumption that second-order observers may refine their understanding of reality by subjecting each first-order observation to their own second-order observing. This is usually based on the belief that some sort of structure, a communicable frame, is being pulled out from the reality being observed. Being linear it must mean that the non-linearity will be lost among the paradoxes. However, what is structured and how structure is perceived depend on the presuppositions, the delusions and the disturbances, with which observers engage in observation. Insofar as the act of observing something must automatically leave something else unobserved, including the non-linearity, then observation as a means of pulling out a structure

from the observed reality is what automatically implies the existence of an unstructured part. But the unstructured part is not something to be viewed as yet another residual category; it is constitutive of the existence of the structured part of the observed reality, and interferes with how the fabric of reality is observed and ultimately perceived.

While this distinction between structured/unstructured reality is different for every observation, the way any perceived structure within the reality comes to be constructed/framed from a series of observations requires that the observer is able to generate linear categories appropriate for describing the scene. Categories are then created, combined and reinforced and imposed on reality by processes that are, to a large degree, presupposed. Such processes are there prior to observation, in the private delusions and choices of frames available to the observer, so that observation can be initiated.

More questions arise at this point. Is it possible to observe something that has originally been left unobserved? The answer is 'yes, but only partially', simply by taking a different distinction. But a different distinction will in itself create another way of differentiating between an observed/unobserved reality. While it may initially appear possible to observe everything by creating different but complementary distinctions, it should not be forgotten that the distinction between observed/unobserved implies interference between the two parts, and each time this interference is different, depending on the observer, his delusions, choices of frame etc. The sum of linear descriptions can never describe non-linearity.

Hence, higher-order observations should not be viewed as refined descriptions of lower-order observations that gather up the distinctions used by the latter. Higher-order observations are not devoid of paradoxes themselves, since they too have to utilize distinctions. And since each higher-order observation is a particular form of observation, it reduces the complexity of lower-order observations while forcing their collapse: their clarification. But in clarifying, something is lost. The complexity hasn't gone away, parts of it have simply been ignored. While the latter outcome is a consequence of observation itself, clarification is only the 'refined ignorance' of a second-order delusion constructed out of the contingent distinctions that are used by the first-order observer. Any higher-order observer remains an observer who requires of himself simply to observe.

Hence, the order of observation must collapse in the mind of the observer. For otherwise each observation would lead to the unending cascade of new observing systems: an infinite regression that perversely would prevent

observation from taking place. Remember 'the world is observable because it is unobservable'.

Observations of a Higher (Dis)Order and the Observing of Disorder

In examining further this concept of order found within the phrase higher-order observations, we can notice that a first-order observation is followed by a second-, a third- and so on. But how is it possible that a linear numerical sequence (1, 2, 3, 4, ...) can describe the totality of observing systems implied in higher-order observations? The answer to that question is very simple: it is not possible. It is not possible for any such linear sequence to depict accurately the complexity of all the interactions present in the multiplicity of observations. Such a sequence cannot account for the hyper-complexity described above. This ordered sequence of numbers that is supposed to account for all this underlying complexity creates a further problem, namely the imposition of the integer sequence, itself an invention that 'was made on the basis of the error [or as we would have it, absurdity], dominant even from the earliest times, that there are identical things (but in fact nothing is identical with anything else)' (Nietzsche and Hollingdale, 1996); there are just different things, and even those are brought out of *chaos* by perception.

Nietzsche's remark that 'mathematics ... would certainly not have come into existence if one had known from the beginning that there was in nature no exactly straight line, no real circle, no absolute magnitude' (Nietzsche and Hollingdale, 1996) acquires a relevance in respect of observation for a number of reasons. The process of theory construction and scientific discovery leads us humans to believe that we are approaching profound truths as we are supposed to deepen our knowledge by putting the outcomes of observations together. But this is only a delusion within perception. We are only refining our ignorance.

We can see this in Nietzsche's example within the context of mathematics: in nature no such object as a line or circle exists, not even an integer greater than one; everything is different. Yet despite their unnatural linear nature, the concepts in themselves constitute acceptable and useful conventions. They are brought into existence despite the absurdity of their *unnaturalness*, that is their loose correspondence to what they describe. Indeed, this 'unnaturalness' seems to be a necessary prerequisite. This artificial process of abstraction indicates a transcendence to a meta-reality that has to be

different from reality itself. By being different from reality, while at the same time being necessary for its representation as an abstraction, a system/environment dichotomy can be conceived between reality/meta-reality. Therefore the relationship between reality, the *natural*, and its abstract representation, the *unnatural*, can be thought of as having been split into two: into a reality that we attempt to represent and into an unreality, namely the meta-reality, created by the representation. Consequently another distinction is constructed: between the possibility of representing reality and the impossibility of representing it accurately. The possibility of representing reality is immediate and self-evident; we do it all the time. However, such representations can never be accurate, because they are *unreal* systemic constructions, and as such they can never be identical with the things in the world they represent.

Hence, imposing an orderly numerical sequence on the concept of observation appears to suffer from a number of logical difficulties. The constructed set of linear numerical abstractions associated with concepts related to observation appears not to match the non-linear complexity of interactions within observation. What is termed as a second or third order of observation simply masks the underlying complexity and reduces it by resorting to a comfortable sequence of numbers that, in this context, cannot make sense. The absolute count exists only as a conventional contrivance for reducing complexity in how we attempt to represent higher-order observations. But each observation is different, separate; it is dependent on different observers with different experiences, different delusions, looking at different scenes, and hence delivering different deconstructions; and these are all muddled together in a contrived order. A higher-order observation eventually brings about an emergent qualitative change in the complexity of interactions. A quantitative framing of a qualitative difference has never been, can never be, much of a success story.

And so we have reached an inevitable conclusion: observing, namely first-order observation, which serves humanity so well, is actually a denial of the complexity involved in what is actually going on in our sensing/perceiving of the real world. However, the moment we attempt to analyse that complexity, by recognizing that we are observing exploding sequences of imagined observers of observations and their differing deconstructions, we are trapped in a futile sequence, which has also to be terminated at some point; again a forceful reduction of this complexity. And we must return to Luhmann's profound insight: 'The world is observable because it is unobservable',

because whenever an observer observes, he creates a contingent distinction between what is observed and what is by necessity left unobserved. The complexity of the real world that is observed rests upon this stratum of such contingent distinctions. Part of the complexity is reduced when the observer observes, and part of it is ignored.

Furthermore, the consequential abstract representation in frames of such impossibly possible observations, whatever the notation in use, be it quantitative, specifically mathematics; qualitative, namely language, images etc.; or arbitrary, can never be an exact description of any single thing in the world. They can only ever be approximations. So much is abandoned, left unsaid, unrepresented by abstraction, and by the various individuals involved in choosing. So much of the complexity and paradoxes are denied. Such representations can never capture the totality, and so cannot be used in any claim on truth. Their sole validity depends on appropriateness, utility and choice.

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 somewhat 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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CHAPTER TWELVE

Collapsing Systems

This chapter covers a concept that the authors call the Principle of Collapsing Systems, which pervades a wide range of different systemic phenomena. They have already introduced this principle with their treatment of orders of observation as a collapsing system. Here they will expand upon that example to provide a wider overview of the principle, and extend it to cover systems in general.

With the coverage of hyper-complexity, we saw that the notion of higher-order observations was problematic because they are commonly believed to clarify and expand upon knowledge already present. However, higher-order observations also entail the introduction of yet more paradoxes; every observation, whatever the order, involves the same distinction between observable/unobservable. These paradoxes ultimately undermine any attempt at clarification of knowledge gained from collating previous observations, and also increase the intrinsic complexity of the descriptions and interpretations being sought. This is what Luhmann meant with his assertion that the ‘world is observable because it is unobservable’ (Luhmann, 2002b).

Self-stokhastik Observation

And yet quite naturally we humans still manage to observe, and in doing so manage to inhibit the paradoxes in and between the distinctions that are being developed/formulated/assimilated in our observations. We operate as if the distinction between observable/unobservable reality does not actually matter. Somehow we manage to cut through all the hyper-complexity implicit in observation by unconsciously/involuntarily and spontaneously collapsing the orders of observation down to the objective order-less observation that is thought. After all, this is what the reader is doing with each and every word in this book. A personal lifetime of previous systemic interpretations of each word has been absorbed into her cognition, and then collapsed down into a private belief that she *knows* what those words *mean*, so that she can make sense of the text. Problems do arise when the authors use a word like *delusion* in an unusual way, but by repetition and the use of definitions, hopefully the reader eventually internalizes and thereby accepts their esoteric meaning.

Thus, we can see that in his inscrutable quotation, Luhmann is actually referring to two totally separate forms of observation. *Real observation*

is impossible, but thankfully humanity is blessed with *self-stokhastik observation*, made possible, indeed brought/thought into existence, by its structural coupling with cognition. Objectivity then is the false assumption, the delusion, that our self-stokhastik observation is identical to the impossible pure kind.

No matter how many orders of observations we include in our analysis, at the very base of each sequence of levels there must always be an observer making a first-order observation. That observer penetrates the complexity of these orders, and in doing so he is collapsing part of that complexity down to an order-less simplicity by the act of self-stokhastik observing. Thus, the principle of collapsing systems has primacy in human cognition, for otherwise the world would be unobservable against the explosion of intricacies that can and do occur; indeed the principle is a necessity.

That the observer is self-stokhastically observing means that he is creating a distinction that leaves part of that world unobservable. This has implications, particularly in the development of theories, as we will now illustrate with a discussion of a very important example from the world of quantum phenomena: the double-slit experiment.

The Double-slit Experiment

Before we go into the details of this experiment, we should start with a comment. We have repeatedly used examples from physics because of the popular and persistent delusion that physics equates to the truth about physical phenomena. The reasons for the persistence behind the physics–truth coupling are twofold: firstly physics deals with a description of the physical world we inhabit, and is thereby seen as a core construct for the representation of reality; and secondly any representation of reality attempted by physics aims at deconstructing our immediate natural habitat, thereby reinforcing any perceptions about reality and its manipulation.

