Cambridge Centre for Risk Studies

Advisory Board Research Showcase – 29 January 2019

Behavioural Science of Catastrophe Risk

Centre for **Risk Studies**

UNIVERSITY OF CAMBRIDGE Judge Business School

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RISK 10

Behavioural Science of Catastrophe Risk

The Centre for Risk Studies provides **frameworks** for recognising, assessing and managing the impacts of systemic threats.

To do this, we need to be able to communicate Catastrophe risk effectively.

1. Make the issue accessible.
2. Identify heuristics and reference points.
3. Provide relevant exposure.
4. Framing the risk.

The Centre for Risk Studies Strategies for Communicating Cyber Threat.

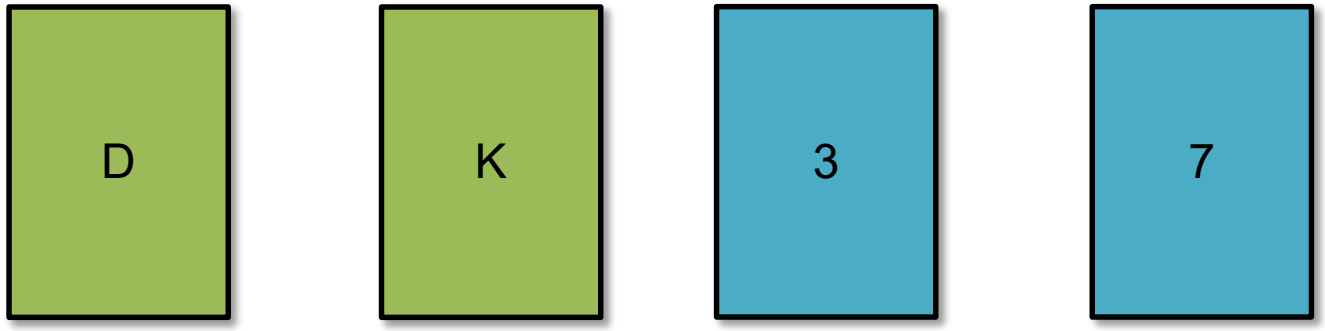
Make it relatable: Scenarios

- To make an impact on an individual's reasoning and decision making, it needs to be **understandable and accessible**.
- Creating scenarios allows for more complicated occurrences to be translated to a broader audience.

Widely Accessible: *thought experiment*

You have four cards in front of you. One side of the card has a letter, the other side has a number.

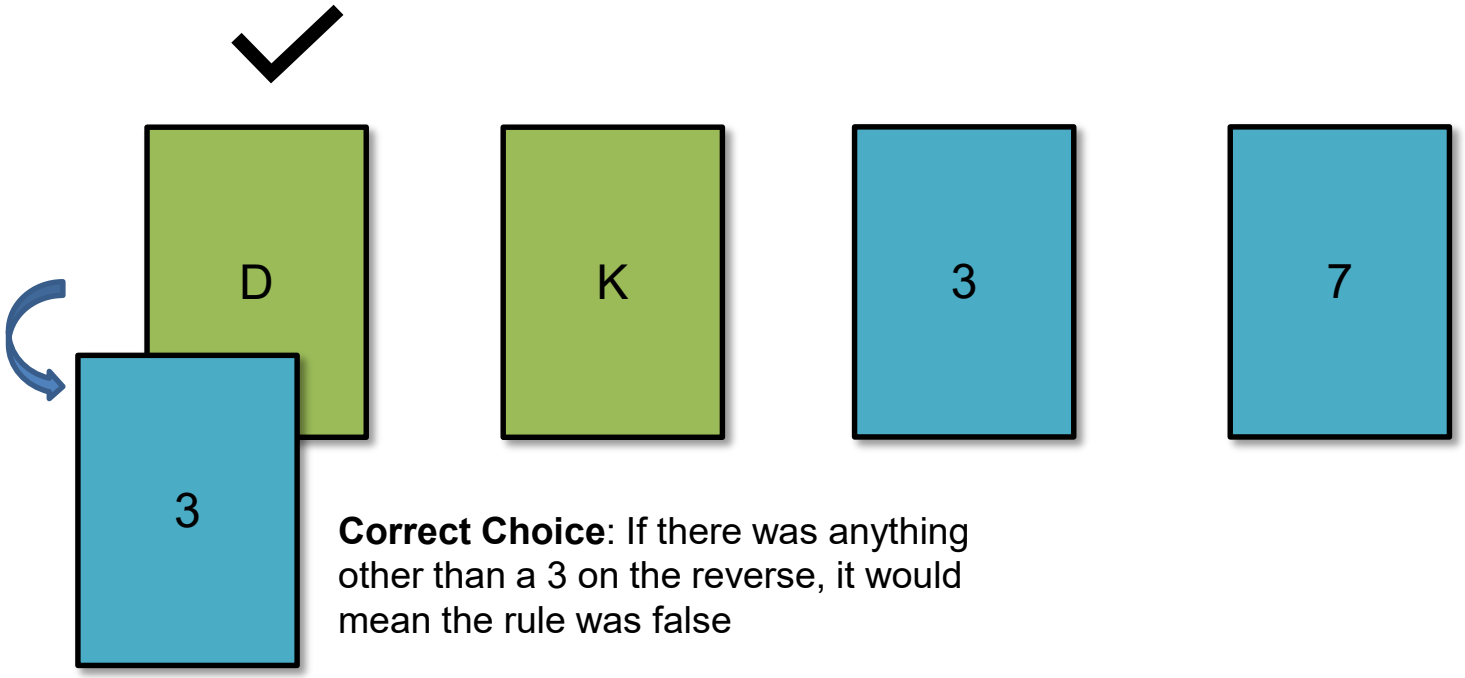
Rule: If there is a D on one side, then there is a 3 on the other side.



Indicate only those cards that you need to turn over to see whether the rule is true or false

