



BEHAVIOUR

BEAR, BULL OR LEMMING?

DISCLAIMER

This document is intended for general information purposes only. Whilst all care has been taken to ensure the accuracy of the information, Lloyd's does not accept any responsibility for any errors and omissions. Lloyd's does not accept any responsibility or liability for any loss to any person acting or refraining from action as the result of, but not limited to, any statement, fact, figure, expression of opinion or belief contained in this document.

DATE AND VERSION: MARCH 2010, VERSION 1.1

CONTACT DETAILS

Director Performance Management

Tom Bolt
020 7327 6700
tom.bolt@lloyds.com

Head of Exposure Management

Paul Nunn
020 7327 6402
paul.nunn@lloyds.com

Emerging Risks Team

Trevor Maynard
020 7327 6141
trevor.maynard@lloyds.com

David Baxter
020 7327 5718
david.baxter@lloyds.com

Communications Team

Bart Nash
020 7327 6272
bart.nash@lloyds.com

ACKNOWLEDGEMENTS

The views expressed in this paper are those of Lloyd's however we are very grateful to the following people for their contributions:

- Professor Peter Taylor-Gooby (University of Kent) for providing an early draft of this paper and for his ongoing advice and expertise.
- The UK Economic and Social Research Council for recommending Professor Gooby to us
- The emerging risks Special Interests Group at Lloyd's

CONTENTS

EXECUTIVE SUMMARY	4
INTRODUCTION	7
1. FACTORS INFLUENCING VIEWS OF RISK	8
2. INDIVIDUAL CHARACTERISTICS AND RISK	8
3. GROUP DIFFERENCES	10
4. FACTORS PROMOTING ILLUSIONS AND MISUNDERSTANDINGS	11
5. FRAMING OF RISKS AFFECTS OUR PERCEPTION OF THEM	14
6. EMOTION	14
7. RISK COMMUNICATION	15
8. GROUP INFLUENCES	16
9. RISK MANAGEMENT IN ORGANISATIONS	17
CASE STUDY: IMPLICATIONS FOR EMERGING RISK MANAGEMENT	19
CONCLUSIONS	22
SOURCES OF INFORMATION	23

EXECUTIVE SUMMARY

UNDERWRITERS TAKE RISKS EVERY DAY OF THEIR LIVES, YET MANY ARE UNAWARE OF THE SUBCONSCIOUS THOUGHTS THAT ARE CLOUDING THEIR JUDGEMENTS. BEHAVIOURAL THEORY TELLS US THERE ARE MANY UNINTENDED FILTERS WHICH DISTORT THE WAY WE THINK ABOUT RISK. INSURANCE PROFESSIONALS WILL BENEFIT BY BEING AWARE OF THESE BIASES, LEADING TO CLEARER THINKING AND A BETTER MANAGEMENT OF RISK. THIS REPORT PROVIDES A GLOSSARY OF THE KEY INSIGHTS FROM BEHAVIOURAL THEORISTS. LLOYD'S BELIEVES A DEEPER UNDERSTANDING OF THESE ISSUES WILL BE OF GREAT BENEFIT TO OUR INDUSTRY. THE KEY FINDINGS ARE:

1 PERCEPTION OF RISK DRIVES BEHAVIOUR. Research suggests that risks which people dread such as cancer are given a high priority as are those that impact a large number of people. Unfamiliar risks (e.g. Nanotechnology) can be given more attention than those that have become commonplace, even when the probabilities suggest the reverse. However, this may fairly reflect the larger uncertainties around new risks.

2 PERSONALITY AFFECTS PERCEPTION OF RISK. Impulsiveness (also termed “venturesomeness”) has been identified as a personality trait that leads to a reduced perception of risk. Some people believe they have a better than average ability to control risk (“self efficacy”). When the outcome is desirable for them they are more likely to accept the risk. Learning theory tells us that this is reinforced when risks are rare; the lack of observable downside tends to increase belief in our abilities to avoid danger. In general, risks that confer benefits to individuals (in an insurance company setting this may include accounts that are high prestige or of significant premium volume) are ranked lower; even when contrary evidence is available.

3 SOME GROUPS PERCEIVE RISK DIFFERENTLY TO OTHERS. Expert groups are more likely to be tolerant of uncertainty. Gender, ethnic background, religious viewpoint and social class have all been shown to affect risk perception. However, there is no firm evidence that age is a factor. Diversity in the workplace and active peer review by those with alternative viewpoints can help mitigate these potential biases.

4 HUMAN BEINGS OFTEN MISJUDGE RISK. Studies over many years have identified a number of biases:

“**Representation Bias**”: people tend to categorise new risks on how much they resemble a more familiar risk, even when the resemblance relates to factors irrelevant to the risk.

“**Availability Bias**”: people judge risks more strongly if they can call examples to mind; hence groups using different media will respond differently to the same risks.

“**Anchoring**”: people’s assessment of risk depends on their starting point.

“**Hindsight Bias**”: most people believe their capacity to perceive and manage past events is higher than it really was; this diminishes the ability to learn from experience.

“**Cognitive dissonance**”: if two ideas are conflicting people tend to alter their opinions to reduce this feeling of tension; people tend to justify their decisions after the fact.

“**Confirmation bias**”: people tend to look for evidence which confirms their view; and will ignore conflicting evidence.

Well designed scenarios can help in many respects: they give an appropriate representation of the risk and provide an example to counter availability bias; using a variety of scenarios can help with anchoring. Active construction of evidence based scenarios can help fight hindsight bias and can flush out dissonant concepts.

5 ATTITUDES TO RISK DEPEND ON HOW IT IS PRESENTED. The presentation of risk or “framing” leads to biases which are powerful, even amongst technical experts. Risk descriptions phrased in positive language lead to an underestimation of risk. Perception of risk is often not economically rational; and those managing risks should be aware of this.

6 EMOTION IS A DRIVER OF BEHAVIOUR. Emotions play a strong role in perception and decision making when time is short and information limited. Positive feelings and anticipated benefits associated with a risk diminish the perception of that risk. Fear is a powerful manipulator of hindsight and ability to predict. Panic is typically short lived and research suggests keeping the public informed in an intelligent debate in disaster planning is very positive.

7 COMMUNICATION OF RISK IS CHALLENGING. The use of emotions and imagery can play a powerful role in communicating risk. Conversely, and perhaps surprisingly, technical communication is a relatively weak tool. Negative messages can be more powerful than positive ones; but can lead to denial when the risk relates to a pleasurable activity. Some groups react well to honest communication of uncertainty whereas for some other groups that will diminish their trust in the information. This reinforces the need to know your audience when communicating risk.

8 GROUPS TEND TO MAKE MORE EXTREME DECISIONS THAN INDIVIDUALS. Being in a group tends to narrow the range of options expressed by members. Individual members can become committed to a group position or feel a sense of “cabinet responsibility” so don’t speak out when they disagree.

9 WHEN MANAGING RISK, THE CULTURE WITHIN A FIRM IS CRITICAL. Studies of disasters often indicate that the problem was not with the processes, but that they were ignored or over-ruled. Attitudes within an organisation such as risk ethics in meetings, internal communications and behaviour of senior managers are critical to setting the tone. It is important to create a “learning culture” and where possible to encourage a rotation of staff to bring fresh ideas and insights.

10 BEHAVIOURAL SCIENCE IS HIGHLY RELEVANT TO EMERGING RISKS MANAGEMENT. See the case study at the back of the report for a discussion of the impact of the behavioural issues raised in this report in the context of the management of emerging risks. It seems clear to us that behavioural issues are particularly relevant in the context of the extreme uncertainty that will apply in this field. Knowledge of potential biases can surely help to avoid them.

PURPOSE

The report seeks to provide an overview of literature on behavioural issues of interest to insurers. It draws on work from a number of disciplines, mainly psychology, social psychology, behavioural economics, decision theory and sociology. We aim to highlight the key findings and also areas where work is currently inconclusive.

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 AonBenfield, Catlin, Guy Carpenter and Lloyd's.

More details can be found at www.lloyds.com/emergingrisks.