However, even though that reality is thoroughly subjected to the scrutiny of observation and subsequent explanation, it is also prone to multiple interpretations because such observation is self-stokhastik. Multiple interpretations of the same set of phenomena imply that in creating distinctions, the physicists who were the original interpreters of each distinction in developing a particular theory have become responsible for the emergence of versions of truth. To use Feyerabend's terminology, thereby alluding to his deconstruction of the concept of truth, it could be said that

physics may be a single word, but there is no single entity that corresponds to this word. There is fragmentation upon fragmentation, all masked by the collapse of this multiplicity into the single connecting word ‘physics’; and that mask is vigorously reinforced by ideas of unification. Of course, the idea of a non-unified, or indeed a fragmented, cosmos of investigation masked by a singular word that claims to capture an entire unifiable discipline is not restricted to physics alone. Indeed, every discipline casually represented under the heading of a single word will be hiding a world of distinctions, which in their own turn will be utilized differently by different observers, and so must give rise to a series of different interpretations.

We have chosen to consider the double-slit experiment here to illustrate these ideas, mainly because it is a most peculiar and truly shocking experiment: one that challenges humanity’s most fundamental ideas about reality, and our relationships to the observation of that reality. This experiment was designed to study the behaviour of particles (electrons, photons etc.) and an attempt to shed some light on the nature of matter.

The world of classical physics presents two essentially different *models* to interpret the experiment. One, the *particle* model, is the representation of the way small spherical objects behave. Undoubtedly, the initial perception engrained in novice physicists on hearing the word ‘particle’ is that it will behave and even look like a billiard ball, albeit at a miniscule scale. The second model is the representation of the behaviour of *waves*.

The particle model appears to be an appropriate description of the single-slit experiment, where electrons are fired randomly at a sheet containing a *single narrow vertical slit*, just wide enough for an electron to pass through. There is an implied assumption here that the particles are of a small but finite size. Electrons that miss the slit but hit the surrounding sheet return back from whence they came; those that make it through collide with a photographic plate set back from the slit to record the impacts. Eventually these impacts combine to form a line vertically down the centre of the plate; just like we’d expect from firing small spherical projectiles through the slit.

This experiment is repeated, but now with a sheet containing two parallel narrow slits placed slightly apart. Extrapolating from the particle model, we would expect to see two lines forming vertically down the photographic plate. However, something completely different is observed. Now an *interference pattern* appears on the plate, which can be described using the wave model.

As illustrated in Figure 12.1, when a single wave passes through both slits, it appears on the other side as two separate wave sources; and as these waves

progress they interfere with each other. Whenever the crest of the first wave combines with the crest of the second at the photographic plate they create a place of high intensity; when the crest of the first wave meets the trough of a second wave then the waves cancel each other out (see Figure 12.2).

But this is absurd. In the single-slit experiment the electron behaves according to the particle model, but like the wave model in the double-slit experiment. The same behaviour is observed if photons or neutrons had been used instead of electrons. So what is going on? Is the result dependent on the experimental apparatus? If the same stuff that we call matter behaves

Figure 12.1 The emergence of an interference pattern

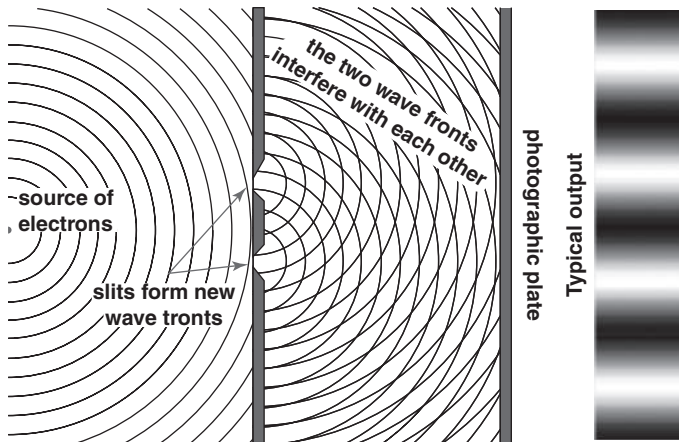
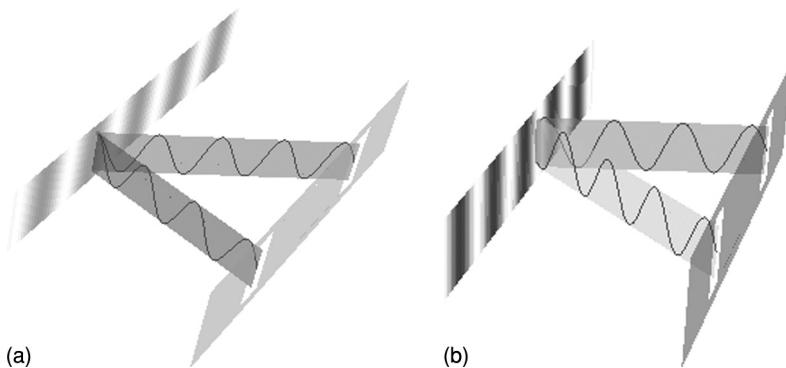


Figure 12.2 (a) The crest of one wave meets the crest of another; (b) the crest of one wave meets the trough of another



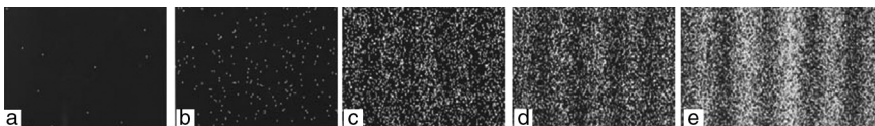
differently under different circumstances then this must automatically raise the question: ‘what is the nature of matter?’ This is a question that haunts physics to this day, although it is one that the authors would claim is a product of the paradoxes: a universal property implicit in self-stochastic observation.

Are electrons/photons/neutrons *particles*, or *waves*? The shocking compromise that has been reached by physicists is that they can be both; it depends on the circumstances. This principle is known as the wave–particle duality. But those physicists didn’t just leave it there. In an attempt to clarify the situation they proposed a variation on the double-slit experiment. Instead of sending a constant stream, the electrons were now fired one at a time in the direction of the slits. By firing the electrons singly meant the experiment would have to be interpreted using single particles, and not wave forms: hence, they would expect to see two vertical lines. However, the scientists were in for a huge shock. The very same wave interference pattern¹ emerged: see Figure 12.3.

How could this possibly be? One interpretation proposed for this phenomenon is that each single electron, or whatever individual particle is used, goes through both slits simultaneously (which is nonsensical), interferes with itself, and then hits the photographic plate, thereby displaying an interference pattern. For there is nothing other than the single electron itself to cause this interference. Furthermore, the same interference pattern will be seen by every observer, and so clearly there can be no individual interfering with the experiment.

Not to be put off, the physicists then planned a variation of this experiment, in which they set out to determine for each single electron, which of the two slits³ it went through; realistically each electron can only go through one. Shock! Horror! The interference pattern suddenly disappeared. The

Figure 12.3 Results of a double-slit experiment² performed by Dr Tonomura showing the build-up of an interference pattern of single electrons. Numbers of electrons are 10 (a), 200 (b), 6,000 (c), 40,000 (d), 140,000 (e)



slow drip, drip of electrons impacts now created two stripes down the plate; that is they suddenly stopped acting like waves, and instead behaved like particles. However, when the experimenters removed the detection device, lo and behold the wave interference pattern reappeared.

What does all this possibly imply? Is it possible that the very *nature of matter* behaves in a completely different *physical way* depending on how an observer interacts with it?

Observing is Disturbing

There are two important implications stemming from this peculiar experimental result. First, and perhaps the more important, clearly the role of the observer appears to be fundamental in interfering with the observable effects of electron behaviour. Unquestionably the observer has the potential to disturb fundamentally any part of reality that he chooses to observe: observing is disturbing. Second, a further problem is introduced. Such a disturbance has a threshold that is defined by Heisenberg's Uncertainty Principle. This principle states that it is impossible simultaneously to determine with any degree of accuracy different physical properties of the electron, e.g. position and momentum. In other words, we can disturb reality up to a certain point that cannot be exceeded without a significant compromise in the accuracy of the measurement. Reality, whatever that is, challenges being disturbed.

Hence it is impossible to determine any one thing accurately without subjecting something else to inaccuracy. Heisenberg's Uncertainty Principle is essentially a realization of the quotation: observing is disturbing; an instance of this distinction between accuracy and inaccuracy. However, by this clause the authors do mean something far more fundamental than the common interpretation of physicists in respect of the double-slit experiment, namely that the act of identifying which particular slit the electron goes through somehow disturbs the behaviour of the electron.

Nobel prize winner Richard Feynman also had much to say about the consequences of the double-slit experiment.⁴ According to him:

No one will give you any deeper representation of the situation. We have no ideas about a more basic mechanism from which these results can be deduced. *We would like to emphasize a very important difference between classical and quantum mechanics.* We have been talking about the probability that an electron will arrive in a given circumstance. We have implied that in our experimental arrangement (or even in

the best possible one) it would be impossible to predict exactly what would happen. We can only predict the odds. This would mean, if it were true, that physics has given up on the problem of trying to predict exactly what will happen in a definite circumstance. Yes! Physics has given up. *We do not know how to predict what would happen in a given circumstance*, and we believe now that it is impossible, that the only thing that can be predicted is the probability of different events. It must be recognized that this is a retrenchment in our earlier ideal of understanding nature. It may be a backward step, but no one has seen a way to avoid it ... the uncertainty principle ‘protects’ quantum mechanics. Heisenberg recognized that if it were possible to measure the momentum and the position simultaneously with a greater accuracy, the quantum mechanics would collapse. So he proposed that it must be impossible. Then people sat down and tried to figure out ways of doing it, and nobody could figure out a way to measure the position and the momentum of anything – a screen, an electron, a billiard ball, anything – with any greater accuracy. Quantum mechanics maintains its perilous but accurate existence (Feynman et al., 2006).

