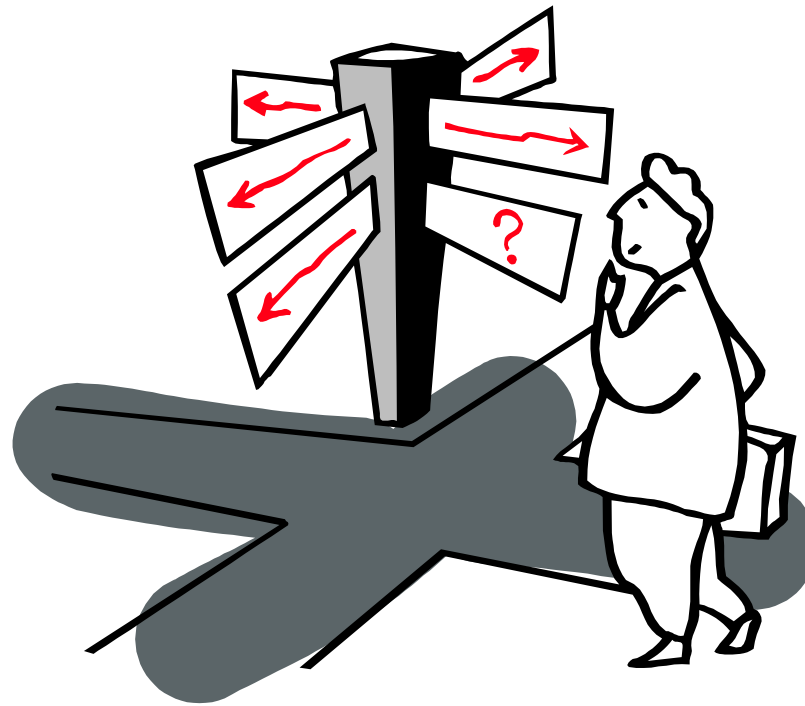




The Human Side of Risk

Erik Simmons, Intel Corporation



The Study of Risk

Risk is a highly studied subject:

- 249 books found on an Amazingly Large Bookstore's Website
- Hundreds of papers, conference proceedings, tutorials, classes, and book chapters

But, few of us understand the human side of risk

Perceptive biases

Cognitive limitations



Decision processes

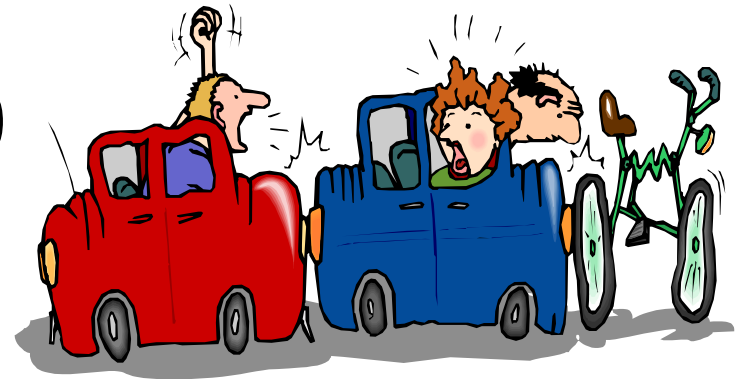
Environmental influences

Are We Rational or Irrational?

What's the greater risk of death?

