Philipps Universität Marburg

UNI FREIBURG

Road, Housing & Urban Development Research Center

Technology Arts Sciences TH Köln

NaDiMa Dialogue 8

Developing Scenarios for Disaster Risk Reduction

Day I

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23 April 2021

DAAD

Higher Education Dialogue with the Muslim World

Auswärtiges Amt

Schedule

Day 1 (23 April)

Introducing scenarios (10am CET)

- Foresight analysis and disaster risk
- Systematic thinking and cognitive biases

Understanding Scenarios

- Definition and concept
- The cone of plausibility
- Towards a taxonomy
- What makes a scenario good?
- Scenarios in natural disaster management
- Scenarios in business, energy, and security

Developing scenarios

- A framework for scenario development
- Key assumptions, truisms, drivers
- Setting the scope
- Developing a narrative
- Supervised group work

Day 2 (24 April)

Independent group work (9am CET)

Break (12pm CET)

Using scenarios (1pm CET)

- Monitoring progress through indicators
- Impact assessment
- Deriving policies and actions from scenarios
- Scenario communication

Presenting and discussing scenarios

- Supervised group work
- Group work presentations

Discussion / Q&A

Yes, we'll even do some breaks...

Expected outcomes

After the successful completion of the workshop, participants …

understand the notion and nature of strategic foresight and scenarios	can decide which situations require strategic foresight tools	can assess and classify given scenarios	can choose the appropriate scenario type for individual situations
know best-practise (and worst-practise) examples for the use of scenarios	can define the scope of scenarios	can identify key assumptions, drivers, and risks	can develop scenario narratives
can derive indicators for early-warning systems	can assess the impact of a scenario	can derive policies (including risk mitigation, resource plans) from scenarios	know about the importance of communicating scenarios to decision-makers

What we will not do in this workshop…

- Look at quantitative scenario development
- Discuss the variety of methods to establish scenarios
- Establish a firm understanding of the various nuances of different kinds of scenarios specific to disaster management
- How to identify or compare between different risks
- Cover how risk arises from various disasters, how emergency response is conducted, or the underlying decision-making process

→ *Please consult advanced courses/literature to gain a deeper understanding of these issues*

Let’s get to know our participants a little more…

Where are you at the moment?

Iran

Germany

Somewhere else

Let’s get to know our participants a little more…

What is your academic background?

Economics

Disaster management

Engineering

Geography / urban studies & engineering etc.

Another background

Let’s get to know our participants a little more…

How much do you know about scenarios?

I’m basically an expert

Quite well

I have some background

Only a little

Nothing so far

Introducing scenarios

- A mutated SARS virus emerges in East Asia over the winter.
- Travellers spread the virus worldwide, with first cases appearing in Europe and North America around April.
- Governments exercise different containment policies, including various forms of lockdowns and travel bans.
- The virus shows a high number of asymptomatic patients and has a significant incubation time, making containment virtually impossible.
- The virus advances and becomes increasingly endemic with society making drastic turns towards social distancing and hygiene policies.

You might think these lines are a brief history of the Covid-19 pandemic.

They are not.

These are excerpts from *MODI SARS* – the very result of a Robert Koch Institute scenario exercise undertaken and present to the German parliament in 2012.

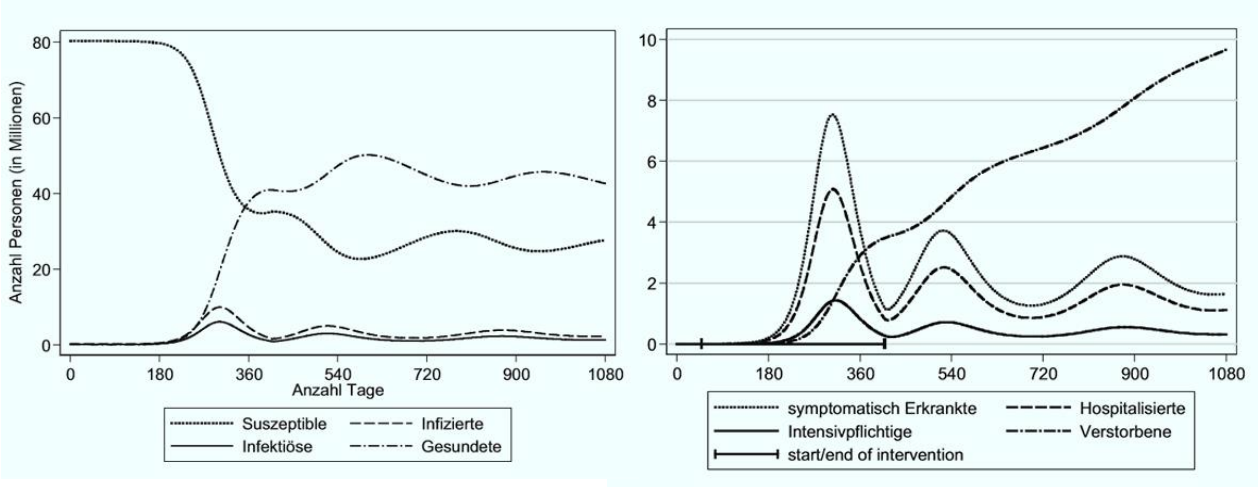
Anhang 4

Risikoanalyse Bevölkerungsschutz Bund

Pandemie durch Virus

„*Modi-SARS*“

Stand: 10.12.2012



Why foresight analysis?

theguardian

Arab spring took British intelligence by surprise, report says

Committee says there are questions about whether agencies should have been able to anticipate how events might unfold

Swedish National Defence College

Strategic Surprise in the Ukraine Crisis

Agendas, expectations and organizational dynamics in the EU Eastern Partnership until the annexation of Crimea 2014

Why foresight analysis?

- Can we anticipate disruptive change?

- Foresight is a reframing process that involves “the exploitation of insight(s) to create a state of being prepared for thinking, seeing, and acting in the future.” (Peppler, 2015)

- Foresight is neither forecasting nor prediction.
- Foresight: What if… ?
- Discovering and mangling of unknown unknowns
- Scenarios as an instrument to navigate in a **v**olatile, **u**ncertain, **c**omplex, and **a**mbiguous (**vuca**) world.

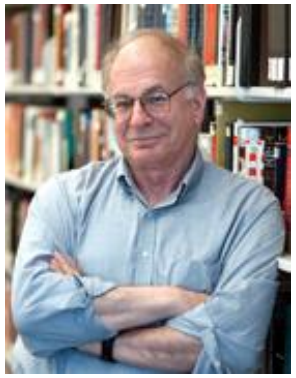
Kahneman: Thinking, Fast and Slow

System-1

Fast Thinking

- Intuitive, unconscious
- Fast & efficient
- Draws on available knowledge, past experience, long-established mental models
- Source of cognitive biases

The world of heuristics.



System-2

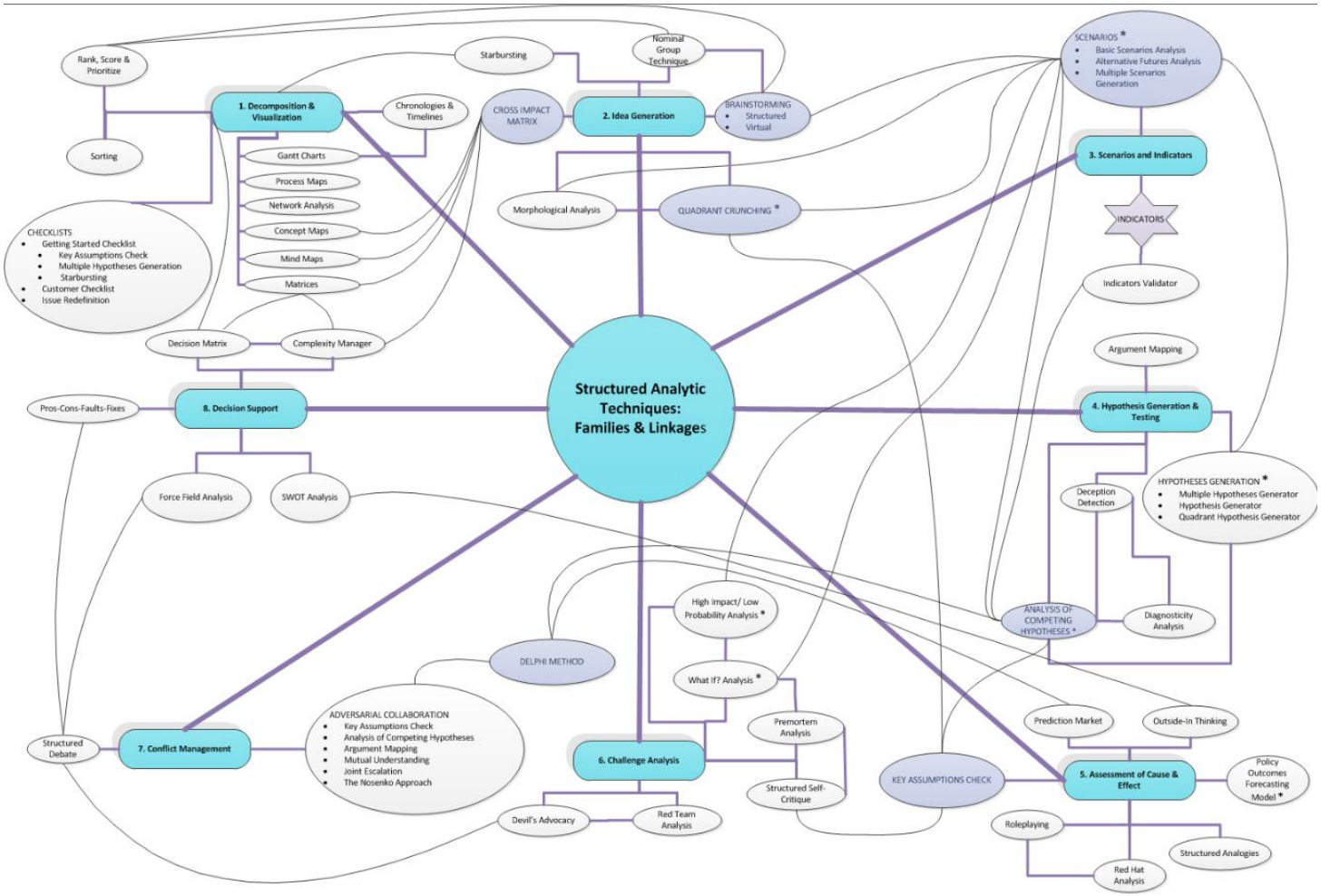
Slow Thinking

- Analytical, deliberate
- Slow
- Critical thinking, structured analytic techniques
- Mathematics and quantitative reasoning