Prediction of Odds

These interwoven interrelationships so beautifully described by Feynman are indicative of the delusion of objectivity that penetrates much of contemporary thinking and practice. Ironically, despite the fact that physics has partly retrenched from its position of objectivity following the discoveries of the quantum world, the delusion of such objectivity lingers on in a number of disciplines. Indeed, after a century of aggregated delusions and suppressed paradoxes, it is still very difficult to abandon this idea about truth. Even at the level where fundamental physical laws were constructed to represent reality, we cannot really tell exactly what is going on. We may provide descriptions of reality, and come up with a series of interpretations, but we cannot really explain anything. There is no answer to the question why? There can be no answer. All that we can talk about is a prediction of odds.

What an amazing irony; what a beautiful antithesis to the thesis of science. The enterprise of science, which has taken upon itself the investigation of the nature of Nature, is having to compromise. Rather than certainty and causality, all that modern science now delivers is a prediction of odds. Who could have expected that the scientific establishment, which has been

pursuing the truth about Nature and reality for centuries, would have to endorse the use of the concept of probability when describing Nature.

These problems surrounding the double-slit experiment indicate that quantum mechanics holds serious implications for observation. But even more importantly, there are grave contradictions in the distinction between classical and quantum mechanics; contradictions that bring to light an even more fundamental problem. Obviously, the development of quantum mechanics came after the development of classical mechanics, and this presents us with an example of a most troubling situation, namely the absorption of previous bodies of knowledge by newly developed theories.

Feyerabend nailed this problem down with the following statement:

the magnitudes (properties) of classical physics can be determined at any time with any required precision. On the other hand, quantum-mechanical entities are complementary in the sense that at a given time they are able to possess only some of their possible properties. Now classical mechanics is a special case of quantum mechanics, which means that all the objects of the macroscopic level obey the laws of quantum mechanics. Hence, we must re-interpret the signs of classical physics as designating properties, which apply to their objects (the objects of the macroscopic level) in almost all circumstances (whereas according to classical physics they apply strictly in all circumstances). This means that *having adopted quantum mechanics we must drop the classical interpretation of classical physics* (Feyerabend, 1975).

This consequential paradox identified by Feyerabend is worthy of further reflection and analysis. We will carry out this analysis by adopting a systems theoretical perspective, considering every theory as a system in its own right. Where a theoretical body of knowledge is considered as a system, then we are inclined to follow Luhmann's way of decomposing that system, in which two distinct possibilities arise. One possibility is to treat each system as an assembly of sub-systems; the other is to treat each system as an assembly of elements and the relationships established between those elements. As we remarked in the chapter of Systems Theory, the first decomposition is a more structural way of viewing a system while the second leads to system complexity, described through a series of elements that are part of that system, namely its theoretical constructs, equations, descriptions, hypotheses etc., and the relationships established between these elements.

Quantum Mechanics Contra Classical Mechanics

We are interested in studying the connection between the two systems of classical and quantum mechanics. The *raison d'être* of both systems is to represent the world of physical phenomena, and so we also want to study what the interaction between the two systems implies for the representation of that physical reality. By abstracting this particular case of classical and quantum mechanics, we will glean some general principles about how two theoretical constructs interconnect. We will label the system of classical mechanics as System1; and the system of quantum mechanics as System2. To see what this abstraction implies for the representation of reality and theory construction, we will resort to some fundamental concepts of Systems Theory using both the basic distinction between system/environment and the concept of system complexity.

As already noted by Feyerabend, it is commonly accepted that classical mechanics (System1) is a special case of quantum mechanics (System2); and so System1 is completely contained in System2. What does this imply? Let us suppose that we have an observer who is operating according to the rules of System2: we will call him observer2. Observer2, familiar with the world of quantum mechanics, will immediately recognize that System1 is contained within System2. From a structural viewpoint of system decomposition, observer2 could thereby assert that classical mechanics is a sub-system of quantum mechanics.

But what if he were to take a system-complexity viewpoint of decomposition? Here things get somewhat complicated, and so we will examine this scenario step by step. Observer2 would recognize that the very existence of System2, quantum mechanics, is dependent on its incorporation of System1, classical mechanics; for otherwise the evolution of quantum mechanics could not have taken place, and the transition from System1 to System2 would never have materialized. Hence observer2 must acknowledge that System2 is an expansion of System1. But the combination of the facts that System1 pre-existed System2 and that System2 evolved from System1 implies that the intrinsic complexity of System1 must have posed a constraint on System2. For System2 needs to include System1 as a special case within itself, and therefore it has to: (a) absorb the complexity of its predecessor; while at the same time (b) develop a complexity of its own, based on the introduction of new elements that will allow it to be differentiated from System1 and be treated as a relatively distinct theoretical entity.

Observer2 now asserts that the existence of System2 is conditional upon the absorption of System1's internal complexity. Hence, the complexity of

System2 is compromised by the necessity to interconnect some of the new elements and relations developed within System2 so that they can interface with the old elements and relations of System1. This theoretical path dependency has important implications for System1.

System1 can now be re-interpreted on the basis of the connective possibilities that arise because of the references that are constructed from System2 back to System1. The transition from System1 to System2 also signifies an increase in the overall systemic complexity if we consider System1 and System2 in tandem. This increase in the systemic complexity is attributable to an increase in the elements' connective capacity that, beyond the mere enumeration of individual elements, creates another problem. The elements of System2 must already be constituted as more complex in order for System2 to engulf System1, and this increase in the complexity of the elements of System2 forces novel distinctions upon the elements of System1, and a re-interpretation of the previous connections established in System1's elements.

The elements and the relations of System1 cannot now be seen in isolation. They must be viewed as the entities that create the path dependency for the evolution to System2 and as a constraint to System2's own internal complexity that has to incorporate them. The description of this systemic process given here essentially reflects upon the paradox unveiled by Feyerabend, namely that 'having adopted quantum mechanics we must drop the classical interpretation of classical physics'.

We claim that the renegotiation of the fundamental system/environment distinctions between System1 and System2 is at the core of this problem. From the perspective of observer1 operating according to the rules of System1, the system/environment distinction will have changed from what it was prior to the introduction of quantum mechanics. Prior to that introduction, the system/environment distinction through which System1 acquired its self-reference was that the environment of System1 was the world of natural phenomena. Since every self-referential system is defined through a difference between itself and its environment, the couplings that were developed between System1 and its environment, so that the world of natural phenomena can be described, were gradually internalized by System1 enabling it to evolve in a self-referential manner.

However, with the introduction of System2, observer1 is forced to re-examine the distinction between system/environment for System1 and to accept that the structural coupling between System1 and its environment must change.

With the introduction of System2 and its incorporation of System1, an internal system/environment distinction is created within System2: namely the system treats part of itself as its environment. This newly developed distinction is essentially the distinction between System1 and the environment of System1 within System2. This internal (Luhmann calls it esoteric) system/environment distinction manifested within System2, and involving both System1 and the environment of System1 within System2, must be distinguished from the external system/environment distinction between System1 and its environment that includes: (a) the environment of System1 within System2, and (b) the environment of System2. The environment of System2 is also an environment to System1; the environment to both systems then represents the world of physical phenomena since both systems attempt to describe the nature of physical phenomena. Through the esoteric system/environment distinction, the internal elements of System1, namely classical equations, descriptions, hypotheses etc., are subjected to a structural coupling with elements of System2, namely quantum equations, descriptions etc. This leads to an inescapable set of conclusions. System2 must already be constituted as more complex than System1, not only because of an increase in the number of elements it has to internalize, but because System2 has to establish relationships between itself and the former system, System1, it now contains. This increase in complexity, justified by the connecting capacity between elements of System2 with elements of System1, forces a new set of distinctions through which observer2 can interpret the elements of System1. The very existence of System2 distorts the self-reference of System1. It does so when the newly developed distinctions of System2 act as positive feedback to System1, and thereby destabilize System1's own set of distinctions.

Essentially, what System2 does is to utilize a different set of distinctions through which the world of physical phenomena is to be interpreted. By utilizing a different set of distinctions, System2 forces part of its own system to be an environment to System1, thereby re-constructing and distorting the self-reference of System1, and to such a degree that even a self-referential form within System1 becomes paradoxical. Hence following Feyerabend, in adopting quantum mechanics we must drop the classical interpretation of classical physics.

The implications stemming from this situation are not to be taken lightly. This re-construction of distinctions by theories, which must totally absorb their predecessor theories, becomes responsible for the emergence of

further paradoxes that highlight the newly developed distinctions forced onto System1 because of the existence of System2. All the ideas behind the possibility of achieving a scientific unification where all is explained and described are, in effect, a denial of the distinctions created between System1 and System2. The trend towards unification essentially constitutes a denial of the esoteric system/environment relationships that are created whenever a new theory absorbs its predecessor and forces a new set of distinctions onto the outcomes of former distinctions/observations of previously gained knowledge.

Any observer operating within the set of distinctions put forward within the scope of System2 is utilizing the distinctions of the quantum mechanics system in order to interpret the world of physical phenomena. However, such an observer is faced with another possibility: that of carrying out a second-order observation, of observing through his own distinctions that are part of System2 the way the distinctions of System1 are used to observe and describe the world of physical phenomena. This type of self-reference is rather unique. System2 uses the primary distinction between itself and its environment, and projects that distinction onto System1 that is contained within System2, so that the distinctions between System1 and its environment can be re-established.