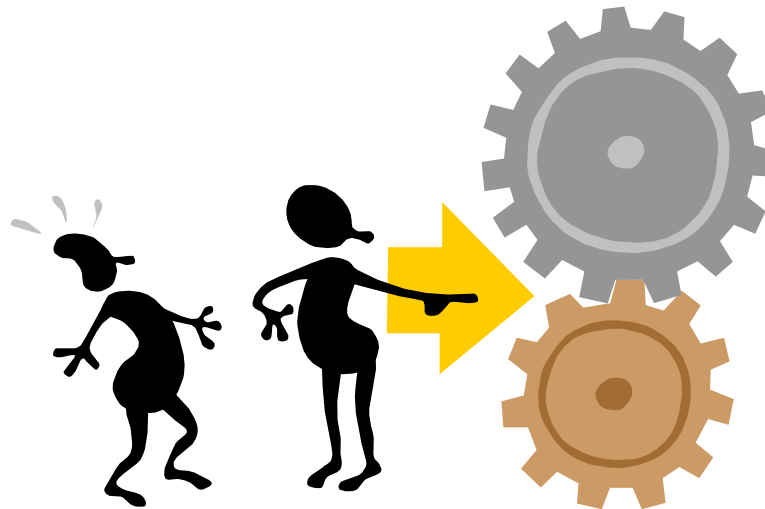


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Risk Perception Influences and Factors





The Two Sides of Risk

Analytical

- Logical
- Data Driven
- Scientific

Failure Modes & Effects
Analysis (FMEA)

Risk Management

Behavioral

- Emotional
- Experiential
- Irrational

Subjective assessment
or ignorance of risk

Gambling



Some Risk Perception Influencers

- *Dread* associated with the risk
- Perceived **controllability**
- *Imposed* versus **voluntary** risk
- *Immediate* versus **delayed** consequences
- *Low* versus **high** knowledge about the consequences
- **Chronic** versus *acute* consequences
- *Severe* versus **non-severe** consequences
- *Signaling* ability for other similar or more severe events
- **Familiarity** (experience) with the risk
- *Availability* of examples

*Heightens
Perception*

**Diminishes
Perception**



Software Examples

- *Dread*: Security flaws, product recall, loss of life
- *Imposed* versus **voluntary** risk: Schedule reductions by management versus the development team
- *Immediate* versus **delayed** consequences: Loss of fixed bid contract versus renegotiation later on
- *Low* versus **high** knowledge about the consequences: Commitment to support a unreleased OS version
- *Severe* versus **non-severe** consequences: Complete build failure versus a few hours lost to an SCM issue
- *Signaling* ability for other similar or more severe events: Performance issues in the first of many products on a new architecture



Cultural & Environmental Influences

Culture and environment influence the way risk is dealt with, and when. For example, the US culture is marked by*:

- Insistence for choice
- Pursuit of dreams
- Big is better
- Impatience
- Tolerance of mistakes
- Urge to improvise
- Fixation on what's "new"

Various cultures might view risk awareness as pessimism, realism, or exemplary behavior

How does your company's culture and environment affect your perception of risk?

*Adapted from *The Stuff Americans are Made of*, J. Hammond and J. Morrison

The Message Matters

Suppose you had a rare medical condition for which surgery was the only cure

If there were two procedures available, would you chose:

1. A procedure where nearly 1 in 5 patients die in surgery
2. A procedure with 85% probability of survival

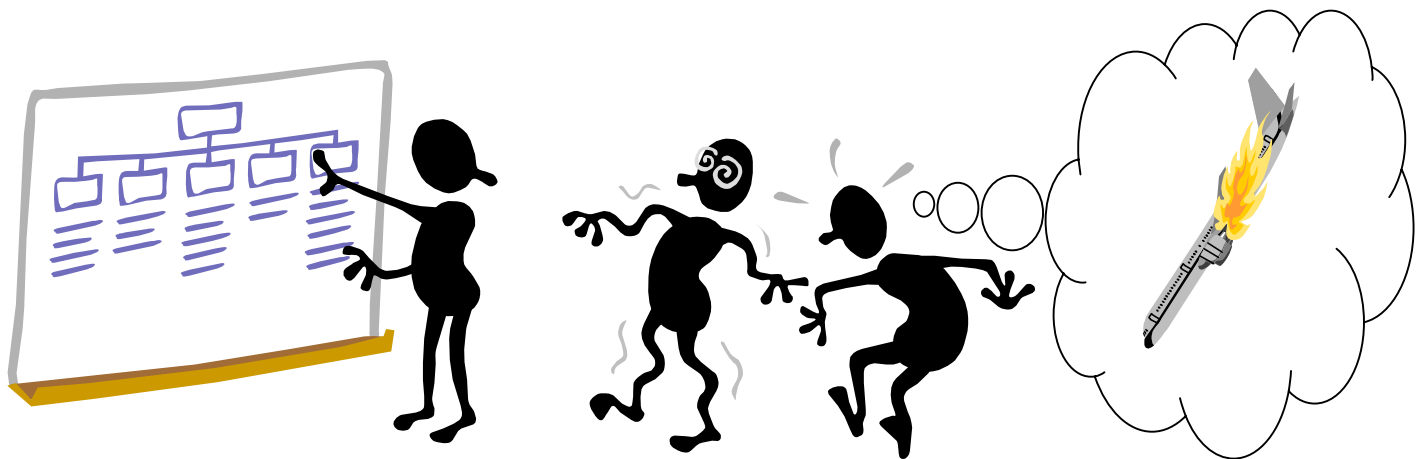


Hmmm... Do the options really feel the same?

Unintended Messages

A fear of flying program had an expert explain to participants how unlikely it was for planes to crash

- The expert listed all the catastrophic failure modes and stated the probability of failure for each
- Result: The participants came away *more* afraid, because no one knew until then that there were so many ways a plane could crash!

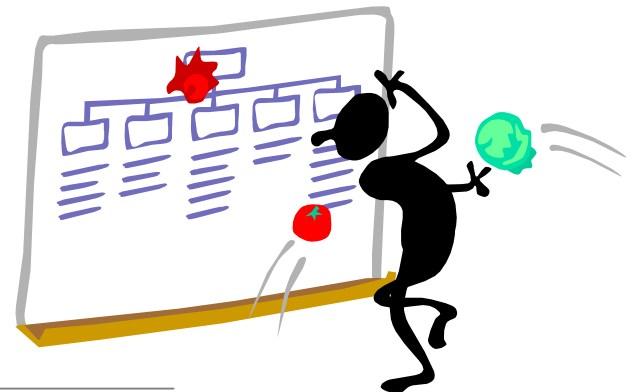


Too Much Information

Software risk spreadsheets can send the wrong message to other team members and management

Rigorous risk analysis and complete spreadsheets can cause:

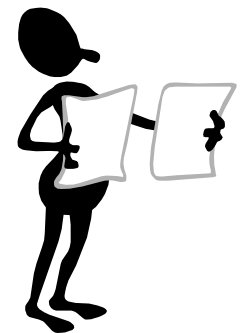
- Added scrutiny from upper management (risk = problem)
- Individuals who state risks to be branded as “negative”, “not a team player”, etc.
- Avoidance of risks because “it’s too much to deal with”



What Could We Do Instead?

Monitor all the risks, but consider using a format other than the entire spreadsheet to report on them. For example:

- Report only the Top 10 risks
- Report rolled-up metrics, such as total exposure (probability of occurrence X impact in time or dollars)
- Rotate the category of risk reported each meeting
- Educate people on risk management



Cognitive & Behavioral Limitations





Test Your Knowledge

How many people died as a result of motor vehicle crashes in the United States in 2000?

- Provide a point estimate and the smallest range that you are certain contains the true answer.
- Write your answer below

Point estimate:

Range:



Questions:

Did you come close?

Was the real answer included in your range estimate?

How did you arrive at your estimate?

What influenced your estimation and decision process?

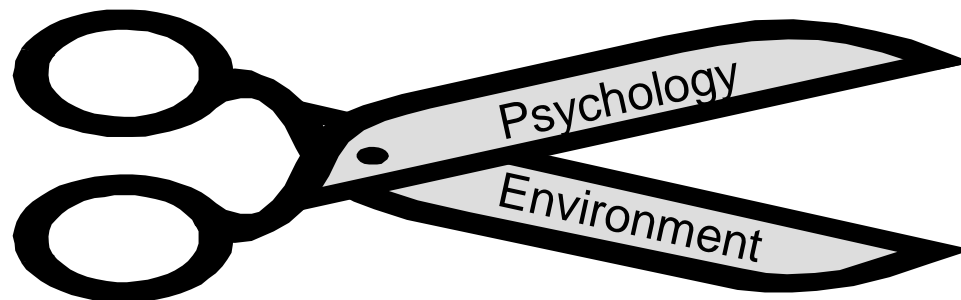
- Incomplete information
- Personal history
- Time pressure
- Cost of being wrong
- Familiarity with the risk
- And more...