Widely Accessible: *thought experiment*

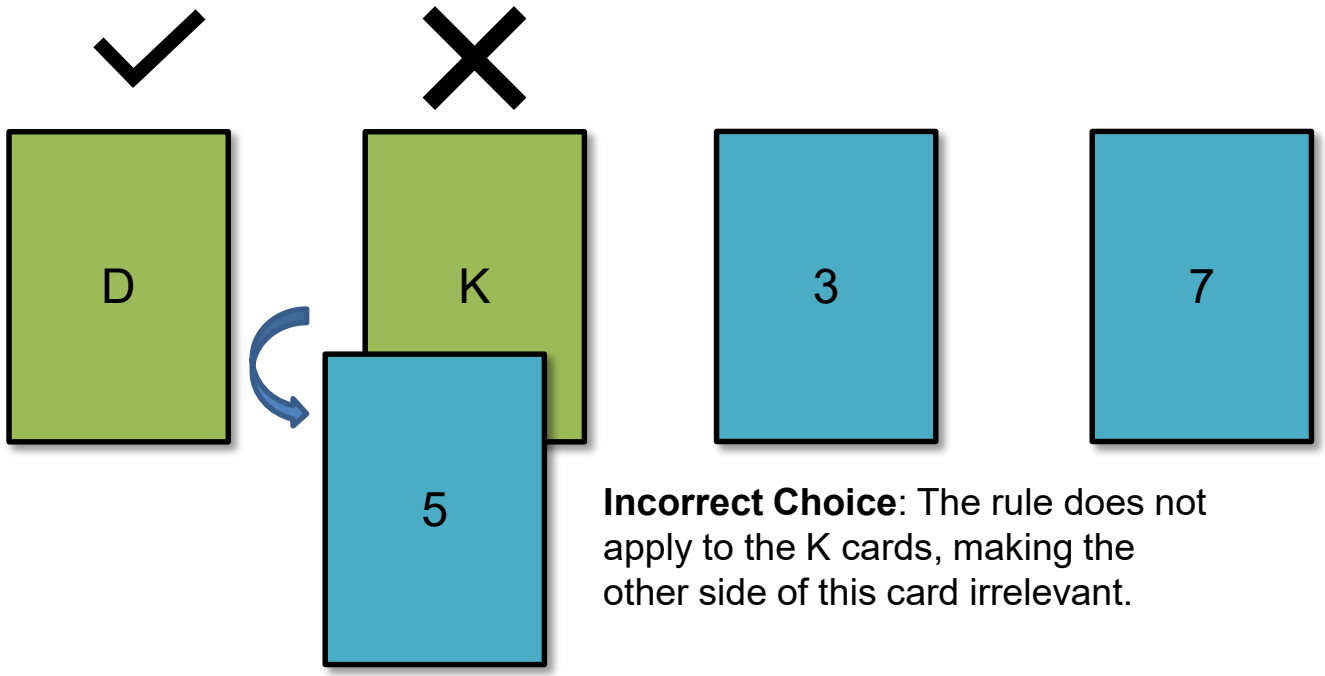
"If there is a D on one side, then there is a 3 on the other side."



Correct Choice: If there was anything other than a 3 on the reverse, it would mean the rule was false

Widely Accessible: *thought experiment*

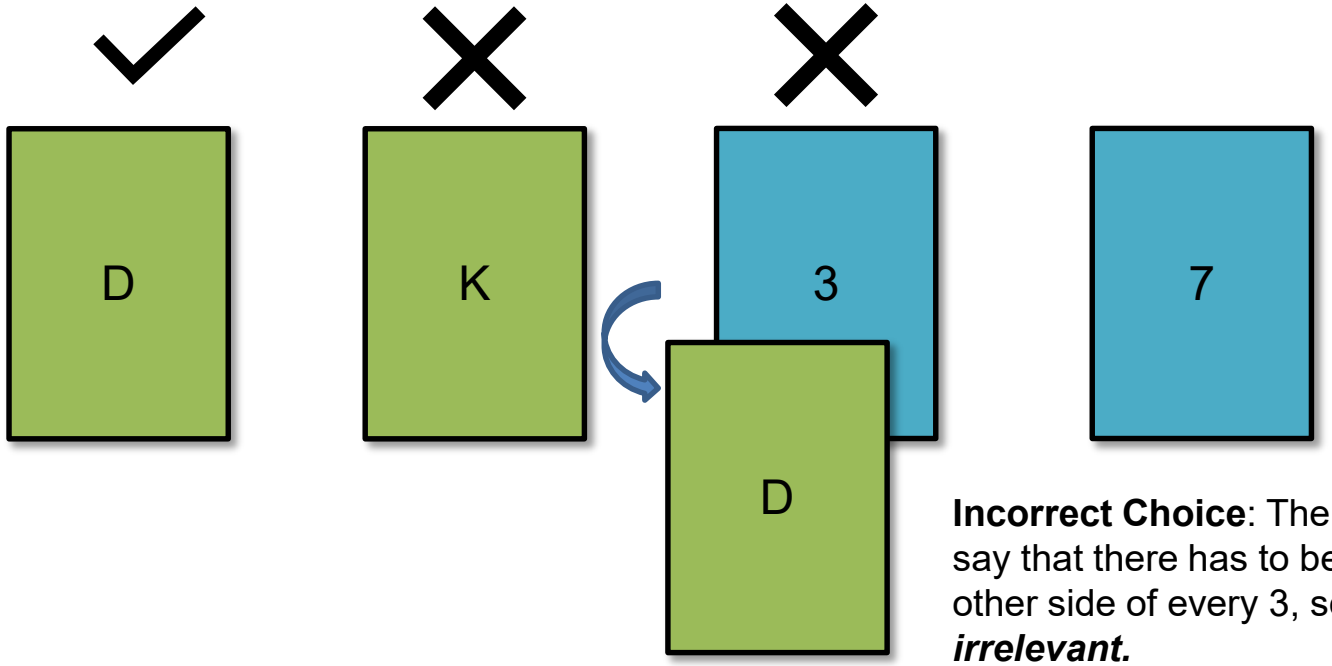
"If there is a D on one side, then there is a 3 on the other side."



Incorrect Choice: The rule does not apply to the K cards, making the other side of this card irrelevant.

Widely Accessible: *thought experiment*

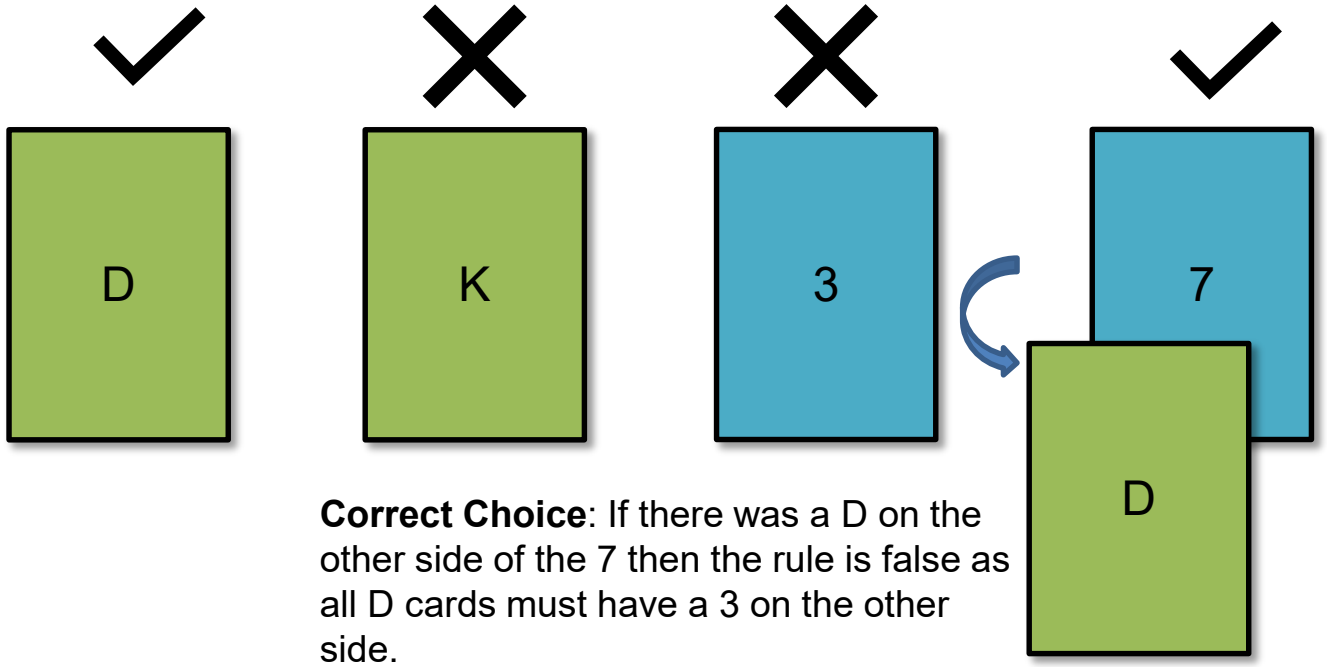
"If there is a D on one side, then there is a 3 on the other side."