When carrying out a second-order observation, it could be argued that both a first- and a second-order observation are occurring simultaneously. In the jargon of physics, this could be described as a quantum observation; however, we refrain from designating it as such since the term quantum is already far too overloaded, and has been heavily misused. It is often forgotten that the initial use of the word quantum was to signify the simultaneous existence of the same object, say an electron, at different states.

The same cannot be said about observation. Taking higher-order observations into account, lower-order observations are subjected to a different set of distinctions that interfere with each other. For the observer responsible for generating such distinctions, they induce an asymmetry that renders the concept of order of observation obsolete. What we have previously asserted is that the asymmetry constituting the fundamental prerequisite for self-reference needs to be factored into this issue. If we consider System1 and System2 in tandem, thereby creating the delusion of unity and encapsulating it into the single word physics that defines the discipline, then a number of systems become visible. Each includes its own set of distinctions; each is representing a different theoretical take on how

the world can be represented. What the seamless unity projected by the use of the word physics does is nothing more than forcing all these systems to collapse; essentially, it masks their underlying distinctions and their ceaseless interference, thereby creating, and constantly feeding, the trend towards some grand unification of theories.

We argue that observations of a higher-order cannot be described as simultaneous observations of various orders, say a first-order and a second-order at the same time, since that would imply some sort of symmetry between them. Ultimately, any form of symmetry would ignore the interference between the distinctions generated by an observer at any one particular order of observation. In observations of what others would term a higher order, we state that the asymmetry between different orders of observation is intensified. In fact, even if from the perspective of those observers who carry out higher-order observations it could appear that the possibility of refined descriptions of reality is strengthened, we must not lose sight of the actuality that a higher-order observer is at the same time always a first-order observation for some particular observer. This ontological duality of a higher-order observer implies that distinctions are created by his observing at two different levels: one level of distinction generation is due to his higher-order observing, and another is due to his first-order observing that constitutes an integral part of the function of any observer. The separate sets of distinctions created at these two different levels will interfere with each other, but more importantly, the primary distinction-generation activity due to the first-order observing is what dictates the asymmetry between the two. No matter how in-depth the higher-order mode of observation becomes, primacy must be granted to the generation of distinctions made during that observer's first-order observation as it demarcates any observer's function.

The Principle of Collapsing Systems

Systems must collapse from the state of their intrinsic complexity so that they may be identified as such and observed, to allow for observation to occur, or for aspects of an observation to be processed computationally, or in more general terms, in order to allow for the communication of information between observing systems.

After a few initial comments we will analyse the implications of this principle. First of all, the reason we provide a generalized form of the principle of collapsing systems is closely interrelated with the underlying

processes behind the definition of a system. Also, observation is crucial for the principle of collapsing systems, as it is observation that forces a collapse of the systems' complexity. Without collapsing systems, there is no observation. Finally, systems collapse so that information processing can be facilitated.

Systems Theory does face some difficulties in the very definition of the word system, as we saw in Chapter 7. The authors believe that part of the reason that many fail to relate to Systems Theory⁵ is that the word system has been continuously misused across a variety of disciplines. This is particularly the case within information technology, where the word has come to mean merely a particular instantiation of technological artefacts and their installation. In Systems Theory, however, the word system takes on a completely different meaning; one associated with a series of concepts including boundary, environment, positive and negative feedback, self-reference etc. that are crucial for describing the systemic effects that a system suffers and triggers, together with the various processes that are important for a system's constitution and survival.

Within Systems Theory, a system can be anything that the observer wishes it to be, and the authors really mean anything. Even though Niklas Luhmann, who has been frequently quoted in this book, talks mostly about 'function systems' within society, such as the legal system, the economic system or the political system, the premise that a system is whatever an observer identifies it to be must be considered to be far more general. The difficulty in initially defining the system often poses problems, but it has to be understood that there is no single correct way of defining a system, and that any definition will be an observer-relative choice. Even for a single observer seeking to describe a particular problem domain, such a definition is partially delimited by that domain, and even when researching within the same research area, it still is possible to describe a system differently.

We will now provide an example of a collapsing system by discussing how the formation of a system itself takes place.

A collapsing system is encountered in the very act of system formation. If we define 'the act of defining a particular system', A say, as a separate system in itself, B say, then the environment of system B will include a number of different possibilities. Such possibilities are typically constructed by the interaction of the observer with his own environment, research interests, and also by the extent with which the observer can describe and/or have access to the complexity of the environment of system B.

System B, which in this example is the act of defining a system, including the observer, whose presence we, as second-order observers, pre-suppose, is itself restricted like any other system, because for any given system the environment is substantially more complex than the system itself. This difference in complexity between system and environment plays a distinct role in the act of defining a system. However, soon enough the destabilizing force of positive feedback enters the picture, and system B, namely the act of defining the system, collapses.

Following the collapse, from the perspective of the observer, an inversion occurs, whereby the part of the environment, which through observation has been identified as being of interest, then becomes the new system to be studied, explored and investigated. The initial system therefore must collapse in order for it to be observed, and thus it gives way to another system. And another, and another ... The observer's cognition facilitates this process of collapsing the system in order to deliver the system we are searching for, and which is so hard to define.

It is interesting to notice here that observation as a system can only be described through the interaction of that observer with what he is observing; this description can in turn be attempted by a higher-order observer who collapses the possibilities of his descriptions down to a simplified form that can be recognized as a system. Hence observation as a system is never static or closed. This holds true for every description, including the authors', because if this were not the case then identification of a system would have been possible without an environment: we have denied this possibility very early on.

We can see an example of the above assertion if we attempt to describe Systems Theory by using the terminology of the theory itself: a most peculiar self-reference. In this attempt, and if we identify the entire set of systems theoretical concepts to be the system to be examined, then the environment includes: either (a) different domains of applications whereby system and environment exchange feedback and hence the system's theoretical concepts can be applied; or (b) other theoretical concepts that cannot be part of the system, and hence are not related to Systems Theory, but which can be incorporated in a fashion whereby the system can change self-referentially.

Here we can delineate two distinct processes: one whereby the system can change self-referentially within its own set of concepts, deducing new concepts from reasoning that relates one to the other; and another whereby a new concept, originally external to the system of Systems Theory, becomes part of the system. Despite both of these processes being intuitive, there is

one thing that should become crystal clear: both of these processes imply that decisions are made by observers; decisions that ultimately identify what concepts must be related to others, and at the same time, what concepts will be left unrelated; both of these processes are collapsing systems in themselves. If they were not, then we would reach the paradox of unobserved systems, which would imply that we would be able to identify and define a system without actually observing it or infusing it with the potential of being observed.

Collapsing systems and self-referential systems are therefore intertwined as the collapsing system collapses in a self-referential manner through it being observed.

CHAPTER THIRTEEN

The *Reality* of the Real

So we are reaching to the end, and at this stage the authors can only hope that the reader has come to accept the appropriateness of the delusions they have utilized, thereby recognizing the book as a self-referential system in itself. Having got this far they are confident that such perseverance does demonstrate at the very least that the reader is intrigued by the authors' 'fabricated reason and its reasonableness' (Heidegger, 1999).

They do hope that she now rejects the *real world* of scientific certainty and instead sees it as a magical unnatural place where, within the realm of imagination, within the realm of chance, within the realm of necessity, the improbable can and does happen. This is a world where everything, including the so-called scientific rationality, is a constructed delusion; a delusion based on the multiplicity of distinctions that are employed by observers, but which are surrounded by the paradoxes these observers must suppress so that they can find real value in the utility of their descriptions. However, that value is only to be found in the certainty induced by self-reference; move outside the scope of that self-reference and the absurdity resurfaces.

Indeed, both authors shamefacedly admit that often while writing this book each had been tempted into believing he had attained 'real understanding', only for some new evidence to change subtly his perspective. Was that new understanding 'more real'? When is more real, real enough? How many times does reality have to be reformulated in order to satisfy our lust for truth? For 'truth' is forever elusive, containing processes that 'challenge each other, recoil from each other, permit or deny each other, are blind to each other'.¹

By standing outside this belief in the real value and truth of such descriptions there emerges a recognition of the grandest absurdity, namely a belief in being able to examine and/or explain the *real nature of reality*. This absurdity takes several distinct forms. From within their own self-referential certainty many scientists see religion as absurd. Religion of course attributes truth to an ineffable supernatural being beyond the realms of observation and sense data, thereby displacing the paradoxes from human territory altogether. From that position all non-belief is absurd. Science, on the other hand, insists on its own absurdity of uncovering the nature of this reality through the human application of scientific method, by inhibiting the

paradoxes that are constructed from all distinction-making process. In doing so, science postulates the possibility of grand theories: all-encompassing frameworks that encapsulate the nature of the cosmos. But there can be no Grand Theory of Everything, because each theory is the answer to some question 'Why?' And there is no 'why?' in the world; it exists only in the head of an observer that finds a particular utility in his/her descriptions.

Natural Contra Unnatural

Each individual human is a self-stokhastik being living in a natural, namely non-linear, world. A world beyond understanding, but one that can nonetheless be described through the use of artificial devised/constructed notational schemas. In this way each individual has access to an abstract/artificial/unnatural linear description of that world constructed from delusions, including theories and methods that were developed self-referentially for just that purpose. The incongruity between the natural world and the unnatural worlds developed out of cognitive abstractions remains haunted by paradox and absurdity.

Each individual's lifetime is a journey of personal discovery on which he develops a private self-referential system of delusions needed for him to survive and prosper. Armed with the structurally coupled abilities of observation and cognition, each individual takes on board the shared-delusions of others that were communicated via the medium of socially agreed frames. By being absorbed into the background of thought, these delusions become deeply engrained within the rational mind of the individual as they are constantly being used to construct meaning: to pull a linear order out of the *Chaos*. That meaning only makes sense within each personal system of self-reference, but outside that system the delusions appear to be absurd. Useful? Yes. But nonetheless absurd.