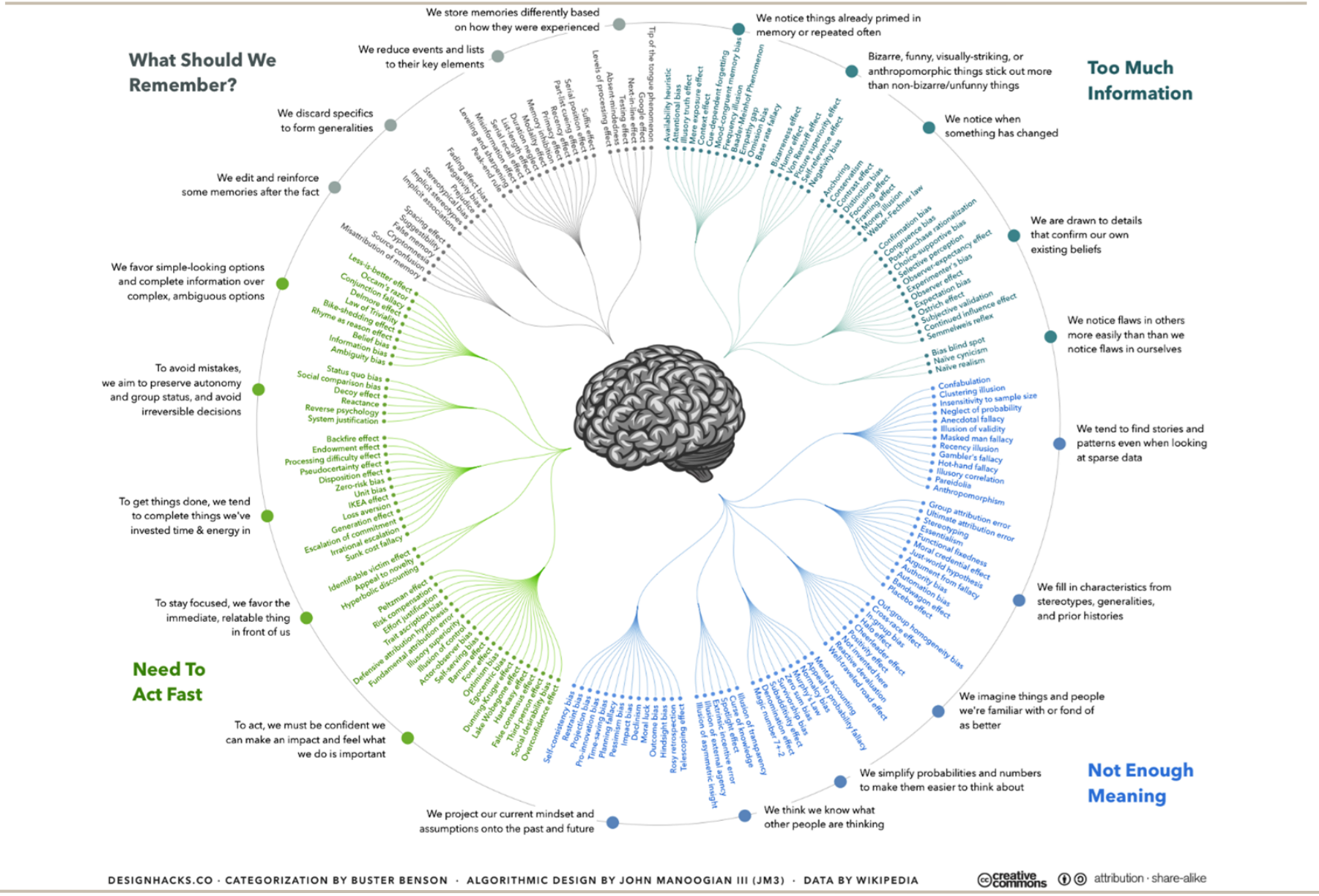
The world of analytics.

Structured analytic techniques

Tools to enable system II thinking for intelligence but also business and engineering



Cognitive biases



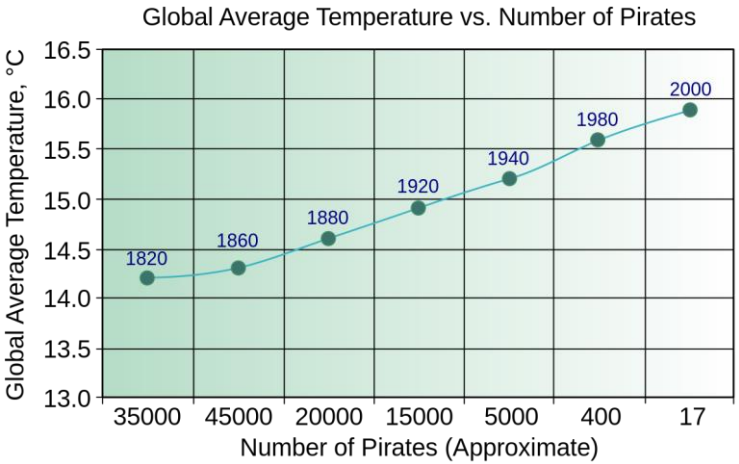
Anchoring effect

Have a guess – what's the population of Latvia.
Is it a) above ten million or
b) below that?

Anchoring leaves us to identify the first piece of information we obtain as a reference point.

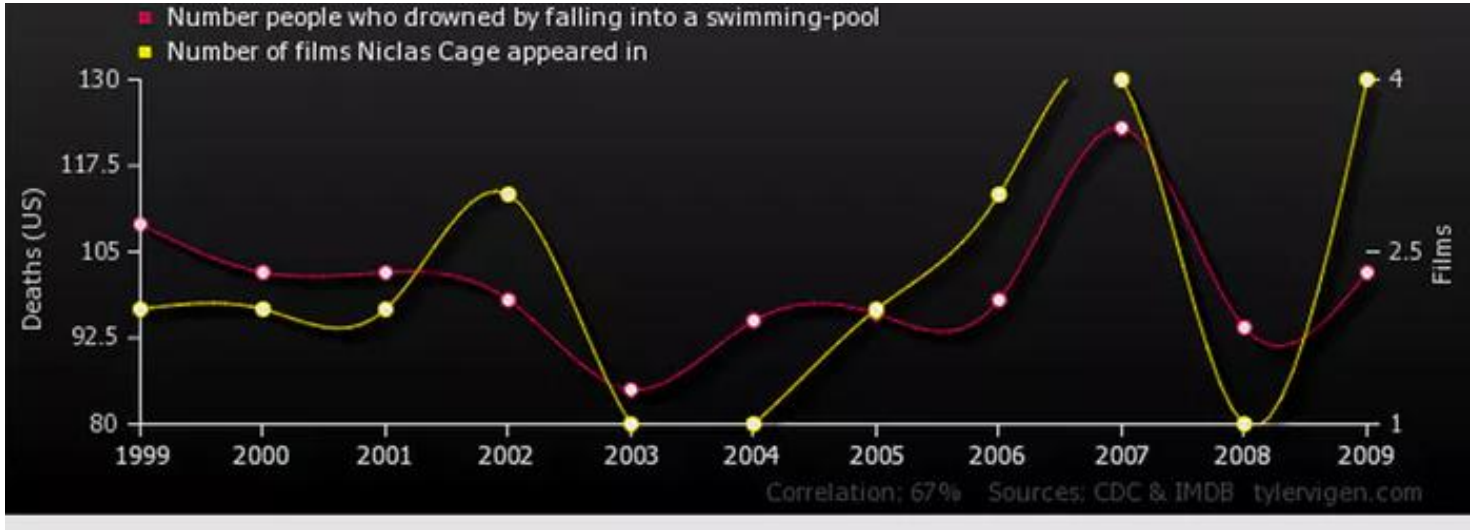
Often used in advertising …
but can also bias a political analyst.

Causality and correlation

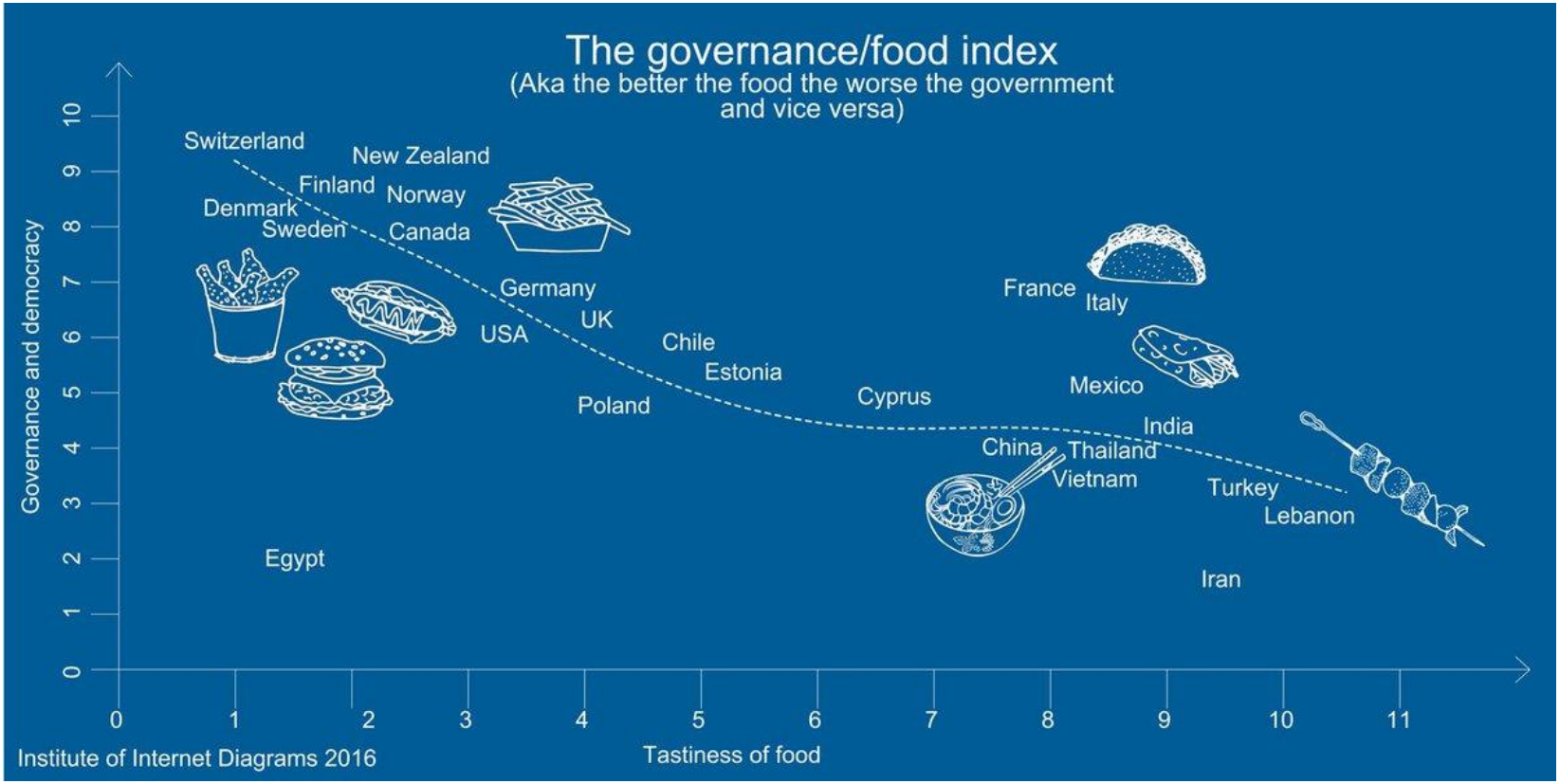


Pirates cause global warming.

Nicholas cage makes people drown in swimming pools.



Causality and correlation



Karl Sharro: “The better the food the worse the government and vice versa”

Conjunction fallacy

Consider the following statements.

a) The EU breaks ties with the US.

b) Iran and Saudi Arabia enter a military conflict.

c) The EU and Iran broker a free-trade agreement.

d) The US issue sanctions against the EU, which is why the EU breaks ties with the US.

