Horizon Scanning Module

Session 5. Futures Methods II

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Coming up

1. Mapping the broad **implications** of PESTELOMI changes for crime and security (continuation of Lecture 3)

2. Focusing on criminogenic/criminocclusive **innovations**

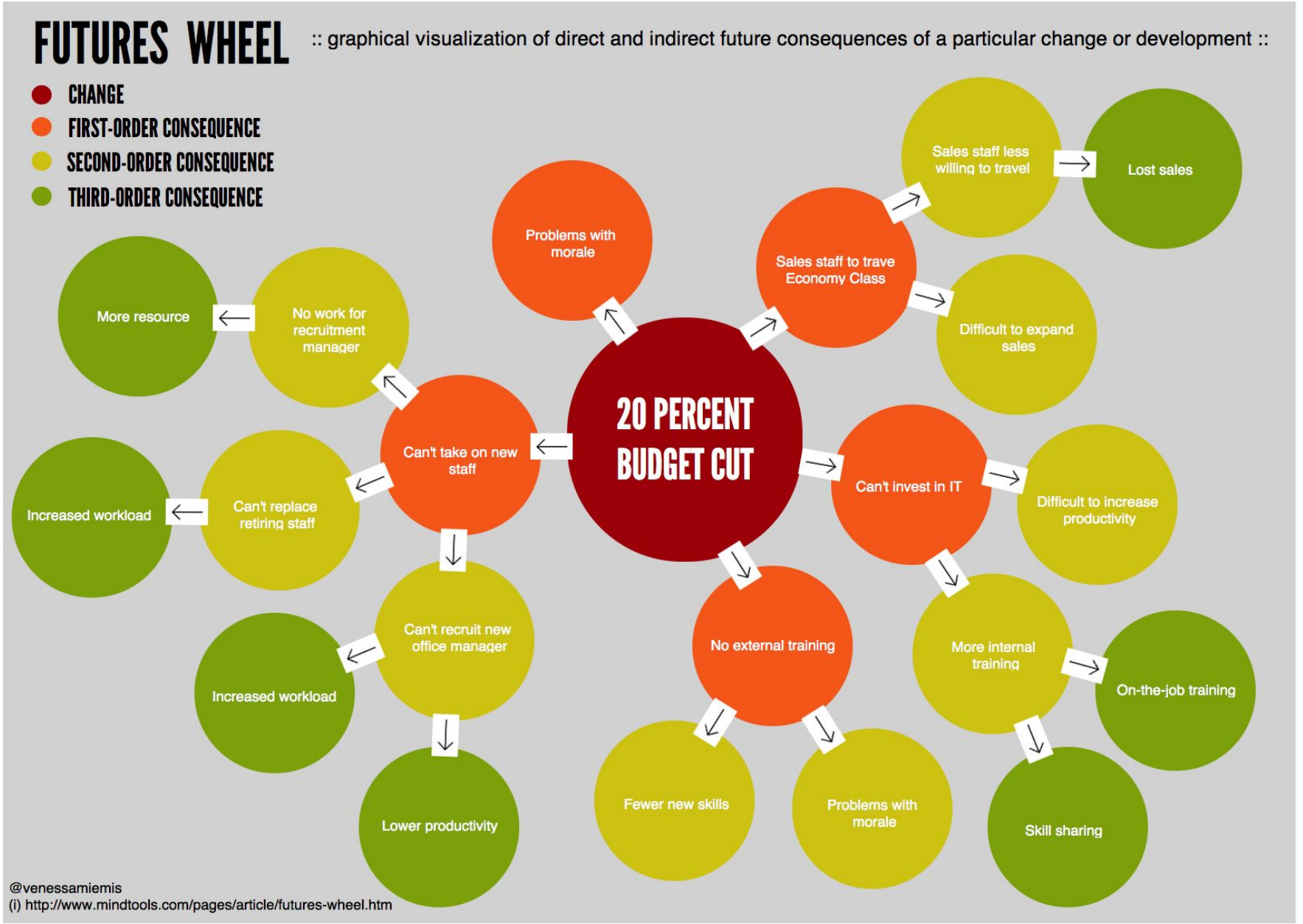
3. Handling **uncertainties**

4. Envisioning the future – **scenarios**

5. Seminar – **Sigma Scans**

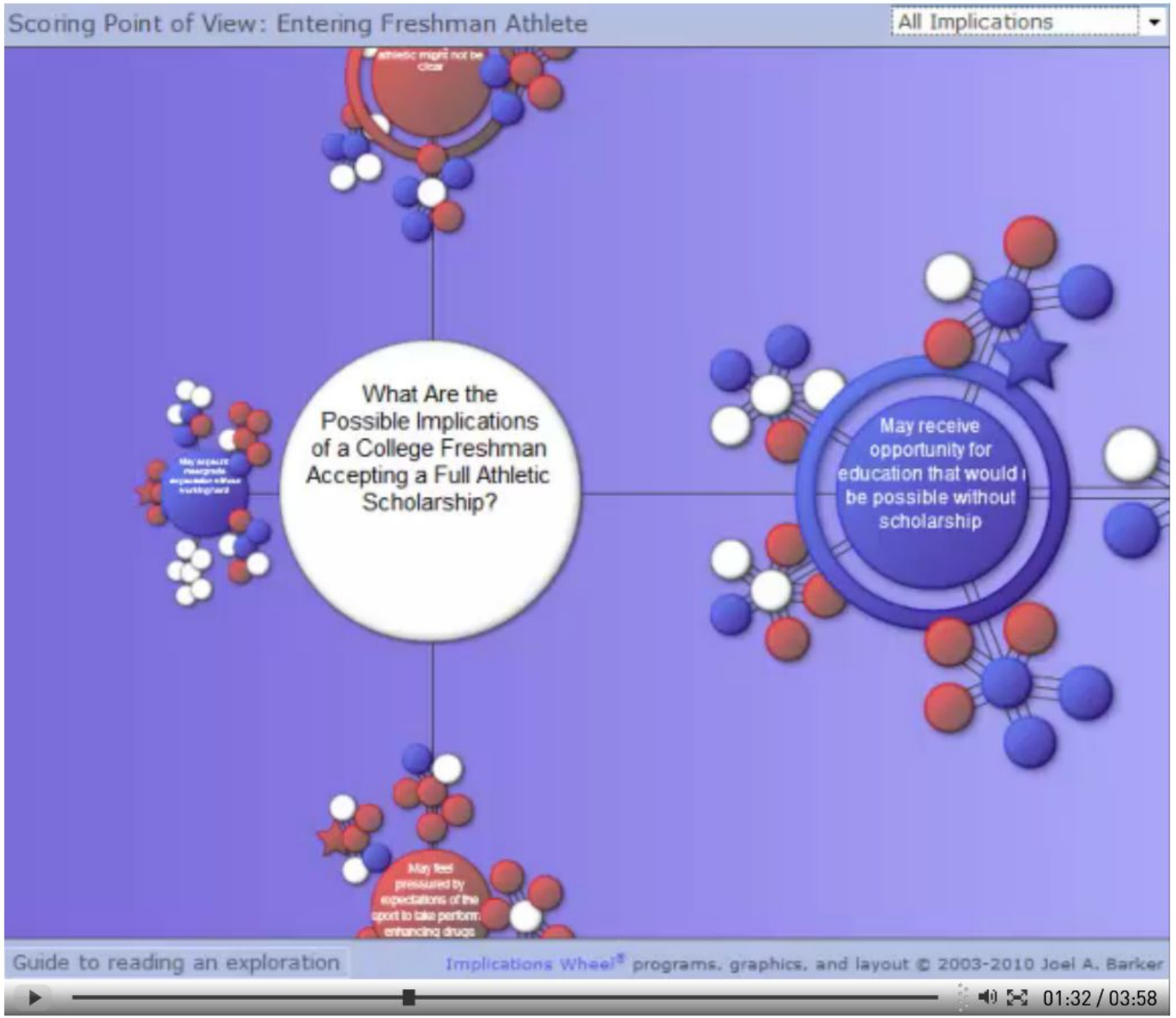
1. Mapping Implications of forecast changes: Implication/Futures Wheel