This book is the authors' attempt to pull readers out of the comfort zone of their personal self-reference, and get them to confront some of that absurdity. Obviously, readers cannot leave their self-referential systems completely; for that would mean the end of cognition itself. Of course they must remain inside their deep-seated self-reference of thought and language, for how else would they be able to read and grasp the ideas in this book? Those readers can, however, question some of their more superficial socially constructed shared-delusions and belief systems. That is why the authors chose to confront the sacred cow of science and some of the particular systems it encloses, namely mathematics and physics. They could

have chosen softer targets like the wannabe science of management, but the authors' iconoclasm is better served by aiming at some of the 'self-evident' self-referential certainties that can be found in abundance in the so-called hard sciences; the supposed pinnacle of human intellectual achievement.

Science is a search for truth ... but truth about what? Scientists typically answer: truth about reality, although this does beg the question that has always preoccupied scientists and philosophers, namely just what is reality? Anyway, there are self-evident benefits in pursuing such nebulous 'truths' that accrue from the utility that emerges when examining the properties of this reality: a utility that appears to us as something truly tangible and of a non-negotiable nature.

An Observer Bias

Whatever forms our intellectual gymnastics around reality may take, our actions will always admit that deep down we do believe there is a reality, and that this reality manifests itself to us through those actions. An examination of that reality yields mechanisms that deliver an immediate utility: the Laws of Nature. The delusion of objectivity serves this function well. For unless we remain convinced of our existence within an objective reality whose consistency we can depend on, and through which our interaction yields benefits, then we would not continue to investigate the various properties seemingly exhibited by that reality. Properties uncovered by such investigation are manipulated to achieve practical/useful applications, and they give us a springboard to investigate further properties. Through our manipulation of this knowledge of the real world, we construct the expectations that may be used to manipulate that reality to advantage.

This book has repeatedly insisted on an observer bias in any understanding of reality. The role of the observer is crucial here in guiding the differentiation that indicates which particular part of reality is being observed, and what is left unobserved. By observing, something is automatically left unobserved, as this fundamental distinction is the functional premise of all operations related to observation.

If there is such a thing as a natural reality then it is never accessible to us exactly as it exists in itself, although it can be approximated *unnaturally* by using abstractions that are themselves formed by cognition through the application of delusions. Of course, the phrase 'exactly as it exists in itself' implies that no observer is necessary. However, this does raise the issue of whether such an ontology, of a world in itself, can ever be

conceived without the paradox of an observer creating a world where no observer exists. As human beings, we unavoidably operate in the world by interpreting the sense data that feeds back from our environment into the observer-equipped cognitive systems that are ourselves. Human beings, as self-stochastic systems endowed with the abilities of observation and cognition, manage to create an interpretation of the non-linear reality through self-reference, albeit through artificial linear abstractions. Such observation and cognition develop by interaction with the 'real world', and lead on to yet further observation and cognition. Through our own personal interpretation of supposedly normal perceptions, we each formulate the fabric of an individual reality. The individual stands in awe of what he can achieve through his private interpretation of reality and its manipulation, and this, almost spontaneously, creates the delusion of a reality devoid of paradoxes. Mostly, this process manages to blur the distinction between appearance/reality, and thus the distinction between utility/truth becomes further compromised. What appears to have a utility suddenly acquires the status of truth; the status of being veritably real.

Truth may be a single word, but it does not correspond to any clear and unambiguous single entity. Science too is a single word and is perceived to be a single entity despite the tremendous disciplinary fragmentation that testifies against that perception. The same can be said about reality. If, for the sake of argument, reality is taken to be a single entity then questions must arise as to the nature of reality.

The Nature of Reality

Given their insistence that all descriptions are linear and thus unnatural, the authors are not foolhardy enough to claim that there can be a definitive answer to these questions. There are, however, circumstances under which an examination of the nature of reality delivers useful meaning. Such circumstances arise when we reflect upon the ways in which we interfere with an observed reality, and attempt to examine how the concept of the nature of reality is influenced by this interference.

In his work on describing the nature of reality, Bertrand Russell used the example of a table to illustrate its elusive character. He asserted that through sense data we perceive the colour and texture of the table. Of course, colour is contingent upon the lighting conditions in the room, and the point of view of the observer. Hence it is difficult to make a convincing inference as to just what the colour of the table is. As Russell puts it: 'we are compelled to deny

that, in itself, the table has any one particular colour'. Colour is therefore not something that is intrinsic to the table; it depends on the observer and the context of observation (Russell, 2004).

An even more interesting problem arises when examining the texture of the table. On this point Russell states:

With the naked eye one can see the grain, but otherwise the table looks smooth and even. If we looked at it through a microscope, we should see roughnesses and hills and valleys, and all sorts of differences that are imperceptible to the naked eye. Which of these is the 'real' table? We are naturally tempted to say that what we see through the microscope is more real, but that in turn would be changed by a still more powerful microscope. If, then, we cannot trust what we see with the naked eye, why should we trust what we see through a microscope? Thus, again, the confidence in our senses with which we began deserts us (Russell, 2004).

The implications of this example for probing the nature of reality are indeed very important. The use of the microscope as an aid to examining a property, in this case the texture, of an observed object, namely the table, raises the issue of whether what we observe through the microscope is *more real*. If that is the case, and taken that more and more powerful microscopes can be invented, more and more refined versions of reality can be attained.

However, in general, the transition from real to more real remains elusive. In such a scenario, two aspects undermine the goal of achieving the real nature of reality. First, there is no end to this sequence: a more powerful aid for examining object-related properties can always be invented assuming no limits to scientific/technological progress. Although we do come up against the absurdity of infinity here, and for consistency must ask if there is a limit. Second, that we can distinguish between real/more real versions of reality itself implies that there are degrees of malleability in our interpretation of the concept of reality. The latter issue alone signifies that there is no such thing as a single and uniform reality, the nature of which we can extract by means of investigation, simply because these investigations imply both distinctions and observing systems that observe on the basis of these distinctions.

The authors' interpretation of Russell's microscope example led them to the issue of degrees of malleability of reality itself, and by implication there is absolutely no reason why the same argument cannot be made for every technology and not just a simple microscope: be it electron microscopes,

x-rays, particle accelerators, radiation detectors etc. What these technologies do is to amplify the feedback of sense data through which we attempt to examine the nature of reality. In all these circumstances, however, we may not speak of the nature of reality, rather the technological construction of reality.

Is There an Issue?

Despite these difficulties in examining the nature of reality, the human mind usually remains unconvinced that there is an issue. The belief that there is a reality, even a single real world, seems to be hardwired into nearly every self-stochastic observer. Perhaps this is an irony to which cognition itself is not particularly sensitive. Indeed, there may be a delusion in the superiority complex of the human intellect that bypasses the paradoxes in the primary mechanisms through which we investigate the fabric of reality: the principle of collapsing systems that denies the paradoxes implicit in observation. Nevertheless, no matter how hard the intellect tries to maintain the denial within its system of self-reference, paradoxes will force themselves out into the open; then the concept of observers as distinction-making entities and the concept of the technological construction of reality will always interfere with the delusion of the one reality.

Thus, it is not only individual observers that disturb reality. Technology too is an instrument that disturbs the *fabric of reality*. If, as we assert, observing is disturbing, then what technology does is to modify both the observation and the disturbance. The only safe conclusion to be made about the nature of reality is that it exhibits considerable variations that depend on the distinctions and disturbances that are caused by self-stochastic observers.

As if those problems were not enough, there is another most troubling problem that interferes with the nature of reality. Philosophically, this poses further problems that would require at least another book to examine it satisfactorily. Here we will only mention it in passing.

In attempting to examine the nature of reality, we cannot but make an ontological connection to what exists in the real world. Reality pre-supposes some sort of existence, and vice versa. However, the existence of entities in the physical world, the existence of a reality that we attempt to uncover, is only part of the reality that is investigated. The processes that we construct in order to examine such a reality pre-suppose another form of reality: some examples are in order.

A Constructed Reality

Plastic for example does not exist in nature. Neither does silicon. Neither does a number of elements in the Periodic Table. Before plastic, or silicon, or anything else that was constructed, and hence brought into existence and thus into reality, it would not have been possible to designate all these things as part of the nature of reality. This creates a differentiation between things that were already present in the physical world and those that were gradually uncovered by humanity, not previously present. We will call the former *already-present reality*, and the latter *constructed reality*. The turning point, and the subtle irony in the interaction between these two, is that things that were not originally part of the fabric of reality, once constructed, are subsequently used to investigate the nature of reality. In other words, constructed reality contributes towards an investigation of the already-present reality. An investigation of the nature of reality through these means implies interference at the level of ontology. The nature of reality is such that it allows for the development of constructed realities, and through this possibility, an investigation of the nature of reality is re-realized.

The self-reference that such a description acquires is rather remarkable and deserves further reflection. How is it possible for realities that did not exist suddenly to come into existence? This question could be re-arranged: above and beyond the already-present fabric of reality, what is it that triggers the possibility of constructed realities? Certainly, we could imagine that one way of looking at this would be to say that, somehow, properties intrinsic in the fabric of an already-present reality must allow emergent properties in the fabric of the constructed reality. But there is a problem here. In our experience, alternative realities do not emerge spontaneously from the fabric of already-present reality. If they do emerge, as far as human beings are concerned, they must either be subsumed in the fabric of an already-present reality or simply disappear into a state where their observation is not possible: as with the parallel universes that exist according to quantum theory.

In the former case where emergent realities could be subsumed into the fabric of an already-present reality, it could make sense to talk about the way in which the nature of reality evolves, provided such a thing is possible, and is not inextricably bound to our perceptions of existence and our evolution. In the latter case, if observation of a reality is not possible then hypothesizing about its existence can only serve a purpose for us as self-stochastic systems; in particular, the purpose of displacing the paradox to another reality, albeit one that is unobservable: how convenient.