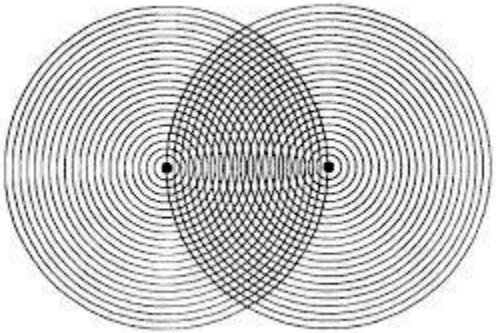
e) The US join the Iranian nuclear deal again.

Which one is more likely?

b) or e) ?

a) or d) ?

Conjunction fallacy

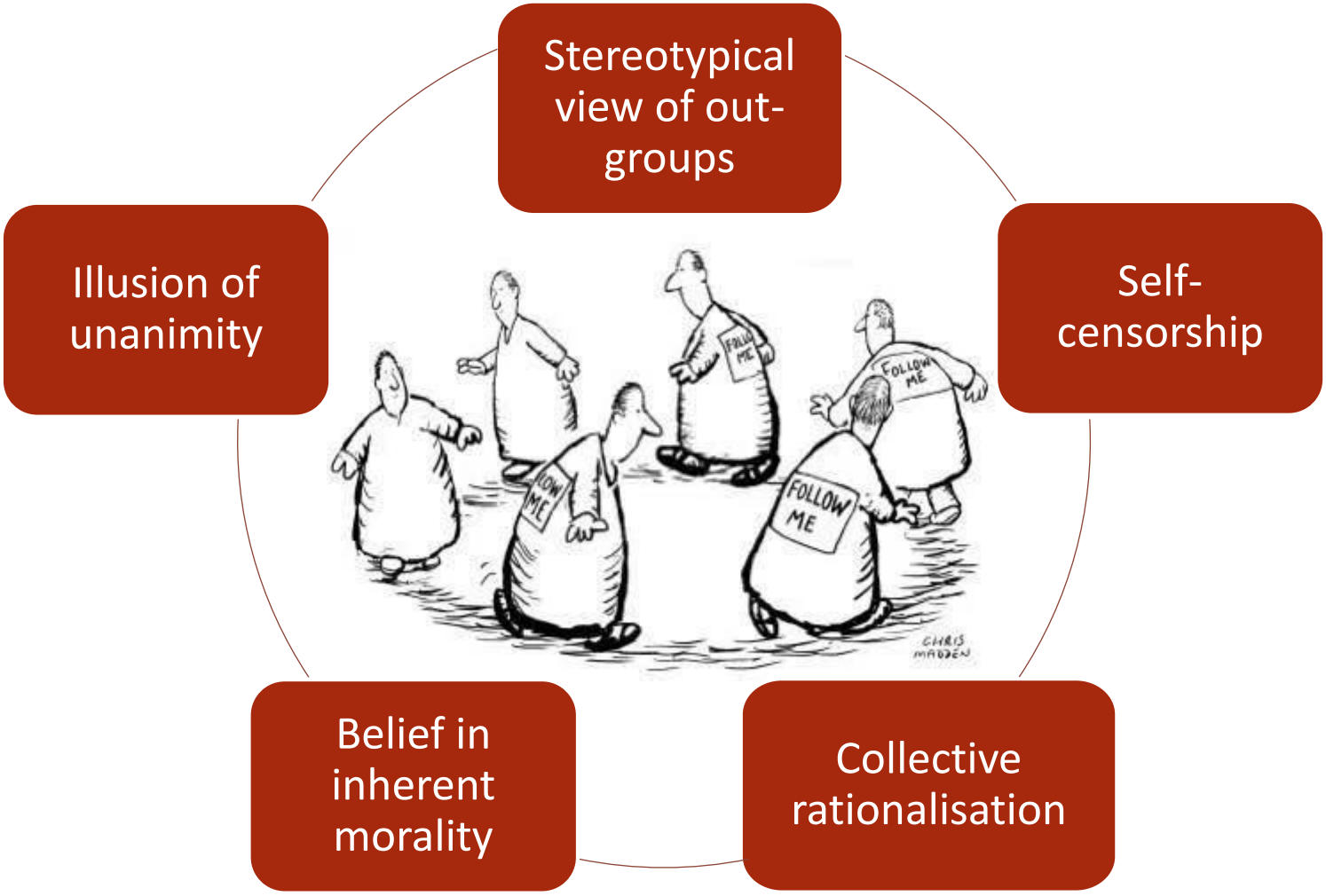


$$P(A \cap B) \leq P(A)$$

- Two things happening can never be more likely than only one of them happening.
- Framing makes us forget about basic logic concepts

➢ We tend to assess probabilities incorrectly!

Groupthink


Stereotypical view of out-groups
Self-censorship
Collective rationalisation
Belief in inherent morality
Illusion of unanimity
FOLLOW ME
FOLLOW ME
FOLLOW ME
FOLLOW ME
CHRIS MADDEN

Randomness & the Law of Small Numbers

Imagine you toss a coin five times. Which of these outcomes is more likely?

a) Head, Head, Head, Head, Head

b) Head, Tail, Tail, Head, Tail

Solution: Both have an equal probability of $0.5^5 = 3.125\ \%$

Randomness & the Law of Small Numbers

Let's change the framing:

Imagine, there is a village with 150 inhabitants.

Suddenly, 10 are diagnosed with cancer.

What is the population going to believe has happened?

The Law of **Large** Numbers: Large samples produce representative results

The Law of **Small** Numbers: Biased believe that population statements can be made from small samples.

Randomness & the Law of Small Numbers

- Gambler's fallacy or cancer cluster?
- Just-world belief
- Illusion of control

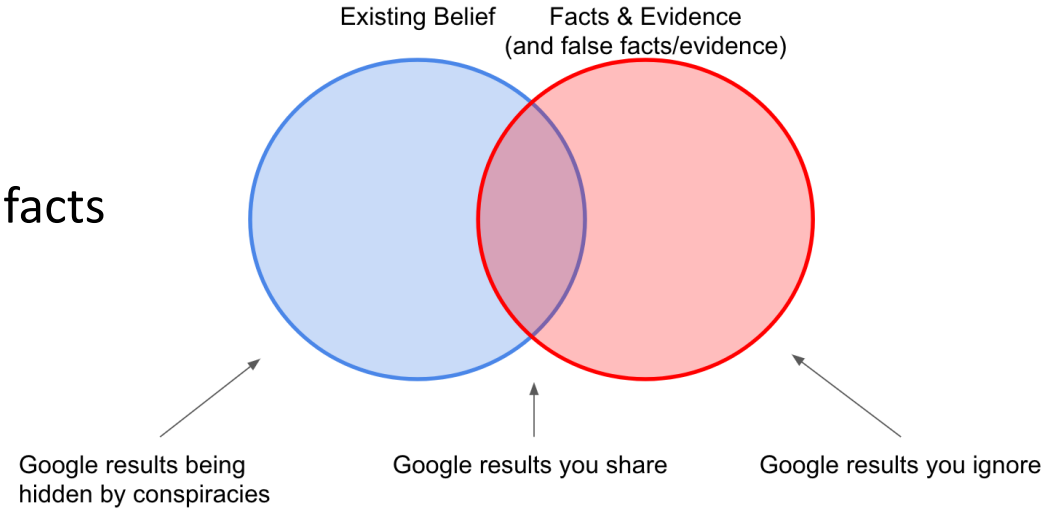
Most individuals have no sense of randomness or probabilities

Availability bias & confirmatory bias

Recent experience, the personal environment, and often-cited issues dominate our thinking.

What will most Europeans be more afraid of?
Terrorist attacks or **car accidents**?

We often choose to believe in facts that confirm our own believe.



Monocausality (Fallacy of the single cause)

Forbes Billionaires Innovation Leadership Money Consumer In

Alom Shaha
@alomshaha
Follow

'Inequality' is behind the rise of Isis, says author Thomas Piketty

There's a new theory behind the rise of Isis. And it's very controve...
A year after his 700-page opus "Capital in the Twenty-First Century" stormed to the top of America's best-seller lists, Thomas Piketty is out with a new argument about
independent.co.uk

11:33 PM - 30 Nov 2015

3,975 views | Dec 10, 2015, 08:54am

Is Climate Change To Blame For ISIS?

Bjorn Lomborg Contributor
Energy & Environment
Getting the facts straight on how to make the world a better place.

Understanding scenarios

Scenarios - how to define them?

- Scenarios date back to ancient Greece, turned into a decision-making tool in the 20th century
- Two important reference points:
  - Herman Kahn's "intuitive logics"
  - Gaston Berger's "la prospective"
- No universal definition or approach towards scenarios

- Kahn and Wiener (1967, p. 6): scenarios are "**hypothetical** sequences of events constructed for the purpose of **focusing attention on causal processes** and decision-points. They answer two kinds of questions: 1) Precisely how might some hypothetical situation come about, step by step? and 2) What alternatives exist, for each actor, at each step, for preventing, diverting, or facilitating the process?"

History of scenario planning

1940s
- First formal scenarios by US in war game analysis after World War II

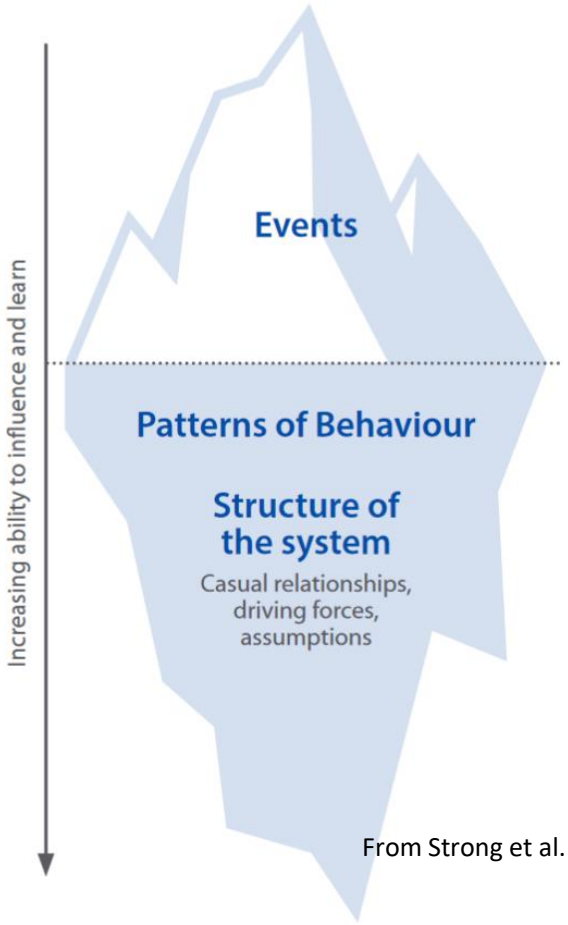
1960s
- Strategic planning in companies

1970s
- Shell refining „scenario planning“ & using it for oil price prediction
- The „oil shock“