INTRODUCTION

“Appreciating what we as a species can and can’t do well. When we are likely to make sound decisions and when we are likely to make a hash of them – requires moving past the idealisation of economic man and into the more sticky territory of human psychology”

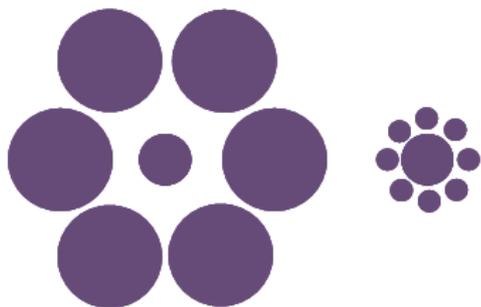
Kluge: The Haphazard Construction of the Human Mind, Gary Marcus

The “financial crisis” of recent years probably has many causes. An over-belief in mathematical models? Perhaps. An overdose of testosterone? Possibly. Assumptions about how different groups will behave, including that they will be “rational”? Ignoring of evidence that didn’t align with plans? Forgetting that, time and again, bubbles happen and then burst. Not noticing that even the experts didn’t fully understand the risks that were being reprocessed, packaged and sold on. Not wanting to miss out; and the presumption that, if others were doing it, they must know something?

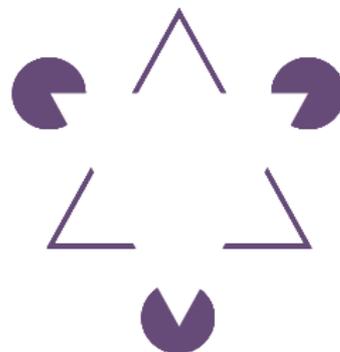
Behavioural theorists have long considered risk perceptions. One of their key insights was that people have two systems of thought: feeling and reason. For many years economists assumed that people would act rationally and built precise theories following on from that assumption. However, before mankind was a “logical being” with the internet, mathematics, the law and governments we were animals, indeed in the 1930s the economist John Maynard Keynes suggested that “Animal Spirits” are a key driver of entrepreneurship. As a result, the logical processes in our brains are built on top of animal instincts and reflexes. We mustn’t forget that these reflexes are essential to stay alive: to steer clear of edges, jump away from pain and make other decisions in timeframes too fast to accommodate reason. But just as they are useful, they are dangerous if we fail to recognise their impact on our rational thoughts.

The report looks at a number of clear biases in our thought processes and the impact they have on our risk assessments, considering how we tend to downplay risks if we can’t think of examples of them, and how risks that look the same superficially are often treated the same. We also tend to anchor our assumptions on last years’ value or on what our initial guess suggested – often in the face of new and compelling evidence. We don’t like to hold conflicting views and will adjust our own beliefs to reduce this tension.

In some settings we are comfortable admitting to cognitive impairment. For example, the optical illusions shown in the figure below lead to predictable errors. The point of this report is to show that there are equally predictable errors in our reasoning; and to suggest some actions we can take to mitigate them.



IS THE LEFT CENTRE CIRCLE SMALLER?



IS THERE A WHITE TRIANGLE?

1. FACTORS INFLUENCING VIEWS OF RISK

"All outcomes, including doing nothing, are choices"

Your Brain is Almost Perfect, Read Montague

Risks may concern both hazards and opportunities. Both are to some extent unavoidable and may typically involve uncertainties. People inevitably accept a degree of risk in the course of their life and insurers use knowledge about the incidence of risks to help people manage them. The most interesting and relevant findings of the behavioural sciences concern the fact that people frequently act in apparently irrational ways in relation to risks accepted. This applies to the general public and may also, in rather particular ways, affect those working in the insurance industry.

An important stream of research is based on survey responses probing perceived characteristics of a wide range of risks. Most of these studies identify three underlying factors:

- 1 DREAD;**
- 2 UNFAMILIARITY; AND**
- 3 SCALE.**

People are more likely to see a risk as severe and report that they will take action to avoid it if they see it as something to be feared (cancer, street crime), if it is unfamiliar (nanotechnology, GM food) and if it is seen to affect large numbers of people (air pollution, pandemic flu).

A further risk characteristic that is thought to affect responses concerns the extent to which a risk is encountered voluntarily or whether it is imposed externally, by nature, government or another external group. People are more accepting of risks where there is a strong voluntary element, for example extreme sports, working in high-risk occupations, travel for pleasure.

A number of factors shape the way people perceive, understand and respond to risks. These include the characteristics they attribute to the risks but also individual psychological and group social processes. The perception of risk does not relate in a simple way to the objective incidence of risk, insofar as this can be judged. Information, imagery and other factors can influence perceptions of risk. Experts in all fields are not immune to these factors although professional or institutional requirements for due diligence will moderate their impact to some extent.

2. INDIVIDUAL CHARACTERISTICS AND RISK

Since the early 1990s, risk research has examined the extent to which individual characteristics affect perceptions of and responses to risk. People are complex and the research investigates the impact of personality type, cognitive style, experience and beliefs and attitudes. These are all areas in which theoretical and empirical work is developing rapidly and it is not possible to identify definitive overall conclusions. However some valuable points can be made.

Research which takes personality into account tends to focus on voluntary risks (sexual behaviour, diet, risk-taking recreations, driving behaviour and so on). Personality theories differ in their understanding of the nature and characteristics of personality and in particular in the number of dimensions or separate aspects to personality they categorise. The research is more successful at identifying factors which predict risk-taking than risk-perception. A large number of studies identify a personality characteristic variously described as 'venturesomeness' or 'impulsivity'. Those having this characteristic tend to take more risks. There is a weaker relationship between neuroticism or anxiety and risk perception. This finding is important in a number of areas since it suggests that individuals who do not differ in their perception of the magnitude of risks may be inclined to behave in very different ways in relation to those risks, and that this is independent from the overall factors of dread, scale and impact and voluntariness of exposure discussed in the previous section.

Further research focuses on the techniques individuals employ in thinking about risk: their cognitive style and the mental models they use to link risk characteristics and expected outcomes together. An attractive idea is that individuals' assumptions about their own capacity to control risks, their 'self-efficacy' would be relevant to risk perception and behaviour. The link is in practice more complex. For voluntary risks the important issue seems to be the desirability of the outcome. For desired activities those who have stronger self-efficacy seem more likely to take the risk. However for imposed risks, self-efficacy seems to relate more to attempts to evade the risk or deal with it in other ways.

Experience also impacts on the way people respond to risks. Here there appear to be two effects that tell in different directions. On the one hand 'normalisation' processes typically lead people to accept higher levels of risk for an established and long-run process with which they have become familiar. On the other, 'sensitivity' processes tend to heighten perception of risk in relation to a new and rapidly developing activity or issue. Thus risks in relation to road transport are widely accepted, whereas hazards in relation to new technologies (nanotechnology, genetically modified food) attract great attention. Normalisation also appears to operate at the individual level. For example, those living close to a nuclear facility tend to be more accepting of risk and to rate nuclear risks less highly than others. The sensitivity aspect appears more complex. Individual experience of a rare and occasional risk (for example, flooding, food poisoning) substantially increases awareness of that risk and willingness to take action to mitigate it in the future. A separate tradition, based on learning theory, reinforces these findings. It identifies the learning processes whereby individuals who engage in high-risk activities will on most occasions perceive no immediate penalty and thus be reinforced in risk-acceptance. They may also develop confidence in a personal ability to manage a risk more successfully than others. Greater familiarity may reduce perceptions of risk for example in relation to the acceptance of road accidents.

FACTORS INCREASING OUR PERCEPTION OF RISK

- **Unfamiliarity**
- **Experts don't understand it**
- **Lack of personal control**
- **Risk is forced upon you**
- **Children involved**
- **Future generations affected**
- **Can identify victims**
- **Dread and fear**
- **Lack of trust**
- **It could happen soon**
- **Man made**
- **Personal impact**
- **Irreversibility**
- **Benefits unclear**
- **Inequity**
- **History of accidents**
- **Media attention**
- **Catastrophic potential**

SOURCE: DAN GARDNER'S BOOK "RISK", QUOTING SLOVIC, 1970

Perceptions at a more general level also play a role. This has been explored in relation to world-views, such as belief in a higher-being, or 'new age' world-views and also in relation to generalised trust in authorities and experts. Belief in a higher being, in a view of the world as intentional and as directed, in the soul, in immortality and that a deeper reality lies behind the appearance of things all relate to greater perceptions of risk from technological interventions in nature and stronger desire to reduce the risks.

Trust has been extensively studied in this field. The main findings are that trust is related to technical factors, such as the perceived competence of the authorities and their capacity to control the hazard in question, and also to their commitment to achieving control of the hazard and the extent to which they cared about the public affected by it. This might be displayed through the transparency of decision-making and its openness and responsiveness. In one experiment an agency which never made an error in regulating risk but did not relate to the public was found to have lower trust than one which made mistakes but consulted the public extensively, admitted errors, apologised and said it would take steps to prevent them happening in the future.

Finally there is considerable evidence that most people tend to perceive lower risk from activities that give them some benefit (reward, pleasure, privilege) irrespective of the availability of evidence on levels of risk.

