Responsible AI Reading Group

Roman Lutz presents

Fairness and Abstraction in Sociotechnical Systems

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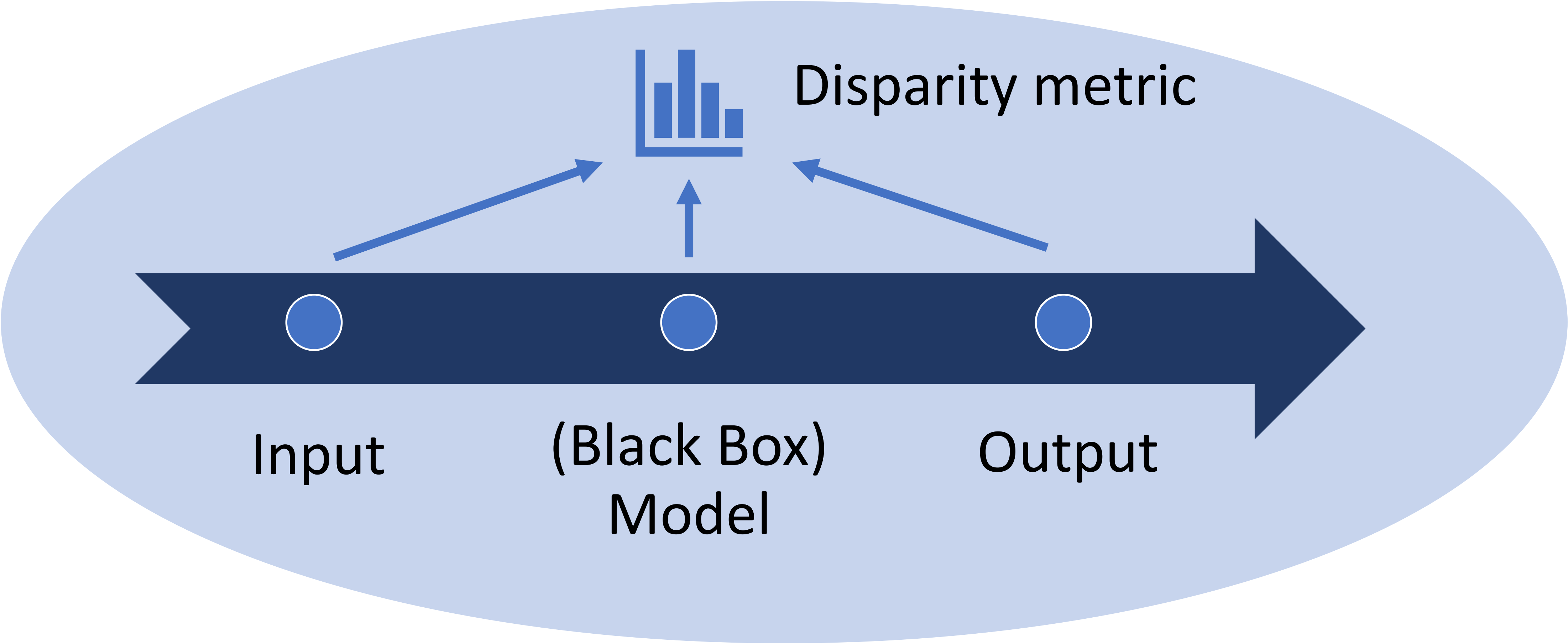
ACM Conference on Fairness, Accountability, and Transparency (FAT)*

Abstraction in Fairness-aware Machine Learning



Societal context abstracted away by considering input/model/output

The Abstraction Traps

- Framing Trap
- Portability Trap
- Formalism Trap
- Ripple Effect Trap
- Solutionism Trap

