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Risk Management

The Paradox of Uncertainty: When Less Means More?

Darren Dalcher

Risk has become a recognised pervasive aspect of life, with the management of risk taking over as a dominant pre-occupation in many business contexts. In the rush to address the visible aspects of risk, there appears to be a human tendency to ignore the inherent uncertainty of situations preferring instead to focus on more quantifiable risks. As organisations re-structure themselves around governance and risk aversion, the article asks if risk management has paradoxically increased the level of risk we face in the same way that safety engineers have concluded that adding safety devices can contribute to further accidents. The way forward is offered through the adoption of a new "design" culture coupled with a resilient society that actively engage with risk and ambiguity, including those that emerge through the avoidance of other risks.

Keywords: Ambiguity, Design Culture, Governance, Normal Accidents, Normal Decisions, Resilient Society, Risk, Risk Society, Risk Organisations, Uncertainty.

1 Introduction

The 2008 meltdown in Wall Street and other financial centres serves to highlight the flip side of opportunity and potential. On September 29th of that year, following some modest sell-offs in stock markets in Asia, the Dow Jones Industrial Average plunged by 778 points, a 7% drop over the course of a single day. In just over six hours in excess of $1.2 trillion was wiped off the value of US industry – the first ever post $1 trillion loss in a single day and the blackest day since the 1987 Wall Street Crash. The world market followed the US trend showing a daily global loss that exceeded $5 trillion.

Brokers, traders, bankers and even regulators were caught by a supposedly impossible scenario. According to

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leading economist and mathematician, Benoit B. Mandelbrot, the odds of such a daily collapse using accepted theory are about one in a billion [1]. Yet the collapse did happen; prompting Mandelbrot to point the finger at reckless risk assessment and lax oversight and their reliance on 'close enough' approximations of 'typical' behaviour.

2 Managing Risk

The management of risk has gradually emerged as a 'normal' activity that is now a constituent part of many professions. Indeed, risk management has become a central pillar of effective governance which has been adopted universally by corporations, governments and NGOs. The concept of risk has become so ubiquitous that we continually search for risk-based explanations of the world around us. Through this pursuit we have developed universal principles of organising and managing through the control of risks.

German Sociologist Ulrich Beck noted in 1992 that risk had become a dominant feature of society replacing wealth production as a means of measuring decisions [2]. The idea of a *risk society* describes the way that society organises and engages with risk. Indeed some may argue that it reflects our pre-occupation with the future and its inherent uncertainty.

The promise of technology is alluring. In the rush to adopt new technologies and embrace new opportunities we have often shown a reluctance to accept the associated risks. This is often accompanied by the assumption that risks can be controlled through the application of skill.

But what if risk is not our real problem?

3 Risk or Uncertainty?

Risk represents a conventional way of expressing uncertainty about potential outcomes. As uncertainty diminishes, it becomes possible to fully quantify risks. Conversely, as the level of ambiguity, uncertainty and complexity of a system rises, it gets progressively more difficult to fully identify, let alone quantify all potential risks.

Uncertainty can be viewed as a novel situation where knowledge of the past offers little or no value. People are generally uncomfortable with uncertainty; Most of us prefer (known) risks to uncertainty.

For a simple demonstration consider the following situation:

- You have in front of you two urns, labelled urn I and urn II.
- Urn I has 100 red and black balls, but you do not know in what proportion.
- Urn II contains exactly 50 red balls and 50 black balls.
- I will now offer you three betting situations:
-Without looking I will extract exactly one ball from each urn.
- Would you prefer to bet $100 on getting a red ball in BOTH Urns, or on getting a black ball in BOTH urns?
- This time you are allowed to take out just one ball (without looking) from either urn. Would you rather bet $50 on finding a red ball in Urn I or finding a red ball in Urn II?
- Once again, you are allowed to take out one ball (without looking) from either urn. Would you prefer to bet $50 on getting a black ball in Urn I or a black ball in Urn II?

The Ellsberg Paradox

The experiment has been conducted with tens of thousands of subjects. It is known as the Ellsberg paradox [3]. The results are almost always the same. Most subjects are indifferent between betting $100 on either red OR black balls in BOTH urns. This is hardly surprising as there appears to be an equal chance of winning in either case.

