



LLOYD'S



# COGNITION: MINDING RISKS

WHY THE STUDY OF BEHAVIOUR IS IMPORTANT FOR THE  
INSURANCE INDUSTRY



## KEY CONTACTS

**Trevor Maynard**, Exposure Management

Telephone: +44 (0)20 7327 6141 [trevor.maynard@lloyds.com](mailto:trevor.maynard@lloyds.com)

**Neil Smith**, Exposure Management

Telephone: +44 (0)20 7327 5605 [neil.j.smith@lloyds.com](mailto:neil.j.smith@lloyds.com)

**Sandra Gonzalez**, Exposure Management

Telephone: +44 (0)20 7327 6921 [sandra.gonzalez@lloyds.com](mailto:sandra.gonzalez@lloyds.com)

### Disclaimer

No responsibility of liability is accepted by the Society of Lloyd's, the Council, or any Committee of Board constituted by the Society of Lloyd's or the Council or any of their respective members, officers, or advisors for any loss occasioned to any person acting or refraining from action as a result of any statement, fact, figure or expression of belief contained in this document or communication.

The views expressed in the paper are Lloyd's own. Lloyd's provides the material contained in this document for general information purposes only. Lloyd's accepts no responsibility, and shall not be liable for any loss which may arise from reliance upon the information provided.

# CONTENTS

EXECUTIVE SUMMARY	5
INTRODUCTION	7
EXPECTATIONS CAN HINDER OR FACILITATE THE IDENTIFICATION OF RISKS	8
RISK PERCEPTION IS CONTEXT DEPENDENT	11
THE EFFECTS OF POWER	15
PUTTING RISKS INTO PERSPECTIVE	17
CHALLENGES AND CONCLUDING RECOMMENDATIONS	21
REFERENCES	24

# ACKNOWLEDGEMENTS

## EMERGING RISKS TEAM

The Emerging Risks team is part of the Performance Management Directorate at Lloyd's. We define an emerging risk as an issue that is perceived to be potentially significant, but which may not be fully understood or allowed for in insurance terms and conditions, pricing, reserving or capital setting. Our objective is to ensure that the Lloyd's market is aware of potentially significant emerging risks so that it can decide on an appropriate response to them. The Lloyd's Emerging Risks team maintains a database of emerging risks that is updated regularly through conversations with the Lloyd's emerging risks Special Interests Group, which consists of experts within the Lloyd's market put together with help from the Lloyd's Market Association. The team also maintains contact with the academic community, the wider business community and government. Contact with academics is often facilitated through the Lighthill Risk Network, an organisation that is run as not-for-profit funded by Aon Benfield, Catlin, Guy Carpenter and Lloyd's. More details can be found at [www.lloyds.com/emergingrisks](http://www.lloyds.com/emergingrisks).

## ABOUT THE AUTHORS

**Mario Weick** is the lead author. He is a Lecturer in Psychology at the University of Kent with a background in social and cognitive psychology. His doctoral research focused on behavioural biases and the role of power and subjective experiences in decision making.

**Tim Hopthrow** is a Lecturer in Psychology at the University of Kent. His expertise is in group decision making and risk behaviour in groups. His doctoral research focused on understanding cooperative behaviour in small groups.

**Dominic Abrams** is a Professor of Social Psychology and Director of the Centre for the Study of Group Processes at the University of Kent. He has published widely across the core of social psychology, branching into organisational, cross cultural, education, and health research.

**Peter Taylor-Gooby** OBE is a Professor of Social Policy at the University of Kent. He is internationally noted for his work on new social risks. He is co-director of the Risk Research Centre at Beijing Normal University.

The preparation of this report was supported by the Economic and Social Research Council grant ESRC/BSB/03.

The authors would like to thank the following people who reviewed and commented on the report:

**Milica Vasiljevic**, University of Kent

**Nigel Ralph**, Performance Management, Lloyd's

# 1 EXECUTIVE SUMMARY

Risk identification is one of the keys to successful risk management, but we are not equally aware of all risks. Because the brain filters information, people make decisions based on a subset of the available evidence. This fundamental principle of cognition<sup>1</sup> can cause problems in a context such as underwriting where subjective judgments are important.

This report introduces insurers and financial decision makers to some fundamental principles of cognition that are important for risk management and discusses how human factors can affect risk perception. The report draws on various areas within psychology and related disciplines to highlight potential biases in risk perception.

The report is a follow-up to the Lloyd's Emerging Risks report "Behaviour: Bear, Bull or Lemming" published in 2010, which provides an overview of behavioural theory and discusses the benefits to insurance professionals of being aware of behavioural biases.

## EXPECTATIONS CAN HINDER OR FACILITATE THE IDENTIFICATION OF RISKS

Expectations can lead people to overlook events that are not part of the normal routine. Accurate expectations rely on prompt and accurate feedback; if feedback is inaccurate, delayed, or diffused, then faulty mental models can develop. People's expectations are strongly influenced by personal experience and current events: frequent exposure to risks may also make it easier to lose sight of infrequent losses. Unexpected losses can arise from interrelated risks, from the way the public responds to a disaster or hazard, and from events that are not captured in risk models.

## RISK PERCEPTION IS CONTEXT DEPENDENT

People cannot attend to all risks; they have to prioritise some over others. Risk priorities are culturally transmitted. Re/insurers may focus more on risks that are easier to evaluate, which can draw attention away from those that are more difficult to assess. This is because people prefer to focus on well-structured problems and veer away from more difficult ones. People are also inclined to take greater risks in environments that encourage ambition. The spatial concentration of expertise in the London Market has many benefits, but it also provides a context that can lead to biases arising from social interactions. Risks may be overlooked when many people rely on the perceptions and actions of a few 'experts' and/or align themselves with commonly held beliefs.

## POWER AFFECTS RISK PERCEPTION

Organisations are characterised by hierarchies, often beyond the formal roles assigned to individuals. People in power tend to be more confident and this can lead them to minimise risks. Power can also reduce willingness to adopt different viewpoints and enhance the tendency to seek information that reinforces already held views, which may cause problems in an underwriting context. Incentives which encourage a low risk appetite can counteract these behaviours and make power holders more averse to risks.

## RISK PERCEPTIONS VARY OVER DIFFERENT TIMESCALES

People often under-emphasise the history of previous similar events, which can increase forecasting error. Short-term incentives can reduce foresight and risks which are likely to happen in the long-term future can be more easily overlooked. People tend to be more optimistic about future events or activities, but as these events draw nearer their attention turns to potential drawbacks or losses. Sometimes events or activities that were once desirable are no longer appealing when viewed from a closer perspective. Finally, losses associated with concrete events are often more compelling than those associated with more abstract events.

## ORGANISATIONAL PRACTICES CAN INCREASE RISK AWARENESS

Analyses of organisations have highlighted factors which can increase risk awareness and improve risk management outcomes. These include fostering mindfulness and analytic thinking among staff, embracing

---

<sup>1</sup>Cognition is the process of thinking, reasoning, and forming judgments.

diversity, giving people a 'licence to think' and the ability to make decisions. Organisational practices should also encourage people to use alternative ways of analysing problems.

### **RISK EXPERTS NEED TO BE AWARE OF HOW UNCERTAINTY AFFECTS THEIR DECISION-MAKING**

Signs of potential hazards are not always clear-cut and can be hard to interpret. A low risk appetite can increase false alarms and a high risk appetite increases misses. Neither attitude helps to identify threats when the evidence is uncertain. Re/insurers need to keep up with the pace of developments and scan risk horizons within relevant timescales. Finally, when dealing with uncertainty people tend to rationalise their decisions, reducing their awareness of their own bias.

### **HUMAN FACTORS ARE AN IMPORTANT PART OF MANAGING RISKS**

Re/insurers can benefit from research conducted in the social sciences and humanities. There is a need for more front-line research and interaction between academia and the industry. There are limitations to the identification of risks; unknowns need to be acknowledged and managed carefully.

## 2 INTRODUCTION

Following the 2008 financial crisis the US government created a commission to investigate its causes. According to the commission, households and lenders took excessive risks. Institutional regulations failed and ethical principles were ignored. Phil Angelides, chairman of the inquiry, concluded that: “Despite the view expressed by many on Wall Street and in Washington that the crisis could not have been foreseen or avoided, there were warning signs. The greatest tragedy would be to accept the refrain that no one could have seen this coming and thus nothing could have been done. If we accept this notion, it will happen again.”<sup>i</sup>

Why did institutions not respond to the looming risk of a global crisis? A few years ago, a group of researchers from Harvard University asked volunteers to watch a video of a small group of people exchanging basketball passes.<sup>ii</sup> Suddenly a person in a gorilla costume enters the scene, walks into the middle of the game, stops in the centre, pounds his chest, and then walks off. The players seemed unimpressed, continuing to throw their passes around the gorilla. The researchers later questioned the volunteers about the video they had watched. Many of the volunteers had no recollection whatsoever of a gorilla. What is more, the more closely the volunteers had focused on the game, the less likely they were to notice the gorilla.

How can people miss a gorilla in plain sight? The answer is provided through a phenomenon called inattention blindness. It is a powerful illustration of the fact that perception involves attention. Without attention, we can look at something yet not see it. We are, in a sense, blind without ever noticing the blindness. There is no black spot, nothing unusual that would attract our attention, yet we have just missed out on a sizable part of the world surrounding us. If you find this hard to believe think about the last time you noticed the office floor had been cleaned; the new flowers on the reception desk; or a new advertisement on the bus. It is easy to miss changes.