- Changes beget other changes – one thing leads to another…
- Examples of this approach
  - www.mindtools.com/pages/article/futures-wheel.htm

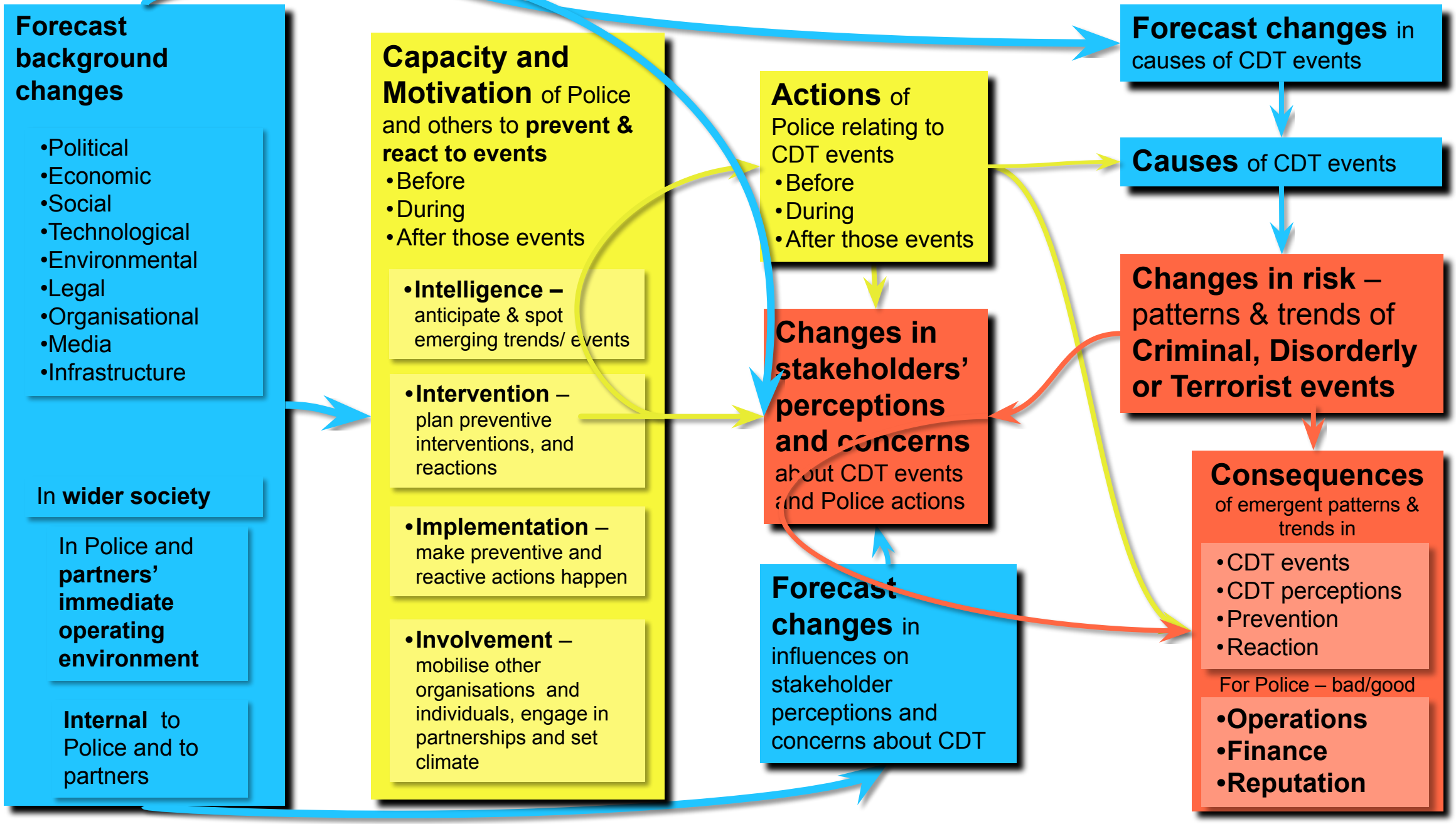


Mapping Implications of forecast changes: Implication/Futures Wheel

- Examples of this approach
  - www.implicationswheel.com/how-to-read-an-i-wheel-exploration.html#



Mapping crime/security implications – systematic and integrated approach



Identifying the forecast changes of interest

- Set a timescale
- Identify likely
  - **Internal** Police changes
  - Changes in **immediate operating environment** – regulations, traffic etc
  - Wider **background changes**
- For each change (or maybe changes in combination), ask
  - *Might it increase or decrease the risk of **crime** and influence **feelings of safety**?*
  - *What might the harmful or beneficial **consequences** be for society (or some specific sector/organisation), of that change in risk?*
  - *How might the change affect the capacity of Police to continue **implementing** current preventive interventions, or to introduce new ones?*
  - *How might it affect Police **partners**' ability and motivation to **support or collaborate** on prevention?*
  - *How might it affect **other stakeholders** in **supporting or undertaking** preventive action?*

Reading the crime implications map

- Set a timescale, and the focus
  - Either 1) start with background changes & work downstream, or 2) with crime risks & work upstream
- E.g. 1) Identify likely future
  - **Internal** Police changes
  - Changes in **immediate operating environment** – regulations, traffic etc
  - Wider **background changes**
- For each change (or maybe changes in combination), ask
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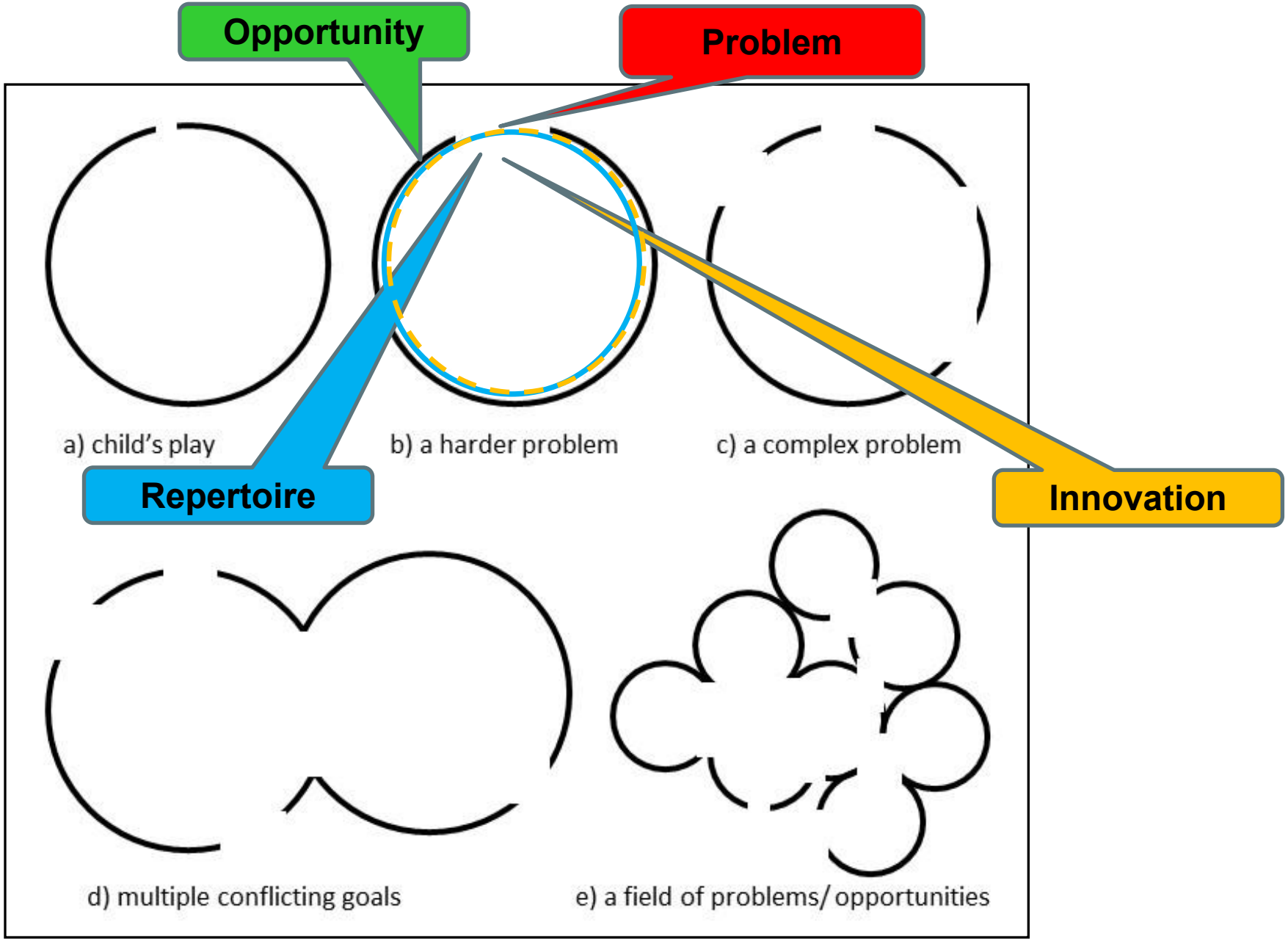
2. Opportunities, problems and innovation