Most people prefer betting $50 on red in Urn II over betting on red in Urn I. They ALSO prefer betting $50 on black in Urn II over black in Urn I. The typical rationale that is given by subjects is that the precise proportions of red and black balls in Urn II are known and therefore this is a 'less risky' bet. The results suggest that people prefer situations of risk (where the proportions of balls of two different colours were determined at fifty-fifty) to those

of true uncertainty (where the balls were taken out of a random mixture - thus implying a probability of a fifty-fifty mix). When betting on a particular colour, most respondents chose the determined proportion for each colour suggesting that the probability of either colour is greater than fifty percent (whilst also showing no difference between the colours when asked to bet for one colour in both piles).

This pattern of preference is inconsistent with rational decision making. The implication of what has been termed the Ellsberg Paradox is that decision makers are more comfortable with risk than they are with uncertainty. Interestingly, the amount of money on offer (i.e. the prize on offer) does not alter the choice preference of participants so that the same results are obtained when the gamble offered is for $50 and for $500,000. Nor does the level of knowledge and expertise in decision making appear to change the preferences of subjects, with experts making similar choices to novices.

Other experiments reveal that decision makers will defer major decisions in the face of uncertainty. This applies even when the decisions are not directly linked, showing that uncertainty in one area can impact our performance in other areas. For example, when offered a special holiday package at a greatly reduced price, most students deferred their choice and elected to pay a non-refundable deposit until they found out if they passed their final year exam. Other groups were told their final result and the majority of those who passed and of those who failed elected to take the very same offer (presumably either as a treat or to feel better). I have tried experimenting with similar configurations with professionals who were waiting to hear the outcomes of a major decision regarding project funding or a promotion with identical results. The majority of those awaiting for results elected to defer and pay a deposit, while the majority of those who were given their result, regardless of the outcome, elected to make the same decision.

"We *cope with uncertainty irrationally by ignoring it or by worrying*" – Detlof Von Winterfeldt.

The paradox and further examples underscore our inability to handle uncertainty. Most of us are uncomfortable in the presence of uncertainty and would prefer some partial knowledge to total ignorance regarding a given situation. As a result, the opportunities that are embedded in uncertain situations may often be sacrificed in an effort to opt for risk as opposed to uncertainty (additional potential benefits may also be lost in a further effort to reduce the level of risk).

The existence of uncertainty and ambiguity is often viewed with discomfort. Uncertainty appears to act as a deterrent and determines where and how we engage with situations. Social scientists Douglas and Wildavsky noted that uncertainty prevents or inhibits risk taking [4]. Indeed, as risk managers and project leaders, most of the time we do not manage risks; we simply try to avoid uncertainties and ambiguities.

4 The Obsession with Risk

In order to tackle uncertainty we expend resources in an effort to reduce the likelihood or the expected impact of some of the risks or to mitigate their consequences. However, complex situations, especially ones with uncertainty and ambiguity, require complex tradeoffs and compromises. Reducing one risk may increase others, or introduce new risks that we are not ready for. Our tendency to avoid uncertainty and control risks is thus translated into the development of mechanisms for the manipulation of risks and the development of safety measures. However safety measures come with a price.

There is also evidence that when some risk is reduced people tend to change their behaviour and behave less responsibly. This is noticeable in terms of where we build houses: As society becomes more adapt at dealing with the outcomes of forest fires or earthquakes, people start building houses deeper into forests and closer to geological faults. Evacuation and rescue in future incidents becomes more and more demanding and increasingly more dangerous for all involved. Moreover the perceived greater safety associated with the area may now encourage chemical plants, nuclear reactors, oil refineries or biological research facilities to relocate to the same areas adding ever more complex interactions, uncertainties and risks. Future incidents and potential disasters thus become more intricate and dangerous. The potential improvement in addressing the risks is thus translated into more reckless behaviour which often undermines the improvements.

Safety specialist Samuel Peltzman demonstrated that safety measures often result in more reckless behaviour as people feel safer. His research suggests that seat belts have made cars more deadly [5]. Edward Tenner in his bestselling book "Why things bite back: predicting the problems of progress" described the 'revenge effect' that accompanies the introduction of safety measures [6]. His book is filled with examples of technology encouraging new behaviours. One of his examples is of flood control systems which encourage settlement in flood-prone areas due to the appearance of added protection. Similarly, better warning and evacuation systems can ultimately lead to greater exposure to risk as people feel safer and hence tend to take greater chances.