Bounded Rationality

A completely rational decision is practically impossible:

- We cannot know everything we would like before making decisions
- Even with incomplete information, the data complexity is often overwhelming
- Emotion also plays a significant and often unpredictable role in decisions

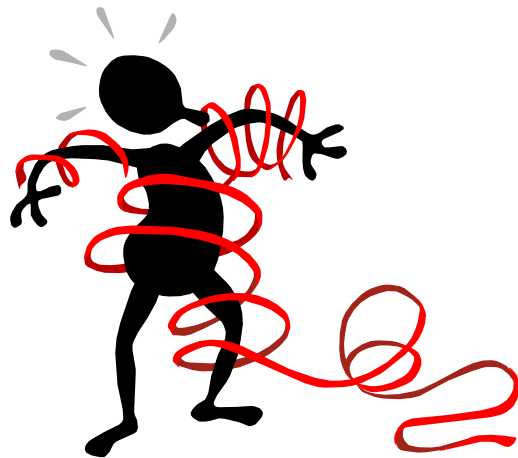
We are forced to create and use simplified heuristics and models to aid decision making



Decisions, Decisions...

Three basic building blocks for a decision heuristic:

- Search rule: How to locate alternatives
- Stopping rule: When to stop looking
- Decision rule: How to decide between alternatives



How much time should we spend deciding how much time to spend?



Cognitive “Limitations”?

Fast and Frugal Heuristics for decision making can outperform more complex decision structures like regression and neural nets in certain environments

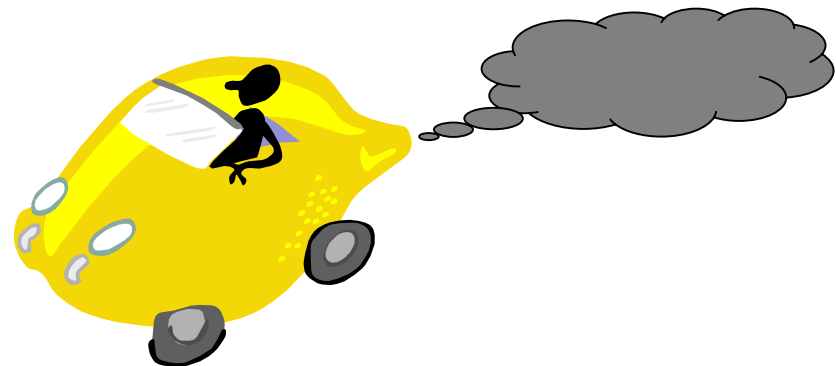
We must consider such heuristics in risk management



There are times when more information is not better

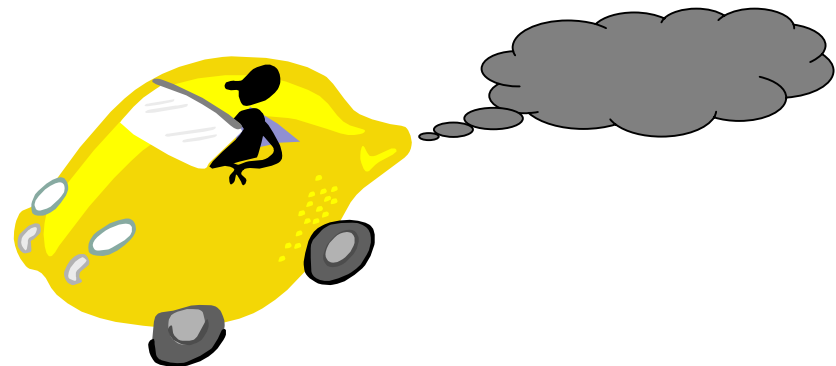
Which Would You Choose?