Incorrect Choice: The rule does **not** say that there has to be a D on the other side of every 3, so this card is ***irrelevant.***

Widely Accessible: *thought experiment*

"If there is a D on one side, then there is a 3 on the other side."

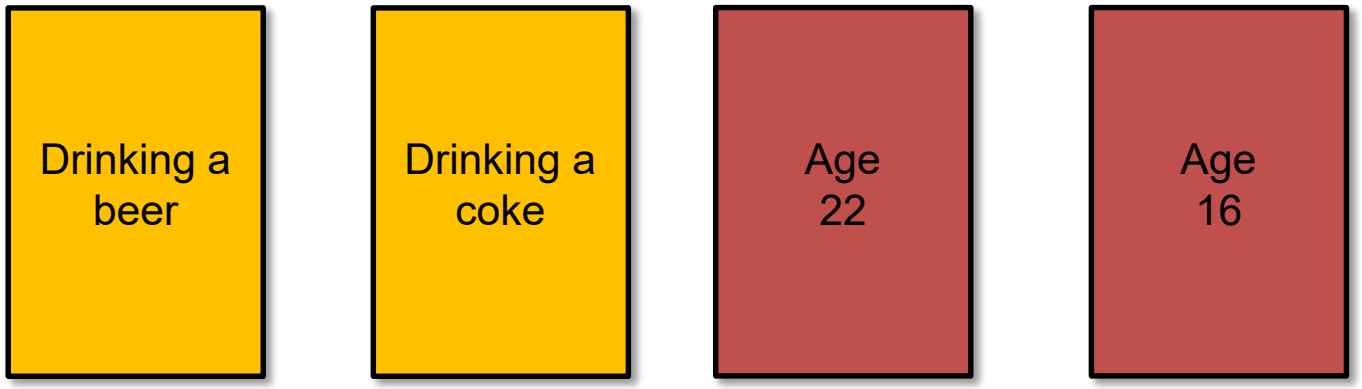


Correct Choice: If there was a D on the other side of the 7 then the rule is false as all D cards must have a 3 on the other side.

Widely Accessible : *thought experiment*

You have four cards in front of you. One side of the card has a drinking option, the other side has an age of the person drinking.

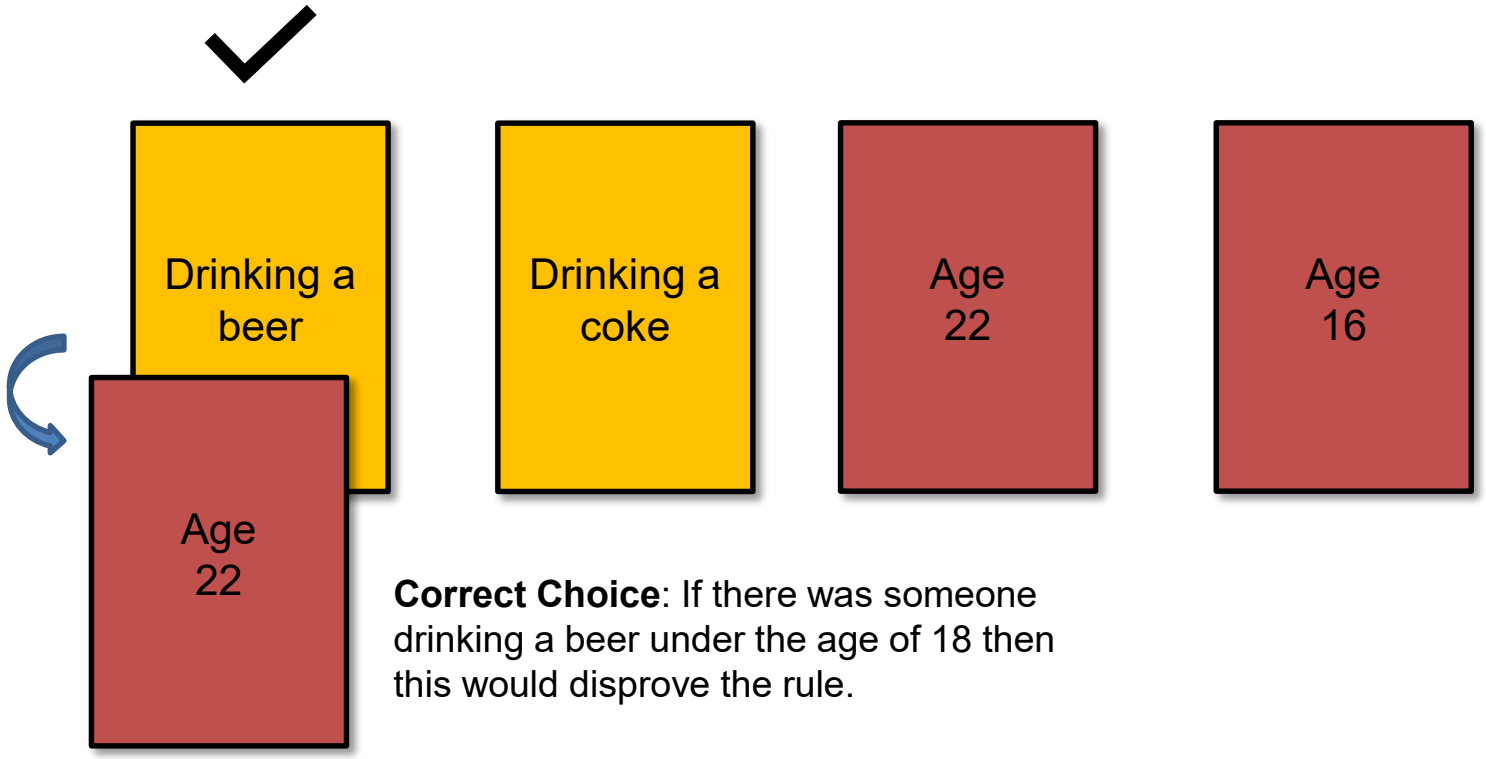
Rule: "If a person is drinking beer, then the person must be over 18 years of age"



Select the card or cards that you definitely need to turn over to determine whether or not people are violating the rule.