So why was the financial crisis not foreseen or avoided? There is no single answer to this question. Considering that people can be blind to a gorilla in plain sight, it is safe to assume that much less tangible things, such as a looming systemic risk, can be overlooked. This is even likelier in complex environments where attention can easily be engaged elsewhere.

This report draws on fundamental principles of human perception and cognition to highlight factors that can hinder or help the identification of risk factors. Under what circumstances are risks likely to go unnoticed? What steps can be taken to increase individuals’ sensitivity to potential hazards? This report examines these questions with a particular focus on new or emerging risks, drawing on examples taken from underwriting. The report is unique in its emphasis on risk identification or awareness.<sup>2</sup> Many of the principles outlined in the report have not been discussed outwith the academic community.

Some may query the relevance of human factors given the prevalence of quantitative risk models in the re/insurance sector; the suggestion being that modelling rules out biases. However, some programmes require re/insurers to evaluate and quantify extreme events that occur rarely or perhaps never. This task cannot be done solely on the basis of modelling and fitting parameters to available data. When extreme events are modelled there are no prescribed ways to compute probabilities from different sources of information, nor for combining this information once probabilities have been established.<sup>iii</sup> With limited data, any source of information that is overlooked can lead to misinterpretations. This implies that human factors play an important role within the actual modelling process. Furthermore, subjective judgements are clearly paramount when it comes to the actual use of modelling outcomes.

---

<sup>2</sup>Biases in the assessment of already identified risks have received a lot more attention in the literature. Please refer to the Lloyd’s Emerging Risks Report “Behaviour: Bear, bull or lemming” for more background on this.

### 3 EXPECTATIONS CAN HINDER OR FACILITATE THE IDENTIFICATION OF RISKS

When street planners removed all markers and traffic signs in London's Kensington High Street, casualties fell 43%.<sup>iv</sup> Drivers could no longer rely on their established mental models, forcing them to be more prepared for the unexpected. Expectations usually come from established mental models, limiting our attention to the few aspects we decide are relevant in any given moment and often overlooking the unexpected. In the aftermath of Hurricane Katrina, for example, disaster plans were inadequate for the level of disruption caused by lost access and transportation, broken down communication channels, and a lack of replacement supplies.<sup>v</sup>

A number of isolated events have caught insurers by surprise but, in general, risk experts such as analysts, brokers, and underwriters are better at identifying risks that are not readily apparent to non-experts.<sup>vi</sup> Experts tend to have more sophisticated mental models that help identify potential problems or pitfalls.<sup>vii</sup> Expertise does, however, not always improve risk awareness; especially in areas where losses are infrequent.

One critical factor that determines whether expertise is beneficial is how much it builds on false or incomplete learning. Before the financial crisis many investors became heavily exposed to toxic debts only to realise the impact later on. Similarly, reinsurers trading different layers of exposure under the false impression of risks and high returns, spurred by commissions as high as 10%, triggered the London Market excess of loss spiral of the 1980s.<sup>viii</sup> Prompt and accurate feedback is needed to accurately identify current risks. If feedback is inaccurate, delayed, or diffused, then mental models can develop that hinder the identification of risks. This, of course, applies to new and emerging risks, which do not offer much scope for feedback. Long tail claims are another point in case where many years can pass between an incident and the resulting claims.

Although people have the ability to learn from others' experiences, the mind prefers to base expectations on personal experience, with ramifications for identifying rarely occurring risks.<sup>ix</sup> Consider the example of company liquidations. Every year since the start of the economic crisis over 15,000 companies in England and Wales have become insolvent.<sup>x</sup> People tend to deal with many companies on a regular basis, leading to their false assumption that all companies are financially viable. The internet provides another example: users are typically unaware of the constant level of threat posed by cyber-attacks. The tendency to overlook rare events based on personal experience is particularly relevant for re/insurers. Arguably, risk experts' increased exposure to, and experience of, risks may numb their sensitivity to infrequent losses. Loss models in the insurance industry are not immune to this. For example, catastrophe models do not explicitly consider the loss potential from tsunamis, which accounted for a significant portion of cedant losses following the March 2011 Tohoku earthquake.<sup>xi</sup>

#### **Box 1: Features of Incubating Disasters** (adopted from Turner, 1976)

Industrial accidents are often unexpected and catch people by surprise. Analyses of disasters have identified a number of facilitating conditions or 'trigger' events, which should ring alarm bells among risk analysts:

1. Collective blindness: Organisations prone to disasters are characterised by rigid perceptions and beliefs.
2. Distraction: A tendency to avoid ill-defined problems.
3. Exclusivity: There is limited external intervention and complaints from outside the organisation are dismissed.
4. Transparency: The information provided is ambiguous, wrong or misleading.
5. Expertise: There is a lack of trained and skilled personnel.
6. Compliance: Poor adherence to regulations and/or safety standards.
7. Scale: Magnitude or dangers are underestimated.

The impact of expectations can also be observed to some extent in the insurance cycle where demands for insurance cover surge and premiums can rise after a loss, while policy renewals drop and markets can soften as losses move further into the past. People generally live in temporal bubbles where current and recent events have the strongest bearing on expectations of how the future will unfold, also known as exploration bias. It is often seen in financial markets where investors have too high expectations after bull markets, but too little confidence after bear markets.<sup>xii</sup> The London Market excess of loss spiral of the 1980s provides another illustration of the exploration bias. The crisis was preceded by a long period of growth and low frequency of major catastrophes.



While personal experience may be the primary factor in shaping people's approach to risk, expectations can of course also be shaped by second hand accounts, such as through the media. These secondary sources, however, may overemphasise rare, sensational events. A corollary of this biased representation of low frequency events – an example being terrorist attacks - is that those potential losses are overestimated while more frequent events are underestimated.<sup>xiii</sup> So people's risk perceptions can vary significantly depending on whether their expectations are based on their own experience, or on secondary sources.

Below we highlight three areas in which expectations may affect re/insurers risk perceptions:

**Dependencies.** Events can unfold in unexpected ways. For example, chain-like processes or correlations are often difficult to anticipate. While large portfolios can protect insurers from major losses if risks are independent, if risks are dependent, then a single incident can cause large losses. One challenge for re/insurers is to try to understand the system relationships of the various risks that they face (see Box 2).<sup>xiv</sup> The more complex these relationships, the more likely it is that low probability events can have a large impact.<sup>xv</sup>

**Risk models.** Mathematical models informed by science and engineering are increasingly used to inform core business decisions. Yet as Hemant Shah, CEO of Risk Management Solutions (RMS) noted: "While models can help optimise a book of business, an overreliance on models can lead to fragile portfolios that are prone to surprises, whether from Mother Nature or from the models themselves."<sup>xvi</sup> Risk models create expectations of how the future will unfold, and when those expectations are not met this can come as a costly surprise. For example, some of the losses from natural disasters in 2011 were well beyond what any models were predicting. The challenge for re/insurers is not to rely solely on risk models and to use them as a guide to decision-making. Re/insurers should be mindful of the uncertainties inherent in predicting rare events.

#### Box 2: Expecting the Unexpected: Related Risks

Interrelated risks are complex to understand and often unexpected and make risk modelling a particular challenge, especially in light of the new Solvency II regulations. Risks can be conditional, such as the loss of a vessel and the loss of its cargo, or correlated due to some variable causing different types of losses. For example El Niño can lead to floods in California, declined fish stock in parts of Southern America, and greater dryness in Australia, which increases the likelihood of wildfires<sup>xiv</sup>. Tail dependency describes a scenario where high damages occur together. For example, property insurance claims and car insurance claims are normally independent. However, when a natural disaster strikes then both are likely to suffer damages, creating a dependency in the 'tails' (i.e., the low probability, high loss end of the distribution)<sup>xiv</sup>. In their analysis of insurance company failure, Ashby, Sharma and McDonnell describe how risks are related in ways re/insurers did not anticipate<sup>xxvii</sup>. One example is investments heavily exposed to economic downturns such as commercial properties, causing re/insurers' assets to shrink while at the same time insured losses increased. A similar squeeze was felt by re/insurers who invested in other insurers in similar markets, causing

**Social amplification.** The public response to disasters is often hard to predict.<sup>xvii</sup> When researchers<sup>xviii,xix</sup> analysed US transport patterns before and after 9/11, they found that the attack led to an increase in road traffic, with the largest increase observed on interstate highways (5.3%). Americans had substituted airplanes for cars – actually a riskier mode of travel. Extrapolating from road accident statistics between 1996 to March 2003, researchers demonstrated that in order to avoid the risk of a terrorist attack a further 1,500 people died on American roads in the aftermath of 9/11. This spike in road accidents illustrates how risks can be amplified by the way people respond to disasters.<sup>xx</sup> Amplification can be difficult to predict for re/insurers. For example, when the same analysis was carried out following the Madrid train bombings in 2004, there was no indication of amplification. Some Spaniards avoided train transport, but only for a very short period of time. There was no increase in highway traffic and consequently no increase in road fatalities.<sup>xxi</sup> Social, cultural, and historical differences may explain why Spaniards responded differently to the attack.<sup>3</sup>

<sup>3</sup> Spain has a long history of terrorist attacks on Spanish soil. Unlike Americans, Spaniards relied on the mode of transport used in the attack (i.e. trains) to attend anti-terrorism demonstrations following the event.