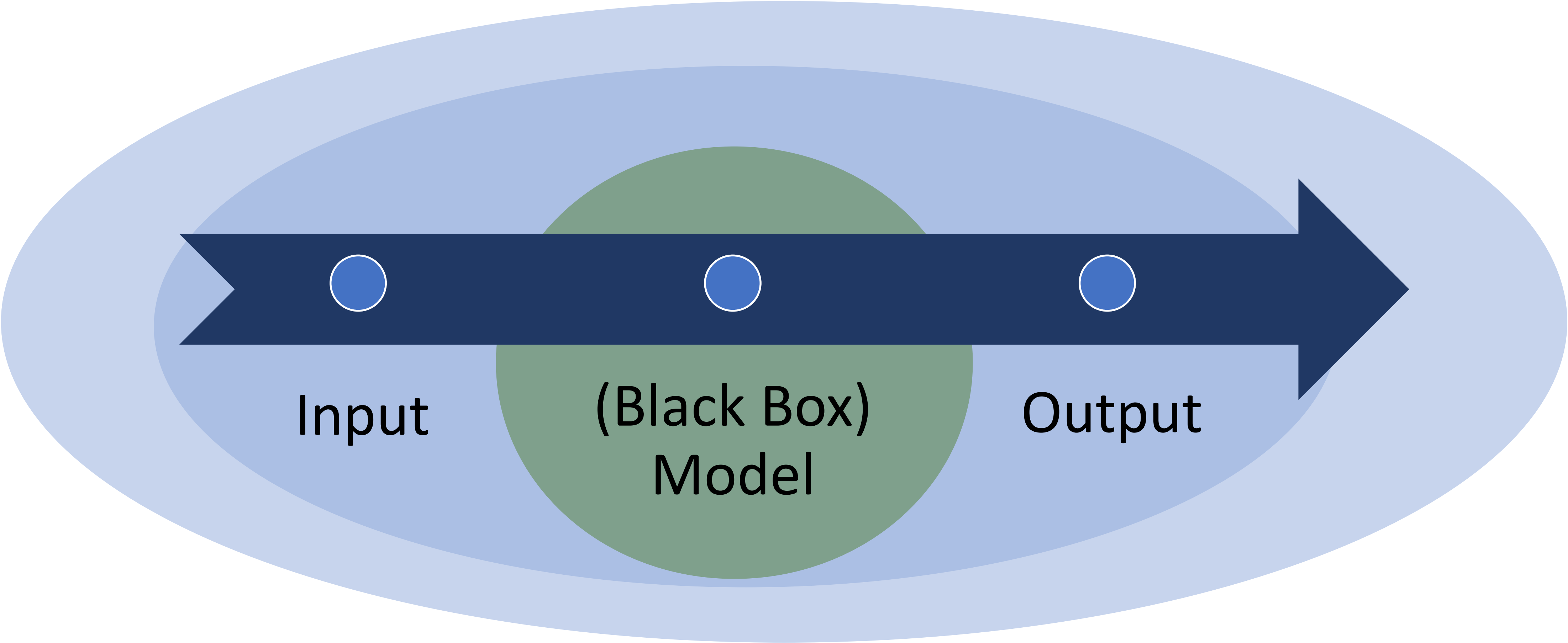
A sociotechnical perspective

- Consider social & technical
- Sociotechnical systems lens →

- Bruno Latour. 1987. Science in action: How to follow scientists and engineers through society. Harvard University Press.
- Trevor J. Pinch and Wiebe E. Bijker. 1984. The social construction of facts and artefacts: Or how the sociology of science and the sociology of technology might benefit each other. Social Studies of Science 14, 3 (1984), 399–441.