Widely Accessible : *thought experiment*

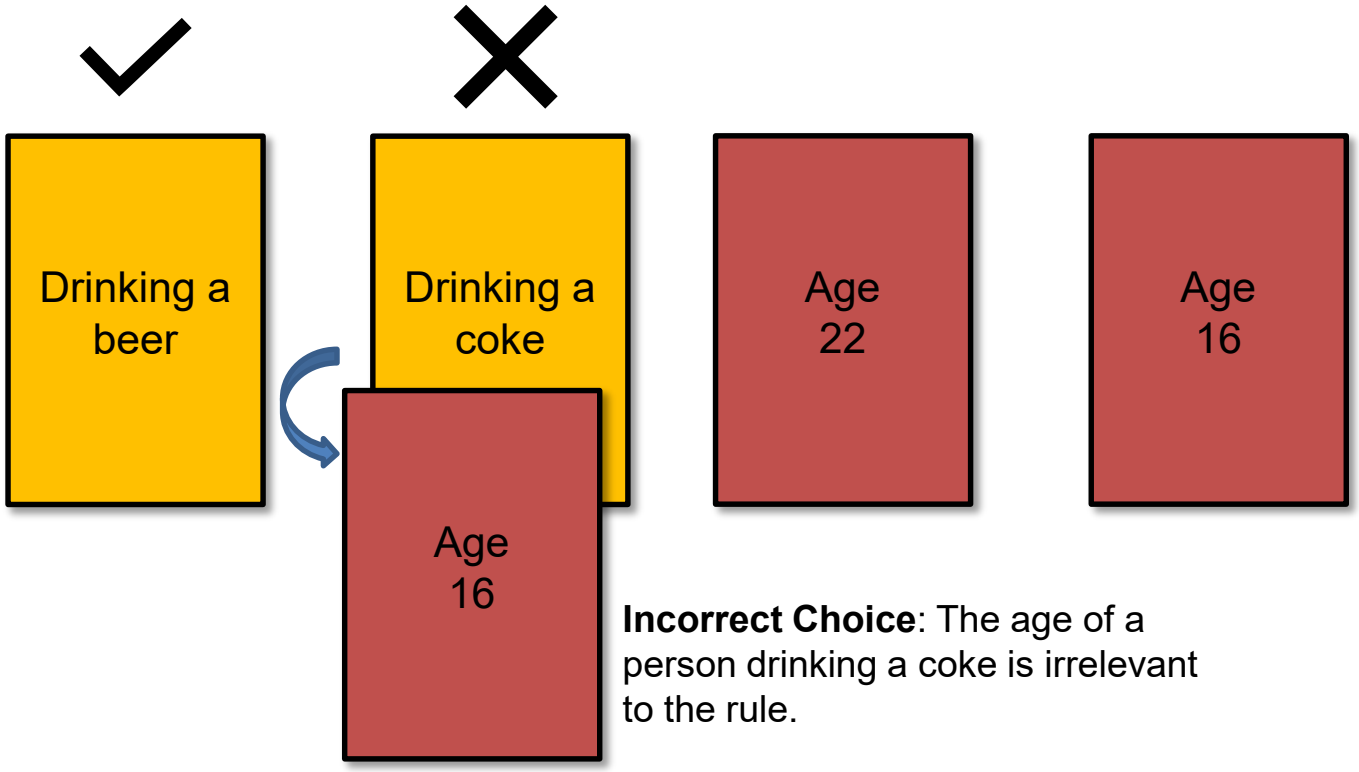
Rule: "If a person is drinking beer, then the person must be over 18 years of age



Correct Choice: If there was someone drinking a beer under the age of 18 then this would disprove the rule.

Widely Accessible: *thought experiment*

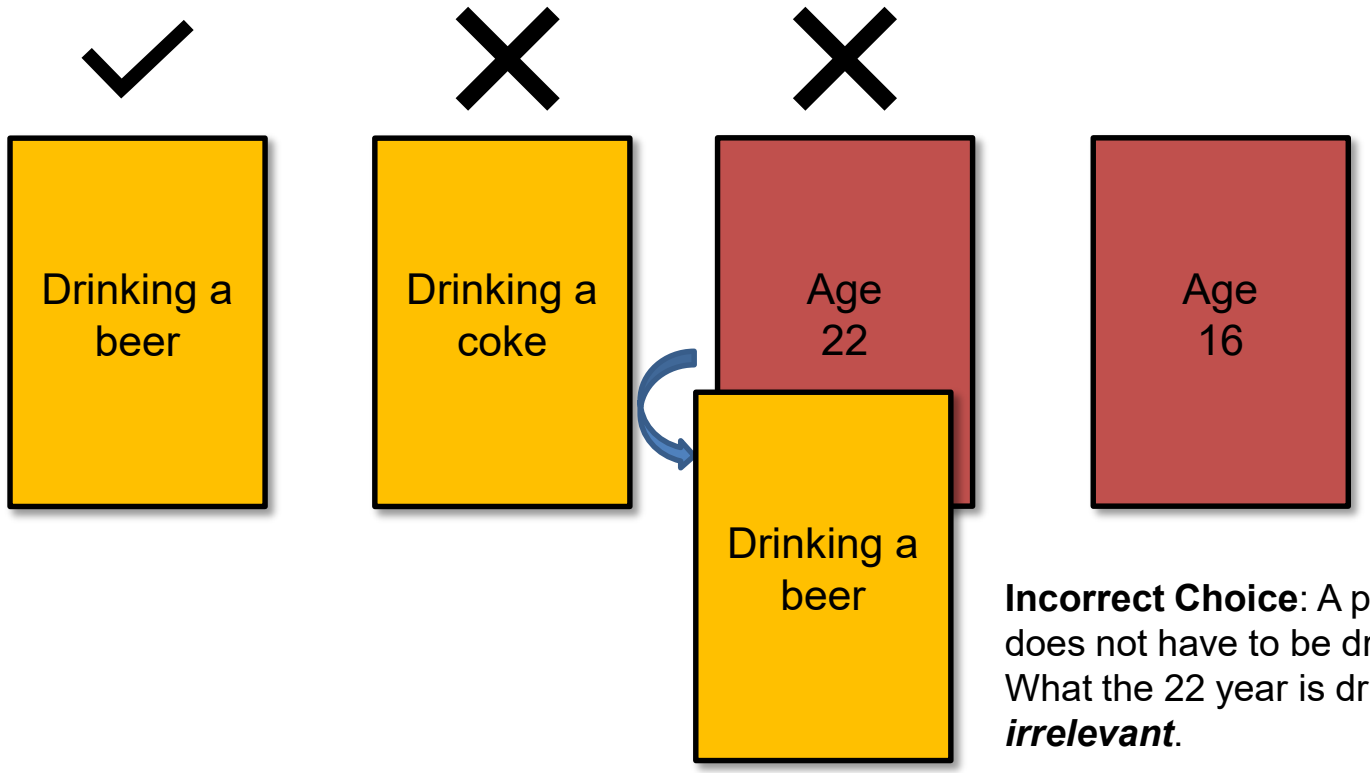
Rule: "If a person is drinking beer, then the person must be over 18 years of age



Incorrect Choice: The age of a person drinking a coke is irrelevant to the rule.