**TIPS: Below we highlight some questions that re/insurers can ask to counteract some of the issues that arise from the way expectations affect risk perceptions.**

<i>Habitual thinking</i>	Do established routines miss out on important pieces of information? Do processes lead to habits that prevent people from asking important questions? Have the parameters changed? Do routines no longer cover all angles?
<i>Missing feedback</i>	Is there enough information to verify your assumptions? How robust are your models? What kind of information would make them more robust? Can you use auxiliary variables as substitutes for missing information? How does your company feed information back to you? How timely and relevant is the feedback?
<i>Desensitization</i>	Have some risks lost their bite? Have some of your colleagues become so familiar with certain risks that they have been caught out? Could you be in the same situation one day? If so, how can you prevent that from happening?
<i>Exploration bias</i>	Are some events forgotten? Is everyone talking about the same thing, with recent or current events consuming all the attention? If you could go back or forwards a few months in time – how would that affect how much attention you devote to different risks?
<i>Media</i>	The media is selective. Does the media influence your underwriting decisions? Media coverage can bias risk assessments. Is there relevant information that has not received media attention? How does the public respond to the media coverage? Are there any risks associated with the public's response? What if you are underwriting a risk that suddenly receives a lot of media attention? Could this increase the number of claims and exacerbate the losses?
<i>Amplification</i>	Some disasters can cause costly shockwaves. Do your models account for the way people may respond to a disaster or accident? People's actions can create dependencies between seemingly unrelated risks. Is it possible, or indeed worthwhile, to account for those?
<i>Risk dependencies</i>	Dependencies can make some risks unaffordable. Do you have guidelines whether or not your premiums should account for dependencies? Do you know how dependencies affect your Solvency Capital Requirement? Is it possible that a line of business is lucrative considered alone, but not in your portfolio?

## 4 RISK PERCEPTION IS CONTEXT DEPENDENT

We are constantly exposed to countless risks, such as pollution, traffic and flu, yet we do not attend to all hazards and instead choose, consciously or unconsciously, to focus on some and ignore others. This is because individuals and companies alike have limited resources and cannot attend to all risks simultaneously. How risk is prioritised is influenced by social and cultural contexts, with scientific evidence often playing a secondary role.<sup>xxii</sup> In the US, concerns arose about silicone implants in the 1990s, which led to the largest class-action settlement in history.<sup>xxiii</sup> Soon attention turned away from the implants to the “Millennium Bug”, which consumed an estimated US\$450bn in protective measures<sup>xxiv</sup>.

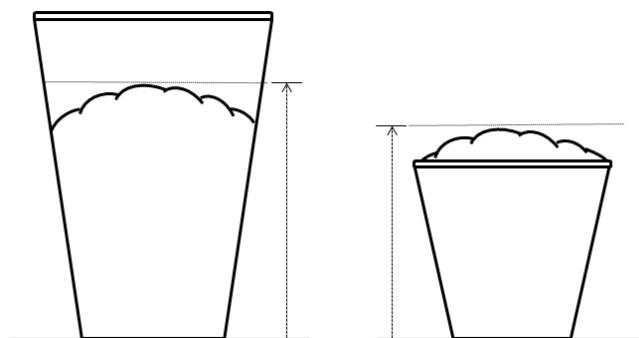
Culturally transmitted risk priorities have consequences for insurers. After the first significant terrorist attack on the World Trade Centre in 1993, insurers did not amend their insurance policies to exclude terrorism from unnamed perils.<sup>xxv</sup> This was before the ‘war on terror’ made the headlines. After 9/11 the industry had to shoulder US\$35bn in claims as their coverage against unnamed perils still included terrorist attacks. Against the backdrop of the current geopolitical context, the decision not to amend policies after the first attacks might seem short-sighted. In the cultural and historic context of the 1990s, it probably reflected a perfectly reasonable response.

There are universal aspects of contexts that draw people’s attention to and away from risks. For example, people are more sensitive to potential hazards in novel or uncertain situations and when the outcome is beyond their control (eg an avian flu pandemic), while risks that occur in more familiar contexts can be overlooked more easily (eg accidents in the home and garden). One implication for re/insurers is that, counter intuitively, rare or novel perils may be overlooked for lines of business that are underwritten frequently.

Re/insurers are exposed to risks that arise from a variety of contexts (eg technology risks; underwriting risks; investment risks; etc.). A recent survey<sup>xxvi</sup> conducted with chief executive officers and managing directors of London insurers found that re/insurers can be accustomed to focus on some risk segments more than others. In particular, underwriting and investment risks tend to receive greater attention in insurers’ own risk assessment than operational risks. It would be a mistake to dismiss this imbalance as a mere reflection of actual business needs; operational weaknesses can play an important role in insurance company failures.<sup>xxvii</sup>

The tendency to favour some risk areas over others can come from the desire to focus on contexts where risks can be quantified, and thus benchmarks established, with greater ease. This tendency is by no means specific to re/insurers. People are inclined to focus attention on things they can grasp easily, and tend to avoid things that are more difficult to understand, even if they are important.<sup>xxviii, xxix, xxx</sup> A simple example is illustrated in Figure 1. People are willing to pay more for an overfilled ice cream serving than for an underfilled serving, although the latter contains more ice cream overall.<sup>xxxi</sup> That’s because it is easier to focus on the relative filling than the total amount of ice cream, which is harder to judge. In the same way, people also tend to favour well-structured problems and shun away from more difficult ones; a recognised problem in risk management.<sup>xxxii</sup> Financial products offer another example. Be it subprime mortgage-backed securities, or excess of loss contracts of the 1980s; problems inevitably arise when executives deal with financial products that involve aspects they do not thoroughly understand.<sup>xxxiii</sup> The tendency to focus on features that are easy to evaluate increases when people have to justify their decisions to others.<sup>xxxiv</sup> Holding people accountable for their decisions is therefore unlikely to eradicate this type of bias.

**Figure 1: A larger (left) and smaller (right) ice cream serving adopted from Hsee (1998). People are inclined to focus on one attribute (relative filling) and ignore others that are more difficult to judge (absolute filling).**

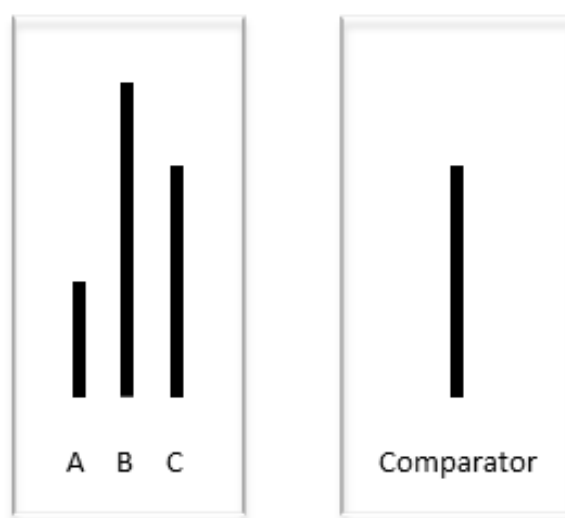


The context can bring concepts to mind that influence the way people deal with risks. For example, in laboratory experiments conducted with students merely thinking about the words “enterprising”, “daring” or “adventurous” made people more likely to take riskier bets, buy a car without a guarantee, or endorse riskier management strategies.<sup>xxxv</sup>

Subsequent research<sup>xxxvi</sup> produced similar results with investment advisors in large commercial banks and accountants in Certified Public Accountant (CPA) firms. Investors were asked to read a story about someone taking a gamble and winning money in a casino. Reading this story made them take more risks in subsequent – unrelated – investment decisions. What is more, the financial experts were more biased than a group of students who performed the same tasks. Subtle hints that bold moves pay off can thus spur people’s risk appetite;

perhaps even more so with experienced market players than others. This provides both a challenge and an opportunity for re/insurers as the way risks and returns are communicated in the market likely affects underwriting outcomes.

**Figure 2: Comparison of line lengths showing the power of the social context.**



Goals explain why people may be willing to take risks to achieve a larger return. Goals can shift the standard of what constitutes a good outcome. When the bar is raised, anything that falls short of the target is unsatisfactory and can be perceived as a ‘loss’. This explains why people can be willing to forgo smaller gains in the pursuit of a larger, albeit riskier, outcome.<sup>xxxvii</sup> Indeed, research has shown that ambitious goals make people more prone to take risks; more so than the goal to do well.<sup>xxxviii</sup> Markets that nourish ambition and offer (short-term) rewards for risky behaviour are bound to trigger greater risk taking among market players. This conclusion may be unsurprising, but our analysis suggests that managing risks needs to go beyond setting company objectives to managing the goals and ambitions of individual market actors.

Goals not only affect how people appraise gains or losses, but also their belief about the likelihood of positive and negative outcomes. Generally speaking, people overestimate the likelihood of positive outcomes and underestimate that of negative outcomes.<sup>xxxix</sup> These optimistic biases are particularly strong when people predict the outcome of their own actions<sup>xl</sup> or when they believe they are in charge.<sup>xli</sup>

The face to face nature of interactions in the London Market can also affect the identification and appraisal of risks. One example is the subscription market where brokers make presentations to the underwriters on the market floor. Initial submissions guide the underwriters’ interpretation of what the offer entails and the risk involved. To illustrate with an example from the legal context: in one study researchers asked professional judges to evaluate a case of sexual harassment.<sup>xlii</sup> The prosecution requested either short (two months) or long (34 months) sentences. The judges’ sentencing decisions differed by a staggering ten months (18 months and 28 months, respectively) depending on whether they had received a low or a high request. The discrepancy arose because the prosecution’s request gave judges clues about the crime and guided their sentencing decisions. In the same vein, brokers’ presentations are likely to play a role in guiding underwriters’ risks appraisals.