Safety interventions often manage to re-distribute or transfer the burden of risk rather than reduce it. Direct effort to eliminate or reduce an identified risk can therefore lead to a net increase in the very same risk, or in new risks. The redistribution relates to the feeling of increased safety but also to new mechanisms that need to be integrated into existing systems and procedures and to the need to ensure that they are correctly activated and used as intended. As we have seen over the years with both storms and floods, safety measures can also contribute new modes of failure, sometimes on new and unimaginable scale.

Rather than being more under control, the world seems to be developing into a 'runaway world' [7]. New risks and uncertainties, including global warming and financial collapses, affect all individuals whether or not they participate in the events leading to them or in their regulation. Their potential size and impact and the methods for dealing with them are also unknown.

5 Risk Organisations

Humanity has long faced risks associated with natural disasters and survival. In an attempt to improve our natural condition we have endeavoured to create, build and design an improved environment. However a major by-product of the progress made in technology and development has been the generation of the new hazards and dangers. Many of these are large, global and irreversible. They are also not well understood and many are accompanied by new risks.

Our modern society increasingly tries to guarantee secure, controlled environments for its citizens, employees and shareholders. This can be a difficult undertaking given the ambiguity and uncertainty that accompany new conditions.

The tendency to control uncertainty through risk reduction persists. As the scale and scope of the risks increase, attempts to manage risks result in the generation of new structures and procedures concerned with control and governance. One of the responses to the growth in risk has indeed been the emergence of risk regulation, the development of global policies and audit regimes that try to control risks and standardise the responses to risk. This in turn leads to new forms and frameworks of governance.

Over the last ten years risk management has become a core pillar of governance. Governance frameworks enable organisations and parts of society to take action by focusing on accountability and control. They also introduce the structure for organising around risks and uncertainties.

In response to a stream of failures, organisational risk management was devised as a set of practices and regulations that attempt to reduce the uncertainty we face. Reactive measures such as certification and disclosure regimes, exemplified by Sarbanes-Oxley legislation in the USA, offer regulatory control. Every collapse, accident or failure can thus be used as a launch pad for imposing additional layers of control mechanisms, structures and policies. This introduces procedures of accountability and regulatory compliance. In this way uncertainty is gradu-

ally reduced into smaller and better understood risks which can be addressed and mitigated.

Risk has also been elevated to an organisational focus. Many large corporations dominate the global economy, and have a large impact on society at large. Due to the legal and governance frameworks risk management has been rising up the corporate chain and plays a key role in organisational life. Enterprise risk management is growing in many leading corporate organisations. Decisions are often referred to risk committees, Chief-Risk Officers or Risk Management Boards and in some organisations risks may be articulated by the Board of Directors or allocated to specific executives. We have therefore moved from being a *risk society* which generates new risks through development to becoming a collection of responsive *risk organisations* closely implementing new governance procedures and structures aimed at reducing variation and providing visibility, control and accountability.

However such structures inevitably give rise to new risks and uncertainties. Governance structures unify and standardise action. Under competitive conditions, and especially in a crisis, they may ensure that all participants will tend to react in the same way thereby exacerbating the crisis. Moreover in common with all safety measures they engender new and unexpected impacts and generate added uncertainty.

One example of a control mechanism devised for mitigating financial risk and alleviating financial panic is the creation in 1913 of the Federal Reserve, the Central Bank of the United States. The Federal Reserve web site states that the 'Fed' "provides the nation with a safe, flexible and stable monetary and financial system". Their success in keeping the lid on the 1987 stock-market crash, the 1998 Long-Term Capital Management scare and the tech-stock collapse in 2000-2001 proved that the system largely works. However past successes and improvements can lead to new attitudes, relaxed behaviour and re-distributed risks.

The financial crisis of 2008 took everyone by surprise partly because past slumps have been relatively minor events. As we have seen, risk reduction often leads to increasingly reckless behaviour. With no major panic in recent memory, people began to behave as if there couldn't be one. After all, multiple layers of protection were in place, and new legislation such as the recently implemented Basel II regulatory framework (meant to provide improved information on exposure to risk and guarantee sufficient capital) would ensure that nothing could go wrong.