Widely Accessible: *thought experiment*

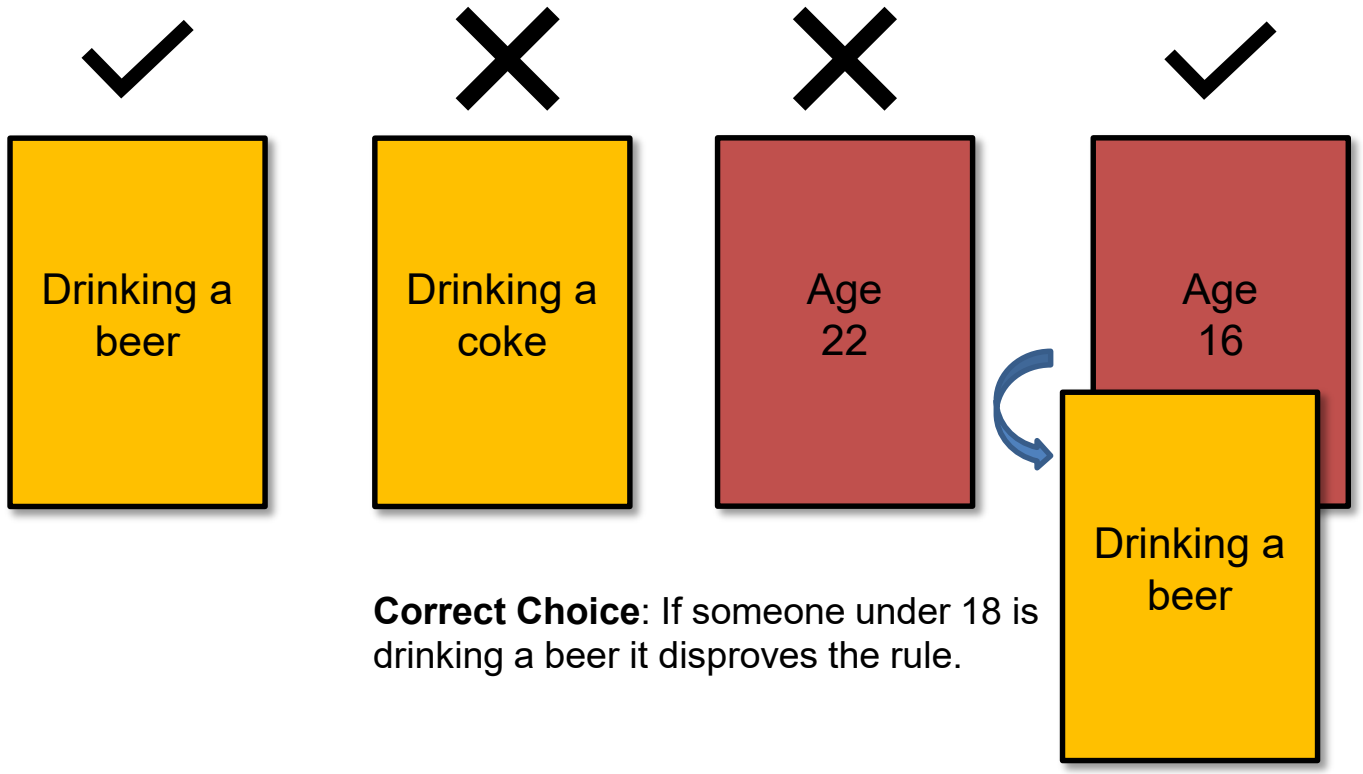
Rule: "If a person is drinking beer, then the person must be over 18 years of age



Incorrect Choice: A person over 18 does not have to be drinking beer. What the 22 year is drinking is ***irrelevant***.

Widely Accessible: *thought experiment*

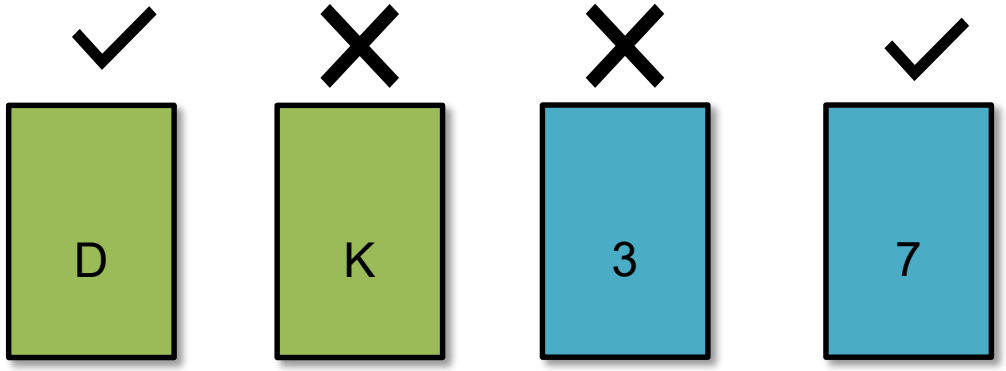
Rule: "If a person is drinking beer, then the person must be over 18 years of age



Correct Choice: If someone under 18 is drinking a beer it disproves the rule.

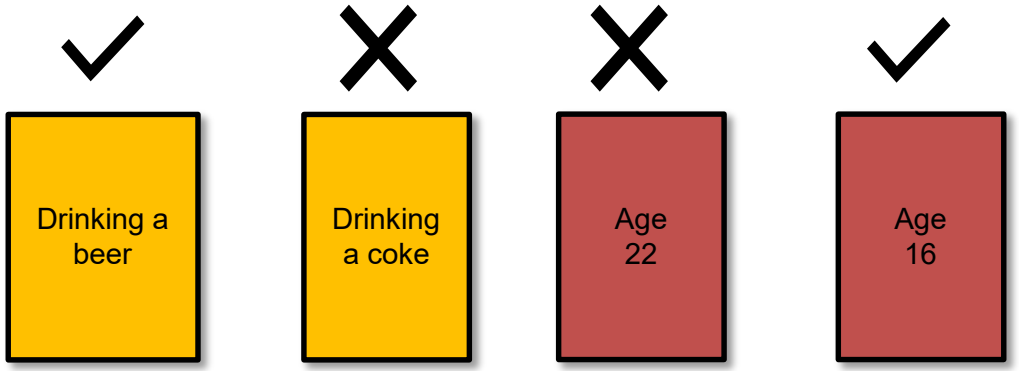
Widely Accessible : *thought experiment*

Rule: If there is a D on one side, then there is a 3 on the other side.



Not Accessible

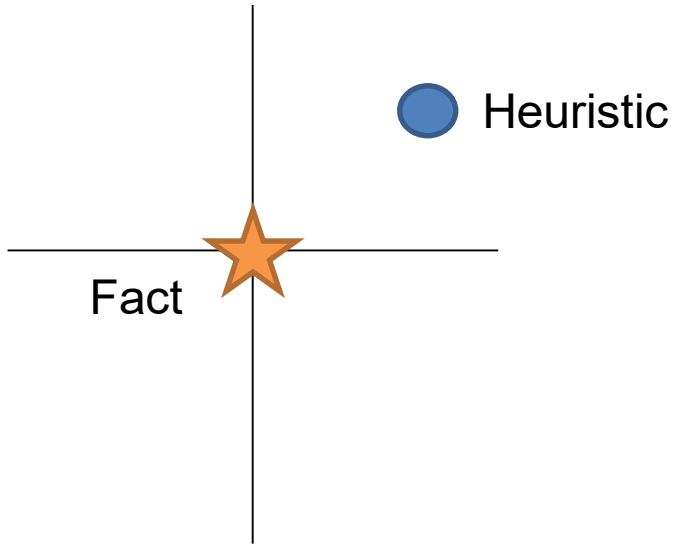
Rule: "If a person is drinking beer, then the person must be over 18 years of age



Accessible

Heuristics: A reference point

People base their intuitive probability and frequency judgments on simple, experience-based strategies known as **heuristics** to help us to make quick decisions which are right (*or good enough*) most of the time, but which will sometimes lead to biased or illogical responses.