How to anticipate crime implications of innovations

- Innovations in products, buildings, services, systems, procedures all have crime implications
  - They can boost risk of crime (criminogenic) or hinder it (criminocclusive)
- Frameworks like **TRIZ** and **technology roadmapping** can help us forecast which innovations in science, technologies and specific applications may be expected to emerge
- But from a crime science POV we need to introduce some structure and theory into how we anticipate these risks, so we can then act on them to forestall crime harvests or to exploit them for security

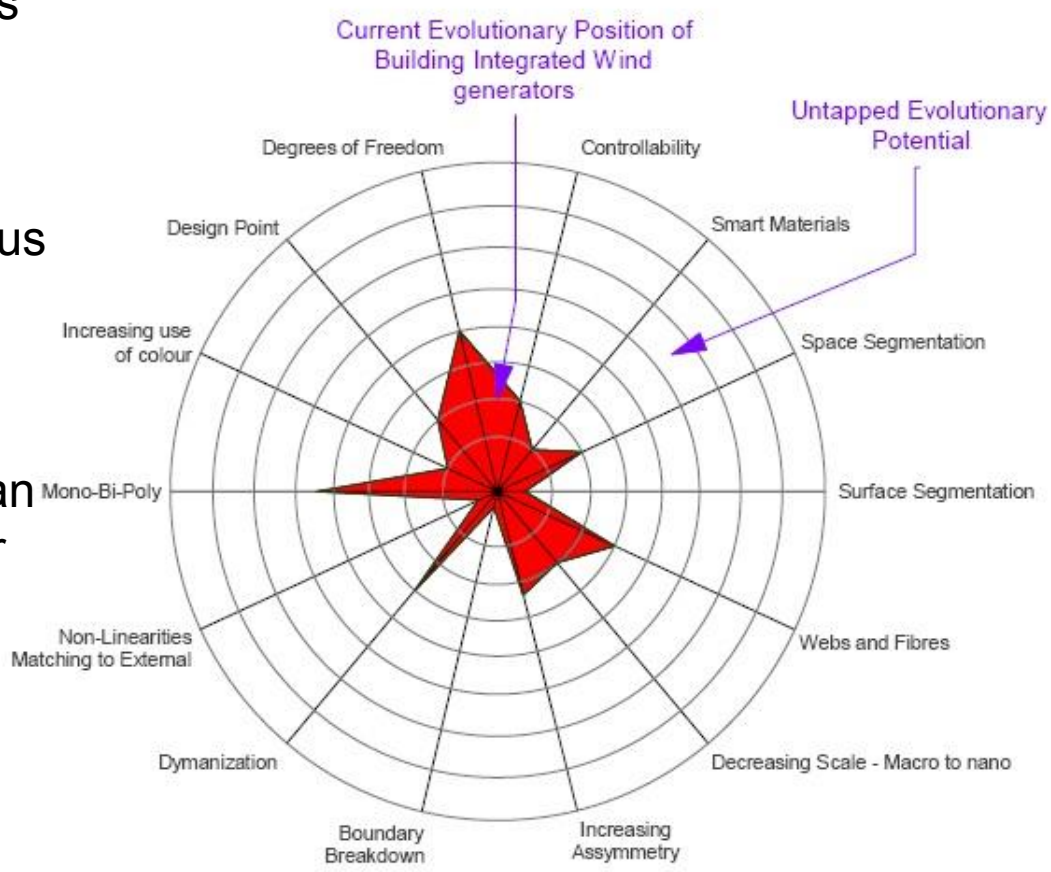
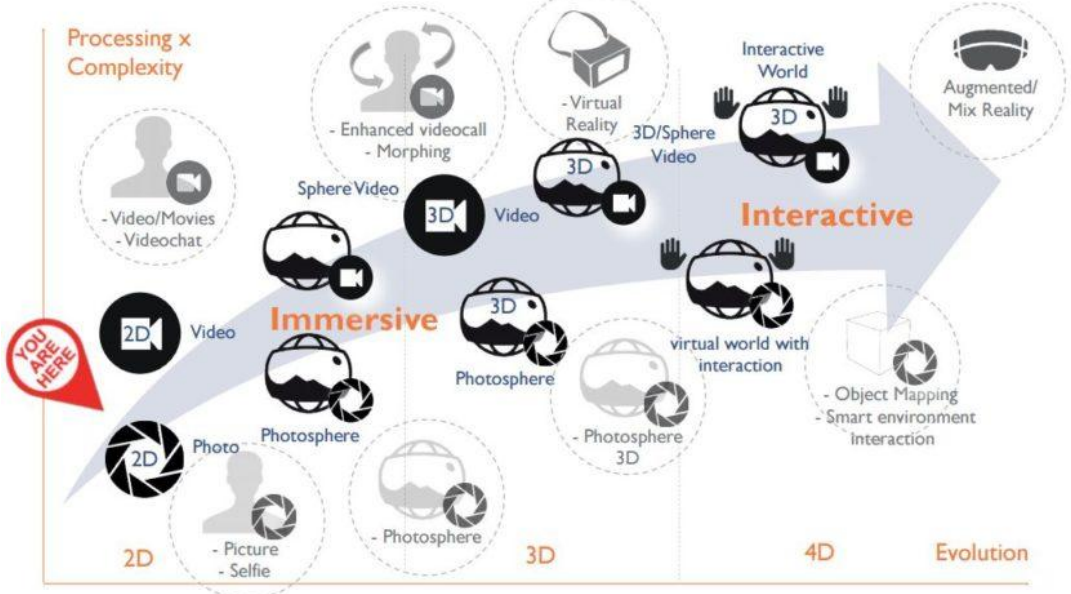


Fig. 4. Untapped Evolution Potential in integration of Wind Energy into Buildings (reproduced from McGee 2005 with permission).