Framing Trap

- Failure to model the entire system over which a social criterion, such as fairness, will be enforced



Framing Trap: Pretrial risk assessment

Judge has to decide whether to release (with or without bail) or detain defendant

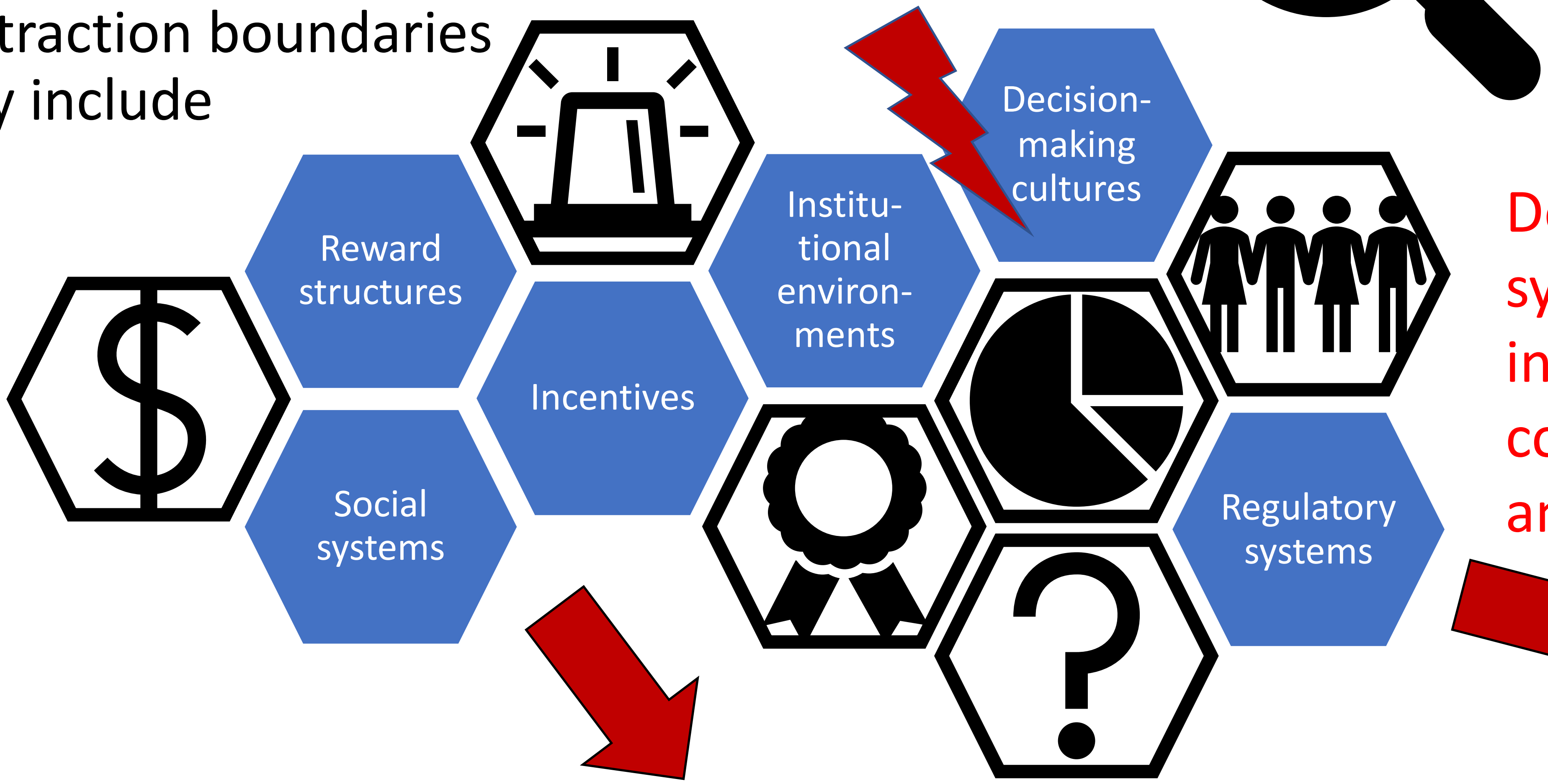
Automated risk assessment is meant to help judge as a recommendation

Sociotechnical frame: model judges' automation bias, deviations from risk scores is the only way to get end-to-end guarantees