Heuristics and Flood Risk

- **Availability**: judgments are based on the ease with which relevant instances come to mind
  - Personal experience with floods are more readily available in memory and individuals have a better understanding of the risk

St. Neots High Street, 1947

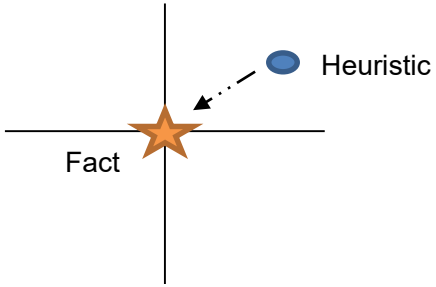
Cambridge, 2002

- **Representativeness**: judgments are based on the extent to which an outcome (or item) is representative of the process or category in question
  - Each time a threat causes a damage it makes reinforces that it is dangerous

Severe Flood Damage

Flooding False Alarm

- **Anchor-and-adjust**: people produce their final estimates by adjusting away from an initial "anchor" value
  - Most adjustments are not sufficient to change a heuristic
  - Need to be emotionally and logically influential

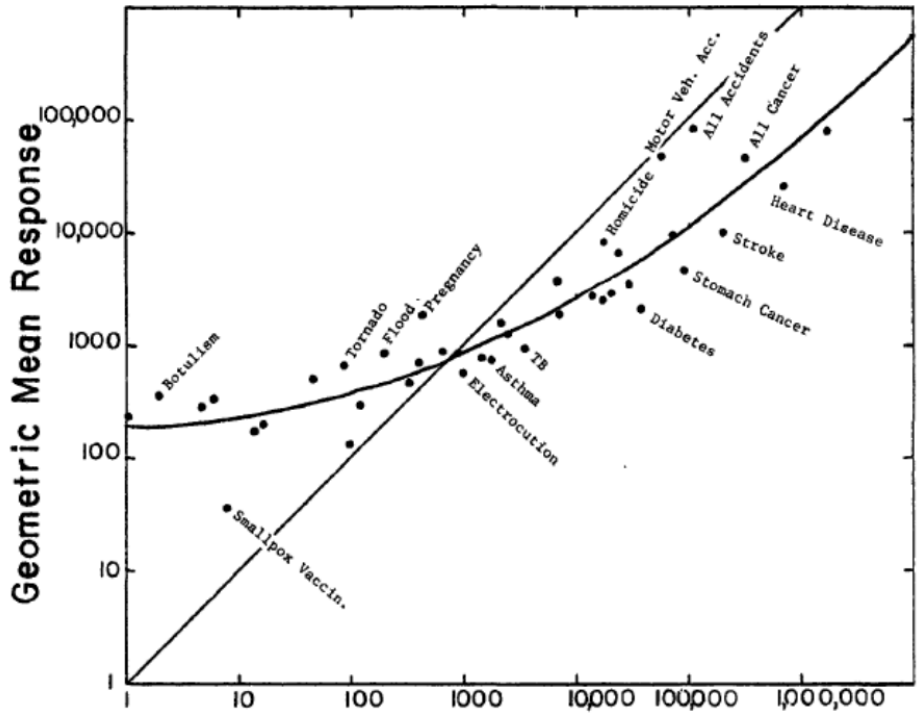


Exposure to relevant facts

- People commonly overestimate the frequency of rare events and underestimate common ones.
  - Attributed to availability heuristics: rare events are often given disproportionate publicity and are correspondingly more mentally-available than their environmental frequency would merit.

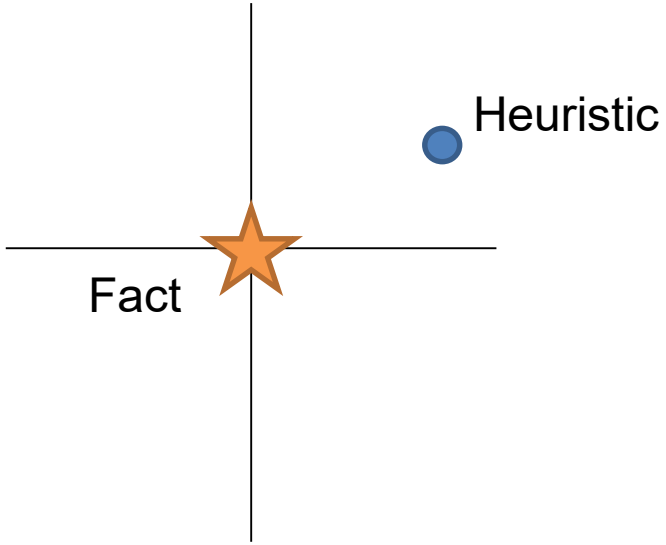
Estimate the number of US deaths per year due to 40 causes ranging common to very rare.

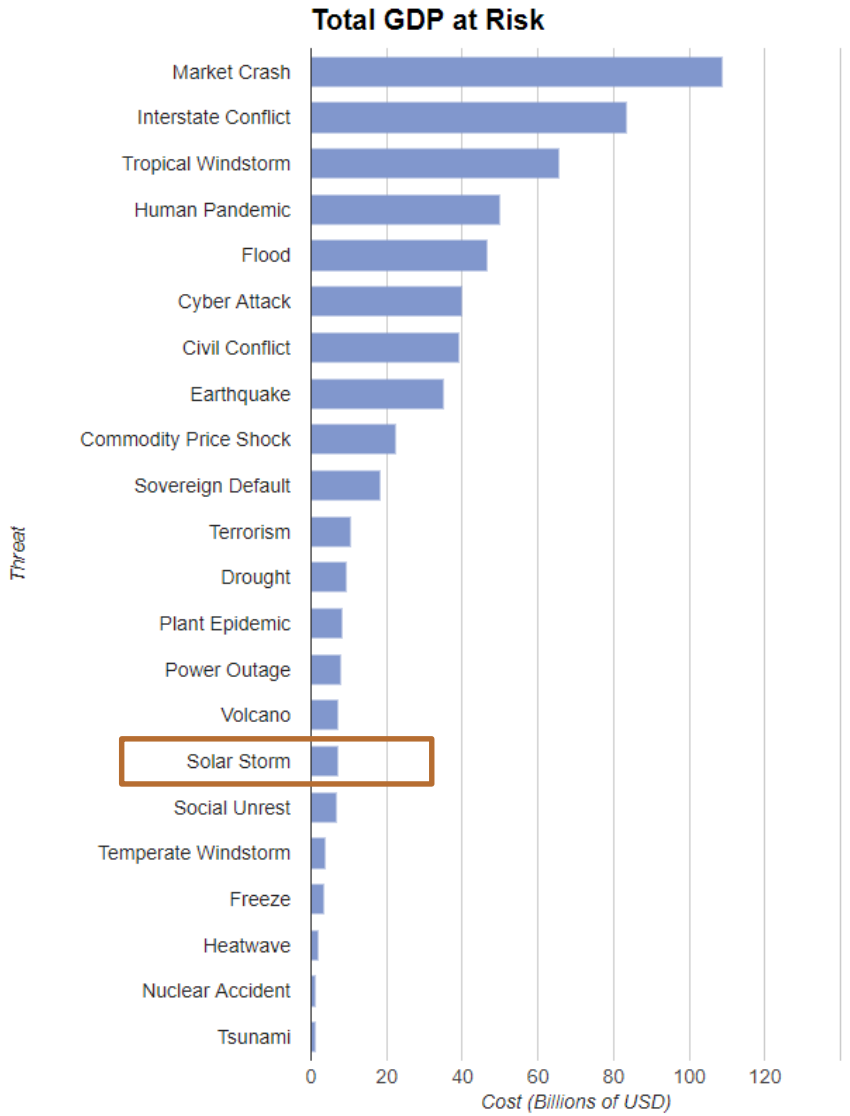
As shown in the graph, participants systematically over-estimated deaths rare causes of death and underestimated common causes.



