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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.