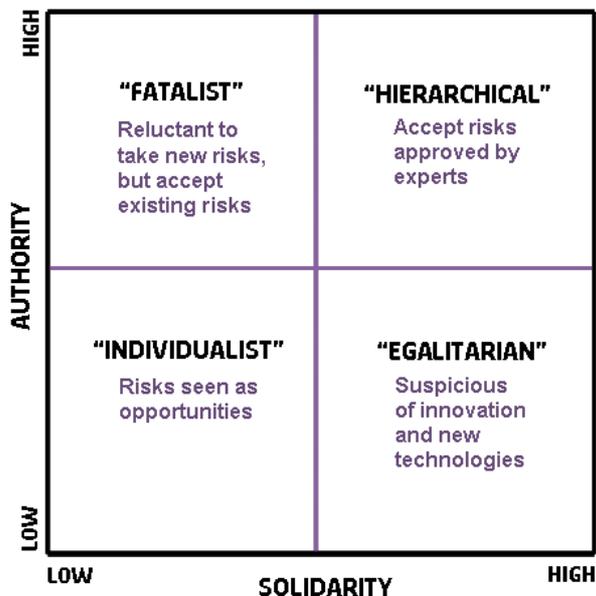
3. GROUP DIFFERENCES

Group differences have been examined along several dimensions. The most significant studies concern differences between expert and lay groups and between socio-demographic groups by gender, social class and ethnicity. Research on expert and lay groups indicates that differences in approaches to abstracted knowledge play a role. It is not surprising that expert groups are more tolerant of uncertainty and more willing to deal with hazards in terms of the probability of an event over a large sample, while lay groups are more interested in processes which might lead to a problem emerging here and now. There is some evidence that experts are more likely to define risks as less significant than lay groups and likely to be more accurate in their perceptions of risks.

Studies of gender differences establish that women are more likely to identify risks in areas such as environmental hazard, nuclear issues, hazardous waste management, crime and food quality. This applies even among sub-groups with technical expertise such as scientists. A number of studies also indicate that black rather than white and lower rather than upper social class groups are more likely to perceive risks, to believe that they are stronger and to call for measures to address them. Level of education also has an effect; the better educated are less likely to perceive risks. There is no firm basis for the view that older people are more risk averse. Some commentators argue that these socio-demographic effects are influenced by social status and risk incidence. There is also some evidence of weak cross-national differences in perceptions of and responses to risks.

A different perspective on socio-cultural differences is provided by the cultural theories of sociologists and anthropologists, concerned to identify general rules underlying human social behaviour. An influential approach reduces the relevant characteristic of social life to two: identity and authority, labelled 'grid' and 'group'. Societies can be understood as more or less solidaristic to the extent to which they contain and permit diversity in people's life-styles and identities, and as more or less hierarchical in the patterns of social leadership.

The two dimensions cross-cut, leading to four general types of society with their own biases in relation to risk. High authority, high solidarity (hierarchical) societies accept the hazards approved by experts, while low authority, high solidarity (egalitarian) societies tend to suspect innovations and new technologies. High authority, low solidarity (fatalist) societies are reluctant to take new risks but accept existing risks. Low authority, low solidarity (individualist) societies tend conversely to regard risks as opportunities. This analysis is controversial, since it is theoretically rather than empirically based, provides an overly determinist model of behaviour that focuses simply on features of society, and fails to allow for the independence of the hermit (or 'nerd'). It has had an impact because it is successful in categorising features of existing societies on an economical basis. Its relevance to risk is that it provides an account of how underlying social factors provide a setting in which particular individual characteristics may emerge as important. Whether or not one accepts cultural theories, there is value to considering factors beyond the individual in explaining risk perceptions and responses.



4. FACTORS PROMOTING ILLUSIONS AND MISUNDERSTANDINGS

One reason why understanding of risk is seen as problematic is that many people appear to make mistakes in their estimates of risk. Probably the most influential work on risk perception and evaluation is that of Tversky and Kahneman (1990) on heuristic biases. These authors argue that people commonly use heuristics to simplify choices in relation to risk. These heuristics are convenient, but may be subject to bias. They identify many kinds of bias which appear to affect risk perceptions:

Representativeness refers to the phenomenon that people seem more likely to see risk in one area as comparable to risk in another if the two areas resemble each other. This categorisation is often irrespective of any evidence on whether the resemblance extends to factors which may be causally associated with hazards. Thus risks from terrorism may be associated with risks from street crime, because terrorism is defined as a crime, whereas in fact they differ markedly in extent and location. Representativeness bias may make it difficult for people to take seriously evidence which points to differences between risks which share similar characteristics and to respond appropriately. Dan Gardner describes this as “the rule of typical things” in his book “Risk”.

Availability bias (some also call this the “example rule”) refers to the tendency for people to respond more strongly to risks when instances of those risk are more available to them, from memory, from imagination, from the mass media, from general social discourse or from their beliefs about the world. The availability of imagery from memory may depend on a number of factors including: how recently the example occurred, personal experience, the extent to which the issue was seen as salient in the past or associated with significant life-events, or the way in which the memory is organised, including the ease of search. Emotion will affect this bias; because emotion affects memory. In relation to imagination, there are differences in the scope of imagination of different individuals. In addition the impact of imagined outcomes may differ. For example, for someone working in the health service, the risk of swine flu may generate immediately availability of imagery associated with high pressure of work, for another person it may be about protecting sick relatives. Groups using different media or those with different peer groups may think differently about risks. Experts can be affected in subtle ways, quoting Kahneman, Slovic and Tversky’s 1982 book “...when presented with a problem, professionals view the problem within the structures they have been trained to see”.

Anchoring relates to people’s starting point in their estimate of risk. Typically people will establish a particular value as the place from which they start and adjust their risk estimate in relation to further information, but distance from the starting-point will have a strong influence on the degree of variation. Availability or representativeness may play a role in relation to the starting point. A number of studies show that information which indicates a particular value for one risk may also have an impact on judgements about other risks. For example if people are asked to estimate various risks in everyday life and given an estimate of 1 in 20,000 of death in a road accident their estimates of risks of death in an accident in the home will be relatively close to this and will be higher than if they are given as starting point an estimate of 1 in 200,000 of death in a rail accident.

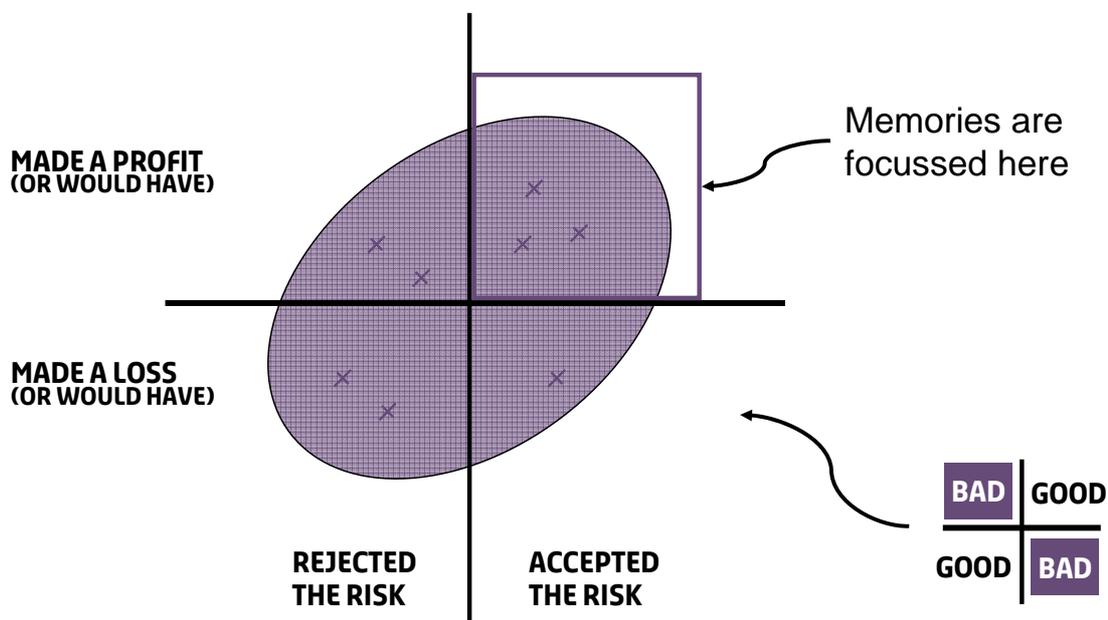
Tversky and Kahneman’s work started out from the position that perceptions of risk could be thought of as analogous to perceptions of aspects of the physical world and therefore subject to similar distortions. Alternative explanations point out that humans have limited cognitive resources and that heuristics may be useful tools for coping with a complex reality and for enabling us to make vital decisions rapidly. Much of this argument turns on the claim that heuristics most of the time guide people towards correct judgements. Further biases seem less easy to understand in this way.