The market offers ample opportunity to turn to others for guidance. This is not in itself a bad thing and can make decision-making more efficient, as seeking other people’s opinion takes less time and effort than gathering and analysing information individually. Seeking guidance from, and relying on the perceptions of a few ‘experts’ or aligning views with commonly held beliefs can, however, also increase the chance that some risks are overlooked. Time pressure and information overload can increase this tendency.

Research conducted by Solomon Asch<sup>xliii</sup> provides a powerful demonstration of how much influence the social context can really have. Asch asked participants sitting in small groups to compare the length of lines.

In particular, the participants had to indicate which one of several lines was of equal length to a reference line (see Figure 2). The answer was obvious: one line was clearly the same, and the other lines were clearly different. However, to the surprise of one person - the only person in the room who was *not* an actor playing the role of a participant – everyone else endorsed an *incorrect* answer, opting for one of the dissimilar lines. Faced with the pressure of the group, the vast majority of participants also chose the incorrect answer. Later research showed that people are especially inclined to follow the opinion of people they share a relationship with.<sup>xliv</sup>

The power of the social context is particularly strong when people's actions are public, when decision makers are under time pressure, and when there is uncertainty or ambiguity surrounding the decisions. Underwriting risks meet all these criteria. For example, the practice of signing a slip could exacerbate the tendency to follow other people's lead, especially when the lead underwriter is more senior and/or someone particularly trusted.<sup>xlv</sup> The lines signed by colleagues can also guide underwriters as to the likely risks involved. In more extreme cases, underwriters could even be inclined to ignore evidence that goes against the decisions of their fellow colleagues. In some cases this so called 'herding' behaviour could draw attention away from potential risks.

Financial markets are also social structures and good relationships and trust have intrinsic value. When judging risks individuals may be reluctant to question the judgment of colleagues.<sup>xlvi</sup> In some contexts this trade-off can be beneficial, in other contexts it may backfire. On 23 March 1994 an airplane captain gave his son the permission to sit at the controls of a Russian International Airline A310-304.<sup>xlvii</sup> The child turned the control wheel during autopilot mode, which set off a chain of events and eventually led to the crash of the airplane killing all 75 passengers on board. The attending co-pilot trusted the captain's judgment that nothing would happen as a result. When dealing with risks underwriters need to weigh up the pros and cons of relying on someone else's judgment.

We have highlighted ways through which being part of a group can amplify risks. It is important to emphasise that there are many benefits of being in a group too. Group members monitor one another and can intervene when individuals breach norms or engage in behaviours that go against the groups' identity or core values.<sup>xlviii, xlix</sup> The London Market provides an important platform for this kind of system of checks and balances; a unique advantage of the close interactions afforded by the environment.<sup>4</sup> For example, if a lead underwriter accepts a risk which others view as bad, they may choose not to follow and therefore the risk is less likely to get underwritten. There are also formal procedures to monitor underwriting at most insurers, such as internal and external reviews, or Lloyd's performance management function within the Lloyd's market.

**TIPS: Below we highlight some questions that re/insurers can ask to make risk perceptions less dependent on the context.**

<i>Decision context</i>	Would you take the same decisions in the presence of other people? What about a different context? How does your workplace impact the decisions you make? Does it affect your risk attitudes? What about your colleagues?
<i>Prioritising easy attributes</i>	Are risk assessments too focused on attributes that can be assessed easily? What about attributes that are more difficult to judge? Could you or your colleagues be overlooking something important? Do you assess risks in the contexts of smaller or larger risks? How relevant are those comparisons?
<i>Sampling</i>	What motivates you to analyse a problem from a particular angle (eg impact on environment; economic impact)? Are your estimates based on a subset of information? Does the selection bias the outcome, and if so in which direction?

<sup>4</sup> See Paula Jarzabkowski, Michael Smets, and Paul Spee's report "Trading risk: The value of relationships, models and face-to-face interaction in a global reinsurance market" (2010), for an analysis of the Lloyd's and Bermuda subscription markets with an emphasis on the comparison between face-to-face interactions and electronic trading.

*Goals*

People with differing goals or interests can come to different conclusions based on the same piece of evidence. Do your colleagues' goals differ from yours? How does this affect your underwriting? What goals do people in different roles or functions in your organisation have? What information are they likely to focus on? Is there something they might be missing out?

*Shifting standards*

Ambitious goals can make people take risks. How realistic are the goals your firm is setting? Do you think unrealistic goals make people more willing to take risks and be less selective in their underwriting practices?

## 5 THE EFFECTS OF POWER

Consider rolling a dice. If you can predict the outcome you get £10, otherwise you get nothing. Would you rather roll the dice yourself or have someone else roll the dice for you? People in power are more inclined to roll the dice themselves. In fact, when researchers gave people this choice, those in power always chose to roll the dice (100%), but participants in a comparison group did not (69%).<sup>i</sup> This discrepancy arises from the fact that power increases people's perceptions of control, even beyond one's reach. After all, in a game of chance one cannot control the outcome.

Power refers to the capacity to alter another person's condition or state of mind by providing or withholding resources or administering punishment. Power is more than organisational rank and is integral to every social interaction. Power can derive from the level of seniority as more junior staff members are often expected to follow the instructions of senior employees. More generally, the less individuals are constrained in their decisions the greater their power. People in power tend to have high status and are more likely to enjoy respect and admiration in organisations, although this need not always be the case.

Power can turn the focus away from potential losses. Power holders feel less vulnerable and are more inclined to take risks, provided that doing so allows them to gain something of value.<sup>ii</sup> For example, in the energy industry the number of CEO stock options correlates with the extent to which oil and gas companies engage in risky projects.<sup>iii</sup> CEO compensation also tends to be higher in firms that take more risks, as indicated by greater stock return volatility.<sup>iiii</sup> In the re/insurance context, research has shown that there is more variation in the stock prices of larger insurance companies than with smaller companies, which could be interpreted as a sign for greater risk taking, allowing for other factors that could influence stock prices.<sup>liv</sup>

The greater risk appetite of powerful individuals can stem from a tendency to focus more on rewards and successes, while people who are lacking power are often more cautious and attentive to threats and potential obstacles.<sup>iv</sup> Power tends to increase optimism although this is probably a consequence, not a cause, of a diminished sensitivity to risks. Figure 3 provides an illustration of how power affects people's judgments of losses. When asked to estimate the number of fatalities across a range of hazards, people who felt powerful gave considerably lower estimates on average than people who felt powerless. Other research has shown that people in power are more inclined to set overly ambitious goals,<sup>lv</sup> which as discussed earlier can exacerbate risk taking.

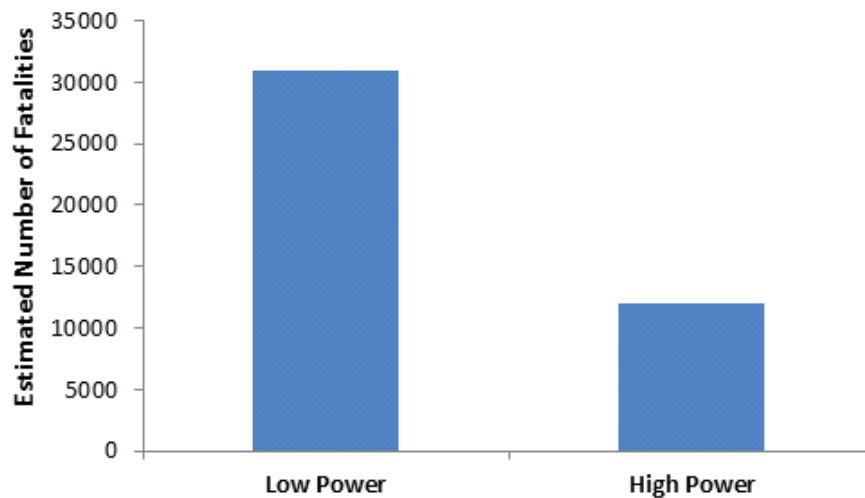
Power can also reduce the inclination to take multiple perspectives into account and can render decision processes more one-sided. For example, studies of US Supreme Court decisions have shown that powerful justices engage in less complex reasoning processes than less powerful justices, who tend to weigh up the pros and cons of various options more.<sup>lvii</sup> Power can also increase people's preference for information that is consistent with their positions and views.<sup>lviii</sup> This tendency can hamper risk identification considering that other people are often reluctant to argue against the decisions of power holders. Biased decision-making of leaders, and blind followership have been linked to well-known disasters such as the Bay of Pigs invasion.<sup>lix,5</sup>

---

<sup>5</sup> The Bay of Pigs invasion was a disastrous attempt to invade Cuba and overthrow Castro planned by J F Kennedy and his advisors. There were numerous failures in the planning such as the invasion force landing in inappropriate terrain and the overestimation of the support amongst Islanders for the invasion.



**Figure 3: Estimated number of fatalities across 17 potential causes of death (eg tornados, lung cancer, airplane accident). Participants made the estimates after having experienced high or low power. From Anderson and Galinsky (2006).**



In the underwriting context more junior underwriters may follow the lead and may be less likely to question the assumptions that underlie a certain underwriting decision if a senior underwriter is the first to sign the slip. More junior underwriters may also be reluctant to engage in actions that deviate notably from others as doing so attracts attention and exposes them to the risk of embarrassment if something goes wrong. Underwriters may also feel under pressure to accept the requests of brokers who control access to ceding insurers. Depending on the lines of business involved, this can place brokers in a powerful position.