Roadmap for immersive and interactive imaging technologies



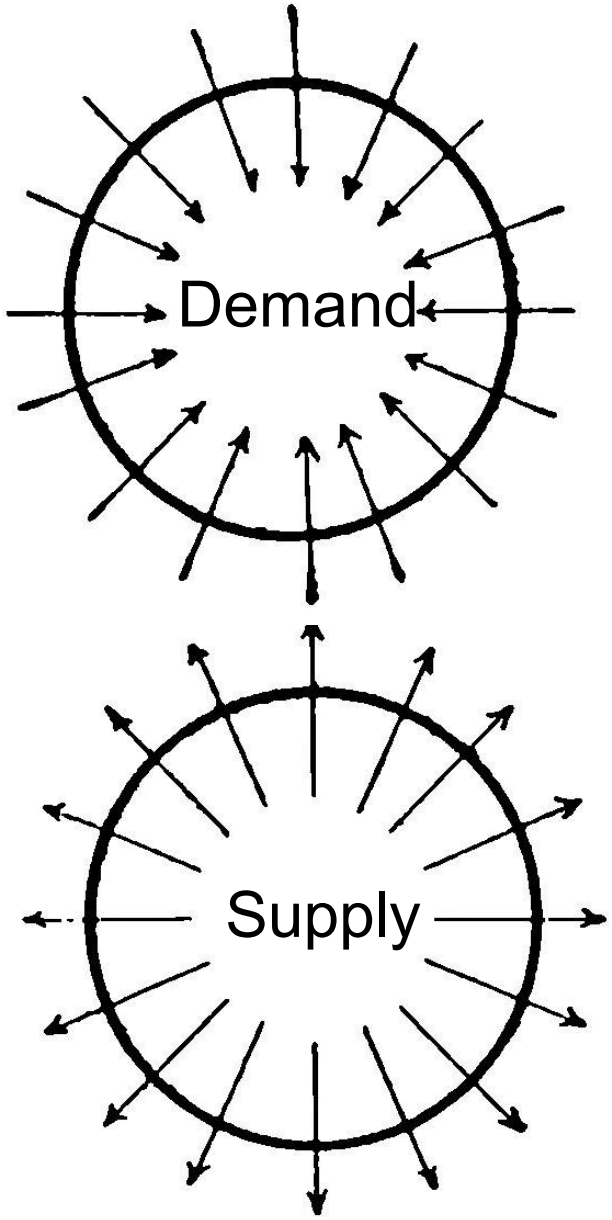
(Yole Développement, June 2016)

https://triz-journal.com/using-triz-architecture-first-steps/
https://www.triz.org/triz/evolution/2-triz
https://cdn57.androidauthority.net/wp-content/uploads/2016/06/immersive-imaging-roadmap-840x554.jpg

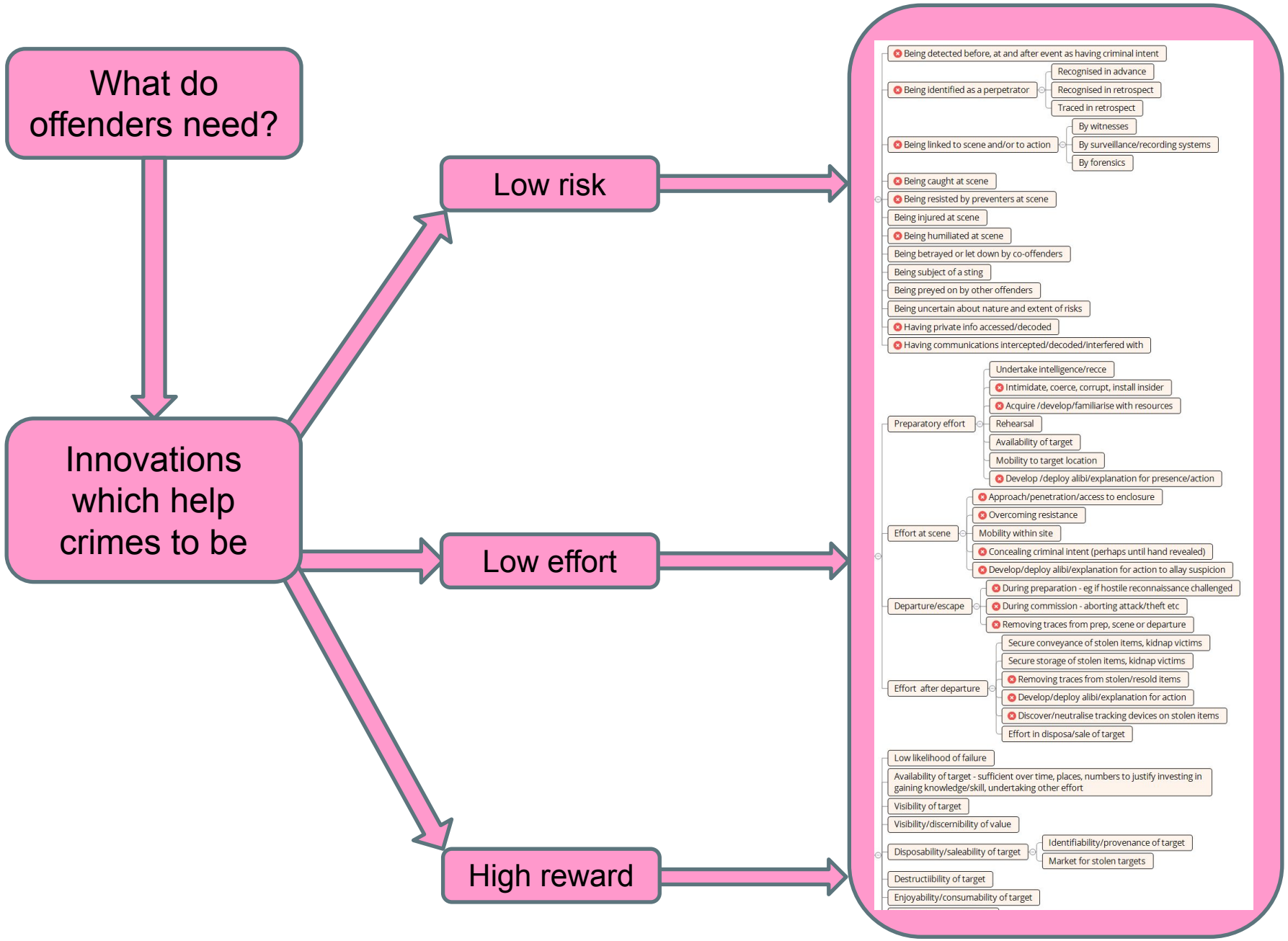
How to anticipate with innovations? Rising to the challenge

Can take different perspectives on future crime/ security

- Causal v functional
  - **Causal** – e.g. how might this innovation generate stress or conflict?
  - **Functional** – how might this innovation serve criminal or security purposes?
- Within functional
  - **Demand-side** focus – what do criminals or security *need* to be invented, to solve their problems/ complete an opportunity? Is any specific requirement holding them back? (If only we had X, we could exploit this criminal opportunity/ plug this vulnerability)
  - **Supply-side** focus – what can *this* new piece of science or technology do for criminals or security?



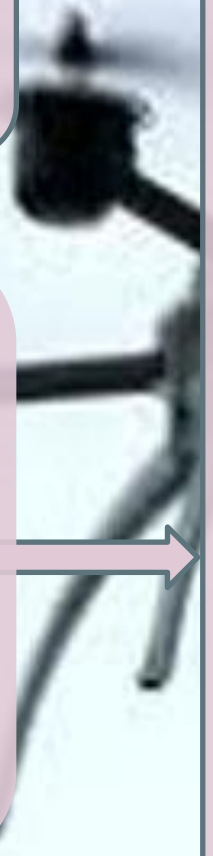
Function – demand-side – offenders' needs



Example – supply – what can Drones do for Crime/ Security?