Optimism bias refers to the extent to which individuals tend to see particular risks as less likely to affect themselves: smokers perceive health risks from smoking in general but see themselves as less likely to suffer from these effects. This bias is particularly noteworthy in relation to voluntary risk-taking activities, where it may be referred to as an ‘immunity’ or ‘invulnerability’ effect. It is additional to the tendency for those who see particular activities as beneficial to minimise risks noted earlier. Optimism bias has been understood in terms of motivations, since it may facilitate undertaking the behaviour in question. There is some evidence that optimism is more likely in industrialised countries and where individuals make comparisons between self and an “average person” or a risk-taker, rather than with a family or group members. Optimism bias may impact an individual’s willingness to respond positively to

recommendations from internal auditors or risk management departments. In market conditions it is quite typical to find all participants believing they are better than average.

Hindsight bias is to do with the extent to which most people believe their capacity to perceive and manage previously encountered risks is greater than it in fact was. Even when evidence of previous risk judgements is made available people will often minimise its significance by claiming that the response was not strongly held or was a guess. Hindsight again links to optimism via availability since it exaggerates the imagery of successful risk management which is available.

Confirmation bias is where people tend to reinforce their own beliefs. People can restrict their focus to data which aligns with their views, and ignore contrary information. They can choose to remember events that agree with their point; and forget those that don't. And they can apply a bias when they interpret evidence, for example deciding a certain data point is "an outlier". The figure below illustrates this point. It is ideal to track outcomes in each of the quadrants (though not always easy to do so). In practice only the two right quadrants are typically tracked and memories tend to be reinforced when the outcome was positive. In essence, people should search for disconfirming evidence. To learn even more from such monitoring other data should be captured: "was I tired?", "did I have to make a quick decision?", "was I under pressure to choose one way?"



Cognitive dissonance is the state of tension that exists when a person holds two thoughts that are psychologically inconsistent. For example, wishing to be healthy, but also continuing to smoke. The theory, first proposed 50 years ago, has been hotly debated but still remains highly relevant today. It suggests that when a state of cognitive dissonance exists **we will adjust our beliefs** to reduce the tension. A number of very clever experiments have illustrated this. In essence it leads to: liking what you have chosen (self fulfilling prophecies), liking what you have suffered for (for example after significant effort we may accept and justify a last minute price reduction to close the deal). This is highly relevant in the context of expensive and complex insurance models under the Solvency II framework. There may be a tendency for those that built the models to defend them, given the effort expended to build them. It links closely with confirmation bias described above. For example, it is arguably, is strongly present in the climate change debate where a desire to retain our current carbon intensive lifestyle is at odds with a desire to reduce emissions to protect against the risks of global warming.

In many cases insurance pricing is determined logically using past data, the views of experts and well constructed models. However, it is still useful for those working in the insurance industry to be aware of the general difficulties human beings have when estimating probabilities. There is even some evidence that the weather affects financial trading decisions. Some typical errors (many discussed in Kahneman, Slovic and Tversky's 1982 book "Judgement under uncertainty") are shown in the table below:

Prior probabilities are often neglected	For example in one experiment subjects were given a description of a person including that they were shy. Then the subjects were asked if the person was more likely to be a farmer or a librarian. The majority answered "librarian". They neglected the fact that there many more farmers than librarians! The prior probability of being a farmer rather than a librarian (i.e. in the absence of knowing the person is shy) is close to one. The new information does not really change that overwhelming fact. People often focus on such details and miss the bigger picture.
Sample size is often ignored	When asked whether a small or large maternity hospital was most likely to have an above average number of boys many people answer "large hospital" (perhaps because it appears complex and more difficult to envisage?). Yet with a small hospital it is much more likely that an above average number will result; due to randomness of the small sample.
People expect short samples to represent the distribution	One experiment related to coin toss experiments. If H is a head and T a tail, they were asked which of HHTHTT and HHHHHH were most likely. The answer most people gave was the first example; yet they each have the same probability. In short samples, runs of very "biased looking" results can occur. People can assume a trend before they should.
Chain like processes are hard to envision	Many business processes are made up from a long string of connected elements. Each element can fail. The failure of a project can be due to a catastrophic failure of one element – but can also arise from minor failures from a large number of elements. People find it very hard to envision the latter type of failure and hence often overestimate the likelihood of project success.
People respond to conceivable examples ("scenario bias")	People can often provide a plausible scenario, starting from realistic initial conditions that lead to the desired end state. The ease of producing this scenario is often taken as evidence that success has a high probability. Conversely (and linked to the above point), a failure that can only be imagined from an "unlikely" combination of events is often taken as evidence that failure has a negligible probability. Of course, this can be correct: but ease or otherwise of producing a scenario (very similar to the availability bias discussed above) is not the same as factual evidence.
People can be swayed by redundant inputs	The presence of a large number of data each pointing in the same direction can be seen as a strong indication on the accuracy of predictions. However, sometimes the data is all driven by a similar cause and these redundant data sets do not increase accuracy. Kahneman, Slovic and Tversky call this the "Illusion of Validity".
Halo effects can distort perceptions	It seems that if people like something about an option then they assume it is all good. This can distort estimates of probability (and is discussed more under framing below).

5. FRAMING OF RISKS AFFECTS OUR PERCEPTION OF THEM

The way a risk is presented (known as “framing”) has been shown to exert a powerful impact on our perception of risk. For example if a risk is framed in a positive or negative way, although describing an identical effect, the impact on the responses, even among technical experts, in the field is substantial.

A classic experiment by Tversky and Kahneman (1981) offered a group two options: One with a certain number of lives saved; and another with an uncertain outcome, sometimes saving more lives and sometimes less. The two options had the same expected number saved. The majority chose to avoid the uncertainty and save a fixed number of lives. Then they repeated the experiment with a different group; this time phrasing the question in terms of lives lost. The two options were the *same* options offered to the first group, just worded differently. Yet in this second experiment the majority opted for the uncertainty: in other words the chance of avoiding deaths was the critical factor.

Psychologists have found that people value losses and gains differently. The same risk will be valued differently depending how it is presented. This has clear implications at the broker/underwriter interface and indeed any business conversation.

The significance of subjective valuation again depends on the reference point. For example research suggests that a prize (or penalty) of £100 makes much more difference to someone, than the difference between a prize (or penalty) of £2000 and £2100, although the amount involved is £100, the same in both cases. Utility theory can help to explain this and suggests that simple cost benefit analyses are flawed.

Many business plans are made in the context of last years’ figures. We know what we thought last year; this “anchors” our calculations. This can be useful and, where there is an unexpected difference, often shows up an error in the latest calculation. But, psychologists have shown that anchoring also leads us to undervalue hard evidence: the new number could be correct and we need to revise our views. In one experiment some subjects were asked an obviously ridiculous question (is the temperature in San Francisco more or less than 558 degrees Fahrenheit?), others were not. Then each group was asked for the average temperature in San Francisco. The experiment showed that those who were asked the 558 degrees question systematically guessed higher than the other group. It was as though the additional piece of information, even though ridiculous, had some magnetic quality to increase estimates towards it. Many studies have found anchoring to be a valid phenomenon. It must surely have significant implications when probabilities for events are highly uncertain; do we know where our best estimates come from and what influenced them?

6. EMOTION

Emotion often has an important influence on our thought processes (“cognitions”). Much advertising and associated commercial activity seeks to exploit this link by associating positive emotions with products. The role of emotional factors in relation to risk perception and response has received considerable attention in recent years. Some have suggested that the recent financial crisis was exacerbated by emotions fuelled by testosterone in male traders. The relationship is complex and is currently not well understood. Most of the research deals with particular emotional factors such as fear or regret.

A considerable body of work demonstrates that feelings are typically associated with risk factors to a lesser or greater degree. They appear to play a stronger role in perception and decision-making under time pressure or when information is limited. This leads to adaptive evolutionary accounts of the relationship: an immediate emotional response that makes you run may be more likely to lead to survival than rational deliberation when you meet a sabre-toothed tiger on the jungle path. One consistent finding is that emotion appears to play a stronger role in influencing perceptions of risk than perceived risk does emotion, except in extreme cases of panic and terror. This suggests that emotion is not a simple risk correlate but contributes as a driver of behaviour.

Some writers use feelings to explain the commonly-observed negative relationship between risk and benefit. People who think that an activity will bring them benefit are likely to think of it as less risky, irrespective of evidence or expert judgement. Positive feelings associated with the relevant risk by the anticipation of benefit (for example a prestigious new insured in the company's commercial portfolio, leading to personal recognition within the firm) diminish the perception of risk.