It is important to note that power does not always increase myopia and risk-taking. If the situation calls for prudence and perhaps even risk-aversion, then one would not expect power holders to exhibit much risk appetite. Examples of such situations in the re/insurance context could be hard markets following a catastrophe or large market loss, or firms running low on capital reserves. New capital requirements are also likely to turn the focus to benchmarks such as solvency at risk, at least in the short run. Lastly, research has shown that power holders are also reluctant to take risks when they are aware that doing so risks them losing their privileges.<sup>ix</sup>

Earlier we have argued that managing risks requires firms to consider the goals and ambitions of individual market actors. The above analysis suggests that this need is strongest for key decision makers within the insurance value chain. This conclusion echoes the earlier analysis of insurance company failures, which has highlighted the importance of management practices as a determinant of insurers' success and failure.<sup>xxvii</sup>

**TIPS: The following questions can help re/insurers raise awareness of potential biases that are linked to power.**

<i>Confidence</i>	Power increases the sense that one can control things, even random events. This goes hand in hand with a stronger belief that things will turn out in one's favour. Have you come across a situation like that? Does over-confidence have a negative impact on the risk-management in your firm? Can subordinates voice their opinions?
<i>Conformity</i>	Do you experience a pressure to conform? What about your colleagues, do you expect them to go along? Do you think the others have different risk-attitudes than yourself? Would your colleagues say the same? Are there ways to improve current practices?



## 6 PUTTING RISKS INTO PERSPECTIVE

Adopting the right perspective can turn the focus on or away from risks. In this section we examine three aspects that are of relevance to risk professionals.

Planners often adopt what the Nobel Prize winner Daniel Kahneman termed an ‘inside’ perspective.<sup>lxi</sup> He observed that planners tend to focus on the specifics of a problem or event, and do not consider the distribution of similar events that have taken place in the past. Because things rarely turn out how we would want them to be, people are motivated to see the future as being distinct from the past, or ‘unique’. Yet, generally speaking, the best predictor for the future is the past. Failure to adopt an “outside” perspective that takes into account similar past events can lead to overconfidence and augment errors in forecasts.<sup>lxii</sup>

People adopt an ‘inside’ perspective when they have stakes in a particular scenario and this affects their estimates of success or failure as potential pitfalls can be trivialised or ignored (eg what are the chances that the deep sea oil drilling platform will be operational in X amount of time?). In the absence of vested interests, people are more inclined to adopt an ‘outside perspective’. Because this implies attending to frequencies and distributional information (eg how many similar oil drilling platforms have been constructed in X amount of time?), risk estimates often become more conservative.

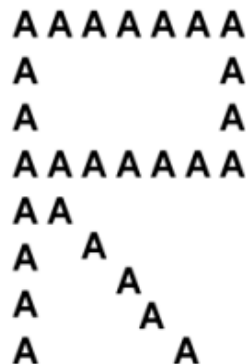
While planners have an interest in the smooth delivery of their projects, re/insurers have an interest in the ability of risk models to make predictions about future events that are sufficiently accurate to guide their business decisions. To the extent that modelling risks is considered too much in isolation (an ‘inside’ view), without an appreciation of the ability of models to predict insured events in the past (an ‘outside’ view), re/insurers can fall prey to Kahneman’s fallacy describe above. Re/insurers should therefore consider the past performance of risk models to make a realistic assessment of their ability to predict the future (i.e. their modelling risk).<sup>lxiii</sup>

Although considering events in too much isolation can lead to biased judgments, re/insurers also need to stay alert to key differences between similar lines of business. For example deep sea oil drilling in the Gulf of Mexico may pose a unique set of challenges when compared to deep sea oil drilling off the coast of India. Underwriting risks requires a high level of technical expertise and an appreciation of both key similarities and differences between programmes.

Time perspective is another crucial aspect. Because people are oriented towards the here and now, a long-term perspective can benefit the identification of more distant risks. Temporal discounting describes a phenomenon whereby outcomes decrease in value as they move into the more distant future, and increase in value as they move closer in time.<sup>lxiv</sup> Compare a 5% saving in operational costs in the next fiscal period against a 5% saving that will materialise in ten years’ time. The fact that closer events or outcomes receive greater weight than distant ones can be problematic if benefits and costs are associated with different delays. The temporal presence of more immediate gains can reduce foresight and draw attention away from long-term risks.<sup>lxv</sup> Natural hazards provide a good example.<sup>lxvi</sup> As developers prioritise immediate gains, the potential for losses grows larger. For example, the popularity of coastal areas in the US has led to a significant concentration of insured value in areas that are highly exposed to natural disasters.<sup>lxvii</sup>

Time is a crucial factor if one wants to determine the consequences of an event. And yet re/insurers often tend to ignore time in their risk assessments.<sup>lxviii</sup> A striking example of the importance of time in risk assessments is the introduction of Superfund. Superfund is the common name for the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) passed by US Congress in 1980 in response to the threat of hazardous waste sites. Superfund exposed insurance companies retrospectively to billions in environmental and asbestos losses. Some estimates of the costs of cleaning up hazardous waste sites exceed US\$1 trillion. The Superfund programme assigned potentially responsible parties retroactive, strict, and joint and several liability.<sup>lxix</sup> Insurers continue to be exposed to environmental and asbestos liabilities, often through older policies purchased before 1986. UK insurers are also affected by asbestos-related claims, many of which are linked to mesothelioma<sup>6</sup>. According to recent estimates, the UK insurance industry is facing £11bn losses related to asbestos in the period 2009 to 2050.<sup>lxx</sup>

**Figure 4: A figure consisting of global (R) and local elements (As). Perception shifts between the two planes. From a distance the global element is more salient; in proximity the local elements lie at the focus of attention.**



<sup>6</sup>Mesothelioma is a cancer that affects the tissue that lines lungs, stomach, heart and other organs. Many people who develop the cancer have been exposed to asbestos particles. It can take several decades between exposure and the development of the disease.

Time is not the only critical element when considering risks. Events or objects can also be thought of in terms of concrete or abstract attributes. An abstract mental image is focused on global, overarching themes and looks at the “big picture”.<sup>lxxi</sup> For example, a flood in London could be thought of abstractly as a “natural disaster”. Concrete mental images on the other hand focus on local details and incidental features. Thinking concretely implies segmenting events or objects into many, smaller categories. Therefore, a concrete representation of a flood in London could entail, for example, the flash flooding of the London Underground; Whitehall, Houses of Parliament and City Hall under water, etc.

Distance increases people’s focus on abstract features. Conversely, proximity increases people’s focus on concrete features.<sup>lxxii</sup> Distance can arise from a temporal dimension (now vs. then), from space (near vs. far), agency (me vs. them), or from realism (real vs. hypothetical). The implication is that distant events or objects are normally perceived in more abstract terms than more proximate events or objects. If you live in London, for example, compare a flood in Papua New Guinea with a Thames flood in London. A disaster closer to home elicits much more concrete mental images. This has implications for risk perception because concrete scenarios highlight potential hazards or obstacles that may not be evident when an event is thought of more abstractly.<sup>lxxiii</sup> People are often more confident about events or activities in the distance, but as the events move closer they come to realise the potential drawbacks or obstacles. Sometimes events or activities that were once desirable are no longer appealing when they are viewed from a closer perspective.<sup>lxxiv</sup> Risk prevention is a good example. Future investments to prevent losses from potential hazards are often considered worthwhile and desirable, but once the time has come to undertake the investments, the efforts seem too vast and the expenditures too great.<sup>lxxv</sup>

Concrete perils are much more visceral and attention-grabbing than abstract ones. Table 1 shows the results of studies that asked people how much money they would be willing to pay for different types of insurance coverage.<sup>lxxvi, lxxvii</sup> As can be seen, people were willing to pay more for concrete, mutually exclusive perils, than for more abstract, all-encompassing ones. In fact, the combined prices for policies covering

**Table 1: Willingness to pay for abstract and concrete causes of losses. Based on Eisner and Strotz (1961), and Johnson, Hershey, Meszaros, and Kunreuther (1993)**

Policy Cover	Amount Willing to Pay for Policy
Hospitalization	
Any disease	\$89.10
Any accident	\$69.55
Any reason	\$41.53
Flight insurance	
Any act of terrorism	\$14.12
Any non-terrorism related mechanical failure	\$10.31
Any reason	\$12.03

specific, mutual exclusive losses were much higher than the prices for policies that covered any loss. The studies looked at health and travel insurances. Insurers are of course much more knowledgeable in those domains where policies can be priced firmly on the basis of historic data. Other programmes, especially those that involve rare or novel risks, do not lend themselves to the same approach. It is in these contexts where abstract perceptions carry the risk that some specific perils are overlooked.

**TIPS: The following questions can help underwriters to put risks into perspective.**

<i>Inside perspective</i>	Do people overestimate the uniqueness of current projects or events? Can you think of processes that would benefit from bearing in mind how similar activities turned out in the past?
<i>Discounting</i>	People can expose themselves to risks because immediate gains carry greater weight than distant losses. Does that also apply to the risks you are underwriting? Are your models based on the assumption that people weigh near and distant losses equally? Do your risk management strategies emphasise short term gains?
<i>Abstract and concrete thinking</i>	Risks that elicit concrete mental images seem more paramount than risks that are more diffuse and abstract. Can you break down diffuse risks into smaller categories (e.g. distinct classes of events)? Ask 'how' questions about future events.