Functional **essence of drone?**

Active, mobile, effective telepresence of human agency



- Remote operation - can go to and do in different places from humans in general, individual agents in particular... remoteness can range from metres to many km... Allows distancing of agent from hazards, tracing by traditional means eg facial recognition
- Mobility and agility in different modes - air, land surface, walls, water
- Different size/shape/body configurability from agent - entry/exit, detectability eg through size/shape/disguise
- Communication with agent - coded/encrypted
- Sensors - human + more - inc Radar
- Image capture, transmission, recording
- Image interpretation
- Autonomy at various levels from tactical to more operational... navigation, risk and objective identification, decision, response
- Ease of operation/ limited training by user
- Conveyance of goods to/from destination
- Actuation
- Self-defence v threats/protection v natura/ accidental human hazards
- Generic regulatory requirements - eg licensing, identification, constraints on flight eg line-of-sight operation, no-fly zones
- Cheap

Function – supply-side – Drone can be:

Tool for criminals

- **Misused** – hostile recce, IED delivery, drug delivery
- **Misbehaved with** – noise, intimidation, voyeurism
- **Misled with** – causing panic, riot

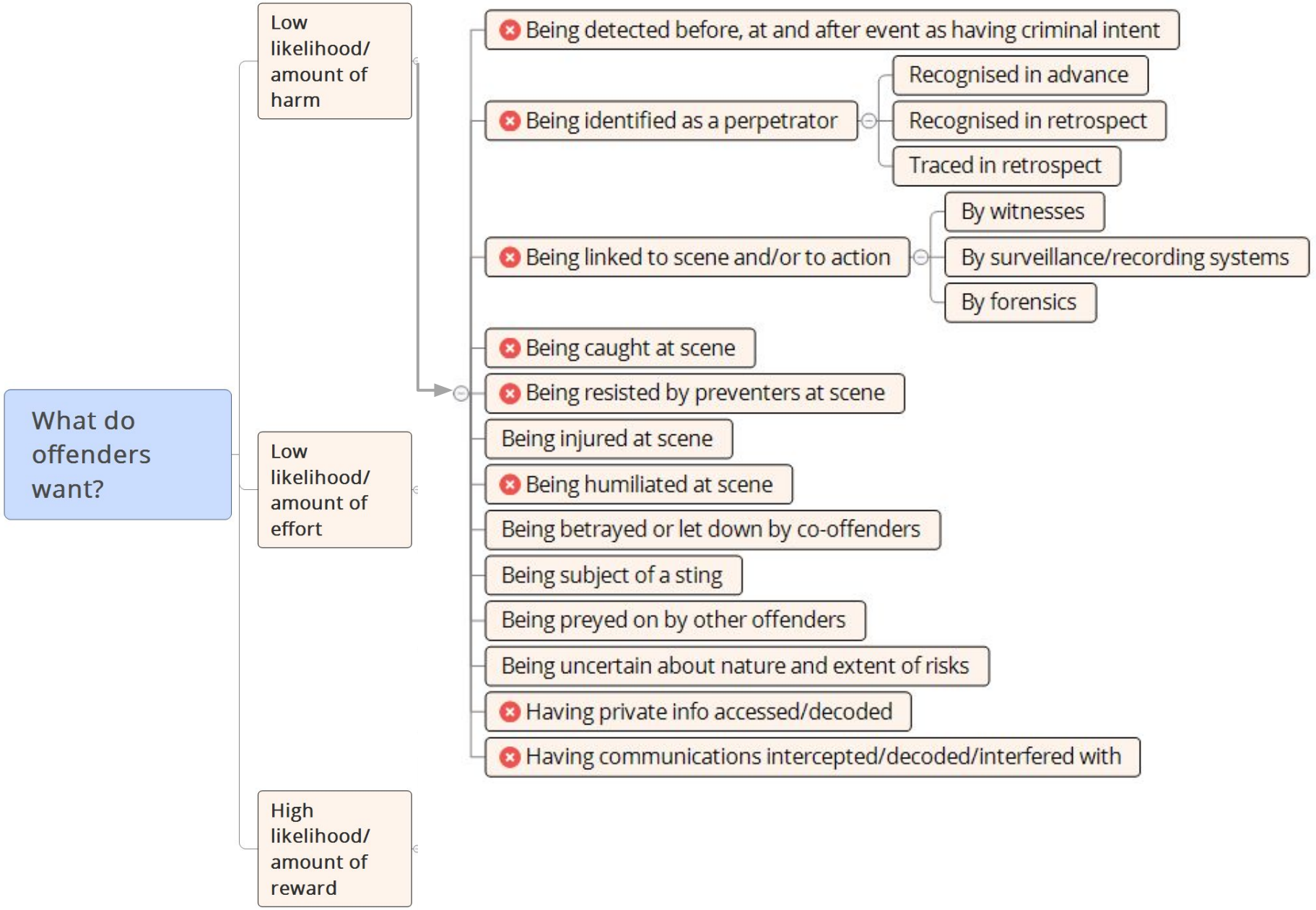
Target of crime

- **Misappropriated – stolen, or stolen from (Amazon)**
- **Mistreated – shot down by angry neighbour**
- **Mishandled – false licence, smuggled in**
- **Misbegotten – counterfeit model, spares**

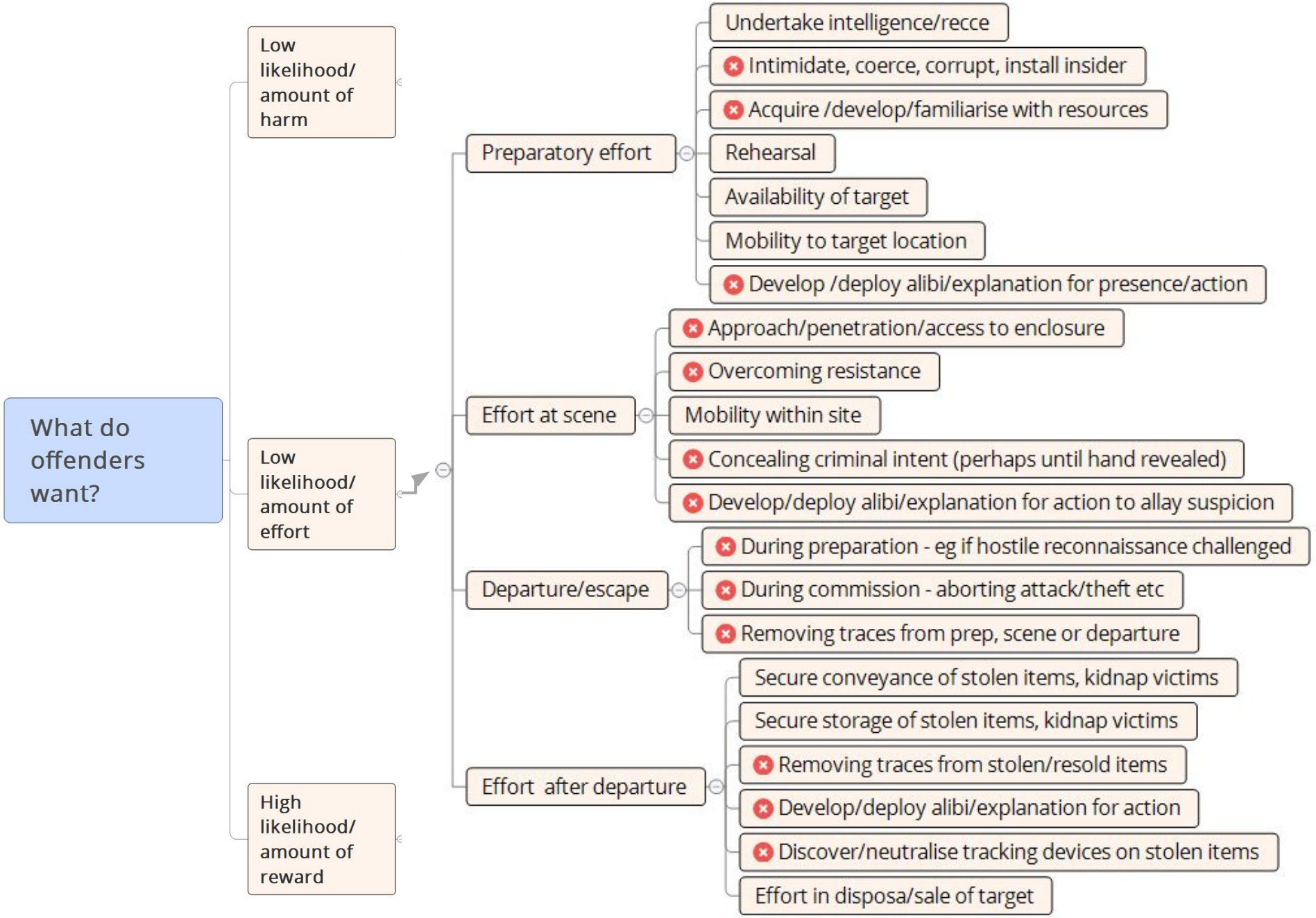
Aligned with security

- **Secured against above risks** – e.g. identification, limiters
- **Exploited to control crime** – surveillance, detection, pursuit
- **Proofed against Mistakes & Mishaps** – e.g. log/ check