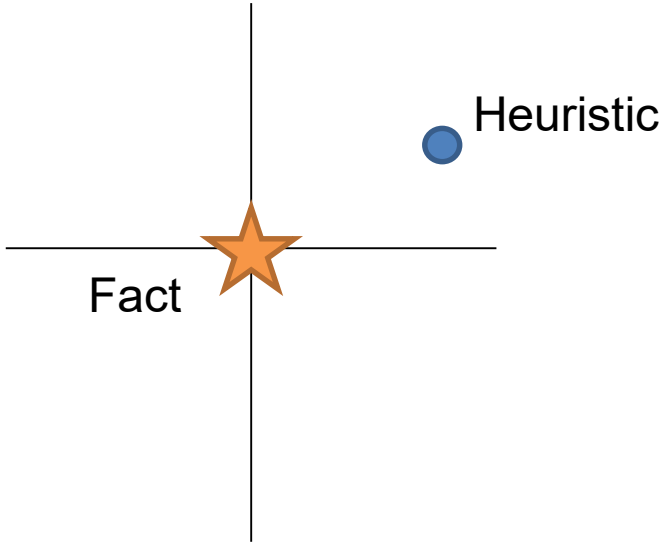
(*Lichtenstein et al. 1987*)

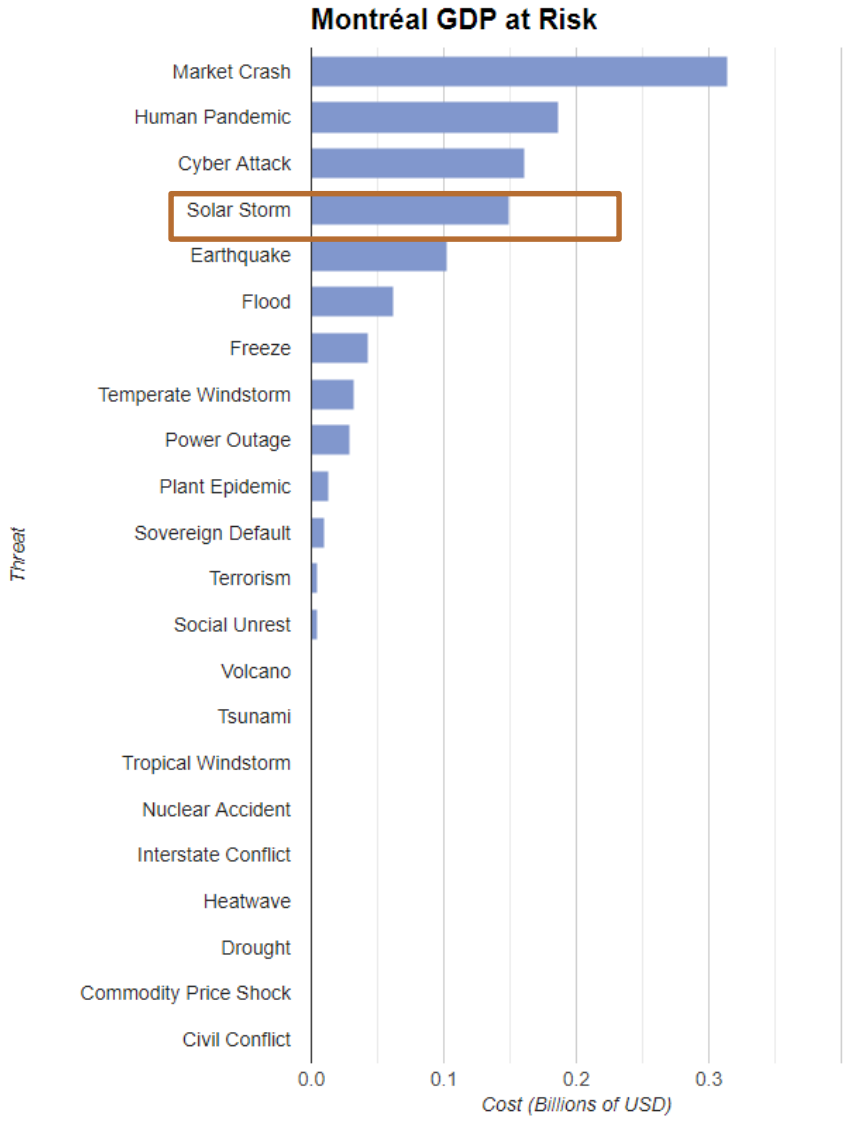
Exposure to relevant facts





Exposure to relevant facts

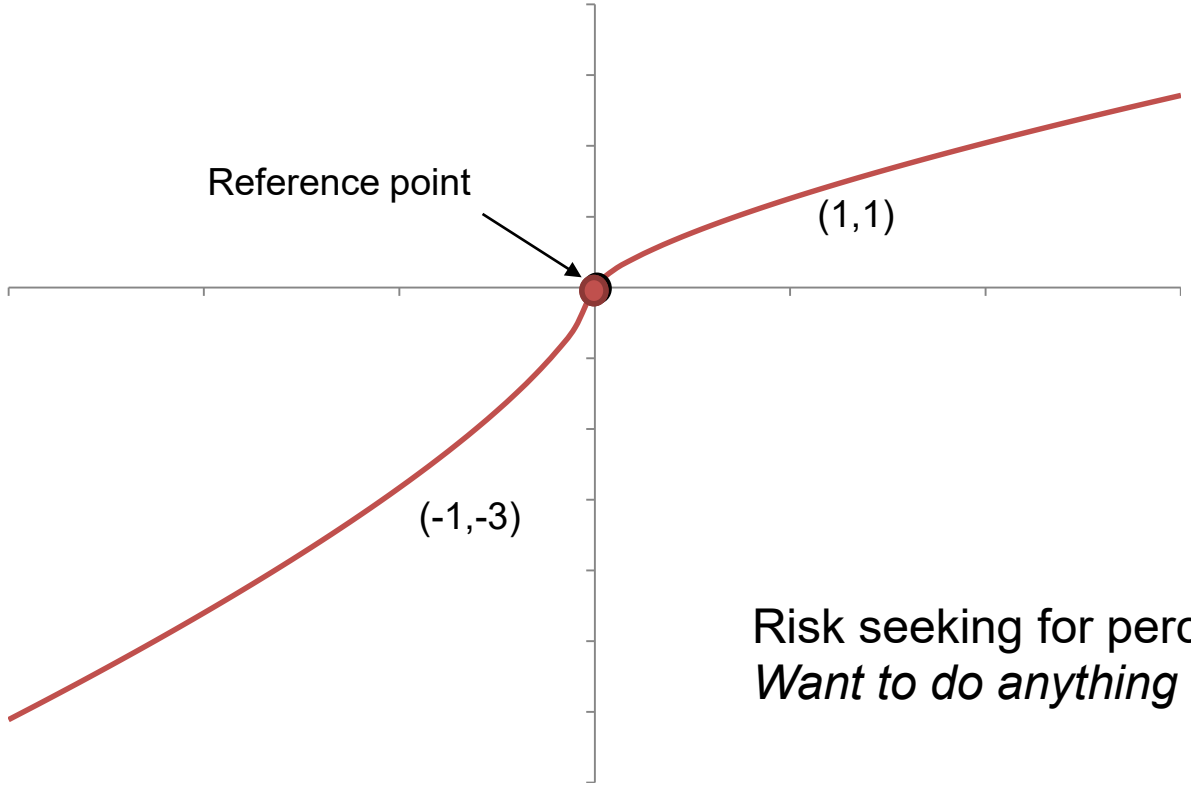




Framing: Losses vs. Gains

"Losses loom larger than gains"

- *Losses and gains are subjectively measured as a change from a reference point.*
- *A loss of a given magnitude has greater subjective magnitude than a gain of the same size*.