One impact of "fear" is that it appears to be a powerful manipulator of hindsight and prediction. People who have been frightened by something are likely to report that they always had a high level of concern and to anticipate future problems in this context to an irrational degree.

Baddeley (2010) notes that emotions can often be "tie-breakers" in situations where there is insufficient information for a rational decision. In situations where there is little empirical data (for example low probability, high impact events) it is therefore possible that emotion has a greater impact on risk acceptance decisions than we might think.

A further emotional driver that can be powerful under specific circumstances is "anticipated regret": the expectation that a particular course of action will lead to negative feelings in the future (indeed arguably most people purchase insurance because they can anticipate the impact on themselves, or family if an accident occurs and they are not covered against the risk). It appears to be particularly powerful in relation to issues where possible consequences are powerful but highly uncertain. It is also subject to rapid erosion by experience. If someone discovers that regret is more limited than they anticipated the capacity of regret to influence their actions diminishes. This can be dangerous too. For example, some of the more worrying possibilities for the recent H1N1 pandemic did not occur. This does not mean that the actions taken to mitigate those risks were "mistakes". There is a clear risk that next time a pandemic, or epidemic occurs the public will not be as inclined to follow guidance: our learning responses can be flawed.

7. RISK COMMUNICATION

Risk communication is clearly important and has been extensively studied in the context of public communications, lobbying and advertising. Although this research is not directly linked to the communication of risk within insurers (for example to Boards of Directors) we can still learn from the available research.

Much communication is between authorities or technical experts who recognise particular risks or wish to change the way people behave in relation to them and the mass public. Many factors influence responses to messages. This is shown by the work on factors such as fear, trust and uncertainty and the impact of the mass media and pressure groups on perception. Successful communication of risk is difficult to achieve. For example, despite enormous quantities of peer reviewed evidence there remain many sceptics on the subject of climate change.

A useful starting point is mental modelling. A mental model is simply the understanding someone has of a risk. It may involve beliefs, attitudes and emotional components. Typically experts will have more complex mental models than the lay public and emotional factors will play a weaker role in them. From this perspective the point of risk communication is to bring the mental models of the public more in line with those of experts.

Various pieces of research indicate that factual communication is relatively weak in achieving this. Use of emotions such as fear may play a powerful role. Negative messages appear stronger than positive ones. However when a pleasurable activity is addressed, messages designed to arouse fear may simply meet denial. People who enjoy smoking may simply reject the message that it is harmful to their health and the same may apply to activities such as long-haul holiday flights in relation to climate change. Arguably this is due to the fact that climate change does not pose an immediate risk to those individuals; coupled with perception that their own actions will have little influence.

Trust is an important factor in the way in which people respond to risk messages. It is also central to the business of insurance – our core product is a promise to pay when disaster strikes. Much research shows that trust is easy to damage but hard to reconstruct. Communication is at the forefront of building

trust. The relationship between communication and trust is complex and not fully understood. One important factor seems to be the extent to which two-way communication which takes the public seriously and respects them as people. This suggests the benefits of consultation, participation and engagement.

Several major studies have focussed on how to engage with people when considering risk. Different kinds of risk require different engagements: for risks that involve considerable uncertainty or affect value-differences engagement must be active, wide-ranging and probably expensive if trust is to be advanced. Uncertainty appears to reduce trust among some groups but to enhance it among others which generates difficulties. Research suggests that risk communication must explain issues, but most also pursue extensive consultation and engagement and do so openly. Risks that are widely understood as technical issues and which do not involve strong value differences between stake-holders (flood prevention, oil storage) may be better addressed through general communication reinforced by the use of opinion polls, media analysis and similar means to check on the effectiveness of that communication. In both cases, authorities must demonstrate competence and effectiveness to achieve public trust.

Risk amplification, where an apparently small risk is magnified out of proportion by social concerns has been extensively studied. The research examines how risk issues and events ripple out in their impact from those directly affected through local communities, professional groups, and other stake-holders to society at large, and how a range of channels of information and influence (from direct experience through informal networks, the media, lobbying and evaluation and political processes) are involved. The mass media and pressure groups have been increasingly important among these in recent years. Pressure groups seek to advance a particular public or private interest and are often successful in exploiting available opportunities for sensationalism. Media often place a high value on imagery. The pictures of dead cattle being incinerated carried a powerful negative message about the policies to contain the BSE outbreak. The emotional content of stories is often as important as informational content.

The new electronic media, which are much more highly networked and subject to bottom-up rather than top-down influences play an increasing role. Whether the opportunities for sensationalism or distortion of messages are as strong in these areas is at present unclear. While it is more difficult for authorities to suppress a message, there are limitations to the role that can be paid by technical expertise as opposed to views that are simply strongly held for reasons of emotion, misperception or interest. However, in some cases new media have made it simpler for experts to share their views. For example the climate change blog www.realclimate.org is authored by leading climate academics who regularly and speedily give their scientifically objective rebuttals to misinformation and bad media reporting, there is even an iPhone application for countering climate skeptics.

8. GROUP INFLUENCES

Heuristic biases, framing, socio-demographic characteristics and other factors influence individual perceptions of and responses to risk. Group membership also exerts an influence and one that is relevant to organisations like those in the insurance industry. It is well-demonstrated that groups tend to make more extreme decisions (either riskier or more cautious) in relation to options for responding to hazards than would the individuals who make them up. This has a strong relevance to decisions made, for example, by war cabinets, by political parties and by insurance firms. In addition, the experience of being in a group tends to narrow the range of options expressed by members compared with that from the same individuals when interviewed separately.

The main explanations of this phenomenon refer to the nature of the problem and the nature of the group, and these factors often appear to interact. In general the shift towards a riskier stance applies to issues where there is less at stake and to a more cautious stance when the issues are seen as weightier. This lends weight to the importance of peer review of underwriting decisions to guard against maverick underwriting. Within a group, individuals may experience a diffusion of responsibility, so they are less reluctant to adopt more extreme viewpoints. Larger groups (where responsibility is even more diluted) are more likely to move towards more extreme positions. Conversely, social processes such as the desire for social acceptance may also tend towards conformity. Leadership may play a role depending on personality differences within a group.

Most of the research indicates that if a group has a separate identity with views that are opposed to “outsiders” and where this identity is valued by its members, then the group is likely to move towards more extreme positions and to maintain them in the face of conflicting evidence. Individual members increasingly become committed to a group position and this reinforces the processes that drive differences between groups and the shift towards riskier or more cautious positions.

Where there is a clear polarisation between two opposed viewpoints within the group issues are more complex. One view may be assimilated by another or both may continue, making it difficult for the groups to generate a common position. However, individual members’ views tend to follow the logic of becoming more extreme, moving towards one position or the other. This may have implications in cases of Boardroom conflicts.

Much has been written on the subject of “herding” in the context of financial bubbles. History has shown that people are repeatedly prepared to follow the crowd, even when evidence begins to warn this may be the wrong action to take. Indeed the economist John Maynard Keynes is reputed to have said “*Worldly wisdom teaches that it is better for the reputation to fail conventionally than to succeed unconventionally*”. Some research has suggested that herding has given many animal species an evolutionary advantage, so it is not surprising that humans share this tendency. However, behaviours which are beneficial in some contexts, can also have unwanted side effects in others. For example, inconsistent actions such as wishing to retain market share but also to write profitable business when premium rates are softening will lead to cognitive dissonance. This dissonance can be reduced if comfort can be gained because “others are doing it”; a potentially dangerous conclusion. Acting as a group or herd may also serve to reduce individual fear – and lead to larger risks being taken than if acting alone.

9. RISK MANAGEMENT IN ORGANISATIONS

Risk management is important in two distinct ways for insurers. First, if our policyholders (either individuals or corporations) manage risk well this will tend to reduce both the quantum of insurance claims and their variability. Second, risk management in our own firms (for example relating to underwriting procedures, reinsurance purchasing, investment selection etc) will help to maintain solvency.

In the context of organisations in general, risk management has always been seen as part of the responsibility of the managers. Attention has been paid to:

- processes for identifying the risks generated by the organisations’ activities,
- evaluating and responding to them,
- putting in place the requisite systems and
- monitoring their operation.

More recently risk has received much more attention. Indeed managing risk is sometimes seen as the primary task of management and is an area which has become a concern of government and of trans-governmental and international agencies such as OECD and the International Risk Governance Council. For the insurance industry the coming Solvency II regulations from the European Commission and CEIOPS have a strong focus on the embedding and practical use of risk management processes.