1980s
- Global spread of scenario planning

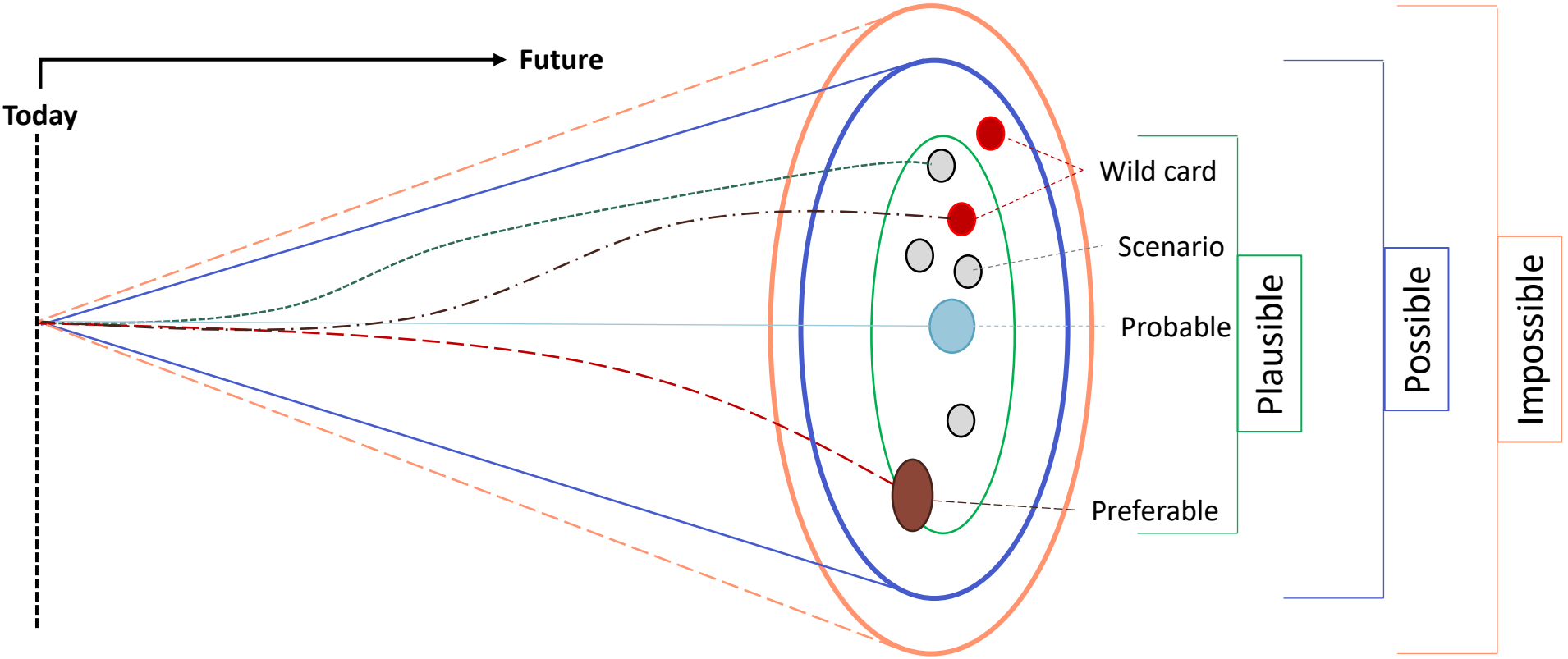
Scenarios - how to define them?

- Scenarios are **plausible** imaginaries capturing counterfactual futures
- They aim at foreseeing the range of different futures
- They are **no** predictions of the future
  - If you don't remember anything else from this workshop, please keep at least this one as a takeaway.
  - Offering point predictions to highly-uncertain events can be misleading and a disservice to decision-makers
  - Consider the role of confidence intervals in inductive statistics
  - Other approaches can do predictions far better than scenarios



From Strong et al.

The scenario cone



Why scenarios?

- Use scenarios for
  - Complex situations, too uncertain outcomes to trust a single prediction
  - Policies or corporate strategies are in the initial stages
  - Bounding the range of possible futures
  - Bring decision-makers, experts and stakeholders together to envisage the alternative futures for which they must plan
- Goals
  - Providing a framework for considering multiple plausible futures
  - Raising awareness by involving decision-makers and stakeholders in the process
  - Obtaining indicators
  - Anticipating otherwise surprising developments
  - Think about how opportunities can be exploited

Different forms of scenarios

On what timescale does the risk materialise?

Trend Risk Scenario	Shock Risk Scenario
Slow-onset, trend phenomena that emerge gradually over time	Sudden-onset, shock events that occur quickly or unexpectedly

Which is the more important scenario outcome?

Exploratory - To ask 'what if?'	**Normative** - To ask 'what for?'
To stimulate imaginative thinking about the future and widen understanding of available options	To better understand the path to desirable futures and evaluate the impact of decisions

Who owns and contributes to the scenario process?

Participatory - Bottom-up, co-production of knowledge	**Expert-Driven** - Top-down, analytical
To incorporate stakeholder culture, knowledge, and experience in the process and end product	To deliver rigorous scientific descriptions of plausible futures to decision makers

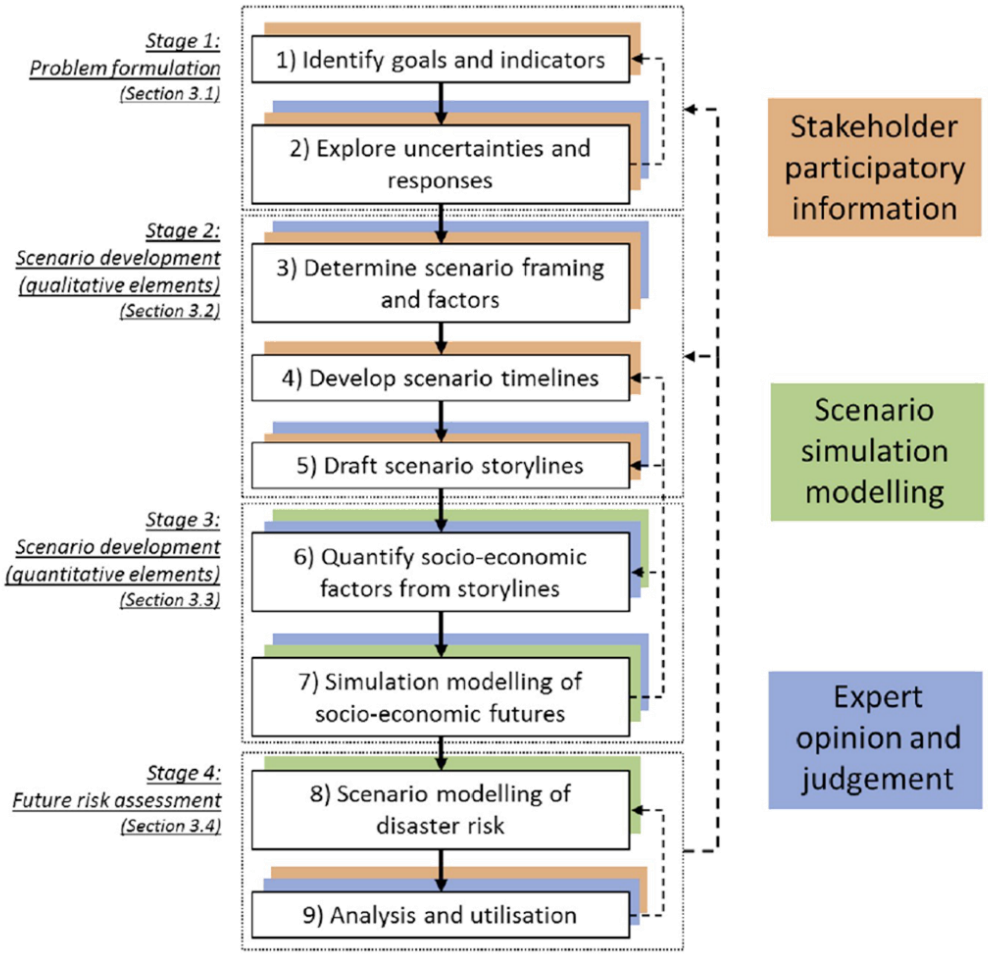
Is the scenario required to define the likelihood of an outcome?

Probabilistic	Deterministic
To estimate the likelihood of occurrence based on the variance of quantified causal parameters	To speculatively explore phenomena that involve a high degree of uncertainty

From Strong et al.

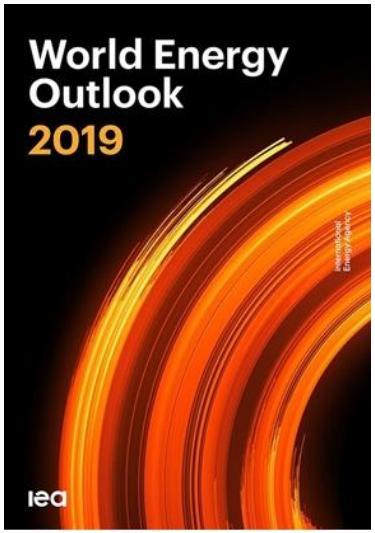
Qualitative and quantitative scenarios

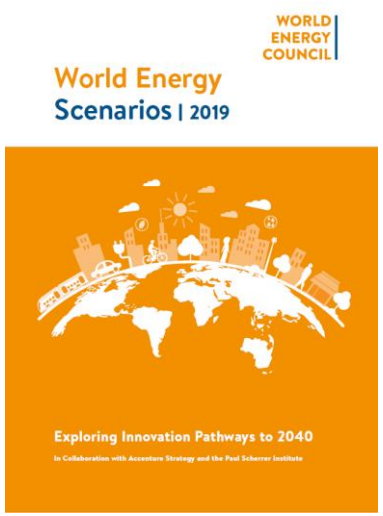
- Scenarios are originally designed to capture highly complex uncertainties and non-linear disruptions – something quantitative models have trouble with
- Disaster scenarios typically use quantitative models to capture specific aspects of their scenarios (e.g. to capture how a fire will spread)
- Outside of disasters: Qualitative-quantitative don't really get along

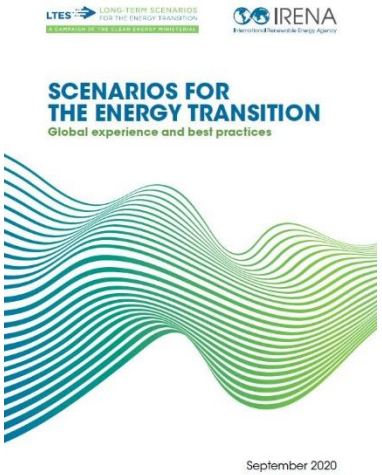


Riddell, G. A., van Delden, H., Maier, H. R., & Zecchin, A. C. (2019). Exploratory scenario analysis for disaster risk reduction: Considering alternative pathways in disaster risk assessment. *International journal of disaster risk reduction*, *39*, 101230.