- Angèle Christin. 2017. Algorithms in practice: Comparing web journalism and criminal justice. Big Data & Society 4, 2 (2017).
- Danielle Keats Citron. 2008. Technological due process. Washington University Law Review 85 (2008), 1249–1313.
- Linda J. Skitka, Kathleen L. Mosier, Mark Burdick, and Bonnie Rosenblatt. 2000. Automation bias and errors: Are crews better than individuals? The International Journal of Aviation Psychology 10, 1 (2000), 85–97.
- Megan T. Stevenson. 2018. Assessing risk assessment in action. Minnesota Law Review 103 (2018).

STS Lens on Framing Trap

- Adopt a heterogeneous engineering approach, abstraction boundaries may include



Reward structures

Incentives

Social systems

Institutional environments

Decision-making cultures

Regulatory systems

Design for system's inherent complexity and fragility

John Law. 1987. Technology and heterogeneous engineering: The case of Portugese expansion. In The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology, Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Eds.). MIT Press, 111–34.

Portability Trap

- Failure to understand how repurposing algorithmic solutions designed for one social context may be misleading, inaccurate, or otherwise do harm when applied to a different context
- Portability is a extremely valuable in software engineering

Portability Trap: Pretrial risk assessment

Assume we avoid the Framing Trap by including all relevant aspects of the context into our model
… then this is now a very specialized solution that is not portable to other domains

BUT TRANSFER LEARNING!

… "not sufficiently expressive to capture the vast changes in social context"

Even within the pretrial risk assessment domain the characteristics of the next courthouse may be very different

STS Lens on Portability Trap

- Contextualizing user “scripts” that describe how technology is used in a specific context since fairness is tied to that social context e.g. model cards, datasheets, nutrition labels

Formalism Trap

Failure to account for the full meaning of social concepts such as fairness, which can be procedural, contextual, and contestable, and cannot be resolved through mathematical formalisms.

Procedural

e.g. firing based on gender is illegal, but firing is otherwise legal; mathematical definition only captures whether somebody was fired