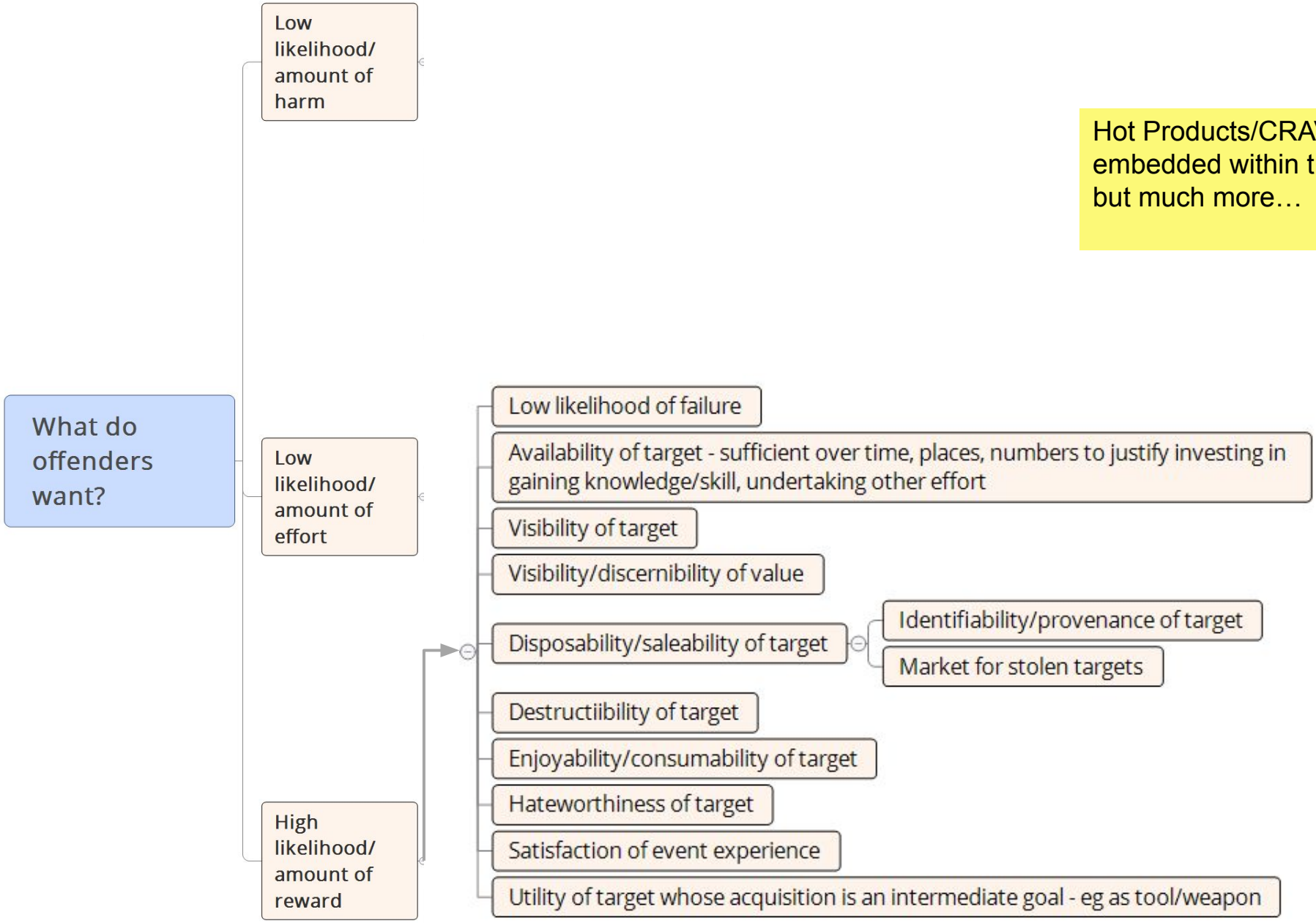
Function – generic demand-side – offenders



Function – generic demand-side – offenders



Function – generic demand-side – offenders

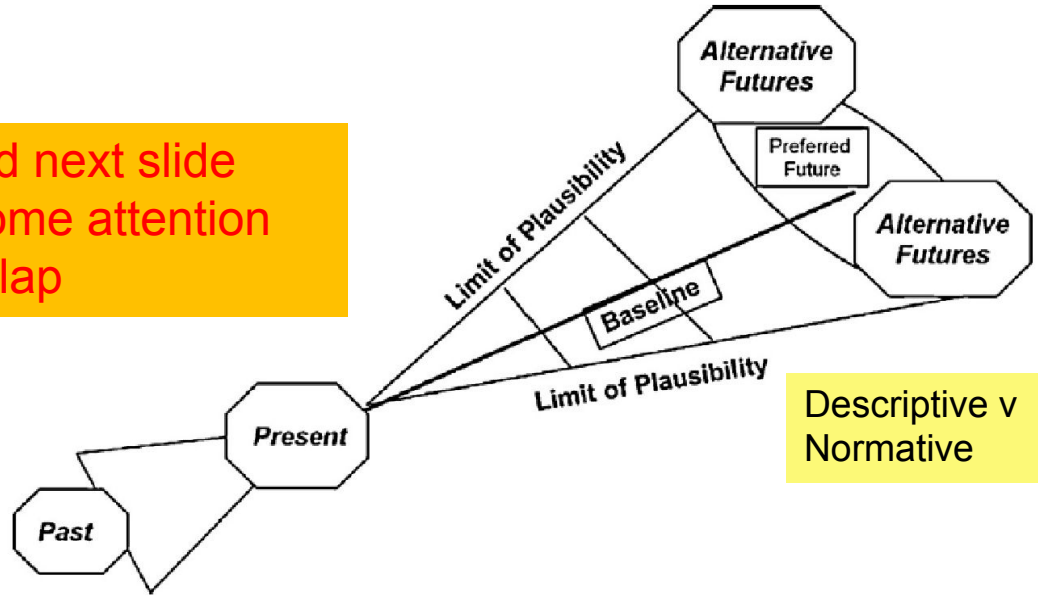


Hot Products/CRAVED embedded within these lists, but much more…

3. Uncertainties, Errors, Complexity

- Forecasting – you will almost certainly get it wrong
- Where alternatives are clearly defined
  - Error bars and confidence intervals
  - False positives and false negatives
  - Likelihood of each of these errors, and consequent harm?
  - But usually can't make any quantitative estimates
- Known and unknown unknowns
- Combinatorial possibilities – state space explosion
- Nonlinearities
- Complex interactions – context dependence of crime and crime prevention (Tilley – Scientific Realism)
- Complex adaptive systems
- Complex, networked, dynamic problems (Dorst, UTS)
- Complex v complicated?
- Events v Actions (Shearer)
- Uncertainty increases, the further into the future we are looking
  - Cone of uncertainty/plausibility
    - Baseline future
    - Alternative futures
    - Preferred future