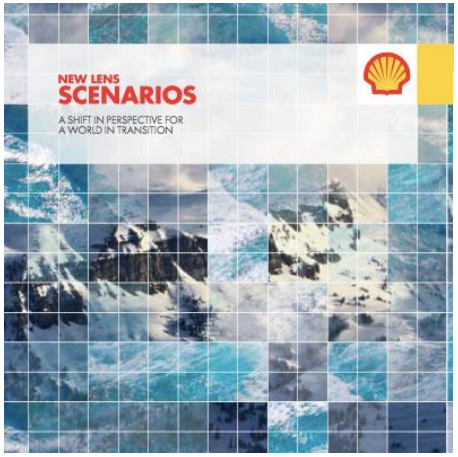
Scenarios in the energy industry

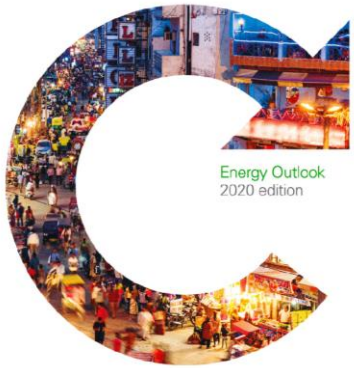


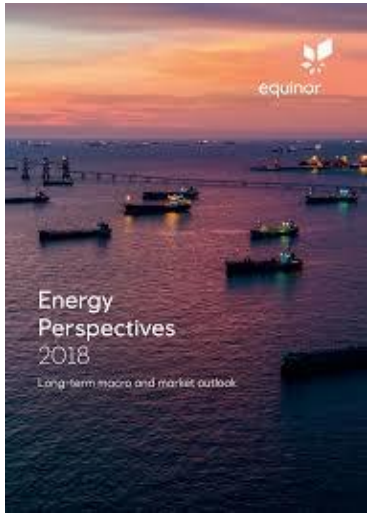


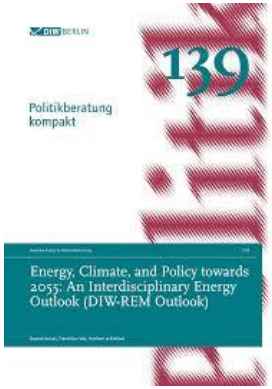


International organisations







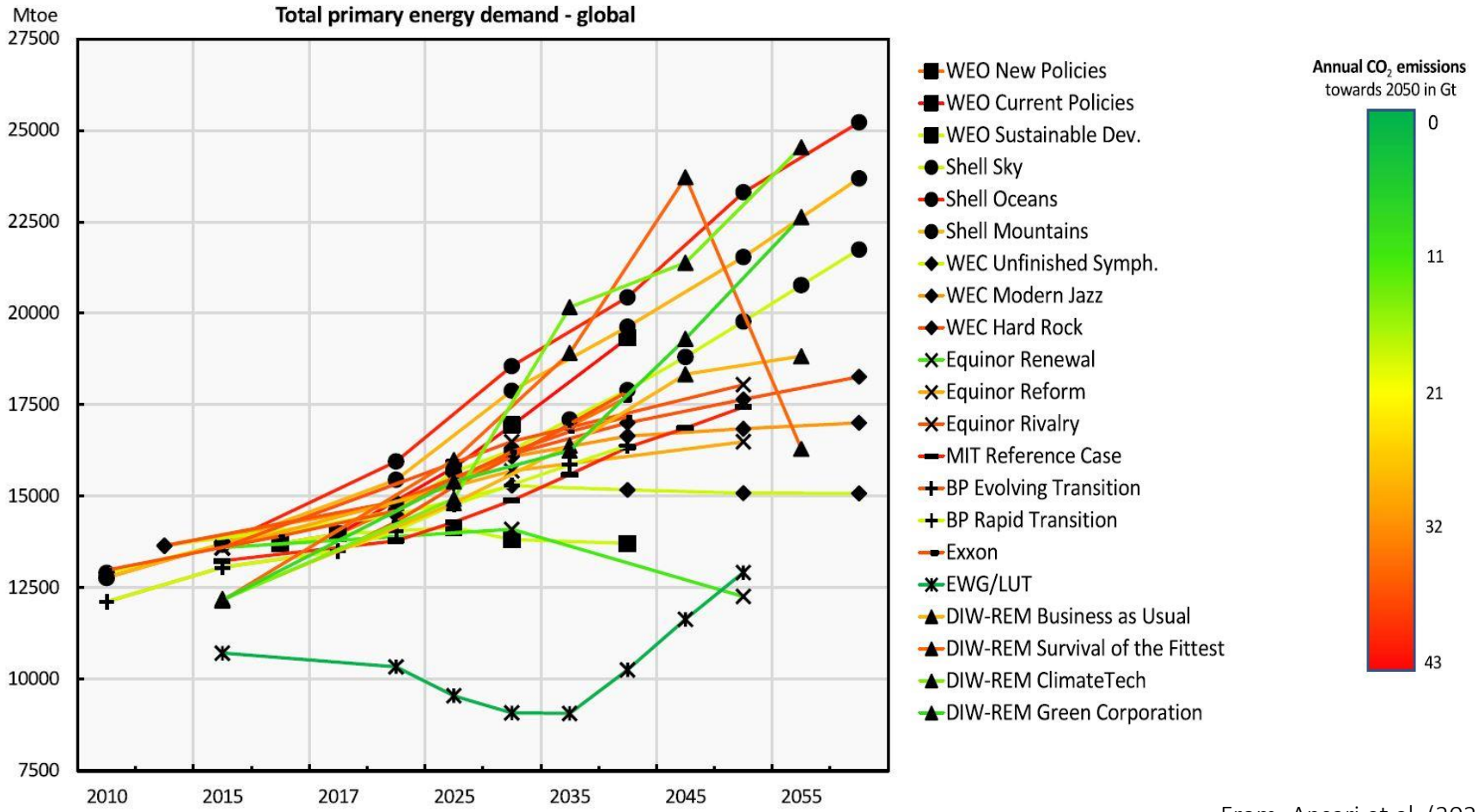


Private and public research

Energy corporations

Scenarios in the energy industry…

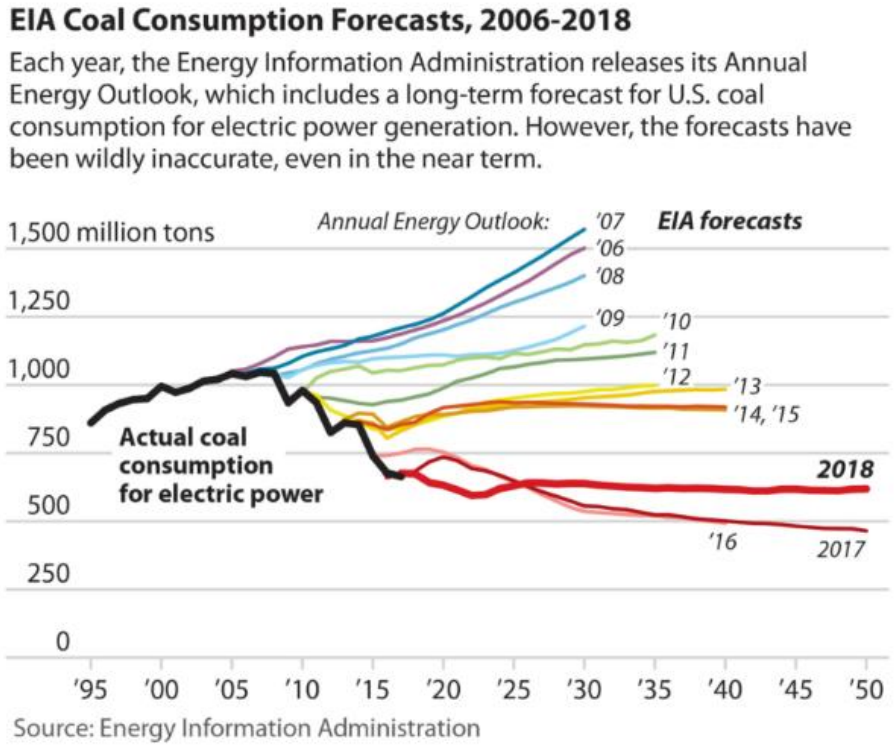
… help to allocate investments and monitor climate/energy developments by assessing the future energy system.

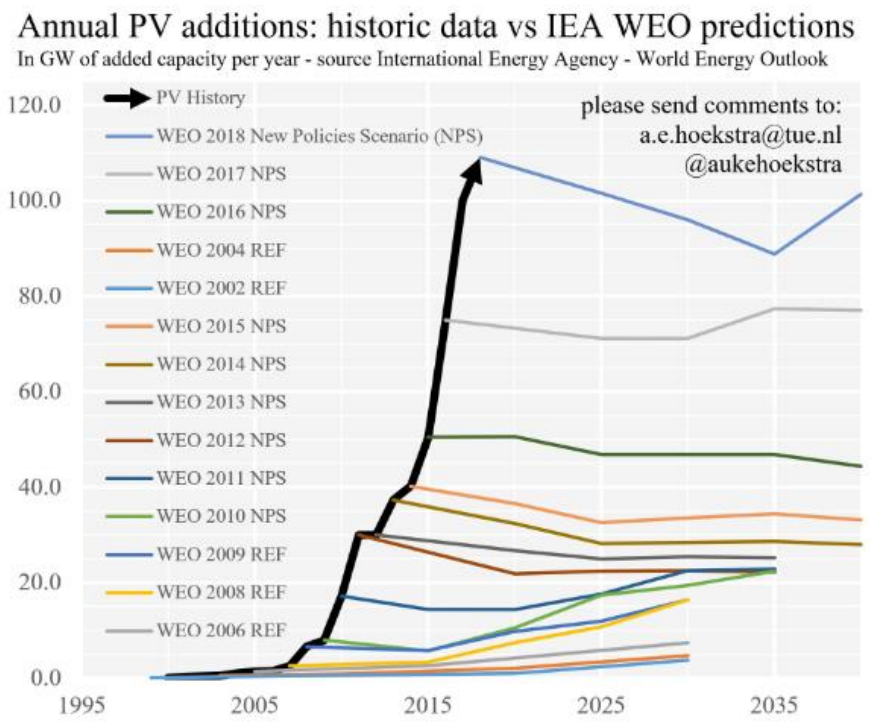


From: Ansari et al. (2020)

Scenarios in the energy industry…

… aren't always right. But should they?