Contextual

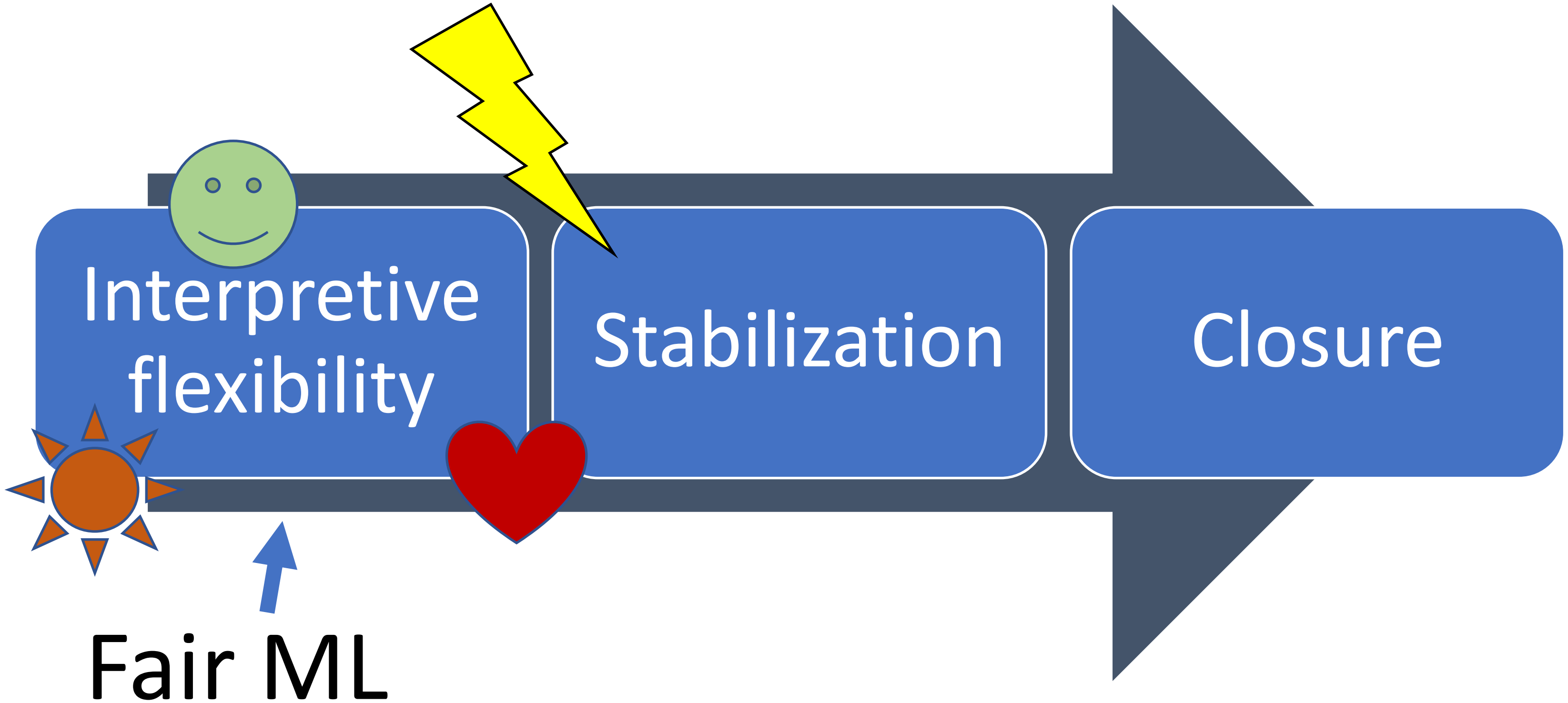
cultural context determines whether discrimination is morally wrong, e.g. a men's clothes manufacturer rejects female model applicant

Contestable

legal definitions and societal understanding of fairness & discrimination change over time, and with legislation or court cases

STS Lens on Formalism Trap

Social Construction of Technology (SCOT)
by Pinch, Bijker describes steps towards adoption of technology



Fair ML

Trevor J. Pinch and Wiebe E. Bijker. 1984. The social construction of facts and artefacts: Or how the sociology of science and the sociology of technology might benefit each other. Social Studies of Science 14, 3 (1984), 399–441.

Ripple Effect Trap

Failure to understand how the insertion of technology into an existing social system changes the behaviors and embedded values of the pre-existing system

https://pxhere.com/en/photo/1447321 (CCO)

STS Lens on Ripple Effect Trap

Reinforcement Politics: Introducing a new technology can affect power dynamic between existing groups