Risk averse for perceived gains.
Want sure gains.

Risk seeking for perceived losses.
Want to do anything to avoid loss.

Framing: *thought experiment*

Imagine that the US is preparing for an outbreak of an unusual avian disease, which is expected to kill 600 people.

Two alternative programs to combat the disease have been proposed…

- If program A is adopted, 200 people will be saved
- If program B is adopted, there is 1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved

Which do you choose?

Framing: *thought experiment*

Imagine that the US is preparing for an outbreak of an unusual avian disease, which is expected to kill 600 people.

Two alternative programs to combat the disease have been proposed…

- If program A is adopted, 400 people will die
- If program B is adopted, there is 1/3 probability that nobody will die and 2/3 probability that 600 people will die

Which do you choose?

Framing: *thought experiment*

Imagine that the US is preparing for an outbreak of an unusual avian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed…

Version 1: Framed in terms gains.

A: 200 people will be saved

B:1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved

Scenario 2: Framed in terms of losses.

A: 400 people will die

B: 1/3 probability that nobody will die and 2/3 probability that 600 people will die

Framing: *thought experiment*

Imagine that the US is preparing for an outbreak of an unusual avian disease, which is expected to kill 600 people. Two alternative programs to combat the disease have been proposed…

Version 1: Framed in terms gains.

A: 200 people will be saved

B:1/3 probability that 600 people will be saved and 2/3 probability that no people will be saved

Gains: 72% of chose option A, the *certain* option.

Scenario 2: Framed in terms of losses.

A: 400 people will die

B: 1/3 probability that nobody will die and 2/3 probability that 600 people will die

Losses: 78% chose B, the *risky* option

Informing Decision Making

- Make the problem accessible to a wider audience.
- Understand heuristics.
- Provide relevant and impactful information for informed decisions.
- Understanding the effects of framing in terms of losses vs gains for the situation.

Communicating Cyber Threat

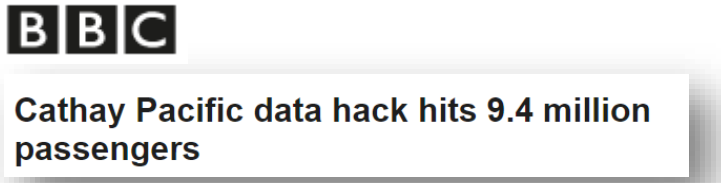
- The concept of *cyber* itself isn't intrinsically accessible, but we have become increasingly connected to our devices as the world itself increases in connectivity
- What is the impact of cyber crime?

Accessible:
- Identity theft – personal violation
- Ransomware – locked out of device
- Stolen data – personal violation

Heuristics:
- Media representation
- Company experience with cyber crime
- Company Risk Appetite

Framing
- Impact of the losses to the company

Relevant Information
- The Cyber Risk Landscape
- Cyber Insurance Market
- Company Diagnostics



Communicating Cyber Threat

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2019
Bashe Scenario: Global infection by contagious malware

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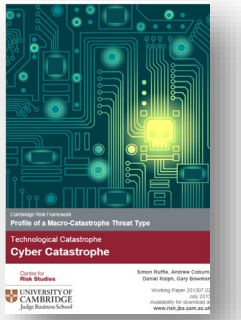
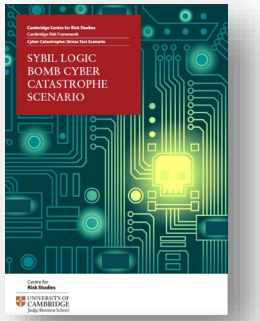
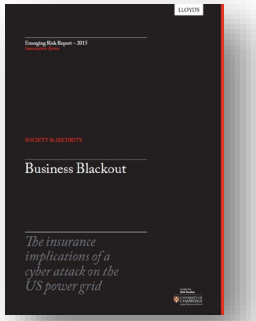
2019
Cyber Risk Outlook



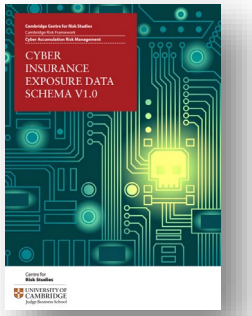
2013
Cyber Catastrophe Threat Monograph



2014
Sybil Logic Bomb Stress Test Scenario

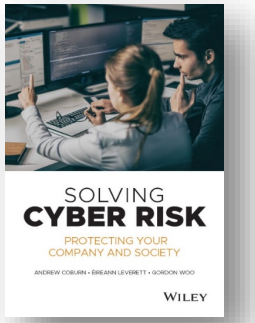


2015
Business Blackout CNI Scenario



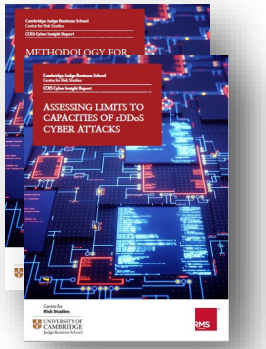
2016
Exposure Data Schema and Accumulation Risk

2017
Cyber Risk Landscape Monitoring



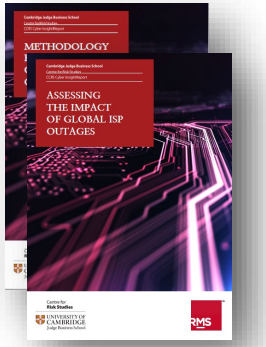
2019
Solving Cyber Risk Wiley Publication

2018
Threat Actors in the Cyber Black Economy

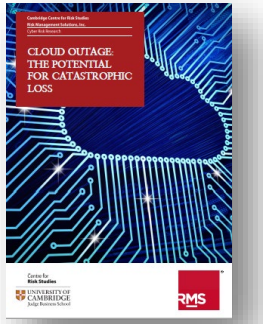


2018
Assessing Limits to Capabilities of rDDoS Cyber Attacks

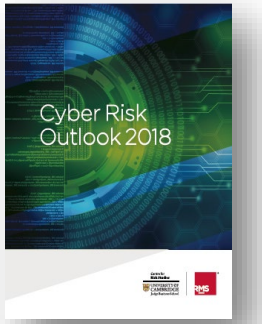
2018
Insights from the MISP Database



2018
Assessing the Impact of Global ISP Outages



2018
Cloud Outage: The Potential for Catastrophic Loss



2018
Cyber Risk Outlook

* Released 29 January 2019
** Released 2019

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