Three examples:

- The SPARS pandemic: https://jhsphcenterforhealthsecurity.s3.amazonaws.com/spars-pandemic-scenario.pdf

- Lloyds' food system shock analysis: https://assets.lloyds.com/assets/pdf-food-system-shock-june-2015/1/pdf-food-system-shock-june-2015.pdf

- DIW-REM: https://www.diw.de/documents/publikationen/73/diw_01.c.676049.de/diwkompakt_2019-139.pdf

Developing scenarios

Today's taxonomy

In this workshop, we will look at two approaches:

Multiple scenario generation (esp. for trend risks)

Generate multiple scenarios of how (known or unknown) uncertain trends create alternative futures

- Understand drivers, opportunities, and risks
- Develop warning systems (e.g. indicators)

Disaster event scenarios (for shock risks)

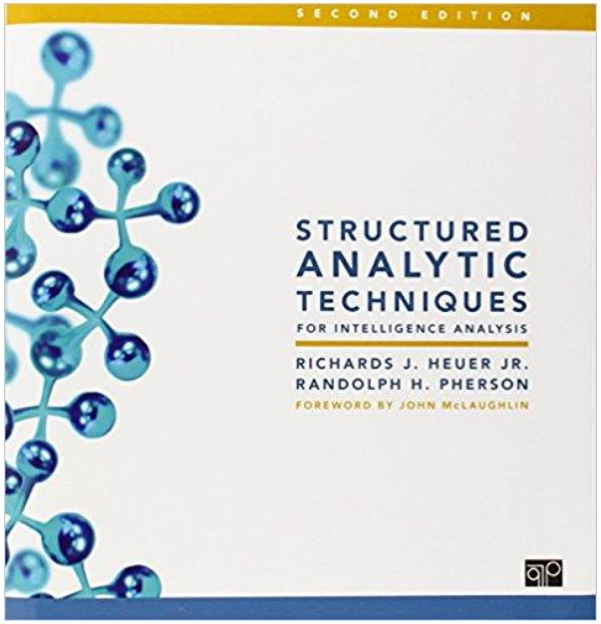
Generate a particular scenario of how a low-probability-high-impact scenario (e.g. natural disaster) unfolds

- Identify impacts and vulnerabilities
- Evaluate how different settings can change (alleviate) impacts

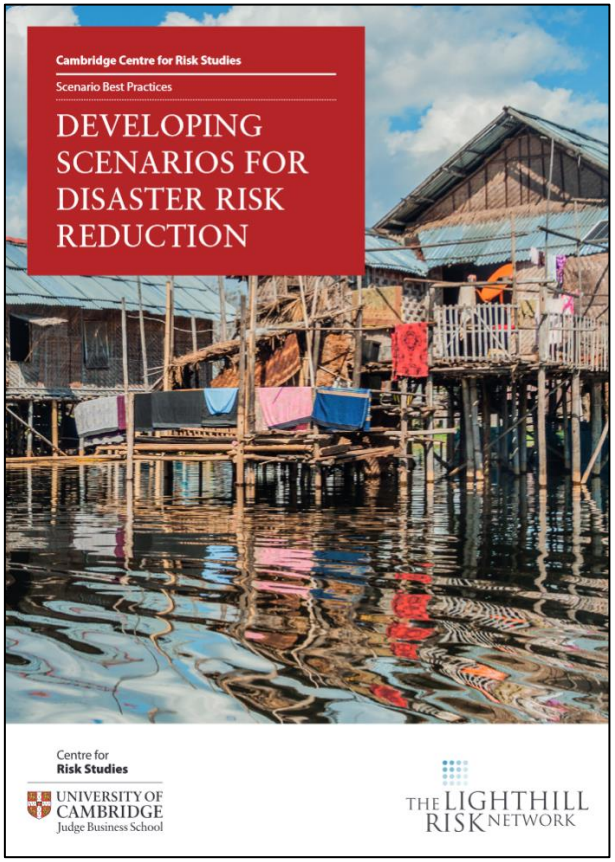
Challenges when using scenario approaches

- Scenarios are typically made in group exercises with a skilled facilitator
- Groups need to be highly diverse and/or require methods to avoid groupthink
- Participants often have issues when thinking beyond their fields
- Participants need to have the conceptual skills to select drivers and assumptions
- Participants need to be knowledgeable enough to provide accurate information but humble enough to challenge own beliefs
- Facilitators have a determining role (towards the better or the worse)
- Scenario exercises can be very time intensive

Foresight: Our techniques

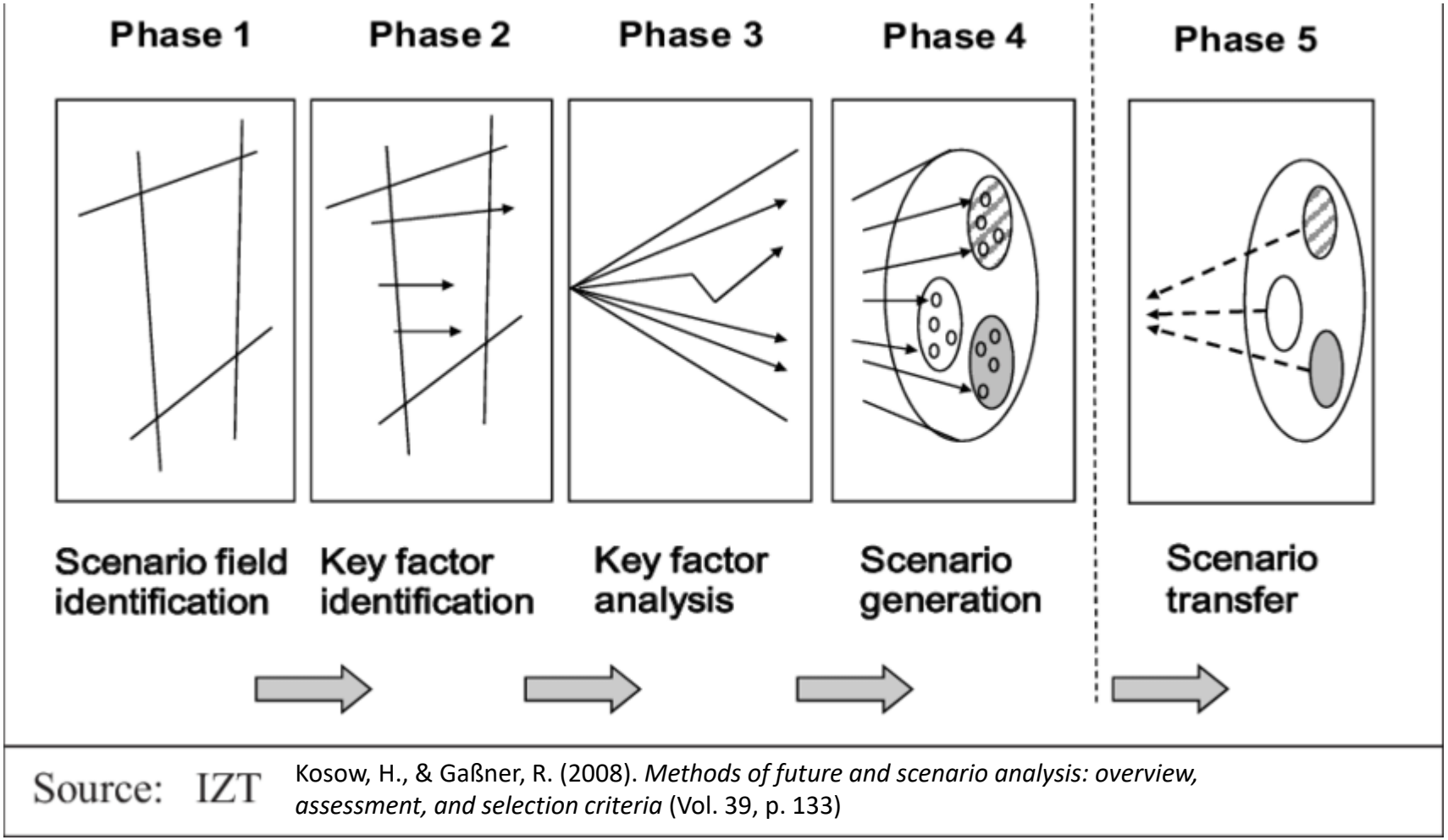


Pherson, R. H., & Heuer Jr, R. J. (2020). *Structured analytic techniques for intelligence analysis*. Cq Press.



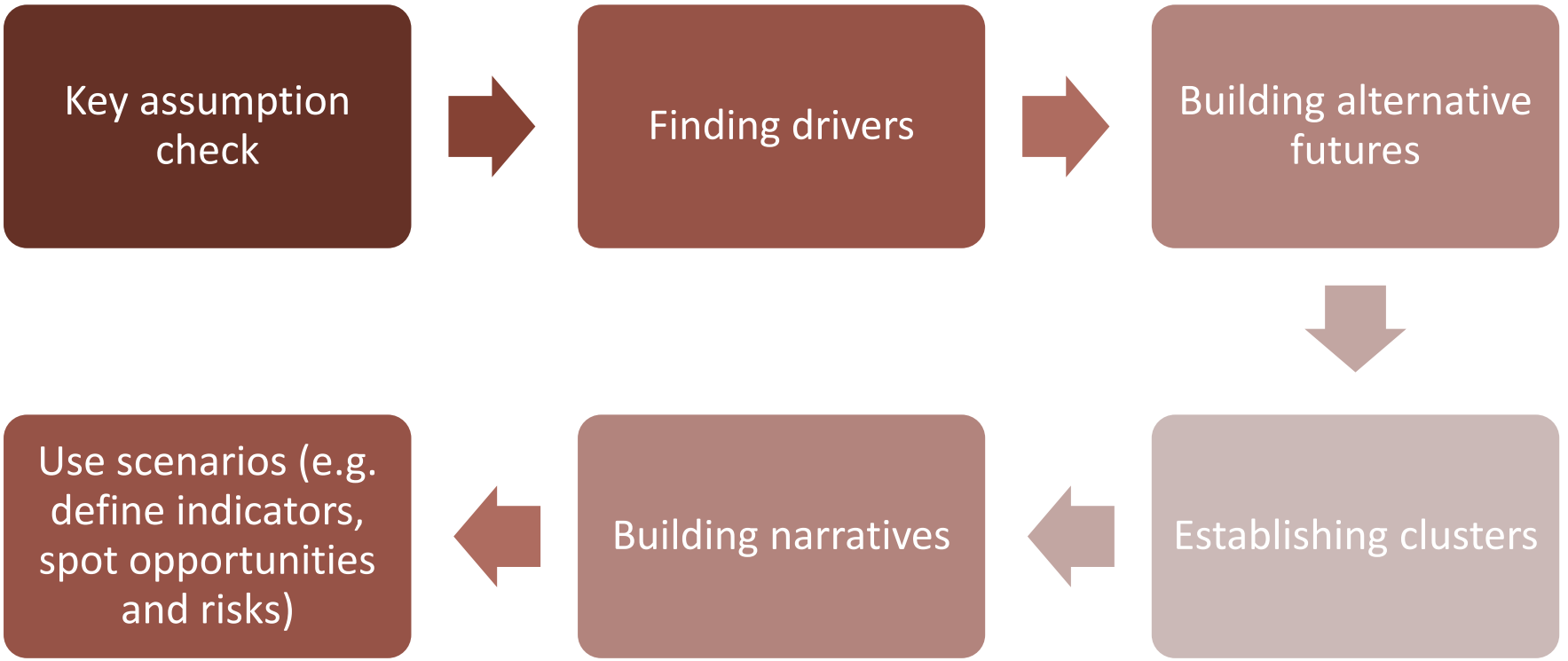
Strong, K., Carpenter, O., Ralph, D. 2020. Scenario Best Practices: Developing Scenarios for Disaster Risk Reduction. Cambridge Centre for Risk Studies at the University of Cambridge Judge Business School and Lighthill Risk Network

Developing (multiple) scenarios



Source: IZT Kosow, H., & Gaßner, R. (2008). *Methods of future and scenario analysis: overview, assessment, and selection criteria* (Vol. 39, p. 133)

Developing (multiple) scenarios



Key Assumptions Check

- Many foresight analyses should include a solid **key assumptions check**

- Key assumptions are the '*rules of the game*'
  - Key assumptions define much of the analysis's scope
  - They give bounds to our analysis and explain which trends/mechanisms appear regardless of uncertainties

- Wrong key assumptions will conceal plausible disruptive change and make it appear 'unexpected' – foreseeable events become so-called *black swans*

- Strategy: Gather key assumptions (online, in-class, etc…) and have a panel of experts and non-experts evaluate whether the assumptions are solid / caveated / unsupported

- Challenge: Straightforward method, but participants need to be able to accept that they could be wrong

- Rule of thumb: 25% of key assumptions collapse

Key Assumptions Check

- Basically solid *(we can expect this to be true)*
- Correct with caveats *(generally true but there are relevant exceptions)*
- Unsupported *(this is not necessarily true)*

How will transport in Berlin develop over the coming 15 years?