**Box 3: The role of the organisation**

Several years ago sociologists coined the term *high reliability organisations* to describe organisations that operate in fields where failure can have dramatic consequences, and yet losses are extremely rare.<sup>lxxviii</sup> *Resilience* is a more contemporary buzz word that describes a related concept. Examples studied in the literature include aircraft carriers or traffic control systems. High reliability organisations are characterised by collective *mindfulness*, which describes a heightened sense of vigilance and focused awareness.<sup>lxxx</sup> Mindfulness reduces overconfidence, fosters greater risk awareness, and reduces risk appetite. Resilience also derives from a culture that emphasises analytical thinking and discourages simple interpretations. Such a "*licence to think*" goes along with an organisational attitude that embraces *diversity* and enables low ranking individuals to step in and *take charge*. For example, crew members on a nuclear powered aircraft carrier's deck can prevent aircrafts from departing or landing without a superior being able to overrule their decision. At the same time, there are also several *layers of redundancy* to buffer against personnel failures in these systems.

Organisations can shape processes and work environments in ways to maximise risk awareness. For example, thinking outside the box can be fostered by exposing employees to different cultures and work environments.<sup>lxxxiv</sup> Reliance on routines can be thwarted by giving people time to make decisions; and feedback about the impact of different courses of action can encourage a consideration of multiple alternatives. Finally, organisations can promote the following principles, amongst others, to assist staff engaged in key risk decisions:

- > Challenge assumptions
- > Consult others with divergent views
- > Adopt different viewpoint to change the frame of the decision
- > Elicit and compare people's understanding of an issue

## 7 CHALLENGES AND CONCLUDING RECOMMENDATIONS

One challenge is that signs of hazards are sometimes hard to interpret. In 1983, a new Russian satellite system detected a missile attack and triggered an alarm. A judgment call by a military commander prevented an escalation. In reality, no attack had been launched. The sophisticated warning system was triggered by a reflection of light from a satellite.<sup>lxxxv</sup>

Unlike the Russian commander, re/insurers can tackle a looming risk with an ‘expect the worst’ attitude. This will make it less likely that a hazard slips through, but it will also increase the rate of false alarms. On the other hand re/insurers can be reluctant to accept more tentative evidence for a hazard, knowing that the premium will be very high or unaffordable, or because regulations restrict the information that can be considered when pricing policies. In some cases, exploring risk characteristics could be deemed impossible or impractical due to the cost, time, or effort involved. Finally, underwriters may simply not want to come across as ‘paranoid’. All these concerns would reduce the number of false alarms, but also increase the likelihood that some risks are overlooked. The important point to remember when interpreting signs of potential hazards is that both risk-avoidant and risk-seeking attitudes are prone to error and lead to an increase in false alarms or misses (see Table 2). Neither attitude helps discern threats where the evidence is uncertain. Uncertainty can be reduced by gathering more or better evidence, or by finding ways to make better use of information that is already at hand.

**Table 2: Possible outcomes in the classification of potential hazards**

		Decision	
		Hazards Absent	Hazard Present
True State of Nature (unknown)	Hazard Absent	Correct Rejection	False Alarm (Error I)
	Hazard Present	Miss (Error II)	Hit

A second challenge for re/insurers is the pace and magnitude of new developments in business and society. The commercial use of the internet only began in the 1990s; it now provides a medium for threats and attacks on an unprecedented scale. With the increasing pace of technological development it is conceivable that the developments we will see in the next twenty years will be similar to the developments we have seen in the past one hundred years.<sup>lxxiii</sup> There is a need to scan new or emerging risks on a regular basis. This is a challenge because re/insurers do not have unlimited resources. One way to address this problem is by focusing on risk horizons that are of strategic relevance to organisations. Table 3 illustrates how strategic priorities and the pace of new developments can be combined into a matrix that specifies different timescales for scanning risks. It is important to note that strategic priorities are not static and can shift over time, which means they also require on-going re-assessment.

Acknowledging that biases exist and may affect business outcomes is a third and final challenge. When dealing with risks, in particular those linked to rare or novel events, people have to face uncertainty. Because uncertainty is unsettling, people tend to rationalise their decisions. For example, underwriters can point to risk models or analysts to justify their business decisions. Rationalising provides a sense of security, but it also carries the risk that potential biases are downplayed or ignored. People prefer to believe that their decisions are sound and objective, and if biases occur they affect others but not themselves. Yet wherever human judgments occur, there is room for selection (focusing more on some aspects than others) and subjectivity (bringing information in line with one’s beliefs).

**Table 3: Timescales for reviews of new and emerging risks**

Pace of Developments	fast	Occasional reviews	Frequent reviews
	slow	Infrequent reviews	Regular reviews
		low	high
		Strategic Relevance	

Acknowledging behavioural risks is also the first step towards using behavioural principles to create added value. The following recommendations highlight how re/insurers, who are accustomed to working with experts at the forefront of technology and engineering, can embrace behavioural principles:

- **Encourage discussions between behavioural scientists and the industry.** This report provides a starting point for communication between the industry and the scientific community. Further dialogue through organisations such as the Lighthill Risk Network<sup>7</sup> should be encouraged.
- **Support research initiatives.** Scientists require the support of industry to apply their knowledge and expertise to situations that are most relevant for organisations. There is a need for more behavioural research in work settings.
- **Involve the social sciences and humanities.** Risk analysis can benefit from the expertise accumulated in the social sciences and humanities. For example, an understanding of social amplification requires an understanding of social, cultural and historical settings.
- **Encourage divergent thinking.** Organisations often create pressure to conform. Insurers can develop platforms and environments where divergent thinking is actively encouraged. For example exposing employees to different roles or environments can promote different viewpoints and remove preconceptions.
- **Acknowledge the limitations of risk identification.** Re/insurers are dealing with complex issues where it is impossible to identify all unknown unknowns. However, by developing robust and comprehensive processes and procedures that take into account human factors, these uncertainties could be managed more effectively.
- **Reward behaviour that contributes to better risk identification.** Organisational reward structures may encourage short-term thinking. Loss ratios may not be a good measure to assess performance

---

<sup>7</sup> A network formed by Aon Benfield, Catlin, Guy Carpenter and Lloyd's designed to foster relationships between academia and the insurance industry and ensure future research relevant to the insurance industry.

in the context of new or emerging risks, or risks that are infrequent. Reward structures provide a means of aligning the goals of employees with company objectives.<sup>8</sup>

Insurance allows companies to take risks and can therefore be seen as a vehicle for innovation and growth. It enables individuals and institutions to overcome uncertainties and expand into unknown and new territories. At the same time, trends, such as the rapid expansion of technology and engineering or environmental changes, mean that risk management is becoming increasingly complex. Managing new and emerging risks therefore requires an integrated holistic approach and, as this report has shown, behavioural factors are an important part of that.

---

<sup>8</sup> 'Rewards' not only include financial incentives, but also other assets that can signal competence and status within an organisation.

## 8 REFERENCES

---

- <sup>i</sup>Financial Crisis Inquiry Commission. The financial crisis inquiry report [document on the internet]. Stanford Law School; Jan 2011 [cited 2011 Nov 25]. Available from: [http://fcic-static.law.stanford.edu/cdn\\_media/fcic-reports/fcic\\_final\\_report\\_full.pdf](http://fcic-static.law.stanford.edu/cdn_media/fcic-reports/fcic_final_report_full.pdf)
- <sup>ii</sup>Simons DJ, Chabris CF. Gorillas in our midst: sustained inattention blindness for dynamic events. *Perception*.1999; 28:1059-1074.doi:10.1068/p2952
- <sup>iii</sup>Franklin J, Sisson SA, Burgman MA, Martin JK. Evaluating extreme risks in invasion ecology: learning from banking compliance. *Diversity Distrib*.2008; 14:581-591.doi: 10.1111/j.1472-4642.2008.00478.x
- <sup>iv</sup>Swinburne G. Report on road safety in Kensington High Street [document on the internet]. No date [cited 2011 Nov 25]. Available from: <http://acocksgreenfocusgroup.org.uk/wp-content/uploads/2009/06/Ken-High-Street-Stats2.pdf>
- <sup>v</sup>Property Casualty Insurers Association of America. PCI White Paper [document on the internet].The Hurricane Katrina Experience – A property casualty insurance perspective: five years later. 2010 [cited 2012 July 01]. Accessed from: [http://www.pciaa.net/legtrack/web/naiipublications.nsf/lookupwebcontent/5ddd0c25b4a42d158625777c004b922/\\$file/whitepaper\\_katrina\\_final.pdf](http://www.pciaa.net/legtrack/web/naiipublications.nsf/lookupwebcontent/5ddd0c25b4a42d158625777c004b922/$file/whitepaper_katrina_final.pdf)
- <sup>vi</sup>Slovic P, Fischhoff B, Lichtenstein S. Rating the risks. In: Slovic P, editor. The perception of risk. London: Routledge; 2000; p. 104-120.
- <sup>vii</sup>Du S, Keil M, Mathiassen L, Shen Y, Tiwana A. Attention-shaping tools, expertise, and perceived control in IT project risk assessment. *Decis Support Syst*. 2007; 43:269-283.doi: 10.1016/j.dss.2006.10.002
- <sup>viii</sup>Schwartzman JA. The game of 'pass the risk': Then and now. Insight.Milliman Inc. Risk Management [Internet]. 2008 [cited 2012 July 01]. Accessed from: [www.soa.org/library/essays/rm-essay-2008-schwartzman.pdf](http://www.soa.org/library/essays/rm-essay-2008-schwartzman.pdf)
- <sup>ix</sup>Hertwig R, Barron G, Weber EU, Erev I. Decisions from experience and the effect of rare events in risky choice. *Psychol Sci*. 2004; 15:534-539.doi: 10.1111/j.0956-7976.2004.00715.x
- <sup>x</sup>Department for Business Innovation & Skills.The Insolvency Service.Table 1, Company liquidations England & Wales [Internet]. 2011 [cited 2011 Nov 29]. Accessed from: <http://www.insolvencydirect.bis.gov.uk/otherinformation/statistics/201111/table1.pdf>
- <sup>xi</sup>Nunn P. Catastrophic Risk Management: Addressing the challenge of non-modelled perils. *Asia Insurance Review* [serial on the internet]. 2012 May; [cited 2012 July 01];78-79. Available from: [www.asiainsurancereview.com](http://www.asiainsurancereview.com)
- <sup>xii</sup>AFAANZ.Extrapolation bias and investors' expectations.AFAANZ conference. [Internet] 2009, February [cited 2011 Nov 20]. Available from: [http://www.afaanz.org/openconf/2009/modules/request.php?module=oc\\_program&action=view.php&id=218](http://www.afaanz.org/openconf/2009/modules/request.php?module=oc_program&action=view.php&id=218)
- <sup>xiii</sup>Slovic P, Fischhoff B, Lichtenstein S. Rating the risks. In: Slovic P, editor. The perception of risk. London: Routledge; 2000; p. 104-120.
- <sup>xiv</sup>Kousky C, Cooke RM. Climate change and risk management: Challenges for insurance, adaptation, and loss estimation. Resource For the Future (RFF) Discussion Paper. [Internet] 2009, February [cited 2012 Aug]. Available from: <http://www.rff.org/RFF/Documents/RFF-DP-09-03.pdf>
- <sup>xv</sup>Taleb NN, Goldstein DC, Spitznagel MW. The six mistakes executives make in risk management. *Havard Bus Rev*; 2009.