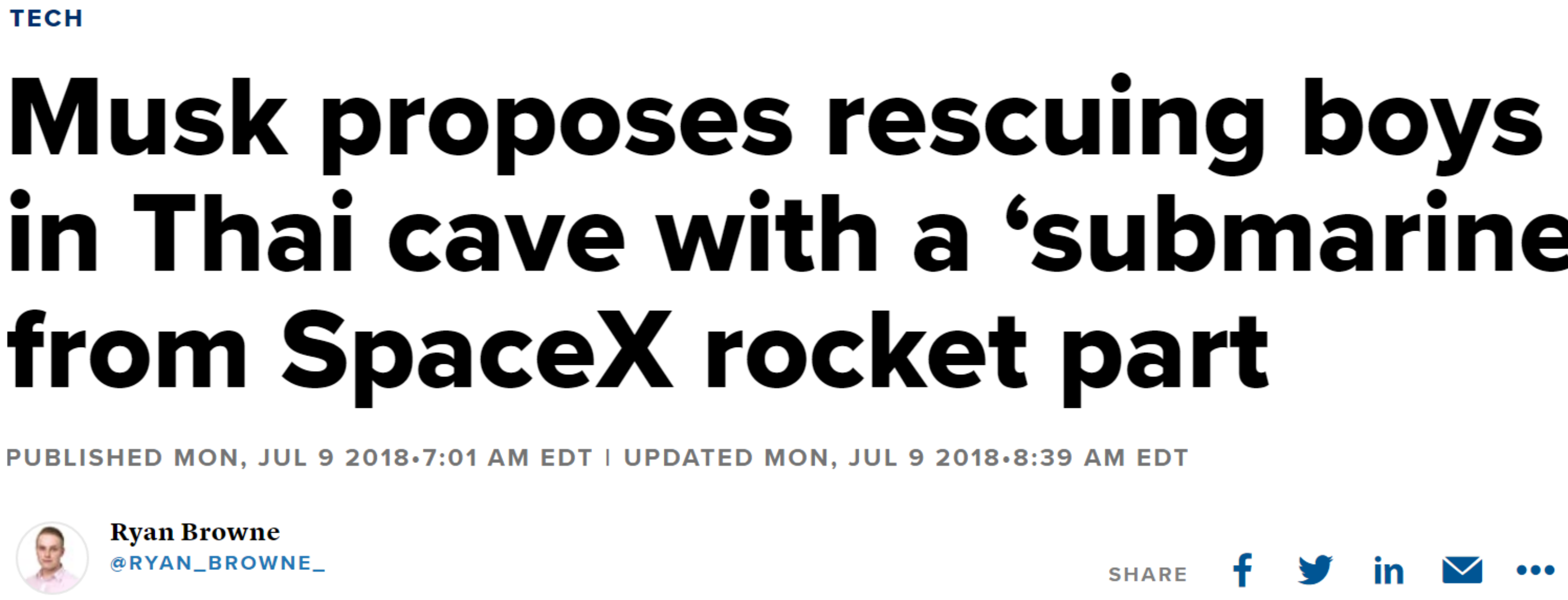
Reactivity behaviors can alter the social context that the design planned for and destabilize existing values, incentives and structures

→ Avoid reinforcement politics and reactivity, study extensive literature on ripple effects

- Rob Kling. 1991. Computerization and social transformations. Science, Technology, & Human Values 16, 3 (1991), 342–367.
- Wendy Nelson Espeland and Michael Sauder. 2007. Rankings and reactivity: How public measures recreate social worlds. Amer. J. Sociology 113, 1 (2007), 1–40.

Solutionism Trap

- Failure to recognize the possibility that the best solution to a problem may not involve technology



TECH

Musk proposes rescuing boys trapped in Thai cave with a 'submarine' made from SpaceX rocket part

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https://www.cnbc.com/2018/07/09/elon-musk-sends-kid-size-submarine-to-help-thai-cave-rescue-mission.html