A case in point is the multiple universes hypothesis. This case becomes part of a distinction of observable/unobservable realities in order to fit with a theoretical projection and a modelling of the already-present reality. In other words, in order for a theory to be constructed, we need the compromise of a hypothesis of existence for a reality beyond reach, beyond observation. This is the tipping point where science suddenly mutates into non-science. What is the hypothesis of an unobservable existence if not the apotheosis of alchemy?

Reality as Self-reference

The problem is that these hypotheses feed forward to construct further paradoxes. Self-stokhastik systems that are able to observe, remove themselves from the perception of observing the reality within which they exist. The immediacy of a first-order observation in which each self-stokhastik system is engaged gives rise to the delusion among first-order observers that whatever reality is observed must be external.

But the observer together with the reality within which he or she exists constitutes a self-referential system. Initially, it might appear difficult to establish a boundary for such a system, or even an environment. However, if we take into account that an observer is a self-stokhastik system, capable of cognition, then it becomes evident that a particular observer and the reality within which his cognition develops exist in tandem with other observers and the realities within which their cognitions develop. Thus, if we define *a particular observer and the reality within which he exists* as a self-referential system, then that system receives information from other similar self-referential systems, constituted by the inextricable binding of other observers and the reality that they perceive.

The structural coupling between such self-referential systems is in effect assisted by the development of theory. Theory becomes the medium through which self-referential systems, that is of self-stokhastik observers within their individually perceived realities, manage to communicate. Part of making sense of the world is not only the development of theory as an explanatory medium, but also as a communication medium between these self-referential systems.

Within each self-referential system, the cognition of a self-stokhastik observer collapses the complexity of the perceived already-present reality. From that collapsing system, the simplifications that arise are communicated on the basis of notational schemas that become the primary

methodological tools for delivering order from the *Chaos* already present before the distinction between an ordered/unordered reality is cognized by a self-stokhastik observer; that is, in this sense it is only when an observer attempts to extract order from the *Chaos* that the distinction between ordered/unordered reality surfaces. In this regard reality is not a singular entity; in effect, reality is a contingent self-referential system that includes an observer who has the capacity to interrogate part of the system by subjecting it to an internal system/environment distinction. In this way, an observer who is trying to make sense of the world artificially separates himself from reality but without ever being able to escape this particular self-reference, unless that is he/she ceases to exist/observe/cognize.

Expanding Reductionism by Self-reference

What is it then that enforces the delusion of being able to uncover the nature of reality? How can the construction of theory, assisted by the technological construction of reality, convince observers that they can have complete dominion over their reality descriptions?

Ultimately, behind these delusions lies the belief that there is some form of truth that through the application of scientific method becomes more and more approachable. It is now time to dig deeper into such a statement to see what it implies. Central to such a description is the idea of reductionism, the process of breaking up a problem into its parts and then examining the parts, with the goal of eventually putting them back together as a solution. Standing in direct contrast to this idea there is holism, that parts cannot exist independently of the whole, underpinned by the assumption of emergent properties that are exhibited in different types of systems, and that such properties cannot be reduced to individual parts.

We must come to realize that both reductionism and holism imply distinctions, albeit with each distinction taking a different form. This is more apparent with reductionism, despite the problematic descriptions that reductionism entails. That both reductionism and holism imply distinctions is a very crucial point, and both need to be considered. Therefore, what we immediately need to examine will be the difference in how reductionism and holism imply and create their own distinctions. The question that is therefore posed takes a position from within the realm of second-order observation, and one that is forced to collapse since we're observing it. We have to ask: what is the difference between the distinctions assumed by reductionism and those assumed by holism?

Reductionism

With reductionism, an initial observation identifies a problem domain, and subsequent observations are required in order to reduce the problem domain into different component parts so that an examination of the parts themselves can begin. This pre-supposes a double movement that first identifies a problem domain, and second dissects it. All the problems in reductionism are then concentrated on the inherent difficulties that are implied when one tries to put the parts back together. However, there is an underlying belief that is even more problematic, namely that an observer can create a multiplicity of distinctions for the same problem domain, and subsequently synthesize the outcome of these observations together so that the problems of reductionism are ameliorated. In other words, the same problem area is dissected over and over again, while the belief remains that in every single act of observation that involves a distinction-making process, the problem of 'residual categories' can be solved by taking yet another slice of the problem before attempting a synthesis: namely a synthesis of unique distinction-making processes that will somehow coalesce to provide some overarching description of the problem domain.

Let us make this more explicit. If each observation is considered to be a unique distinction-making process, as there can be no observing without the creation of a distinction, then synthesis can be defined as the attempted structural coupling between two or more distinct paths of observation. A path of observation is considered to be a sequence of unique distinction-making processes, that is a sequence of observations and the system/environment differentiations these entail.

By the unavoidable construction of system/environment differentiations that are included in any process of observation, every single observation dissects a problem domain by making an observable/unobservable distinction. This, as we have previously mentioned, is guided by the function of the frame that is used for that particular observation to take place. Reductionism then can be characterized by an expansion of these distinction-making processes onto the same problem domain.

The same problem domain is dissected once and an aspect of it is internally isolated for study; then the same or another observer goes back to the same problem domain and identifies another aspect for study, but along a slightly different path of observation. Even though different paths have been chosen, the underlying shared belief is that there can be a synthesis that is justified by the unity of the problem domain. The process gives rise to another belief:

that one can go back to the problem domain and attempt all the possible paths of observation, by observing, and observing, and observing again, a virtually infinite amount of times, and therefore exhaust all possibilities for exploration.

Findings from different observations are then supposed to collide together to produce theories, and then different findings from other observations need to be incorporated or dismissed. The synthesis that is then attempted aims at recombining all such findings into categories that supposedly create a theoretical solidarity: a construct that incorporates different observations and their findings, findings that can be virtually reproduced by the theory pertaining to the functional differentiation of science into theoretical and experimental, as analysed in previous chapters.

Within the self-consistent logic of reductionism it is evident that the underlying stratum upon which theoretical constructs are created takes different forms and hence different theories are created. The variety of these different theories is then constructing a different challenge: observation of the theoretical constructs finds a unique applicability between the theories themselves, and hence the possibility of combining different theories becomes realized and becomes an application itself. An example for such a process could be the combined theory of electromagnetism. The combination of the two, however, can never be the mere sum of the former theories, or some form of bizarre addition where a new frame or form needs to be created: a frame that will incorporate the combined schemas and hence another distinction needs to be created; one that carries its own implications and assumptions.

But what is it that happens to former theories that give rise to the possibility of their synthesis? Do they become obsolete in light of the creation of new theories or do they continue to find applicability? Actually, the previous forms/frames/theories are simultaneously rendered obsolete by the existence of the new form that may include them, perhaps as a limit case, and they continue to find applicability and descriptive power elsewhere. The simultaneous operation and applicability of different frames or theories to the internally proclaimed same problem domain, with each containing enough descriptive power to spawn practical applications, creates a setting whereby unification becomes intrinsically problematic. We examined this previously with our analysis of gravitational theories.

As the variety of approaches and solutions secures variety in how the world is represented, the opposite becomes equally realized. The world contains the

possibility of being represented differently, and more differently, and more differently, and hence the structural coupling between world representation and the world it represents resists unification in the self-referential sense. This means that we end up with a variety of scientific systems that expand by self-reference on the premises of reductionism while utilizing observational data from the world and the myriad different systems that can be identified within it. By ignoring that the technological construction of reality also assists these processes, the delusion becomes grander. We are back to Russell's microscope example and our interpretation of it. Technology assists the expansion of the reductionist mode of the self-referential system of science, but in doing so it simply orchestrates the distinctions of observers and amplifies the sense data that they receive. It does not, it cannot assist in penetrating the real nature of reality.

Holism

With holism, the set of observations that are performed in a problem domain pre-suppose a duality that considers reductionism and its flaws, as well as an emergence that cannot be attributed to individual parts. Emergent phenomena are examined within the scope of a structural coupling between a system and its environment, but such a study has perhaps been mistakenly attributed the name of holism.

Holism implies different distinctions than those of reductionism. The premises of holism distinguish between properties that are attributed to specific parts and properties of a system that emerge from the interaction between parts and are particular to the whole. But what 'whole' is that? It needs to be made clear that despite the implication in the meaning of the word, holism does not and cannot deal with everything; as we noted in Chapter 8, observation by its very nature is based on categorization and distinction-making, and so is non-holistic by default.

Holism is based on the Greek word ὅλον that does indeed imply a totality, but one that is quite far from what is actually being examined in the systemic sense where holism identifies a particular system to be the whole to be examined, a system that exhibits a set of emergent properties. The whole in such a scenario is nothing more than an identified system where the fundamental distinction between system/environment continues to apply. The distinction between system/environment actually becomes far more fundamental in the observation of a system. This generates considerable ambiguity regarding the dawning of emergent properties and whether they

are to be attributed to the interaction between systemic elements or to the structural coupling between system and environment. Resolution of such an ambiguity cannot but incorporate both aspects; that is, both distinctions. Such a handling of distinctions in holism becomes more sensitive to emergent properties without losing sight of potential elements that could also be approached within and by reductionism.

Furthermore, scope for unification is considerably undermined despite the hypothetical treatise of the whole, as in the systemic sense, no whole can escape the fundamental distinction between system and environment, a distinction that is constructed from acknowledging the importance of an observer.

The idea behind unification essentially requires both reductionism and holism. In effect, it requires two radically different sets of distinctions to coalesce into a distinction-less form. We take this possibility of constructing such a distinction-less form to be a remote, if not impossible, circumstance.