- <sup>xvi</sup>Shah H. A risk model paradigm shift. CEO Risk Forum [serial online]. 2012 [cited 2012 July]. July; 16-17. Available from <http://www.reactionsnet.com>
- <sup>xvii</sup>Pidgeon N, Fischhoff B. The role of social and decision sciences in communicating uncertain climate risks. *Nat Clim Chang*. 2011; 1:35-41.doi: 10.1038/NCLIMATE1080
- <sup>xviii</sup>Gigerenzer G. Dread risk, September 11, and fatal traffic accidents. *Psychol Sci*. 2004; 15(4):286-287. doi: 10.1111/j.0956-7976.2004.00668.x
- <sup>xix</sup>Gigerenzer G. Out of the frying pan into the fire: Behavioral reactions to terrorist attacks. *Risk Anal*. 2006; 26(2):347-351. doi: 10.1111/j.1539-6924.2006.00753.x
- <sup>xx</sup>Kasperson R, Renn O, Slovic P, Brown HS, Emel J, Goble R, Kasperson JX, Ratick S. The Social Amplification of Risk: A conceptual framework. *Risk Anal*. 1988; 8:177-187.doi: 10.1111/j.1539-6924.1988.tb01168.x
- <sup>xxi</sup>López-Rousseau A. Avoiding the death risk of avoiding a dread risk: The aftermath of March 11 in Spain. *Psychol Sci*. 2005; 16(6):426-428. doi: 10.1111/j.0956-7976.2005.01551.x
- <sup>xxii</sup>14. Covello VT, Johnson BB. The social and cultural construction of risk: Issues, methods, and case studies. In: Johnson BB, Covello VT, editors. *The social and cultural construction of risk: Essays on risk selection and perception*. Dordrecht, Holland: Reidel Publishing; 1987; p.vii-xii.
- <sup>xxiii</sup>Gardner D. *Risk: Why we fear the things we shouldn't and put ourselves in greater danger*. Toronto: Emblem; 2009.
- <sup>xxiv</sup>MacGregor, DG. Public response to Y2K: social amplification and risk adaptation: or, "how I learn to stop worrying and love Y2K". In: Pidgeon NF, Kasperson RE, editors. *The Social Amplification of Risk*. Cambridge University Press; 2003; p. 243-261.
- <sup>xxv</sup>Kunreuther H, Pauly M. Insurance decision-making and market behavior. *Found Trends Microecon*. 2005; 1(2):63-127. doi: 10.1561/07000000002
- <sup>xxvi</sup>Risk appetite: A market study. Grant Thornton [Internet]. 2012 [cited 2012 July]. June; 1-20. Available from: <http://www.grant-thornton.co.uk>
- <sup>xxvii</sup>Ashby S, Sharma P, McDonnell W. Lessons about risk: Analysing the causal chain of insurance company failure. *Journal of Insurance Research and Practice*. 2003; 18: 415.
- <sup>xxviii</sup>Hsee CK. The evaluability hypothesis: An explanation for preference reversals between joint and separate evaluations of alternatives. *Organ Behav Hum Decis Process*. 1996; 67:247-257.
- <sup>xxix</sup>Hsee CK, Loewenstein GF, Blount S, Bazerman MH. Preference reversals between joint and separate evaluations of options: A review and theoretical analysis. *Psychol Bull*. 1999; 125(5):576-590. doi: 10.1037/0033-2909.125.5.576
- <sup>xxx</sup>Bazerman MH, Moore DA, Tenbrunsel AE, Wade-Benzoni KA, Bount S. Explaining how preferences change across joint versus separate evaluations. *J Econ Behav Organ*. 1999; 39:41-58.doi: 10.1016/S0167-2681(99)00025-6
- <sup>xxxi</sup>Hsee CK. Less is better: When low-value options are valued more highly than high-value options. *J BehavDecisMak*. 1998; 11:107-121.doi: 10.1002/(SICI)1099-0771(199806)11:2<107::AID-BDM292>3.0.CO;2-Y
- <sup>xxxii</sup>Turner BA, Pidgeon NF. *Man-made disasters*. 2<sup>nd</sup> ed. Oxford: Butterworth-Heinemann; 1997.
- <sup>xxxiii</sup>Schwartzman JA. The game of 'pass the risk': Then and now. Insight.Milliman Inc. Risk Management [Internet]. 2008 [cited 2012 July 01]. Accessed from: [www.soa.org/library/essays/rm-essay-2008-schwartzman.pdf](http://www.soa.org/library/essays/rm-essay-2008-schwartzman.pdf)
- <sup>xxxiv</sup>Curley SP, Yates F, Abrams RA. Psychological sources of ambiguity avoidance. *Organ Behav Hum Decis Process*. 1986; 38:230-256.doi: 10.1016/0749-5978(86)90018-X

- 
- <sup>xxxv</sup>Erb HP, Bioy A, Hilton DJ. Choice preferences without inferences: Subconscious priming of risk attitudes. *J Behav Dec Making*. 2002; 15:251-261.doi: 10.1002/bdm.416
- <sup>xxxvi</sup>Dalia G, Kliger, D. Priming the risk attitudes of professionals in financial decision making, *Rev of Finance*. 2008; 12:567-586.
- <sup>xxxvii</sup>Heath C, Larrick RP, Wu G. Goals as reference points.*Cogn Psychol*. 1999; 38:79-109.doi: 10.1006/cogp.1998.0708
- <sup>xxxviii</sup>Larrick RP, Heath C, Wu G. Goal-induced risk taking in negotiation and decision making.*SocCogn*. 2009; 27(3):342-364. doi:10.1521/soco.2009.27.3.342
- <sup>xxxix</sup>Lench HC. Automatic optimism: The affective basis of judgments about the likelihood of future events. *J ExpPsychol Gen*. 2009; 138(2):187-200. doi: 10.1037/a0015380
- <sup>xl</sup>Price PC, Pentecost HC, Voth RD. Perceived event frequency and the optimistic bias: Evidence for a two-process model of personal risk judgments. *J ExpSoc Psychol*. 2002; 38:242-252.doi: 10.1006/jesp.2001.1509
- <sup>xli</sup>DeJoy DM. The optimism bias and traffic accident risk perception.*Accid Anal Prev*. 1989; 21(4):333-340. doi:10.1016/0001-4575(89)90024-9
- <sup>xlii</sup>Englich B, Mussweiler T. Sentencing under uncertainty: Anchoring effects in the courtroom. *J ApplSoc Psychol*. 2001; 31(7): 1535-1551. doi: 10.1111/j.1559-1816.2001.tb02687.x
- <sup>xliii</sup>Asch SE. Opinions and social pressure.*Sci Am*. 1955; 193:31-35.
- <sup>xliv</sup>Abrams D, Wetherell M, Cochrane S, Hogg M, & Turner J. Knowing what to think by knowing who you are: self-categorization and the nature of norm formation, conformity and group polarization. *Brit J Soc Psych*. 1990; 29:97-119.doi: 10.1111/j.2044-8309.1990.tb00892.x
- <sup>xlv</sup>Kunreuther H, Hogarth R, Meszaros J. Insurer ambiguity and market failure. *J Risk Uncertain*.1993; 7:71-87.doi: 10.1007/BF01065315
- <sup>xlvi</sup>Zinn JO, Taylor-Gooby P. The challenge of (managing) new risks.In Taylor-Gooby P, Zinn JO, editors. *Risk in Social Science*. Oxford: University Press, 2006; p. 54-75.
- <sup>xlvii</sup>Avian Safety Network.Accident description [Internet]. c2004 [updated 2004 Aug 1; cited 2011 Nov 20]. Available from: <http://aviation-safety.net/database/record.php?id=19940323-0>
- <sup>xlvi</sup>Frings D, Hopthrow T, Abrams D, Guitierrez R, Hulbert L. Groupdrink: Group membership, alcohol intoxication and judgmental accuracy. *Group Dyn*. 2008; 12:179-190. doi:10.1037/1089-2699.12.3.179
- <sup>xlix</sup>Charness G, Karni E, Levin D. Individual and group decision making under risk: An experimental study of Bayesian updating and violations of first-order stochastic dominance. *J Risk Uncertain*.2007; 35:129-148.doi: 10.1007/s11166-007-9020-y
- <sup>l</sup>Fast NJ, Gruenfeld DH, Sivanathan N, Galinsky AD. Illusory control: A generative force behind power's far-reaching effects. *Psychol Sci*. 2009; 20(4):502-208. doi: 10.1111/j.1467-9280.2009.02311.x
- <sup>li</sup>Anderson C, Galinsky AD.Power, optimism, and risk-taking.*Eur J Soc Psychol*. 2006; 36(4):511-536. doi: 10.1002/ejsp.324
- <sup>lii</sup>Rajgopal S, Shevlin T. Empirical evidence on the relation between stock option compensation and risk taking. *J Account Econ*. 2002; 33:145-171.doi: 10.1016/S0165-4101(02)00042-3
- <sup>liii</sup>Cyert RM, Kang S, Kumar P. Corporate governance, takeovers, and top management compensation: Theory and evidence. *Manage Sci*. 2002; 48:453-469.
- <sup>liv</sup>Eling M, Marek SD. Internal and external drivers for risk taking in UK and German insurance markets. *International Journal of Banking, Accounting and Finance* 2012; 4:48-76. doi: 10.1504/IJBAAF.2012.045513