Recent focus on risk management has led to an increasing interest in the multi-faceted nature of risk. For example, production of a sub-standard product may not only create risks to profitability and market share to be addressed through quality control, but also risk to the reputation and longer-term future of the firm, requiring a concerted response, including quality, communication and public engagement. The recent recall by Toyota relating to various design faults is thought by some to have damaged overnight a long built reputation. This leads to approaches such as scenario planning in which the interaction and reinforcement of various hazards and responses are mapped out under different circumstances.

The broader perspective has led to a greater emphasis on safety culture within an organisation which includes not only the rules and procedures in place but the social and emotional factors that influence how people perceive risks and behave in relation to them. Studies of disasters (Bhopal, the space-shuttle Challenger, Chernobyl, the King's Cross fire) indicate that the key problems lay not with procedures but with the fact that, for various reasons, they were over-ridden or ignored. Research in this field has shown that safety culture depends on: appropriate rule-making and training, actual embedding in day to day practices, reinforcing behaviour of senior managers and ensuring there are no negative connotations in terms of promotion prospects (evidence of which is sure to inhibit risk cautious behaviour). The recent financial crisis has arguably shown that certain bonus cultures and remuneration structures can incentivise short term aggressive risk taking.

In this context the role of government includes advice and inspection. The tradition of inspection since the early 19th century contains many examples of 'regulatory capture', the process whereby those initially appointed to inspect an industry come to recognise its problems and identify with it so that they finally become advocates for existing safety regimes. There is considerable evidence that this problem, while recognised, has not been overcome.

One way forward stresses the importance of a learning culture within the industry and in particular of opportunities for individuals to act as no-blame 'whistle-blowers'. Examples from food safety, to social work, to government service, to the nuclear industry to pharmaceuticals indicate that while progress has been made, this ideal has not been achieved. A major factor that highlights the importance of safety culture is the recognition that the short-comings of a firm may contribute to a damaging decline in trust. As pointed out earlier, trust is easy to destroy and hard to rebuild. The transparency of safety culture is an important factor in this, as is the responsiveness of management to external and customer concerns. For insurers this issue is absolutely critical. Our fundamental product is a promise: we promise to pay in the event of claim. Trust that we have the procedures to safeguard our financial strength is paramount.

CASE STUDY: IMPLICATIONS FOR EMERGING RISK MANAGEMENT

This section considers what can be learnt from the psychology of behaviour in the context of emerging risks management. For a number of reasons, ranging from the greater integration of processes of economic, fiscal and cultural globalisation, to the increasing sophistication of litigation, many of the risks that may now confront insurance markets involve the interaction of a complex array of factors. Better understanding of the way psychological issues influence judgements may help avoid common biases.

Successful underwriting in relation to emerging risks requires that insurers should combine traditional skills and acumen with the imagination to envisage and integrate a wide range of factors that may interact. This requires a particular organisational culture and particular approaches by the individuals working within it.

The psychology of behaviour suggests that three kinds of factors may be relevant:

- 1 General processes seem to affect the way most people perceive and respond to risks. These include the operation of rules of thumb (representativeness, anchoring and availability) and biases (such as hindsight and regret), and also processes such as the normalisation of familiar risks;
- 2 Processes that seem to apply differently in different individuals, such as personality factors and, in particular, the impulsiveness that might encourage risk-taking behaviour, or the emotional responses which appear to crowd out judgement, particularly in rapid responses to complex risks; and
- 3 Factors to do with organisational contexts, most importantly the group interactions which tend to lead groups to take up more extreme positions than individuals typically do; organisational culture and in particular the extent to which safety is valued; and the factors such as competence, commitment to the interests of the customer and transparency which contribute to trust.

The following table considers all the issues raised in this report and suggests some questions to ask in the context of emerging risks management:

DREAD	What is your gut feel about the proposed scenario? Do you fear it could damage your company or the insurance industry? How are other people reacting to the scenario? Gut feelings are helpful, provided you also seek confirming and disconfirming evidence.
FAMILIARITY	You may often hear “this is an old issue” (a current example might be the risks or otherwise of Electromagnetic Fields). Is there new information? Has scientific understanding of the risk changed? Have there been legal developments in related areas that would make a successful claim more likely now? Have contract wordings become less tight since you last reviewed the risk. Does your company write different lines of business now; might other companies in your group now be affected? What’s new?
SCALE	A very large scale event may feel very risky. This may lead to denial or despair. Perversely this can lead to the risk being put out of mind, but left within coverage (“if it does happen we’ll have bigger things to worry about”). Can smaller versions of the risk occur; but still do damage we might be expected to survive? Is their probability significantly higher? An example might be the impact of an asteroid on earth. A 300m asteroid would cause devastation, but has a probability of 1 in 50,000; however a 30m asteroid would explode with the force of 2 million tonnes of dynamite and may still cause a large loss – this has a probability of 1 in 250. (source: “Risk”, by Dan Gardner)
BELIEF	Where do your colleague’s beliefs about the level or risk come from? Might their background, culture, sex, colour or social class be affecting their views? Have you asked a diverse group for their opinions; including wider stakeholders such as different professionals and academics.
VENTURESOMENESS	What is your colleague’s attitude to risk generally? Do they favour riskier sports or gambling; or do they avoid them at all costs? Might this be affecting their judgement one way or the other?
SELF EFFICACY	How do your colleagues rate their own ability? Do they think they can manage risk well? Does this fit with past experience?

HIGH BENEFITS?	If a risk has associated high personal benefits then objective assessment may be clouded. If the risk were to occur, what would you lose? Conversely, what action would you have to take to avoid the risk (e.g. exclusion, sublimit, decline the policy, exit the class of business). What would you lose in that case (Bonus? Job? Kudos?). Might anticipated regret in each case be clouding your judgement? What about your colleagues?
GROUP BIASES	Is your emerging risks group well balanced and diverse? Does it contain a variety of professional disciplines? (Claims, Underwriting, Actuarial, Risk Management, Policy wording) If not, can you seek external input? The deliberate pursuit of perspectives from different positions (as in De Bono's 'six thinking hats' approach) can be useful, so that the process becomes a conscious and explicit part of the culture of the group.
CULTURE WITHIN FIRM	Is there a learning culture within your firm? If you speak out would it harm your career prospects? Do senior staff exhibit encouraging or inhibiting behaviours regarding risk management? Do they follow the rules and procedures they set?
REPRESENTATIVENESS	If the risk is new might your colleagues be thinking it is "like" something else? In what sense? Are the similarities superficial or relevant to the risk? Are they jumping to stereotypes? Look for differences rather than similarities and ask how significant they could be.
AVAILABILITY	Are there lots of past examples in your personal experience? Or within the corporate memory of the firm? Could you seek examples from other sources or industries? Is there an appropriate proxy? Are near misses tracked? Would a different profession have something to add?
OPTIMISM	People tend to assume plans will go well. Have your colleagues considered all the data? Is the plan in line with past experience: did you meet similar targets before? Why are the usual hurdles not expected to apply this time?
HINDSIGHT	You may hear "...if it does happen, we'll cope. We did last time". Did they? Was it due to their actions or some element of luck? What really happened? Are the files available; can they be reviewed? How might things have turned out differently; and how likely was that? Was a review carried out to determine learning points? If not, would that help in future?
CONFIRMATION	Have your colleagues looked hard for disconfirming evidence? Can you find someone with the opposite point of view? Why do you discount their assessment? Where possible, does the company track a sample of the risks they have declined? Would they have been more profitable than those accepted?
COGNITIVE DISSONANCE	If your company is considering a scenario, might this lead to dissonance? For example, they may want to write liability insurance, but previously felt the risks of certain new technologies were too uncertain to be insurable at present. If they are now assessing the risks as lower than before: on what evidence was that based?
ESTIMATING PROBABILITIES	<p>Are conditional probabilities involved? Are rigorous Bayesian methods being employed or simple heuristic methods? How would your colleagues perform if asked to <i>estimate</i> the probability in this question:</p> <p>There are two bags: (1) has 70% purple balls and 30% white, the other (2) has 30% purple and 70% white. A friend randomly picks a bag by tossing a coin. They then pick 12 balls, one at a time, replacing them as they go. They tell you they picked out 8 purples and 4 whites. Knowing this additional information; what is the chance they picked the first bag?</p> <p>Don't let them do the maths: just ask them for their best guess – the point of this is to see how their gut feel is when faced with conditional events. (The answer and mathematical method is on the last page)</p>