The Delusion of a Deeper Understanding

The human species has no doubt come a long way in the manipulation of the properties of reality. By this unique structural coupling between observation and cognition that gave rise to self-stochastic systems, namely us as human beings, our species has managed both to achieve an unnatural/artificial representation of the Laws of Nature and to construct technologies that have assisted in expanding this particular self-reference.

However, as self-stochastic systems, the observers engaging in all these processes are unavoidably trapped within the vast abstract realms of individual theories, which are sometimes combined and sometimes move in opposite directions. Regardless of how these processes gain momentum, the conceptually rich yet limited theoretical streams show no sign of remaining static anytime soon, if at all. They appear to grow, and grow, and grow, while at the same time they constitute collapsing systems that reduce world complexity so that communication between self-stochastic systems can become possible. This process of growing in the body of knowledge we have accumulated over centuries of continuous effort constitutes a continuing expansion from which the delusion of being able to achieve a deeper understanding emerges. From this delusion, with a considerable amount of faith involved in the legitimacy of our methods, the belief in achieving complete understanding arises.

But the nature of 'reality' not only resists a true interpretation; the real nature of reality remains rigidly impenetrable, since in order to penetrate it

we have to observe it, and by observing it we cannot but disturb it. The role of observation in this process is absolutely critical.

From this starting position of examining the consequences of observation, its complexity and the paradoxes that are inextricably bound to any distinction-making process, such as observing, the authors have laid down what they believe to be the storyline of how such distinctions come to interfere in humanity's efforts to probe the nature of reality. By tying in the processes of theory construction, the concepts of delusion and paradox, and the concept of observation as a distinction-making process to a theory of self-referential systems, they believe that they have provided ample justification to their rather unusual position.

This book is not meant to dismiss, reject or deny the efforts of the scientific establishment; furthermore, it is not meant to be a rather depressing thesis aimed at those who find comfort in the delusion of certainty and cause-and-effect processes.

It is simply meant as an instrument for reflection on the individual or collective self-referential systems in which all humans are trapped. This trap is so subtle that it subdues any perception that our cognition could have of itself from within our self-referential and self-stochastic systems. It is a trap that functions in a most perplexing way. The by-products of the distinction-making observing process, that is the consequent paradoxes and delusions, are internalized within cognition itself. This makes cognition itself a risk. The structures created by cognition deliver the benefit that the observer can develop a plan of action to deal with his environment, but this is tempered with the hazard of ignoring the inevitable paradoxes.

By raising the readers' awareness of the processes of observation and what every observation entails, the authors do hope that each reader will question herself on the individual and collective self-referential systems that she participates in and/or helps to construct. Perhaps, by acknowledging the limitations that every self-referential system entails, some benefits can be found.

EPILOGUE

Science's First Mistake

We have finally reached the end of our journey, and so it is appropriate that we now discuss and clarify the book's rather cryptic title. That title is a play on Nietzsche's notorious words: 'Woman was God's second mistake' (Nietzsche et al., 2003); a quotation guaranteed to raise the hackles of any reader who is politically correct or religiously minded. Although we should explain these words were not Nietzsche as a male chauvinist, rather they were his idea of a joke.

Woman was not the target of his rhetoric. No; he was referring obliquely to God's first mistake, or rather humanity's, and as we would have it science's also: namely that *homo sapiens*, godlike, via its intelligence, had been placed in control of the planet: the Sixth Day as described in Genesis 1, verses 27–28:

27: So God created man in his own image, in the image of God created he him; male and female created he them.

28: And God blessed them, and God said unto them, Be fruitful, and multiply, and replenish the earth, and subdue it: and have dominion over the fish of the sea, and over the fowl of the air, and over every living thing that moveth upon the earth.

How paradoxical that, in its attempts to replace God, science should take up the baton of domination from Genesis? This too was recognized by Nietzsche in his most infamous quotation 'God is Dead!' (Nietzsche, 2006), although most people don't realize these words are completed with '... And we have killed Him'. Here Nietzsche is pointing out the conceit of modernism and the rise of secular societies, all grounded in the arrogance of scientific certainty. With devastating simplicity he accentuated the vanity of believing that we could stand alone; that with scientific method, our intelligence would show us the truth about things: that we could be indisputable masters of all we survey.

For science does not give us dominion. Total control of events through the application of scientific method is a myth. Because of fundamental absurdities described in this book, we have seen that there can be no permanent solutions to the ineffable human condition, and that there are

no truths that will cover every eventuality. We are all at the mercy of the Fates, and while science may masquerade as a force for control, its tunnel vision conceals an underlying torrent of basic problems. Indeed, the hubris that comes with an unquestioned belief in the scientific method, particularly when it is targeted at social/political/commercial concerns, and especially when it involves technology, is an accident waiting to happen.

It's time to nail the big lie of the last three centuries, and stop this obsession with tidy methodical solutions. The message of this book is that understanding through scientific theory, and applied via its methods, does not place humanity in control of its destiny, and it can in no way expose the real nature of reality. Indeed there is no such thing as 'understanding', only mere description through observation. Observation is itself a delusion steeped in paradox that emerges from the unavoidable distinction included in each observation: the distinction between observable and unobservable.

For human observation does not allow us access to a real world: observation is deceived by the linearity inferred in causality. The authors have asserted in this book that we humans do not observe cause and effect in the world; instead a belief in causality is a necessary prerequisite of observation and cognition. Indeed, they claim that without the delusion of causality there would be no observation; observation and cognition are only possible because linearity is erroneously imposed on what is an always complex, non-linear world.

Linearity: just one thing after another. An assumption of sequential and consequential developments that are free of interference and surprise. Linearity: bring A and B together, and the outcome is predictably C. Here A, B and C are the categorical things that we observe and focus on in the world. However, that world is non-linear and drowning in a bubbling chaotic alphabet soup of causes that have created effects previously, only for them to interact and become new causes, and on and on; any one of which may interfere with specific instances of A or B before they interact, or mess with and change C, even before C's existence has become apparent to us; and all is swamped in the delusion and paradox of observation.

For we must recognize that each particular A, B and C is an instance taken from an expanding set of categories that each of us has been developing self-referentially since birth, and that form the cognitive building blocks of individual so-called understanding. However, these categories are abstractions, ideals, parts of a map; they are not the inaccessible things-in-the-world that they are supposed to represent. Rather they are merely pale

intellectual shadows created inside our heads; overconfidence in what these chimera whisper to us is absurd.

During our lifetimes, each of us continuously categorizes the things-in-the-world we observe; and we bunch each instance together with other similar things as if they are the same, and each group of similar entities is identified with a particular abstraction. However, in categorizing, that cognitive ideal must miss the unique totality of each particular instance of the thing-in-the-world to which it corresponds. Indeed, in order to observe, it is essential that we don't include every miniscule facet of all the components that make up the world. Without the filtering property of linearity we would be overwhelmed by the sheer enormity of the detail and complexity. However, this filtering gives rise to paradoxes that come with this categorical basis of observation, and which have the potential of interfering with that categorizing. Hence the imagined linear predictability of the behaviour of things-in-the-world, and the accompanying wish for control, will always prove illusory.

And yet observation is our cognitive laboratory, a place of enforced linearity, where we experiment as we make our way in the world, and that is only possible because we utilize the fiction of linearity that is categorization. It's not only in the Harry Potter books that we humans can induce a change in the world by chanting incantations and waving a magic wand. We may not realize it, but this is what we humans do every day when we self-referentially use our categorizations/descriptions/observations of objects in the real world to create ideas, so that when ritually applied, the world bends to our will ... usually. What is this but casting a magic spell?

However, we remain apprentices, never to be the sorcerer. The paradoxes that stem from delusion, along with unexpected events, will ultimately conspire to upset our desired imposition of control mechanisms. Nevertheless we can create transitory stabilities that enable us to make our way in the world. Humanity's trick is to introduce social, cultural, intellectual, as well as physical artefacts into the world that form a pragmatic sink for much but not all of the surrounding noise, and which limit the disrupting influence of both detail and non-linearity. Unfortunately, these filters can never hold the complex world of surprises at bay indefinitely. The linear incantation that is understanding will never totally control the non-linear world, which cannot be truly seen. That 'world is observable because it is unobservable' (Luhmann, 2002b).

So there we have it. The authors' answer to the question what is science? From their own personally 'refined ignorance', they see science as an

umbrella-term covering an incoherent and un-unifiable set of socially constructed, self-referential linear abstractions for describing what is our non-linear world. *Science's First Mistake* is to forget that its abstractions do not deal with reality, rather its models and theories are unnatural and artificial, and indeed quite absurd when viewed from outside the tunnel vision of science's self-referential certainty. Scientific descriptions, enmeshed as they are in the structural coupling of cognition and observation, may deliver clarity of purpose along the tunnel's axis, but leave the periphery littered in paradox and absurdity.

That having been said, some of these abstractions and their consequent technologies have been enormously successful in humanity's drive to control its environment. However, science is and will forever remain unnatural; an artificial construct produced by self-stokhastik systems, we human beings. If we do not wake up to the hubris in the products of our intellect, then nemesis will most certainly follow.

Science's First Mistake is a failure to recognize that there is no permanent dominion over a world that can only ever be observed by ignoring the enigma of delusion and paradox implicit in observation itself. Even so, this book is not a council of despair. Granted our world is unknowable, but it is variously interpretable thanks to the structural coupling of human cognition and observation. For ours is a magical world where within the realm of imagination, within the realm of chance, within the realm of necessity, the improbable can and does happen. With this bounty we are capable of creating structures, both tangible and intangible, many beyond the limitations of science, that furnish us with information that is a tenuous handle on the surrounding uncertainty, so that we may survive and prosper.

That having been said, the world that we perceive can never be the world as it is.

All that I know is that I know nothing.

ΕΝ ΟΙΔΑ ΟΤΙ ΟΥΔΕΝ ΟΙΔΑ

Socrates – Σωκράτης

Notes

Preface

- 1 By 'information system' we mean far more than mere computer systems, and include every aspect of collecting, disseminating, analysing and utilizing 'information'.