- Bicycles will be part of the modal split.
- The share of bicycles will constantly increase.
- The government will always provide bicycle infrastructure (e.g. bike paths).
- Flying cars will never become a widespread mode of travel.
- There will always be a need for individual modes of traffic.

The art of creating a driver

- Drivers are the (uncertain) forces that affect and change a system.
- Generating (multiple) scenarios is built around the realisation of drivers
  - Scenarios result from combinations of driver realisations
- How to get drivers?
  - Key assumption check → Unsupported assumptions can be key drivers
  - Structured brainstorming

Description
- short and to the point

Language
- Precise and commonly understood

Content
- Value-free, non-ideological, apolitical

Character
- Should not entail a future projection, need to have a spectrum or polarized properties

The art of creating a driver

Title: Short and to the point

- ⛔ **Overall security situation in Europe w/special emphasis on Islamist radicalism**
- ✓ Status of security in France

Characteristic: Not comprising a future projection

- ⛔ **Economic boom (projection / property already included)**
- ✓ Economic development

Language: Precise and commonly understood:

- ⛔ **Regional cooperation (reference is missing, property already included)**
- ✓ Relation of stakeholders in region

Example for a driver projection (driver: 'Status of ethnical minorities in Germany')

- ⛔ **Good – Bad**
- ✓ Marginalized – integrated

Example by Oliver Gnad, Bureau fuer Zeitgescehen

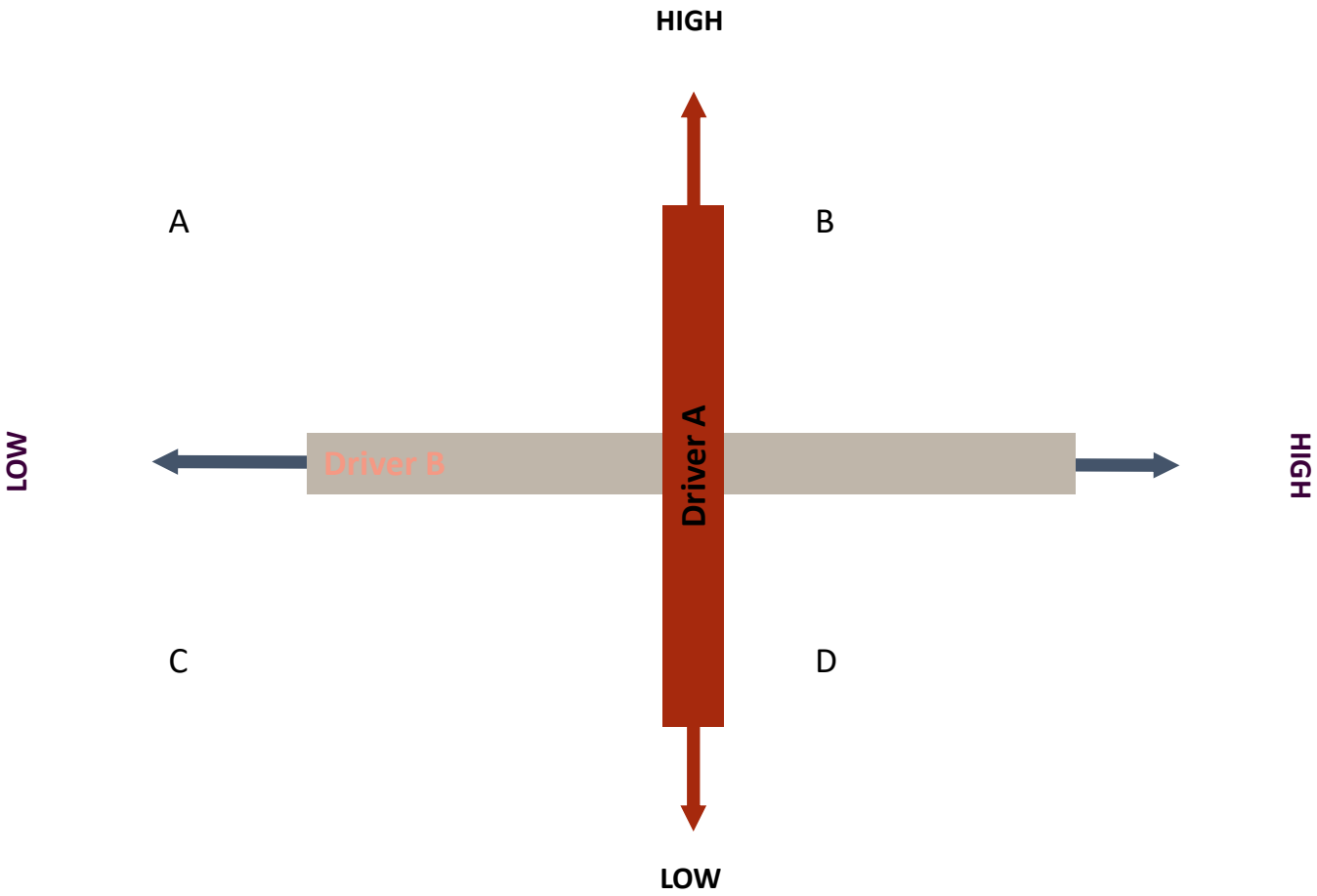
BUREAU FUER ZEITGESCHEHEN

Drivers

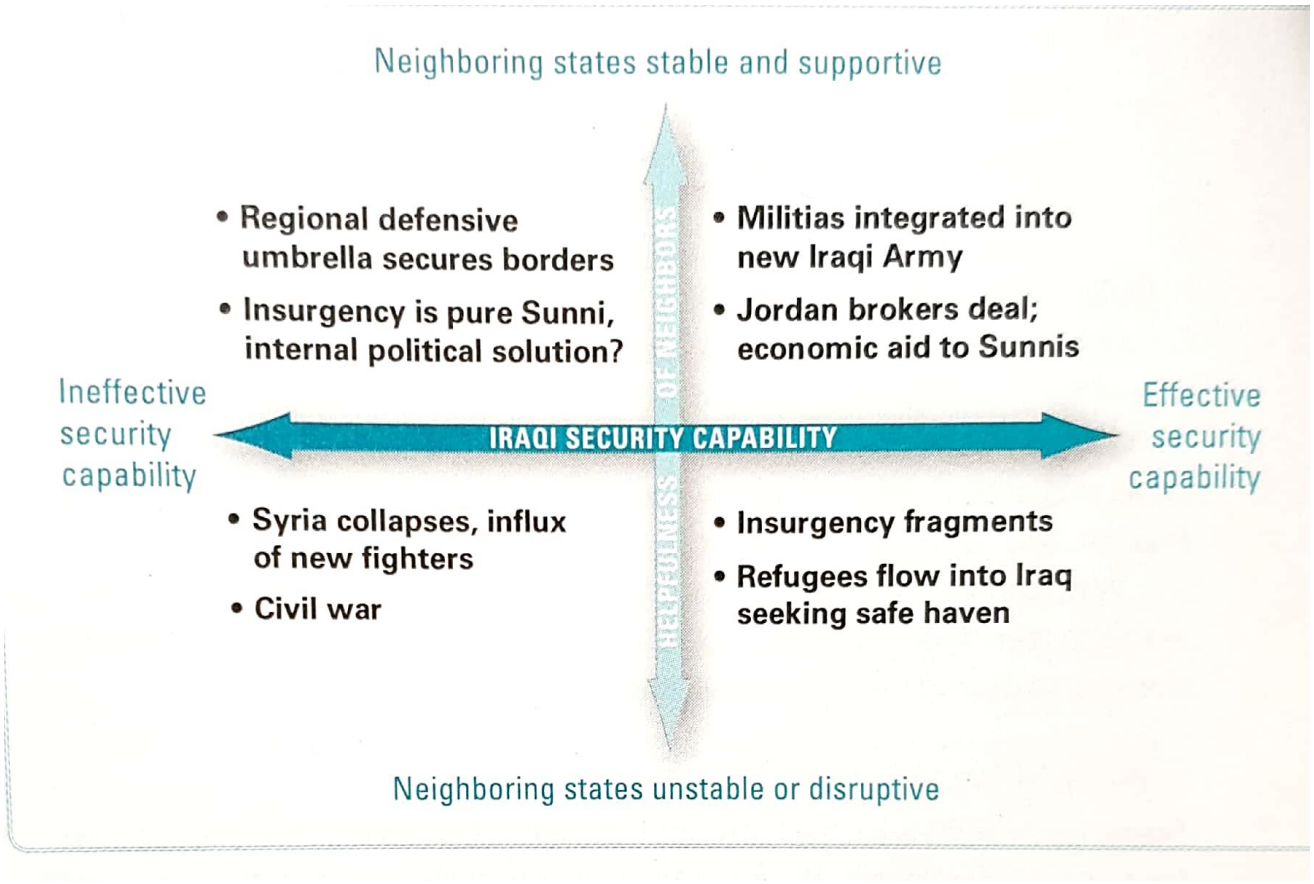
- **Which drivers will affect how transport in Berlin develops over the coming 15 years?**

Building alternative futures

Alternative futures the basis for scenarios - the result specific driver combinations.

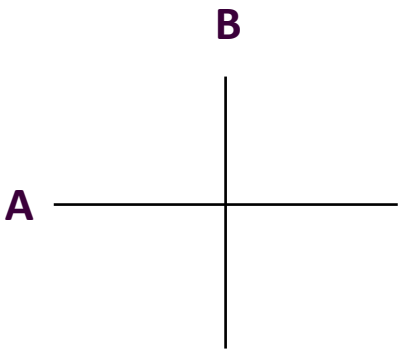


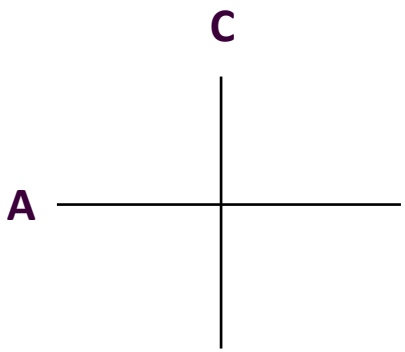
Building alternative futures

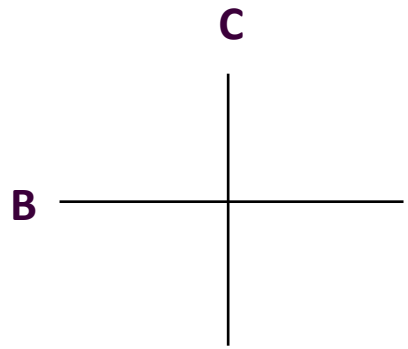


Example from Richards Heuer & Randolph Pherson

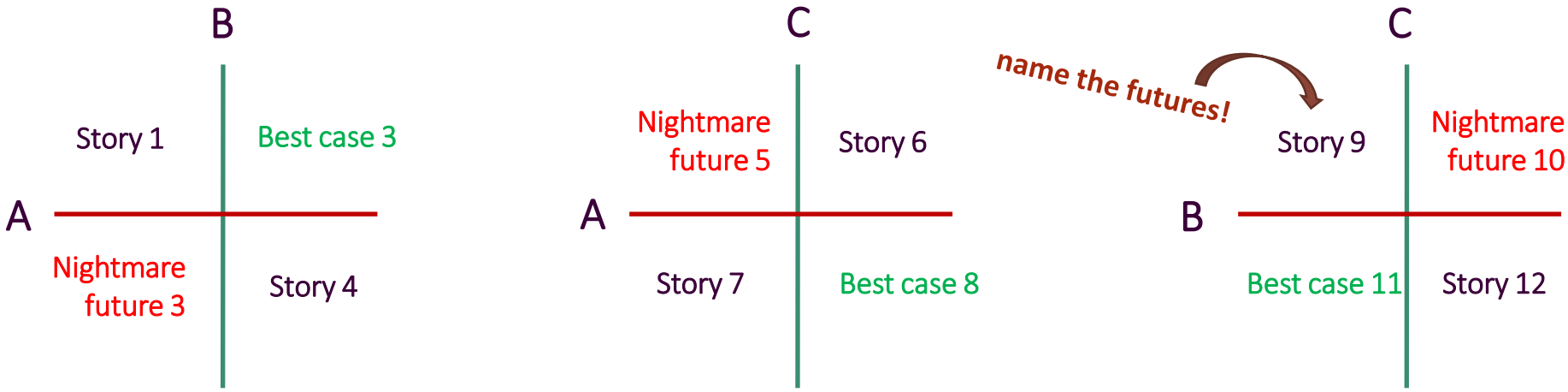
Building alternative futures







Clustering



Combine futures that are

- **Not mutually exclusive (!)**
- Reflect new, previously unexamined trends or reframe the issue
- Represent best or worst cases