The lure of getting something for almost nothing was too tempting the memory of past uncertainties too distant. Indeed in a new development, risk itself was sold as a commodity so that risk exposure was packaged and traded. Bundles of sub-prime mortgages were then chopped up and re-sold as securities. Risk was thus re-distributed to risk organisations with accountable governance structures and matching legislation - all under the watchful eye of government bodies.

Instead of developing our capability, flexibility and the resilience to deal with unexpected events and fluctuations [8], we often invest in standardised and more universal measures to deal with common aspects as perceived in the light of previous failure episodes thereby providing greater levels of formalised assurance. We thus embody the Precautionary Principle, in trying to act in anticipation of the worst form of harm that is deemed as unacceptable. However in addressing risks we do not wish to tolerate, we often take actions and introduce new measures whose impacts we do not understand. The new uncertainty thus introduced may in some cases prove to be more menacing than the original risks.

6 From Normal Accidents to Normal Decisions

New global threats surround us from all directions. In what would appear to be an increasingly more closely–coupled world, any perturbations in one part will impact on all others. As *risk organisations* link to others forming extended impact

chains, they become more dependent on others and more vulnerable to the new risks. Threats ranging from a tsunami in Indonesia, or a blocking of the flow of oil to Europe, to a border dispute in India, an explosion in Japan or a market meltdown in China can ripple through the global economy affecting supply chains and the flow of money and goods.

The environment within which we operate can be characterised as increasingly more complex and demanding, increasingly global, within high stakes for all participants. Given the many changes, some caused by our responses to risks, knowledge of the environment needs to account for uncertainty, ambiguity and even some ignorance. As we have seen from the financial meltdown example, *risk organisations* engage in a variety of perplexing problems with social and technical dimensions. *Risk organisations* play an active part in pursuing their own agendas and shaping both the form and the context of dilemmas and controversies that their actions generate. Their perceptions of risks are shaped by the human content and the social context as well as the technical concerns.

Risk systems entail structures, procedures (including those meant for reducing risks), participants with personal perceptions and *risk organisations* operating in a dynamic environment. Interfacing with technology in such systems in an effort to reduce uncertainties to risks thus results in messy and complex environments. Adding regulatory risk devices adds to the complexity.

Sociologist and accident researcher Charles Perrow observed that in such environments, characterised by interactive complexity (where two or more failures can interact in unexpected ways) and tight coupling (where parts of the system are intertwined and have major impact on one another) accidents become inevitable, thus introducing his idea of '*normal accidents*' [9]. Technologies with these characteristics are by their very nature unsafe. The large number of components and the multiplicity of links between them entail many potential ways of interaction. Components can thus affect each other

unexpectedly and are also capable of spreading problems. Adding new safety measures increases the number of potential interactions and therefore also increasing the number of potential ways for some thing to go wrong. In other words the re-distribution of risk resulting from an intervention, aimed at reducing a known risk, may be uncertain, unpredictable, and uncontrolled.

Progressing our discussion, the implications of 'normal accidents' as they relate to the control of risks are that:

■ Stakeholders are confronted by unexpected and mysterious interactions among failures (i.e. we can't always understand how modern failures come about).

■ Great events have small beginnings (small changes and interventions may run out of control)

■ Organisations and management play a major role in causing, and preventing, accidents and failures (*risk organisations*, and their risk actions, shape the environment and the organisation itself in turn).

■ Fixes as well as safety devices add to the inherent complexity and thereby, to the likelihood of accidents (attempts to reduce risk may have the opposite effect).

We have long known that a system is as strong as its weakest component. Complex systems with multiple components and human participants have multiple vulnerabilities. Targeting specific risks without sufficient knowledge of their connectedness can lead to system failures and accidents. Indeed, many technological disasters and some financial failures can be caused by systemic organisational factors and be exacerbated through action meant to reduce the inherent risks.

Nonetheless, effective management requires crucial decisions to be made. *Risk organisations* must therefore learn to develop a wider perspective that will enable engagement with the environment and will result in intelligent normal decisions about action, attention and intervention.