Chapter One

- 1 From 'Akasha', the Sanskrit word meaning 'space'.
- 2 In the original Greek this is 'EN ΟΙΔΑ ΟΤΙ ΟΥΔΕΝ ΟΙΔΑ'.
- 3 The authors refuse to disrupt the text with politically correct references to he/she, him/her, his/hers. In this book they are describing their own personal delusions (their refined ignorance), and since both are male, they will use a gender-free 'he' when referring to the third person singular. They have no objections should female readers choose to feminize the text with global edits. There are, however, sections where they do use 'she' where for clarity they need to differentiate between two separate third persons – furthermore, the text will always refer to the imagined reader of this book as 'her'.
- 4 A similar paradox appears in the famous ancient quotation: 'Epimenides the Cretan says all Cretans are liars'.
- 5 The book expands on issue of 'zero' in Chapter 5.
- 6 Higgs boson a.k.a. the God particle, proposed by Professor Peter Higgs as an 'explanation' of how the universe holds itself together. The multi-billion dollar Large Hadron Collider that came online in CERN on 10 September 2008 will be leading the hunt.
- 7 <http://www.viscog.com> and for the full story read (Chabris & Simons, 2010).

Chapter Two

- 1 For the uninitiated, 'the Scottish play' is what superstitious actors call Shakespeare's *Macbeth*.
- 2 Some American geologists support Plutarch's suspicions that the high priestess at Delphi made her predictions while 'high' from sniffing a gas (ethylene) that seeped up through a rock fissure under the temple.
- 3 An excellent introduction and a list of further readings may be found in the Encyclopaedia Britannica.
- 4 For instance, the notion of profiling and belief that 'identity' can be captured in a database.
- 5 A peculiarly sixteenth-century spelling of 'forward'.
- 6 There are books galore based on the 2012 prediction – see for example Douglas, D. (2009), *The Mayan Prophecy 2012: The Mayan Calendar and the End of Time*, London: Godsfield Press.
- 7 Rees, N. (1997), *Cassell Companion to Quotations*, London: Cassell.
- 8 The late Douglas Adams, a proselytizing technophile, gave the answer 42 to this ultimate question in his *Hitchhiker's Guide to the Galaxy*. At the behest of 'a group of hyper-intelligent pan dimensional beings', the giant computer Deep Thought took seven and a half million years to come up with '7 times 8 equals 42', which in ridicule makes exactly the same point as this book. This was quite unintentional on Adams's part: he was not making a philosophical joke – once, in a private conversation, he informed Ian Angell that he used the solemn announcement of this ironical statement simply because it sounded funny.
- 9 Hawking, S. (2001), *Universe in a Nutshell*, London: Bantam Press.
- 10 The famous quotation of American composer Charles Ives.

Chapter Three

- 1 For a treatise on the case of Galileo the interested reader may refer to Professor Paul Feyerabend's study in Feyerabend (1975).
- 2 What Alexander Pope actually wrote was 'All discord, harmony not understood' in *An Essay on Man* (1733), Epistle 1, line 289.
- 3 Many of the qualifications do not qualify the qualified to do anything; these merely differentiate (often arbitrarily), separate and place in order (a hierarchy), thereby sustaining order in society.

Chapter Four

- 1 Allusion: an expression designed to call something to mind without mentioning it explicitly.
- 2 From Hamlet, Act II, scene ii by Shakespeare.
- 3 The five senses of Aristotle are used here for rhetorical purposes. We deliberately ignore the many other senses proposed by neurologists including balance, pain, temperature difference etc.
- 4 The authors' mutation of Descartes's *Cogito Ergo Sum* – 'I think, therefore I am.'
- 5 A common variant on the Socrates quotation 'I know nothing except the fact of my ignorance' found in *Lives of Eminent Philosophers* by Diogenes Laertius. See note 2 of Chapter 1 above.
- 6 One of the many variants of this quotation; attributed to both Alexandre Dumas *fils* and Mark Twain.

Chapter Five

- 1 Measurement is the comparison with an artificially designated standard unit (an ideal).
- 2 There are many competing claims about who invented zero, although there is unambiguous documentation of the great Indian Astronomer Aryabhata using the concept in the sixth century AD.
- 3 <http://www.johnstonsarchive.net/nuclear/radeventdata.html> (statistical summary of radiation accidents and other events causing radiation casualties).

Chapter Six

- 1 Quoted in the Sunday Telegraph, 26 May 1968.
- 2 The notions of negative and positive feedback are revisited in more detail in Chapter 7.
- 3 Theoretically, even the 'insignificant' flapping of a butterfly's wings (originally it was a seagull's wings, but that wasn't so picturesque), through complex feedback, can trigger a major weather feature. This was proposed in Edward Lorenz's 1972 talk to the American Association for the Advancement of Science, 'Predictability: Does the flap of a butterfly's wings in Brazil set off a tornado in Texas?' as reported by Hilborn (1994).
- 4 The Guardian, 17 February 2008: 'Scandal of patients left for hours outside A&E'.
- 5 The first linking of this diabolical trinity is attributed to British Prime Minister Benjamin Disraeli.
- 6 'Markets can remain irrational longer than you can remain solvent.'

Chapter Seven

- 1 This definition is a combination of those given by Ackoff (1981) and Beishon and Peters (1972).

- 2 Strictly speaking ‘... every organization must be *both more and less* than the sum of its parts. It is less, because organization constrains. ... It is more because, when organised, [components] are enabled to do together what none could do alone, or if unorganised, even together’ (Sir Geoffrey Vickers).
- 3 The notion of holism was promoted in the 1920s by Jan Christiaan Smuts, the South African general, prime minister and statesman.

Chapter Eight

- 1 Which came first, the chicken or the egg? The classic causality dilemma within any structural coupling.
- 2 This creates another paradox because notations have to be communicated as well. Interestingly enough, this may create either self-referential processes (whereby a notation like language uses itself to communicate about itself) or structural couplings between different notations. But if a common notation is what is being used for depicting a frame for communication, what are the implications if the notation itself is the frame through which a notation communicates itself? Ultimately, the very fact that we are using language to communicate ideas about the implications of the communicability of language itself (based on observation) contains further paradoxes.
- 3 A more elaborate treatise on the issue of self-referentiality follows in the next chapter.

Chapter Nine

- 1 Resolving a paradox doesn’t mean the paradox goes away, only that it is encapsulated and ignored.
- 2 The observation as a whole does not imply B as a whole – the observation can only ever sample B.
- 3 To be pedantic, never-ending here means only ending with the extinction of the self-stochastic species.
- 4 The importance was that for the first time, an introduction to *quantum* (and therefore discrete energy) levels was introduced. In this, n could take only positive integer values.
- 5 Isaac Newton described himself (and all scientists) as standing on the shoulders of giants. The original use of this imagery is ascribed to twelfth-century monk, Bernard of Chartres.
- 6 On a more general note, this is exactly what happens with the development of a culture, and with individuals’ acceptance of the world as the way their community describes it.

Chapter Eleven

- 1 Nils Roll-Hansen (2004) in *Lysenko Effect: The Politics of Science*. For thirty years, until the mid-1960s, Soviet agriculture was dominated by the fanatical Trofim Denisovich Lysenko, who claimed his technique of ‘vernalization’ could radically increase wheat yield. The theory fitted the Soviet ideology, and so all evidence to the contrary was suppressed. This is just an extreme case of a ‘Scientific Establishment’ being compromised by the political correctness of the time.
- 2 Following Feynman here, and in the sense of the *natural sciences*, mathematics is a non-science; it is an abstraction that allows physics to formalize its problems, and also to provide the language for their better modelling. We are not debating here the ‘scientific’ value of mathematics and its considerable contribution to physics; we are just re-describing this crucial epistemological distinction with sheer amazement!
- 3 Teaching is the way a self-referential group/system reinforces its particular absurdities. Repeated exposure and the rites of passage of examination ensure that the ideas become ‘sensible’ among initiates.

Chapter Twelve

- 1 This experiment (i.e. *the double-slit experiment with single electrons*) was performed by the Hitachi research group. The reader of this book can find more information about this at: <http://www.hitachi.com/rd/research/em/doubleslit.html> where there is also a short video from this version of the double-slit experiment.
- 2 http://en.wikipedia.org/wiki/File:Double-slit_experiment_results_Tanamura_2.jpg2. http://en.wikipedia.org/wiki/File:Double-slit_experiment_results_Tanamura_2.jpg
- 3 This is typically done by placing a detector at one or both of the two slits (see *The Feynman lectures*).
- 4 ‘Quantum Behavior’, Chapter 37, *The Feynman Lectures on Physics*, Addison-Wesley, Reading, MA, 1964.
- 5 An observation that comes from years of teaching in the field. Equally surprising is the fact that others display a profound enthusiasm for Systems Theory on being introduced to its ideas, regardless of their background field of study.

Chapter Thirteen

- 1 This quotation is taken from Harold Pinter’s acceptance speech of the 2005 Nobel Prize for Literature.

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Science's FIRST MISTAKE

Delusions in Pursuit of Theory

How do we humans know what we know?
Can there ever be knowing about knowing?

This ambitious book is written in reaction to the so-called 'rigour' that pervades much of today's scientific research and practice. Taking examples from across the natural and social sciences, the authors examine the deep-seated assumptions that underpin the discovery of knowledge. They claim that all scientific methods are delusions in pursuit of theory. Their controversial argument uses Systems Theory, and in particular the concept of self-reference. For them, the very process of observing must mask the underlying delusions, tricking the human mind into developing a self-consistent description of itself. This opens up a belief in the certainty of a causal 'reality'. However, our esoteric descriptions, our theories, our ways of thinking, in fact all the abstractions we use to examine the world around us, are distinct from the 'reality' being observed.

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