- 
- <sup>lv</sup>Keltner D, Gruenfeld DH, Anderson C. Power, approach, and inhibition. *Psychol Rev.* 2003; 110(2):265-284. doi: 10.1037/0033-295X.110.2.265
- <sup>lvi</sup>Weick M, Guinote A. How long will it take? Power biases time predictions. *J ExpSoc Psychol.* 2010; 46(4):595-604. doi:10.1016/j.jesp.2010.03.005
- <sup>lvii</sup>Gruenfeld DH. Status, ideology, and integrative complexity on the U.S. Supreme Court: Rethinking the politics of political decision making. *J PersSoc Psychol.* 1995; 68(1):5-20. doi: 10.1037/0022-3514.68.1.5
- <sup>lviii</sup>Fischer J, Fischer P, Englich B, Aydin N, Frey D. Empower my decisions: The effects of power gestures on confirmatory information processing. *J ExpSoc Psychol.* 2011; 47(6):1146-1154. doi:10.1016/j.jesp.2011.06.008
- <sup>lix</sup>Vandenbroucke LS. Anatomy of a failure: The decision to land at the bay of pigs. *PolitSci Quart.* 1984; 99(3):471-491.
- <sup>lx</sup>Maner KT, Gailliot MT, Butz DA, Peruch BM. Power, risk, and the status quo: Does power promote riskier or more conservative decision making? *PersSocPsychol B.* 2007; 33(4):451-462. doi: 10.1177/0146167206297405
- <sup>lxi</sup>Kahneman D, Tversky A. Intuitive predictions: Biases and corrective procedures. *Manage Sci.* 1979; 12:313-327.
- <sup>lxii</sup>Lovallo D, Kahneman D. Delusions of success: How optimism undermines executives' decisions. *Havard Bus Rev.* 2003; 81:56-63.
- <sup>lxiii</sup>Taylor PR. The mismeasure of risk. In Roeser S, Hillerbrand R, Sandin P, Peterson M. *Handbook of risk theory: Epistemology, decision theory, ethics, and social implications of risk.* Netherlands: Springer, 2012; p. 441-475.
- <sup>lxiv</sup>Loewenstein G, Prelec D. Anomalies in intertemporal choice: Evidence and an interpretation. *Q J Econ.* 1992; 107(2):573-597. doi: 10.2307/2118482
- <sup>lxv</sup>Hardisty DJ, Weber EU. Discounting future green: Money versus the environment. *J ExpPsychol Gen.* 2009; 138(3):329-340. doi: 10.1037/a0016433
- <sup>lxvi</sup>Kunreuther H. Mitigating disaster losses through insurance. *J Risk Uncertain.* 1996; 12:171-187. doi: 10.1007/BF00055792
- <sup>lxvii</sup>Kunreuther H, Meyer R, Michel-Kerjan E. Overcoming decision biases to reduce losses from natural catastrophes [internet]. In: Shafir E, editor. *Behavioral foundations of policy.* Princeton University Press; in press [cited 2011 Nov 20]. Available from: [http://opim.wharton.upenn.edu/risk/library/C2009\\_HK,RJM,EMK.pdf](http://opim.wharton.upenn.edu/risk/library/C2009_HK,RJM,EMK.pdf)
- <sup>lxviii</sup>Taylor PR. The mismeasure of risk. In Roeser S, Hillerbrand R, Sandin P, Peterson M. *Handbook of risk theory.: Epistemology, decision theory, ethics, and social implications of risk.* Netherlands: Springer, 2012; p. 441-475.
- <sup>lxix</sup>Anderson DR. Development of environmental liability risk management and insurance in the United States: Lessons and opportunities. *Risk Management and Insurance Review.* 2008; 2:1-23.
- <sup>lxx</sup>Future asbestos claims set to rise. *The Actuary* [magazine online]. Date unspecified [cited 2012 July]; [about 2 screens]. Available from: <http://www.theactuary.com/archive/articles/future-asbestos-claims-set-to-rise/>
- <sup>lxxi</sup>Trope Y, Liberman N. Construal-level theory of psychological distance. *Psychol Rev.* 2010; 117(2):440-463. doi: 10.1037/a0018963
- <sup>lxxii</sup>Liberman N, Trope Y. The psychology of transcending the here and now. *Science.* 2008; 322(5905):1201-1205. doi: 10.1126/science.1161958
- <sup>lxxiii</sup>Trope Y, Liberman N. Temporal construal and time-dependent changes in preference. *J PersSoc Psychol.* 2000; 79:876-889. doi:10.1037/0022-3514.79.6.876
-

- 
- <sup>lxxiv</sup> Gilovich T, Kerr M, Medvec VH. Effect of temporal perspective on subjective confidence. *J Pers Soc Psychol.* 1993; 64(4):552-560. doi: 10.1037/0022-3514.64.4.552
- <sup>lxxv</sup> Kunreuther H, Meyer R, Michel-Kerjan E. Overcoming decision biases to reduce losses from natural catastrophes [internet]. In: Shafir E, editor. *Behavioral foundations of policy*. Princeton University Press; in press [cited 2011 Nov 20]. Available from: [http://opim.wharton.upenn.edu/risk/library/C2009\\_HK,RJM,EMK.pdf](http://opim.wharton.upenn.edu/risk/library/C2009_HK,RJM,EMK.pdf)
- <sup>lxxvi</sup> Eisner R, Robert HS. Flight insurance and the theory of choice. *J Polit Econ.* 1961; 69:355-368. doi:10.1086/258500
- <sup>lxxvii</sup> Johnson EJ, Hershey J, Meszaros J, Kunreuther H. Framing, probability distortions, and insurance decisions. *J Risk Uncertain.* 1993; 7:35-51. doi: 10.1007/BF01065313
- <sup>lxxviii</sup> Roberts KH. Managing high reliability organizations. *Calif Manage Rev.* 1990; 101-113.
- <sup>lxxix</sup> Roberts KH, Stout SK, Halpern JJ. Decision dynamics in two high reliability military organisations. *Manage Sci.* 1994; 40: 614–624.
- <sup>lxxx</sup> Weick KE, Sutcliffe K, Obstfeld D. Organizing for high reliability – processes of collective mindfulness. *Research in Organizational Behavior.* 1999; 21:81-123.
- <sup>lxxxi</sup> Lakey CE, Cambell WK, Brown KW, Goodie AS. Dispositional mindfulness as a predictor of the severity of gambling outcomes. *Pers Ind Diff.* 2007; 43:1698-1710. doi: 10.1016/j.paid.2007.05.007
- <sup>lxxxii</sup> Feldman G, Gresson J, Renna M, Robbins-Monteith K. Mindfulness predicts less texting while driving among young adults: Examining attention- and emotion-regulation motives as potential mediators. *Pers Indiv Differ.* 2011; 51:865-861. doi: 10.1016/j.paid.2011.07.020
- <sup>lxxxiii</sup> Muessig A. The financial crisis: Caused by unpreventable or organized failures? *International Journal of Economic Sciences and Applied Research.* 2009; 2(1):51-70.
- <sup>lxxxiv</sup> Maddux WW, Adam H, Galinsky AD. When in Rome ... Learn why the Romans do what they do: How multicultural experiences facilitate creativity. *Pers Soc Psychol B.* 2010; 36(6):731-741. doi: 10.1177/0146167210367786
- <sup>lxxxv</sup> Forden G. False alarms in the nuclear age. *Nova beta* [Internet]. c2001 [updated 2001 June 11; cited 2011 Nov 25]. Available from: <http://www.pbs.org/wgbh/nova/military/nuclear-false-alarms.html>