Car Name	Cost	Quality	Performance
Aardvark	Best	Best	Average
Belchfire Mark II	Worst	Average	Best
Conestoga Coupe	Average	Worst	Worst



How About Now?

Car Name	Cost	Quality	Performance
Aardvark	Best	Worst	Average
Belchfire Mark II	Worst	Average	Best
Conestoga Coupe	Average	Best	Worst



Some Fast & Frugal Heuristics

- Take the **first** solution that meets minimum requirements in the most important dimension
- Take the **best** solution in the most important dimension
- Take the **equally weighted best** solution in all dimensions
- **Imitate the most successful** in cases where no clear best solution exists
- **Imitate the majority** in volatile or complex environments
- Take the **recognized** solution over unrecognized solutions



Schedule

Security

Performance

Ease of Use

Cost



On The Other Hand...

Experts sometimes run things intuitively rather than analytically

In those cases, new twists, unseen conditions, or novel combinations of events can be disastrous

Chernobyl happened to a very experienced team

Many reasons behind it, including

- Overconfidence from repeated safety rule violations without negative consequences
- Time pressure
- Perceived controllability



It Happens in Software, Too

An experienced team wants to skip inspecting a requirements document in order to save time. Why?

- *Time pressure & short term thinking*: over-insuring small, likely losses while under-insuring for catastrophic loss
- *Perceived controllability*: Exposures to this risk without catastrophic consequences in the past
- *Over-weighting local experience*: Generalization of local experience to infer a lower risk than really exists

What can you do about it?

- Express the risk over time rather than single incident
- Provide data that describes risk rates and consequences based on large samples and studies
- Advocate a balance between short and long term thinking

Emotion, Risk, and Decision Making

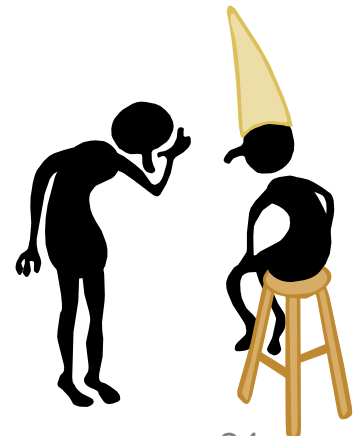
Past success creates pride and self worth

- In this setting, people tend to chose risk minimizing strategies

Failures create stigma, shame and a lack of self worth

- When this happens, people tend to chose reward maximizing strategies and ignore risk

Dread can focus inordinate attention on certain risks and influence decision making





Affect and Risk Perception

Affect is the feelings or emotions elicited by an external stimulus

Affect can strongly influence risk perception

What feelings and emotions do the following terms create?

- Ice cream
- Nuclear waste
- Tropical vacation
- Chemicals
- Public speaking

- Inspections
- Metrics program
- Agile methods
- Process improvement
- Object Orientation

What's the Greater Risk of Death?



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Summary

- We sometimes hold very inaccurate and irrational views about risks
- Risk means different things to different people, and risk perception is influenced in many ways
- Risk definition is an exercise in power. If you control how risk is defined, you can greatly influence which strategy is best in response
- More information is not necessarily better - it may confuse or alarm rather than inform
- Presentation matters!



Summary

- We must better understand our tendencies and limitations as humans when it comes to assessing risks and estimating their severity and probability
- We must better understand how the way we express a risk influences someone's response to it
- We must better understand how culture, values, corporate and personal history, and other similar factors influence risk perception and management

Otherwise, the best analytical tools and methods for risk will have little effect



For More Information

- *The Perception of Risk*, Paul Slovic, Earthscan Publications Ltd, 2000
- *The Logic of Failure*, Dietrich Dörner, Metropolitan Books, 1996
- *Bounded Rationality: The Adaptive Toolbox*, Gerd Gigerenzer and Reinhard Selten, MIT, 2001
- *Elements of Reason: Cognition, Choice, and the Bounds of Rationality*, Arthur Lupia et al, Cambridge, 2000