CHAIN PROCESSES	Recall a chain process has a number of interconnecting stages, each with a probability of failure. Can you get information on the individual links and their uncertainty? Could you build a simple model? How did you model the failure rate: were your chosen distributions fat tailed and how would the answer change if they were? If you have aggregated several strands – how did you do you so: what allowance was made for dependency? Did you use a tail dependent copula – what difference did this make? The act of reviewing large claims and catastrophes that have occurred in the past can be very useful. It can highlight the possibility of interaction between previously unconnected factors, and will often illustrate that an adverse outcome was the “impossible” combination of a number of factors – this may help suspend disbelief when considering new scenarios.
SCENARIO BIAS	Are your colleagues struggling to think of a robust scenario to illustrate the risk? Is this leading them to conclude adverse outcomes are unlikely? Alternatively has a strong willed member of the group convinced them that a positive outcome is likely by illustrating with a plausible success scenario? Would additional objective evidence help?
HALO EFFECT	How do your colleagues appear to feel about the risk? Does some aspect seem to attract them? (For example a genetically altered seed may promise to solve famine problems – a clearly desirable outcome). Might the positive elements of the risk be affecting their perceptions? Do the positive elements have any bearing on whether adverse outcomes could occur?
REDUNDANT INPUTS	Is there a lot of apparent evidence that the risk is low? Examples might be: lack of past claims, low media attention, few court cases in the past, no clear adverse scenario. In this example these are arguably not four facts but one driver- the lack of events. These would drive media attention, claims, cases and help bring scenarios to mind. Might there be a long term risk about to emerge?
FRAMING	How was the risk presented? Was positive language used? An example might be: <i>“...we have to write this policy because it is expected to be <u>very profitable</u>, brings <u>large premium volume</u> that would give <u>job security</u> to your colleagues. It fits in with our <u>expansion plans</u>, and demonstrates we are <u>leading experts</u> in this field.”</i> How might your response be different if it was presented as: <i>“...we should <u>be careful</u> when writing this policy because <u>losses</u> could be very large, which, given planned volumes, could <u>threaten our solvency</u>. It may cause us to <u>grow too quickly</u> and illustrate that we have a <u>poor grasp</u> of the facts, <u>damaging our reputation</u>.”</i>
ANCHORING	Where did that assumption come from? Was this what we assumed last year? Was it based on evidence and data? Or a rough estimate under pressure in a meeting? Did the person making the estimate know what it would be used for? Have any parameters been tweaked to bring the answer from a new model closer to initial expectations? Why are those expectations thought to be more accurate? One response would be to consciously shift anchoring by rephrasing the problem as another factor that might be relevant is identified. For example when considering the impact of Climate Change on insurers you can start from physical effects, economic effects, impacts on global security, opportunities from new low carbon industries etc.
EMOTION	It is unusual in business to consider emotion; but it can be useful and very relevant as research suggests. The way you feel may affect your attitude to risk. Are you tired, under pressure, stressed, angry, is your mind elsewhere? Self-awareness is the first step to controlling this potential bias in yourself and spotting it in others.
COMMUNICATION	You may need to convince your Board of the appropriateness of a proposed scenario. Remember that they are also subject to the same biases as you and your colleagues. Do they trust you? Are they usually swayed by evidence or more vivid personal descriptions? Do they tolerate uncertainty – or does that undermine your presentation? As with all communication understanding your audience is critical.
GROUP INFLUENCE	Did you seek the views of individuals before a meeting at which you discuss emerging risks? This may be a useful step. Then track how their views changed during the meeting and ask them why. Has group think been beneficial; or served to dilute initial feelings? Did peer pressure have a role?

CONCLUSIONS

This report has highlighted that human beings, whilst often rational, are also subject to well studied behavioural biases. As essentially animals we have developed complex “instincts” which are designed to make quick decisions based on scant evidence to save us from harm. To do this we have hard-wired responses such as basing actions on past experiences. But we are much more than just animals; we also have a complex brain that suffers from predictable biases in our reasoning similar to optical illusions.

Some people are more impulsive than others; and this will lead them to make different decisions about risk. Risks that we dread, are new and unfamiliar, or potentially large scale will all be assessed as having higher probability than those with which we have become familiar. Sometimes this can be appropriate: but it may also allow a risk to smoulder unnoticed and re-emerge later much larger than before.

Some groups think differently to others. Relevant factors are: sex, colour, religious belief and social class. There is no firm evidence that age affects views of risk. This evidence points to the benefits of diversity within companies.

Individuals have many cognitive biases including: availability, anchoring, optimism, hindsight, confirmation of beliefs and cognitive dissonance. Typically people are poor at estimating probabilities and neglect prior information, don't take account of sample size, find complex “chain like” systems hard to envision and are biased by halo effects.

The way risks are framed and communicated will impact our assessment of them. Communicating risk is difficult and has as much to do with trust as information.

Emotions do influence thought processes: they are a driver of behaviour. If positive emotions can be associated with a risk people tend to rank it as having lower probability of occurrence. The impact of feelings is particularly strong under time pressure or when information is limited. Fear is a powerful manipulator of hindsight and prediction. This seems to reinforce the observation that people take risks more seriously after they have happened; which is challenging for risk managers trying to plan ahead.

People think differently in groups than alone. This can lead to a greater acceptance of risk if group members hide behind a diffused responsibility; or it can lead to over cautiousness. The important thing is to be aware of these influences and take steps to mitigate them. Peer pressure can be strong, and can inhibit the consideration of broad enough scenarios – a challenge under the new Solvency II environment.

Key actions¹ to mitigate these biases include:

- Be aware that behavioural biases exist: admit that you are likely to suffer from them from time to time
- Look at costs as well as benefits; including opportunity costs
- Don't make quick decisions if possible; reflect, this reduces the opportunity for emotion to shape your response.
- Framing of risks which include victims and images, whilst often compelling, can distort the underlying risk – think objectively.
- Consider alternative scenarios and how your business plans would change if these were to arise rather than the central plan.
- Consider how you would feel if the risk was reframed. e.g. “Lives saved” versus “Fatalities”
- Seek peer review
- Incorporate diversity into the workforce
- Seek advice from a wide variety of stakeholders, especially those outside of your industry
- Gut feel can be very informative and should not be ignored. The critical point is to recognise this as it is; and seek evidence before acting.

We believe that insurance professionals will benefit by being aware of the cognitive biases described in this report, leading to clearer thinking and a better management of risk.

¹ Many are highlighted in the book Kluge: The Haphazard Construction of the Human Mind

SOURCES OF INFORMATION

The following were useful sources of information used when drafting this report. Links are shown for ease of use and were valid at the time of publishing the report:

GENERAL

- Breakwell, G. (2007) *The Psychology of Risk*, Cambridge University Press
 Taylor-Gooby, P. and Zinn, J. (2006) *Risk in Social Science*, Oxford University Press
 Renn, O. (2008) *Risk Governance*, Earthscan.
 Renn, O. and Walker, K. (2008, eds.) *Global Risk Governance. Concept and Practice Using the IRGC Framework*. International 5. Risk Governance Council Book series. Vol 1. Springer 2008.
 Slovic, P. (2000). *The Perception of Risk*. London: Earthscan.
 International Risk Governance Council: <http://www.irgc.org/>
 Decision Research: <http://www.decisionresearch.org/>
 Dialogik: <http://www.dialogik-expert.de/en/>
 Risk and Regulation Advisory Council: <http://www.berr.gov.uk/deliverypartners/list/rrac/index.html>
 Social Contexts and Responses to Risk: <http://www.kent.ac.uk/scarr/>
 Baddeley (2010) Herding, social influence and economic decision making: socio-psychological and neuroscientific analyses, 10.1098/rstb.2009.0169
 Tavis and Aronson (2007) *Mistakes were made but not by me*. ISBN 978-1-905177-21-9
 Morgan and Henrion (1992) *Uncertainty – A guide to dealing with uncertainty in Quantitative Risk and Policy Analysis* ISBN 0-521-42744-4
 Cooper (2007) *Cognitive Dissonance – Fifty Years of a Classic Theory* ISBN 978-1-4129-2973-8
 Marcus (2008) *Kluge – The Haphazard Construction of the Human Mind* ISBN 978-0-571-23651-0
 Montague (2006) *Your Brain is (Almost) Perfect – How we make decisions* ISBN 978-0-452-28884-3

SECTION 1

- Florin, H.Granger-Morgan, M, Morgan, M. et al (2001) 'A deliberative methods for ranking risks', *Risk Analysis*, 21, 913-22.
 Flynn, J., Slovic, P. and Kunreuther, H. (Eds.) (2001). *Risk, media, and stigma: Understanding public challenges to modern science and technology*.
 Johnson, B. (2004) 'Risk comparisons, conflict and risk acceptability claims' *Risk Analysis*, 24 131-45
 Eiser, J (2004) *The Public Perception of Risk: Foresight Review* available at:
<http://www.foresight.gov.uk/OurWork/CompletedProjects/IIS/Docs/Risk.asp>
 Cvetovitch, G. and Lofstedt, R. (1999) *Social Trust and the Management of Risk*, Earthscan, London.