7 Towards a New Culture

Risk assessment as a scientifically disciplined way of analysing risk and safety problems was originally developed for relatively well structured mechanical problems where the technical issues are well defined and the reliability of components could be analysed. However many problems relating to effects of scientific, engineering and technological inventions and devices cannot be understood by science, and managers increasingly find themselves operating outside the limits of scientific uncertainty. Indeed, many of the questions relating to future performance and delayed impacts can be asked of science, but cannot be answered by science.

Risk organisations operate in the presence of ambiguity, uncertainty, ignorance, contradiction, contention and disagreement. Dealing with uncertainty clearly requires a more holistic approach rather than a reduction to an isolated number. Organisations and the public interact in a very uncertain environment, trying to resolve messy, perplexing social and technical problems.

In a famous lecture English physicist, C.P. Snow highlighted a gulf between the two representative "cultures" of modern society, natural science and literary intellectualism [10]. The dichotomy results in a schism which has led to the isolation of the scientific process and way of thinking. According to Snow the breakdown in communication between the two distinct positions was becoming a major hindrance to the resolution of real world problems.

Dialogue between the two cultures has a distinct potential as it enables the critical to interact with the imaginative. The literary approach acknowledges the role of uncertainty and allows for a plurality of concepts and interpretations. But how can we account for our interventions and how do we ensure that they fit into our context?

The solution is to call on a further, third culture focused on practice, which I will refer to as design [11]. Design is a dynamic and evolving solution-oriented discipline, steeped in fluidity and change, concerned with initiating and creating novel forms in response to real needs. A question that is often asked is whether design fits in with the scientific approach or with the literary culture. The answer is both and neither. Design feeds on decisions and judgements and is concerned with the environment and the interactions with participants. It relies on practical knowledge based on creating a balance between invention and adaptation, and understanding and adjustment. The culture of design thus augments the theoretical knowledge and processes of the sciences and the critical ideas, discourse and aesthetic values of the humanities by offering a new dimension on the practical resolution of dilemmas.

The dynamic nature of design allows for reconciliation and resolution of multi-disciplinary dilemmas, decisions and trade-offs. The key focus on creating artefacts that result from human intervention in the natural world means that it is attuned to the reduction of mismatches and can thus thrive in the presence of uncertainty and ambiguity. Design provides the link between the cultures, allowing natural law to adapt to human environments in a practical setting thereby bringing together the natural, technical and social domain as represented through the three cultures.

Design embodies a negotiation process. The process benefits from the iteration and learning that emerge from the interaction with the problem. From our risk perspective, design represents a continuous process for engaging with uncertainties and risk. Invented solutions stimulate knowledge and further improvement through trial-and-error. Risk management thus becomes an intermediate step in an exploratory process of engaging with situations in a dynamic and continuous search for a solution. Responses to concerns and risks can thus continue to emerge from the practice of negotiating and learning. Rather than anticipating all responses, design generates a balance between anticipation of responses and resilience in the ability to continue the negotiation in order to improve the interface with the environment. It also allows us to address multiple perspectives and concerns.

The activities of arguing and negotiating are critical to the process of de-

sign, as they are responsible for the generation of insight and sensemaking and ultimately for the aggregate problem formulation. The key to success is in involving multiple stakeholders with different sets of concerns and attempting to reconcile multiple perspectives and rationales in light of emerging insights. Decision making, evaluation and sensemaking are at the hub of such action as we endeavour to make sense of the environment and create workable solutions that satisfy our needs and concerns.

The three cultures, or the three main areas of human knowledge, can therefore be depicted as the scientific disciplines, the humanities, and the disciplines of design. The glue in such a new world-order is derived from the sensemaking process, which pervades all disciplines and offers the requisite and driving tool for intelligent trade-offs between them. This can be depicted as a model linking the three cultures (see Figure 1).

8 Beyond Risk Management

The prism provided by the model facilitates the adoption of a new perspective on uncertainty and its management. Uncertainty has proved to be a defining character of development and growth. As we engage with our environment we must continue to learn and adapt.

Uncertainty itself is complex and multifaceted. Engaging with it reveals some of the contradictions and paradoxes which help to define what can be achieved. This article concludes with some of the contradictions that we need to consider in an age of uncertainty – where risk is never the total solution.