This and next slide need some attention for overlap



Descriptive v Normative

Need example

https://www.health.org.uk/sites/default/files/ComplexAdaptiveSystems.pdf

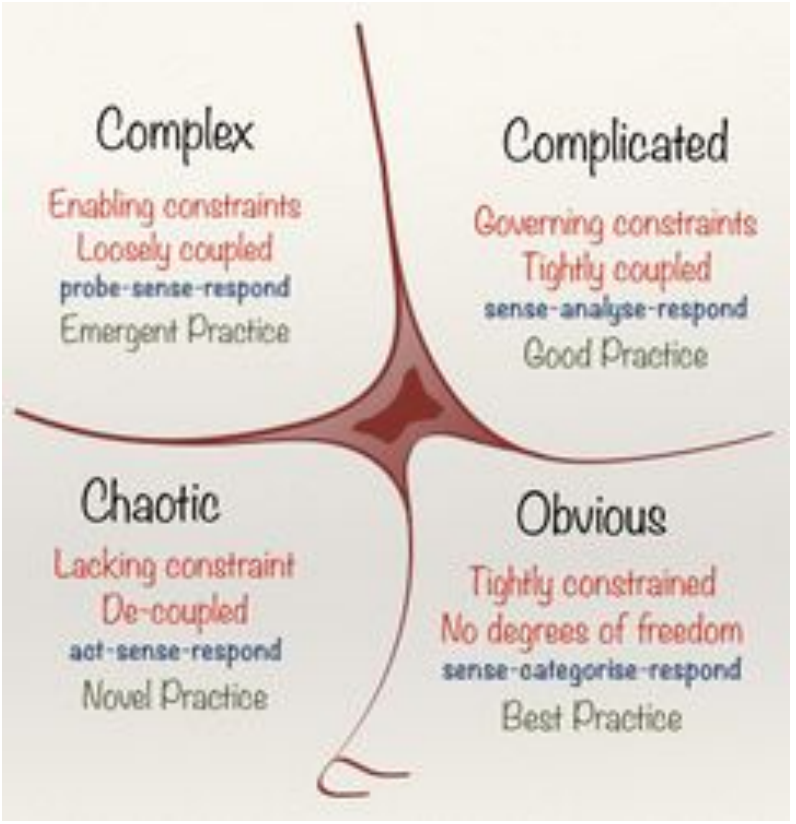
www.uts.edu.au/about/faculty-design-architecture-and-building/news/new-thinking-resolves-complex-problems-design

https://www.researchgate.net/publication/23541474_Approaching_scenario-based_studies_Three_perceptions_about_the_future_and_considerations_for_landscape_planning

Handling uncertainties and other issues

- Risk = **effect of uncertainty on objectives** – ISO 31000 – positive or negative
- Risk = **likelihood** of some **event** x harmful/beneficial **consequences**
- For simple/ known unknowns? – **confidence intervals, error-bars and inference errors** (false positive and false negative)
- Errors can have serious **consequences** – e.g. failure to predict earthquake; or unnecessary panic evacuation
- For proliferation and multiplication of uncertainties over time, consider the **Cone of Plausibility/ Uncertainty**
- Where plausible becomes implausible – **wildcards/ STEEP surprises**
    - Type I Wild Card: low probability, high impact, high credibility
    - Type II Wild Card: high probability, high impact, low credibility
    - Type III Wild Card: high probability, high impact, disputed credibility
    - Type IV Wild Card: high probability, high impact, high credibility

- For wider uncertainties and unknowabilities, consider dividing up the issues as per **Cynefin**



www.sciencemag.org/news/2015/02/why-italian-earthquake-scientists-were-exonerated

https://en.wikipedia.org/wiki/Cynefin_framework

4. Envisioning the future

- **Scenarios**… a way of developing a more holistic picture of alternative futures to aid understanding and decision-making
- Usually based around several explicit **axes of uncertainty**
- But in many cases the **choice of axes** is a bit arbitrary
  - Are they the 'right' ones?
  - Why stick at 2?
- Shearer (ref on slide 17) provides useful account/critique of scenarios

key variables:
energy sources and global governance

Amongst the uncertainties, we identified two as the most critical in influencing future mobility solutions: **energy supply and demand, and governance systems**. Our research indicated that these are the most uncertain trends and have the greatest potential impact on the future of urban mobility. We identified two very different outcomes for each, and used this to construct the 'axes': the overall framework for the scenarios that defines the key differences between the scenarios.

Axis 1: what kind of energy mix will be dominant?

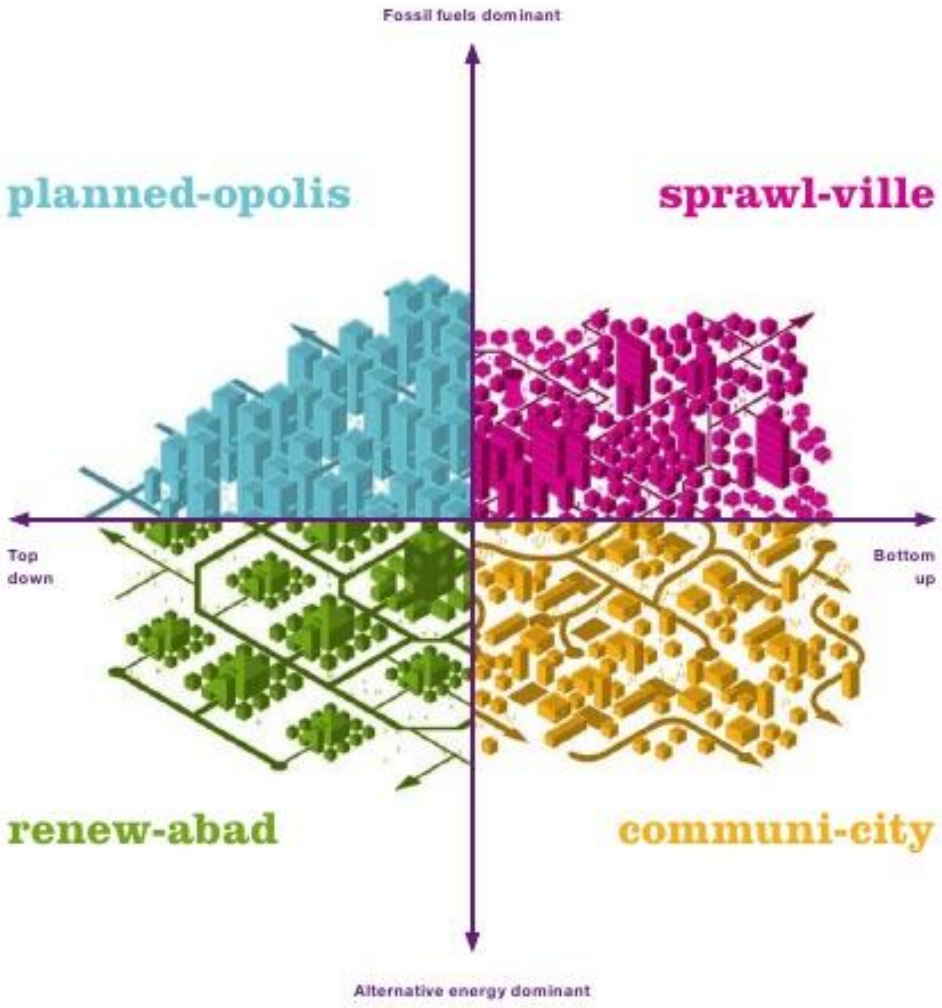
Fossil fuels dominant: The world is still running on fossil fuels. Although there are significant constraints in supply, a mix of mitigating factors – including efficiency gains, clean-up mechanisms, and supply augmentation through different sources such as shale gas or tar sands – help maintain fossil fuel dominance.

Alternative energy dominant: Alternative energy sources have been scaled up and are much more affordable. Conventional oil supply has peaked. Simultaneously, a mix of cost and technology breakthroughs in alternative energy generation spurs innovation that changes the energy mix.

Axis 2: what kind of global governance framework will we have?

Top down: Global governance frameworks are strong and well coordinated. A convergence of opinion on key issues such as climate change has led to the develop-ment of stronger institutions and binding frameworks, and a more collaborative world order.

Bottom up: Decentralised governance solutions are preferred to global-level action. Trade relations are more regionalised, and innovation happens in local power hubs. The world is focused on self-sufficiency, resilience and localised solutions.