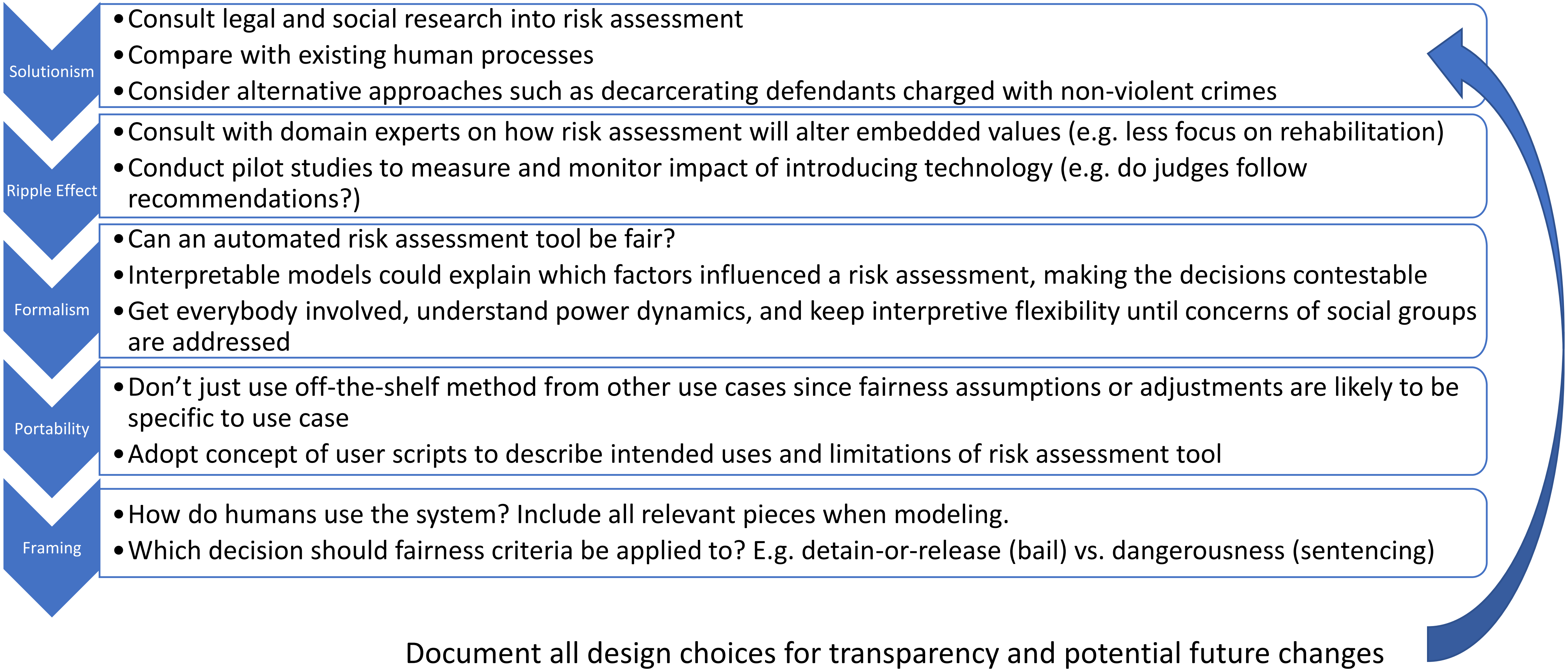
STS Lens on Solutionism Trap

- When not to build solution with technology:
  - Shifting definitions of fairness (see Formalism Trap)
  - Problem is too complex, computationally intractable
- Hippocratic oath: “first, do no harm”
- Takeaway from the field of human-computer interaction: sometimes it is better not to design a solution

Baumer, Silberman. "When the implication is not to design (technology)." *SIGCHI*, 2011.

An example: Risk Assessment

Goal: reduce pre-trial detention



Solutionism

- Consult legal and social research into risk assessment
- Compare with existing human processes
- Consider alternative approaches such as decarcerating defendants charged with non-violent crimes

Ripple Effect

- Consult with domain experts on how risk assessment will alter embedded values (e.g. less focus on rehabilitation)
- Conduct pilot studies to measure and monitor impact of introducing technology (e.g. do judges follow recommendations?)

Formalism

- Can an automated risk assessment tool be fair?
- Interpretable models could explain which factors influenced a risk assessment, making the decisions contestable
- Get everybody involved, understand power dynamics, and keep interpretive flexibility until concerns of social groups are addressed

Portability

- Don't just use off-the-shelf method from other use cases since fairness assumptions or adjustments are likely to be specific to use case
- Adopt concept of user scripts to describe intended uses and limitations of risk assessment tool

Framing

- How do humans use the system? Include all relevant pieces when modeling.
- Which decision should fairness criteria be applied to? E.g. detain-or-release (bail) vs. dangerousness (sentencing)

Document all design choices for transparency and potential future changes

Sources

- Paper: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3265913
- Thanks to danah boyd and Suresh Venkatasubramanian for sharing their slides which served as an inspiration for this deck