■ **Progress leads to new risks**: Through our modern history, innovation and new advances have given rise to new vulnerabilities. As such, many risks are by-products of the advances that created them.

■ **Risk management is risky**: *Risk organisations* that enhance their capacity to govern risk also simultaneously produce new uncertainties. Risk management is often utilised due to our aversion of ambiguity. The solution that it brings may increase ambiguity (thus potentially leading to new responses and new regulations which will themselves lead to new uncertainty).

■ **Buying safety is not always safe**: Adding safety devices may actually decrease safety as the new devices interact with the old systems and structures in new and uncertain ways. Buying protection may also have a similar outcome.

While many of our advances over the years have aimed to improve our condition and make us safer, they have also left us more vulnerable. A focus on the elimination and reduction of risk is insufficient. We cannot address what we do not know.

We have only to consider the following example to see the folly of this approach. Recently, Britain's 400 Coast guard rescue units have been instructed to complete a multiquestion, prejourney risk assessment before they respond to emergency callouts. Coastguard personnel must characterise and quantify the they expect to face, submit an account of the actions they make take to mitigate the risks, and determine whether the overall risk is acceptable — all before leaving the station. Given the fact that the Coastguard units often operate in uncertain conditions, saving lives may thus need to be deferred until speculation about the potential on-scene conditions is completed and translated into a risk score based on the crew's best guess about a situation they are yet to arrive at!

9 Learning to live with Ambiguity

Courting progress entails a long adaptation process which can benefit from an open stance receptive to the recognition of ambiguities and mismatches. As we realise through our new lens that total anticipation and eradication of risk is not attainable, we can start learning to balance the need to control risks with the need to respond, co-evolve and prosper in an uncertain environment. Creating a **resilient society** will endow us with the flexibility and the innate capability to adapt and respond whilst maintaining the resources to cope with the unanticipated dangers after they have become manifest. It will also open up the possibility to benefit from new opportunities that were not decimated through our pursuit of controlling risks.

"*Love of certainty is a demand for guarantees in advance of action*" – John Dewey

In our pursuit of greater certainty we encounter an emerging paradox of the 21st century, showing that the obsession with risk and our organisational and societal attempts to enhance our capability to govern risk can actually produce new uncertainties. In the same way that safety engineers have learned that increasing safety actually contributes to failures and accidents, the *risk organisation*, which is a new element
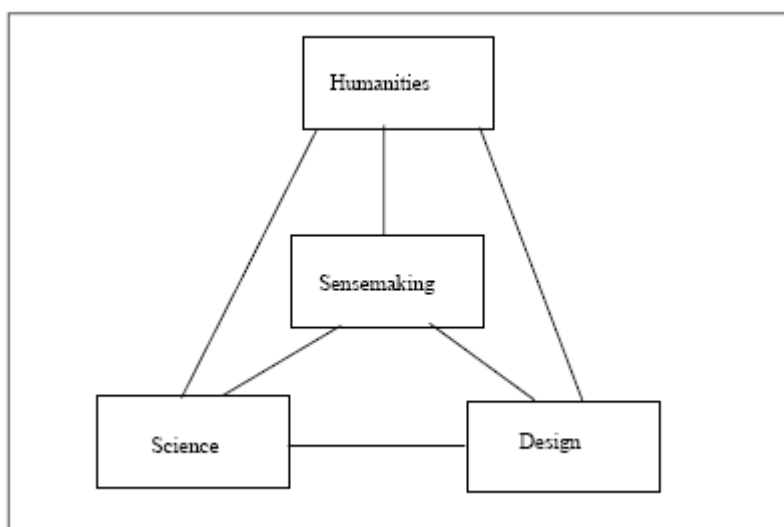

Figure 1: Managing the Three Cultures.

in our 'risk society', is beginning to recognise that the new uncertainties we encounter are sometimes greater than the risks we thought we left behind.

Our paradox of uncertainty shows that less risk can actually mean more. Risk will remain a consequence of technological innovation. In a society obsessed with the elimination of uncertainty, organisations and their actions directly manufacture and incubate new risks. Consequently, if risk alone is the new measure of wealth, the pursuit of risk reduction may still leave us impoverished and starving.

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