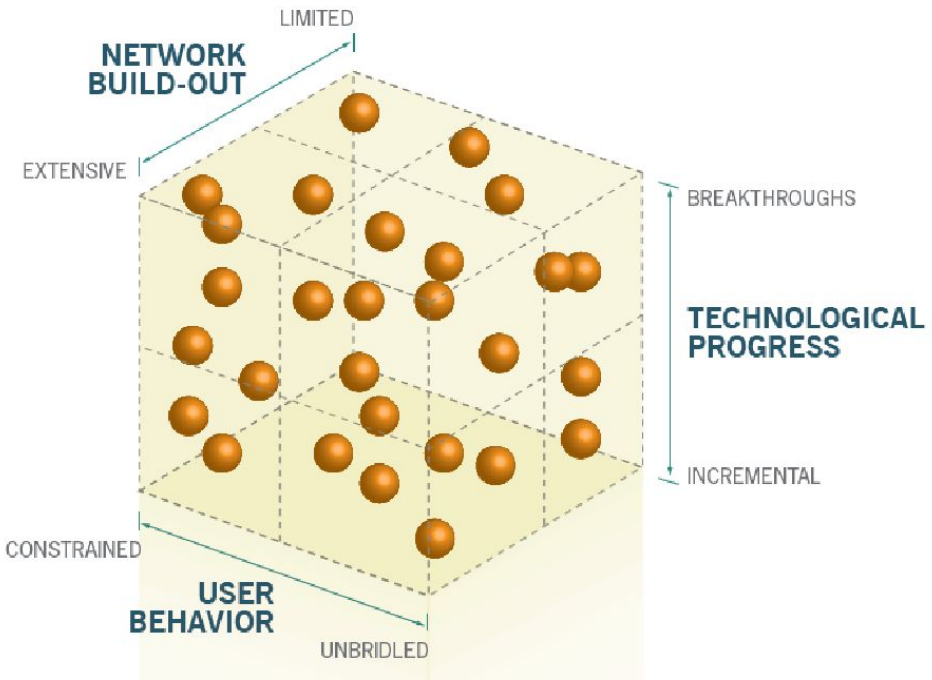
www.slideshare.net/Texxi/mega-cities-full-report

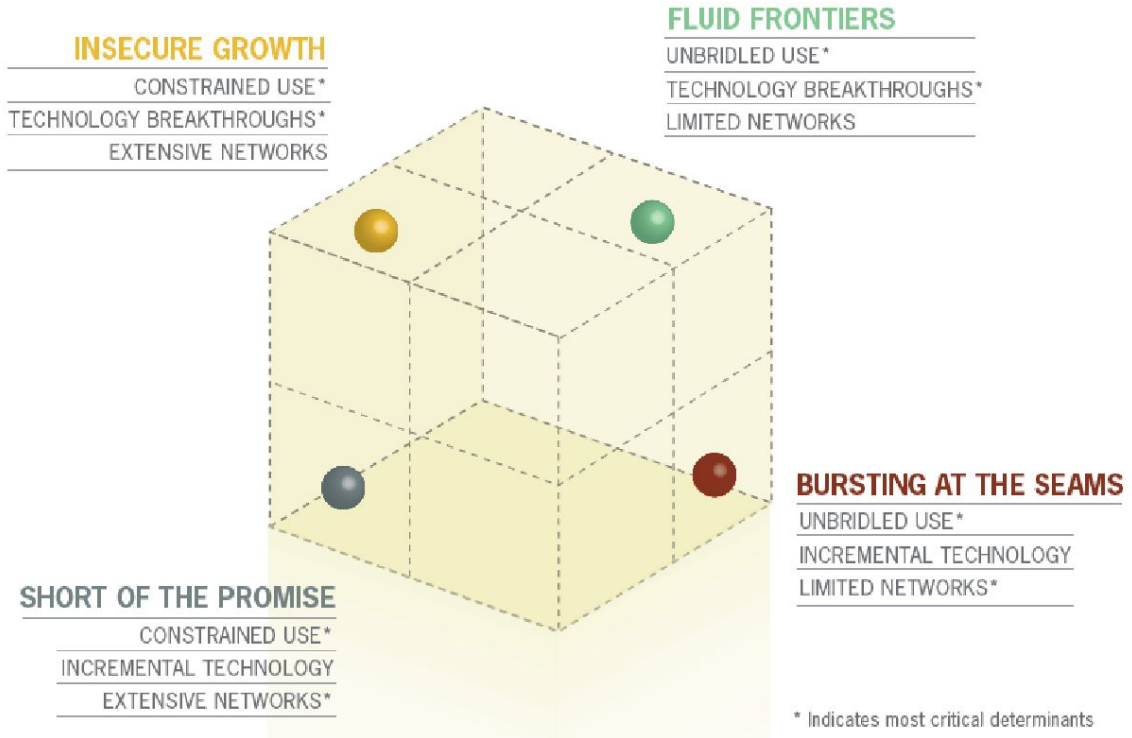
More systematic search for key dimensions and their implications

- Eg future of the Internet based on 3 axes of uncertainty

How/why do we label the scenarios?

Using the "axes of uncertainty" as the basic scaffolding, we created a scenario "cube" to visually depict the full range of possible future states, or scenarios, suggested by permutations of network build-out, technology progress, and user behaviors.





https://newsroom.cisco.com/dlls/2010/ekits/Evolving_Internet_GBN_Cisco_2010_Aug_rev2.pdf

Even more systematic – Morphological Analysis

- Paper on Internet of Things x future crimes and terror attacks (Roey Tzezana)
  - **General Morphological Analysis** – developed in astronomy, now used in analysing wicked problems
  - Identifies key **parameters** (equivalent to axes of uncertainty) and crosses them to generate a **typological field** (multidimensional space of possible futures)
  - This then used to generate scenarios
- GMA used on a **crowdsourcing** platform with 50 experts in cyber-security and other fields, to analyse the futures of crime and terror in the age of IoT
- The experts identified the most important factors in each of three **parameters**: *targets, motives* and *methods*
- They then ranked each factor according to its **likelihood or impact**
- A **typological field** was created containing 9,660 **combinations** of factors – each of which being the basis for a scenario to be developed (state space explosion)
- Following some systematic **filtering** based on expert rankings plus other considerations, 3 combinations of high impact and high likelihood were expanded on and developed into **scenarios**, as well as 3 combinations of high impact but low likelihood (**wild cards/steep surprises**)
- Scenarios
  - (Hi/Hi) Blackmailed power plant, The open cyber-wallet, Malicious smart assistant
  - (Hi/Lo) Green war (drones v power plant), Botnets v rail signaling for Lulz, AI worm infecting hospital systems for ID theft

www.emeraldinsight.com/doi/abs/10.1108/FS-11-2016-0056

Tradeoffs in scenarios and other futures methods

- Effort/rigour ~ validity, utility, credibility
- Cognitive load for generating, interpreting and communicating results – how many dimensions can users consider simultaneously?
- Expert judgement v theory input – what combinations work best in what circumstances?
- Purpose – normative (e.g. public policy) v descriptive (e.g. how does our company continue to make a buck in this future?)
- Stimulation of thinking v systematic planning?
- …And how do we judge
  - Benefit of a particular set of scenarios
    - Quality of process/sources, appropriateness of scope, clarity of choices? Stimulation of new thinking?
  - Advantages/validity of a particular method of generating scenarios, for a particular purpose?

Seminar: Sigma Scans

- This week, we would like you to review and be prepared to discuss a sample of Sigma-Scan reports. In discussing the scans, amongst other things, we would like you to consider:
- The extent to which crime or security implications are discussed in the scan (and if so how well), or should have been
- The extent to which any predictions have come to pass, and if they didn't, whether this was because of direct crime preventive action taken or some other reason. For example, perhaps the change discussed didn't emerge, or perhaps it emerged differently.
- The sources of evidence consulted to produce the scan and the evidence and stimulus ratings allocated to them