SECTION 2

- McRae, R. and Terracino, A. (2005) 'Members of the personality profiles of cultures project', *Journal of Personality and Social Psychology*, 88, 547-61.
 Miller, J., Lynam, D., Zimmerman, R. et al (2004) 'The utility of the Five Factor model in understanding risky sexual behaviour', *Personality and Individual Differences*, 36, 1611-26.
 Zuckerman, M. (2005) *The Psychobiology of Personality*, Cambridge University Press.
 Wallston, K. (2005) 'Overview of special issue on research on the multi-dimensional health locus of control scales' *Journal of Health Psychology*, 10, 619-21.
 Sjöbergh, J. and Wahlberg, A. (2002) 'Risk perception and new age beliefs' *Risk Analysis*, 22, 665-9.

SECTION 3

- Satterfield, T., Mertz, C. and Slovic, P. (2004) 'Discrimination, vulnerability and justice in the face of risk', *Risk Analysis*, 24, 115-29.
 Johnson, B. (2004) 'Varying risk comparison elements: effects on public reactions' *Risk Analysis*, 24 103-14.

SECTION 4

- Tversky, A. and Kahneman, D. 1974) 'Judgement under uncertainty', *Science*, 185, 1124-31.
 Pease, M., McCabe, A., Brannon, L. and Tagler, M. (2003) 'Memory distortions for pre Y2K experiences: a demonstration of hindsight bias' *Journal of Psychology: Interdisciplinary and Applied*, 137, 397-9.
 Gilovich, T., Griffin, D., & Kahneman, D. (Eds.). (2002). *Heuristics and biases: The psychology of intuitive judgment*. New York: Cambridge University Press.

SECTION 5

- Furnham, A. (2006) *The Psychology of Behaviour at Work: the individual in the organisation*, Psychology press, Hove, esp ch 10.
 Thacher, D (2009) 'The cognitive foundations of human governance' *International Public Management Journal* 12, 2, 261 – 286
 Making actuaries less human lessons from behavioural finance, SIAS paper (2000) - Nigel Taylor

SECTION 6

- Forgas, J. (2003) 'Affective influences on attitudes and judgements' in R. Davidson, K. Scherr and H. Goldsmith (eds) *Handbook of Affective Studies*, Oxford University Press.
- Loewenstein, G., Weber, E., Hsee, C. and Welch, N. (2001) 'Risks as feelings', *Psychological Bulletin*, 127, 2, 267-86.
- Loewenstein, G. and Lerner, J. (2003) 'The role of affect in decision-making' in R. Davidson, Peters, E., Vastfjall, D., Garling, T. and Slovic, P. (2006) 'Affect and decision-making: a 'hot' topic', *Journal of Behavioural Decision-Making*, 19, 79-85.
- K. Scherr and H. Goldsmith (eds) *Handbook of Affective Studies*, Oxford University Press.

Williams, S., Zainuba, M. and Jackson, R. (2003) 'Affective influences on risk perceptions and risk intention', *Journal of Managerial Psychology*, 18, 126-37.

SECTION 7

- Petts, J., Horlick-Jones, T. and Murdock, G. (2001) *Social Amplification of Risk: the media and the public*, Research report 329/01, Health and Safety Executive, London
- Pidgeon, N., Kasperson, R. and Slovic, P. (2003) *The Social Amplification of Risk*, Cambridge University Press, Cambridge.
- Cox, S., Jones, B. and Collinson, D. (2006) 'Trust relations in high-reliability organisations', *Risk Analysis*, 26, 1123-38.
- Gurmankin, A., Baron, J. and Armstrong, K. (2004) 'Intended message versus message received in hypothetical physician risk communication', *Risk Analysis*, 24, 1337-47.
- Kiizinger, J. (2009) *The Media and Risk*, Risk and Regulation Advisory Council, London, available at: <http://www.berr.gov.uk/deliverypartners/list/rrac/index.html>
- Morgan, K., Fischhoff, B. Bostrom, A. and Atman, C. (2002) *Risk Communication: a Mental Models Approach*, Cambridge University Press.
- Poortinga, W. and Pidgeon, N. (2003) 'Exploring the dimensionality of trust in risk regulation', *Risk Analysis*, 23, 5, 961-73.

SECTION 8

- Brewer, M. and Brown, J. (1998) 'Intergroup Relations' in *Handbook of Social Psychology*, Oxford University Press, Oxford.
- Buchanan, L., O'Connell, A. (2006) 'A century of decision-making', *Harvard Business Review*, 84, 1.

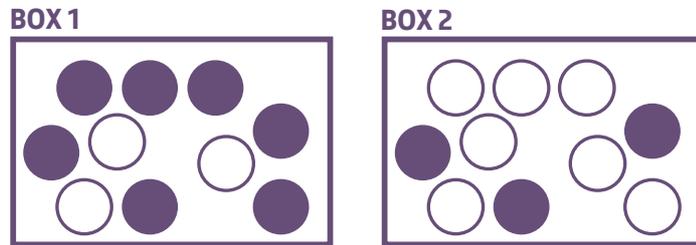
SECTION 9

- Mearns, K., Whitaker, S. and Finn, R. (2001) 'Benchmarking safety climate in hazardous environments' *Risk Analysis*, 21, 771-86.
- Wilson-Donnelly, K., Priest, H., Salas, E., Shawn Burke, C. (2005) 'The impact of organizational practices on safety in manufacturing: A review and reappraisal' *Human Factors and Ergonomics in Manufacturing*, 15, 2, 133-176.
- Kasperson, R. and J. (2005) *Risk analysis, Corporations and the Globalization of Risk*, Earthscan, London.
- Turner, B.A. and Pidgeon, N.F. (1997). *Man-made Disasters, 2nd Ed*, Butterworth-Heinemann, Oxford.

Links to third party sites in this report are provided solely for your convenience. Lloyd's makes no representations as to the security, quality or propriety of any site which may be accessed by following these links and accepts no liability for the content or for any loss or damage caused or alleged to have been caused by the use of or reliance on information contained in such sites or goods or services purchased from them. If you decide to access any of the third party sites linked from this report, you do so entirely at your own risk.

CONDITIONAL PROBABILITY EXAMPLE

There are two boxes: (1) has 70% purple balls and 30% white, the other (2) has 30% purple and 70% white. A friend randomly picks a box by tossing a coin. They then pick 12 balls, one at a time, replacing them as they go. They tell you they picked out 8 purples and 4 whites. Knowing this additional information; what is the chance they picked the first box?



The answer is: it is 97% likely that they chose box 1.

According to Kahneman, Slovic and Tversky (1982) the majority of people guess between 70% and 80%. They clearly understand the general impact the new information has on the risk. But their intuition does not grasp how significant it is.

MATHEMATICS OF THE PROBLEM	OUR EXAMPLE
----------------------------	-------------

Given events A_1, A_2, \dots, A_n which span all possibilities (in other words the probabilities of occurrence add up to 1)

In our example we have we have two events with equal probability $A_1 = \{\text{pick box 1}\}$, $A_2 = \{\text{pick box 2}\}$ and $P(A_1)=0.5= P(A_2)$, where $P(A)$ is the probability that A has occurred.

The law of total probability says that the probability of an event D can be calculated as:

In our case D is the event $\{8P, 4W\}$ P is Purple, W is White. $D|A$ means the event D "given that" A has occurred.

$$P(D) = \sum_{i=1..n} P(D | A_i).P(A_i)$$

$$P(\{8P4W\} | \text{Box1}) = \binom{12}{8} \times 0.7^8 \times 0.3^4 = 0.231$$

$$P(\{8P4W\} | \text{Box2}) = \binom{12}{8} \times 0.7^4 \times 0.3^8 = 0.008$$

So,
 $P(\{8P4W\}) = 0.231 \times 0.5 + 0.008 \times 0.5 = 0.119$

Conditional probabilities are calculated as:

$$P(A_i | D) = \frac{P(A_i \& D)}{P(D)}$$

And

$$P(A_i \& D) = P(D | A_i).P(A_i)$$

Putting this together is Bayes Theorem:

In our case:

$$P(A_i | D) = \frac{P(D | A_i).P(A_i)}{\sum_{i=1..n} P(D | A_i).P(A_i)}$$

$$P(\text{Box1} | \{8P4W\}) = \frac{0.231 \times 0.5}{0.119} = 97\%$$

This is very difficult to do without formally carrying out the calculations.