Some interesting scenario: Futures 1, 7, 12

Best-case scenario: Futures 3, 8, 11

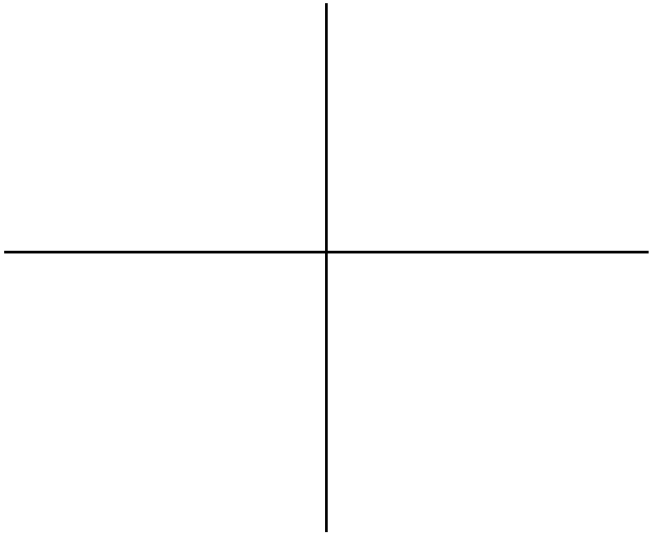
Worst-case scenario: Futures 3, 5, 10

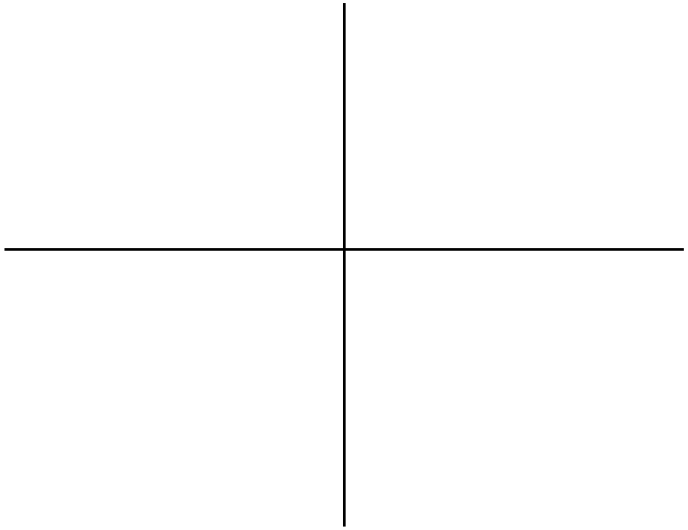
Storytelling

- Give your scenario a sticky title, something to remember
- Develop a chronology of events
- Describe factors, actors, trends and events which steer your scenario
- Define an end-state for your scenario

Multiple scenario generation

- **How will transport in Berlin develops over the coming 15 years?**





Scenarios for disaster events

- Scenarios covering the consequences of disaster events typically follow a less stringent qualitative process
- Strong reliance on background research
- Disaster scenarios may include stakeholder formats at various stages throughout the process
- Several of the techniques discussed before – e.g. the key assumption check – can be very valuable too

Scenarios for disaster events

- Contextualise objective
- Specify questions

- Consult literature and stakeholders

- Determine the exact type of scenario to be developed

- Qualitative exploration of scenario parameters
- Assess uncertainty and impact

More on the coming slides

- Consider if the intended goal of the exercise was achieved
- Update scenarios with new developments/data

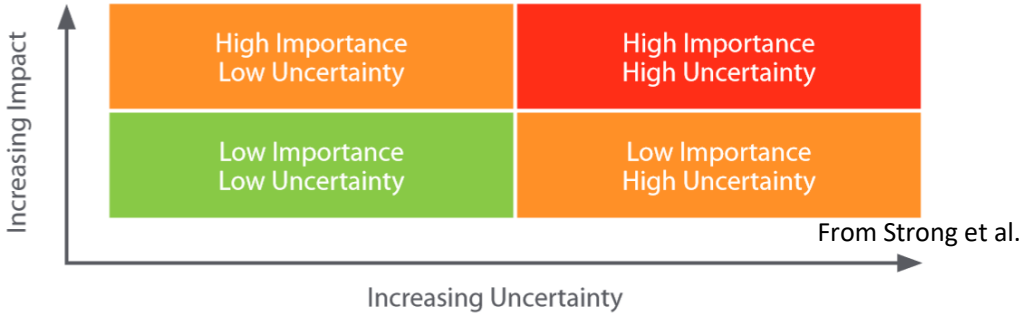
- Transfer results to decision-makers

- Investigate what the scenario means to various systems

- Build a scenario storyline
- Examine variations to the storyline

Develop candidate scenarios

- A (mostly qualitative) exploration of scenario parameters and sequence of events
- After defining the framework, several scenarios are possible?
  - What exactly is the disaster considered
  - How does it manifest?
  - Where and when does it occur?
- How to choose a scenario candidate?
  - Option A: Impact-uncertainty risk matrix (Highest risk)
  - Option B: Uncertainty breadth (Largest range of outcomes)



From Strong et al.

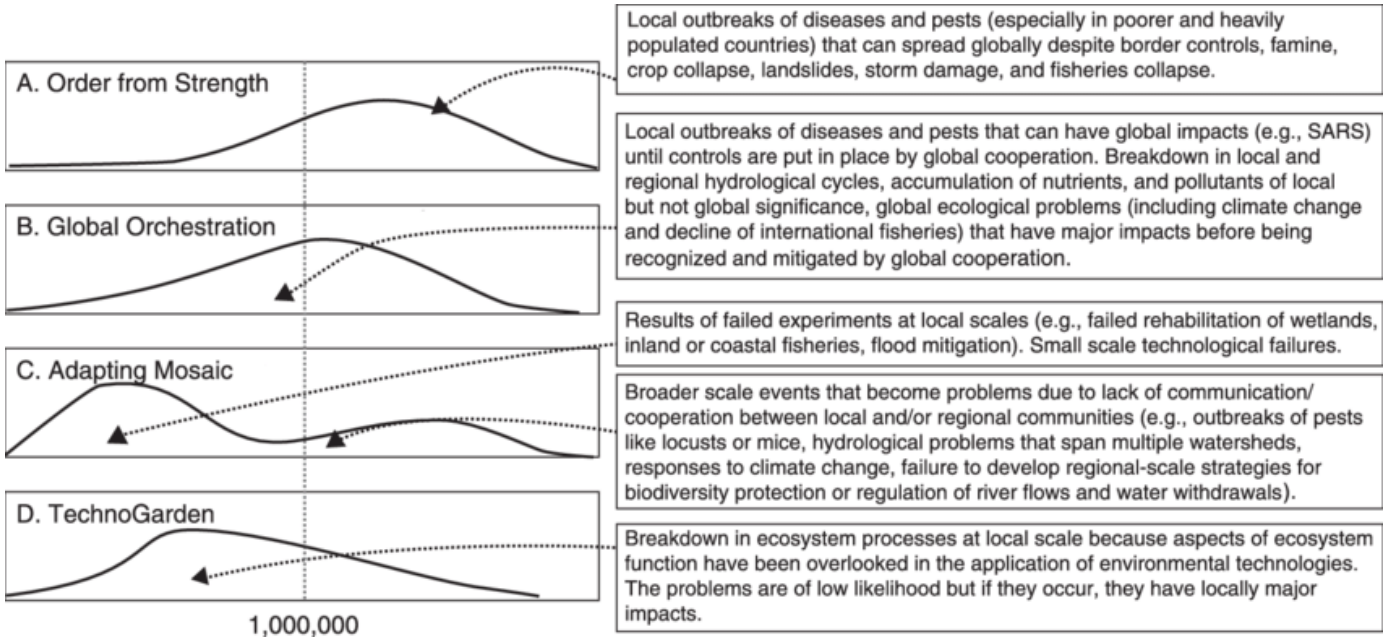
Develop a narrative

Trigger	What and how is the event triggered?
Location	Where exactly does it occur, and how far is its reach? *make sure to include indirect impacts*
Timing	When does what occur? *specify lengths and durations*
Impact	Who exactly is impacted in which way? *make sure to consider delayed impacts*
Recovery	How does the recovery process work? Which resources can be recovered?

- Create a detailed storyline of how your event unfolds – from disaster to recovery
- This process may involve (or iterate) quantitative modelling
- Having at least an implicit understanding of key assumptions and drivers in the situation is valuable

Variations of the narrative

- After completing the “baseline”, variations of the narrative show the impact of further uncertainties or decisions
- Counterfactual experiment: How does the scenario change …
  - … if certain action is taken? (decision-support)
  - … if exogenous parameters were different? (robustness)



Cork, S., Peterson, G., Petschel-Held, G., Alcamo, J., Alder, J., Bennett, E., . Zurek, M. (2005). Four scenarios. *Ecosystems and human well-being: Scenarios*, *2*.

Assessing impacts & making your scenario vivid

- The scenario will have mostly focussed on a tight scope
- Consider further cascade effects and spillovers/feedbacks from other systems (e.g. economy, society)
  - STEMPLE+
    (social, technological, economic, military (security), political, environmental, and cultural systems)
- Look at the scenario again: Are there feedbacks changing the storyline?

- Make your scenario vivid, e.g.
  - explain the story from different PoVs
  - Imagine societal and cultural responses
  - draw imaginary

Group assignments

- For the remainder of the workshop, you will work in one of five groups.

- Each group has a unique case and will prepare scenario-based research, to presented during the competition at the end of the workshop.

- Each member of the group that wins the competition will receive a special certificate.

Group assignments

Case 1: An earthquake in the Eastern Mediterranean

Case 2: Jordan's socioeconomic challenges – Covid-19 and beyond

Case 3: Wildfires threatening Antalya

Case 4: Iraq – Drilling in a tightening climate?

Case 5: A cold wave haunts Cairo